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Table of Contents

Effect of Core Training on the Motor Median and Ulnar Nerve Conduction Velocity in Basketball Players

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Abstract

Performance of the movements in the upper extremities, specifically used intensively in basketball, depends on the level of strength and coordination of the muscles located in that area. In this regard, the present study aims to investigate the effect of core training on the median and ulnar nerve conduction velocity (NCV) in basketball players. Ten male basketball players (avg. age: 18.4±0.78 years, height: 191.6±8.65 cm, weight: 80.9±10.15 kg) were participated in the study voluntarily. Core training program was applied to athletes for 8 weeks, 3 days a week, and 30-45 minutes per session. Median and ulnar NCV measurements were performed before and after the training program (pre- and post-test). For the analysis of the pre- and post-test, the MANOVA test was used, and the probability value of $p<0.05$ was considered statistically significant. No statistical differences were observed in the dominant hand motor median and ulnar NCV measurements after the core training ($p>0.05$). A statistical difference was found only in the "distance" parameter in the non-dominant hand median and ulnar NCV measurements ($p<0.05$). As a result, 8 weeks of core training in basketball players was found to have no effect on the dominant and non-dominant hand NCV values. In further studies, changes in NCV in different exercise protocols and sports branches can be investigated to identify the parameters and chemical changes that are believed to have an effect.

Keywords: emg, core exercise, basketball.

1.Introduction

In the human organism, intercellular communication is provided by electrical currents(1). Electrical currents are interpreted in both the central nervous system (CNS) and peripheral regions. CNS is also the part where technical skills specific to sports branches and types of exercises of different intensity are perceived and interpreted by the human organism (2). Exercises and physical activities are known to positively affect the central and peripheral nervous system (3,4,5). However, the nervous system formed by structurally different fibers leads to the use of both sensory and motor functions. Therefore, investigating how exercise-based responses are developed is also of importance for the interpretation of the relationship between CNS and sports performance (6). In this regard, it is important to determine the nerve conduction velocity (NCV), which is a marker of the peripheral nervous system and also has a positive relationship with physical performance (7,8). NCV, however, is also directly related to the size of fibrils in muscles and the distribution of fibril types (9).

Performance athletes such as basketball, volleyball, baseball, ice hockey, and tennis players are known to have a high risk of experiencing peripheral nerve injuries that involve median, radial, and axillary nerves (10). In particular, repeated movements specific to basketball, such as a shot and a pass over the head, lead to excessive strain on the upper extremities (11). Although these movements are usually performed in short-term bursts, repeated movements can cause nervous system injuries and disorders (12). These injuries usually occur because of collisions and in the form of peripheral nerve injuries. The assumption that such compulsive upper extremity movements have an effect on the nerves located in the elbow area of basketball players has also been reported in the literature (13).

Core training, which is basically aimed at strengthening the muscles located in the body (core) and improving motor control in athletes that has become popular in the last two decades, is an important type of exercise in basketball in terms of transferring energy generated from the lower extremity of the body to the upper extremity and providing a posture control (14). Core stabilization supports the body when running, jumping, and falling, while core mobilization allows force to be transferred to the spine and hips when

dribbling a ball or making the pivot movement with the ball (15). Core exercises do not only mean strengthening the body area. Lack of adequate coordination in core muscles can reduce movement effectiveness, can cause tension and excessive injuries (16).

In this regard, performance of the movements in the upper extremities, specifically used intensively in basketball, depends on the level of strength and coordination of the muscles located in that area. The present study aims to investigate the effect of core training on median and ulnar nerve conduction velocity (NCV) in basketball players.

2. Material and Method

2.1. Subjects

Ten male basketball players (avg. height:191.6±8.65 cm, avg. BM:80.9±10.15 kg, avg. age:18.4±0.78 years) in the Youth League Team of Trabzonspor Basketball Club participated voluntarily in the study. Not having any neurological symptoms or history, not having had a concussion, and not having had any limb injuries in the last six months were determined as the criteria for participation in the study. The hand used by basketball players when shooting was considered the "dominant hand", while the other hand was considered the "non-dominant hand".

2.2 Electromyography (EMG) Recording

EMG measurements of the athletes were performed by a specialist neurologist in the EMG Laboratory of the Department of Neurology of the Karadeniz Hospital. Medelec Synergy brand EMG device was used for measurements. Motor NCV values of the median and ulnar nerves innervating the upper extremity muscles were measured since basketball players use their wrists, elbows and above-elbow areas intensively. A surface electrode was used to record muscle motor response (M wave), a compound motor action potential. The active electrode was placed on the most bulging part of the muscle, while the passive electrode was placed on the tendon. The peripheral nerves were stimulated from two separate points in accordance with their traces, while the extremities were held in the standard position during the recording and measurement. The distance between proximal and distal stimulation points were measured by a measuring tape. By selecting the duration of the stimulus used as 0.1 or 0.2 ms, the intensity of the stimulus was increased enough to stimulate all axons in the nerve (17).

The recording of median nerve conduction was performed in the sitting position, arms extended, and the palms in upward-facing position. Using Ag/AgCl surface electrodes, the active electrode was placed on the bulging part of the abductor pollicis brevis muscle, the reference electrode was placed on the metacarpophalangeal joint of the 1st finger, and the ground electrode was placed on the wrist. Stimulation was provided from 3-4 cm above the distal line in the wrist or 8 cm proximal of the active electrode, from the medial of the brachialis, just anterior of the brachialis in the axilla, and from the ERB region. Ulnar nerve conduction recording, however, was performed in the sitting position, elbow flexed slightly (15-30°), forearm in supination, and the palm facing up. Of the surface electrodes, the active one was placed on the bulging part of the abductor digiti minimi, and the reference electrode was placed on the tendon 3 cm distally. Stimulation was given from the 8 cm proximal of the active electrode in the wrist, from the distal of epiconylus medialis and from the proximal region behind brachialis (18).

2.3 Eight-Week Core Training Protocol

Applied core training program (Table 1) was performed regularly at the beginning of the season for 8 weeks, 3 days a week, and 30-45 minutes per session, following the normal basketball training programs of athletes (19).

Table 1. Core training program

EXERCISES	Set 1	Set 2	Set 3
Side Bend	30 sec	30 sec	30 sec
PowerShiver	30 sec	30 sec	30 sec
AlternateLegsJump	30 sec	30 sec	30 sec
Side Bridge	30 sec	30 sec	30 sec
AbdominalPlank	30 sec	30 sec	30 sec
AlternatePlank	30 sec	30 sec	30 sec
Squat	20 rep	20 rep	20 rep
V-Up	20 rep	20 rep	20 rep
Crunch	20 rep	20 rep	20 rep
LyingTwistTrunk	20 rep	20 rep	20 rep
AlternateSuperman	20 rep	20 rep	20 rep

2.4 Statistical Analysis

Statistical analyses were carried out using the SPSS 22.0 program. The Kolmogorov-Smirnov test was used to test the normality distribution of the data, and it was found that the data have a normal distribution. In addition, the homogeneity of the data was tested with Levene's test, and it was found that the data distribution is homogeneous. For the analysis of the pre- and post-tests, the MANOVA test was used, and the probability value of $p<0.05$ was considered statistically significant.

3. Research Findings

The dominant hand motor median and ulnar EMG values of the athletes involved in the study are shown in Table 2.

Table 2: Dominant hand motor median and ulnar EMG values

Nerve Area	Parameters	N	Test	X	f	P
Motor median nerve Wrist area	Latency (ms)	10	PreTest Post Test	4.75±.41 4.67±.52	.111	.742
	Amplitude(mV)	10	PreTest Post Test	9.94±2.76 10.11±2.22	.023	.881
	Distance (mm)	10	PreTest Post Test	280±16.3 283±20.8	.175	.681
	NCV (m/s)	10	PreTest Post Test	58.99±4.13 60.85±5.69	.701	.414
Motor ulnar nerve Elbow area	Latency (ms)	10	PreTest Post Test	4.09±.47 4.34±.44	1.541	.230
	Amplitude(mV)	10	PreTest Post Test	8.98±2.42 9.52±1.50	.359	.322
	Distance (mm)	10	PreTest Post Test	242.0±11.3 247.0±10.6	1.037	.322
	NCV (m/s)	10	PreTest Post Test	59.66±5.85 57.17±4.55	1.129	.302
Motor ulnar nerve Above elbow area	Latency (ms)	10	PreTest Post Test	1.80±.23 1.78±.32	.021	.886
	Amplitude(mV)	10	PreTest Post Test	9.05±1.89 10.46±1.58	3.281	.087
	Distance (mm)	10	PreTest	107.0±6.7	.327	.574

			Post Test	109.0±8.7		
	NCV (m/s)	10	PreTest Post Test	60.95±9.80 63.21±14.34	.169	.686

P<0.05

As shown in Table 2, the dominant hand wrist area motor median nerve latency pre-test value was 4.75±0.41 ms, post-test value was 4.67±0.52 ms, and there was no statistical difference between them (p>0.05). The dominant hand motor median nerve wrist area amplitude pre-test value was 9.94±2.76 mV, post-test value was 10.11±2.22 mV, and there was no statistical difference between them (p>0.05). The dominant hand motor median nerve wrist-area distance pre-test value was 280.0±16.3 mm, post-test value was 283.5±20.8 mm, and there was no statistical difference between them (p>0.05). The dominant hand motor median nerve wrist area NCV pre-test value was 58.99±4.13 m/s, post-test value was 60.85±5.69 m/s, and there was no statistical difference between them (p>0.05).

The dominant hand above-elbow-area motor ulnar nerve latency pre-test value was 4.09±0.47 ms, post-test value was 4.34±0.44 ms, and there was no statistical difference between them (p>0.05). Elbow-area amplitude pre-test value was 8.98±2.42 mV, post-test value was 9.52±1.50 mV, and there was no statistical difference between the two (p>0.05). The elbow-area distance pre-test value was 242.0±11.3 mm, post-test value was 247.0±45.5 mm, and there was no statistical difference between them (p>0.05). Elbowarea NCV pre-test value was 59.66±5.85 m/s, post-test value was 57.17±4.55 m/s, and there was no statistically significant difference between them (p>0.05).

The dominant hand above-elbow-area motor ulnar nerve latency pre-test value was 1.80±0.23 ms, post-test value was 1.78±0.32 ms, and there was no statistical difference between them (p>0.05). The above-elbow area amplitude pre-test value was 9.05±1.89 mV, post-test value was 10.46±1.58 mV, and there was no statistical difference between them (p>0.05). The above-elbow area distance pre-test value was 107.0±6.7 mm, post-test value was 109.0±8.7 mm, and there was no statistical difference between them (p>0.05). Above-elbow area NCV pre-test value was 60.95±9.80 m/s, post-test value was 63.21±14.34 m/s, and there was no statistically significant difference between them.

The non-dominant hand motor median and ulnar EMG values of the athletes involved in the study are shown in Table 3.

Table 3: *Non-dominant hand motor median and ulnar EMG values*

NerveArea	Parameters	N	Test	X	f	P
Motor mediannerve wristarea	Latency (ms)	10	PreTest Post Test	4.74±.41 5.04±.42	2.536	.129
	Amplitude(mV)	10	Pre Test Post Test	8.84±2.67 9.45±2.17	.313	.583
	Distance (mm)	10	Pre Test Post Test	282.0±21.0 285±18.4	.116	.738
	NCV (m/s)	10	Pre Test Post Test	59.58±4.60 56.71±4.29	2.083	.166
Motor ulnar nerve Elbow area	Latency (ms)	10	Pre Test Post Test	4.07±.36 4.26±.50	.894	.357
	Amplitude(mV)	10	Pre Test Post Test	9.58±1.70 10.58±2.25	1.256	.277
	Distance (mm)	10	Pre Test Post Test	241.0±15.2 244.0±11.7	.243	.628
	NCV (m/s)	10	Pre Test Post Test	59.34±5.09 57.74±5.87	.424	.523
Motor ulnar	Latency (ms)	10	Pre Test Post Test	1.76±.23 1.73±.15	.076	.785

nerve Above elbow area	Amplitude(mV)	10	Pre Test Post Test	9.69±1.97 10.19±1.97	.322	.578
	Distance (mm)	10	Pre Test Post Test	105.0±5.3 101.0±3.2	4.235	**.040***
	NCV (m/s)	10	Pre Test Post Test	60.35±7.11 58.37±5.31	.498	.489

*:P<0.05

As shown in Table 3, the non-dominant hand wrist-area motor median nerve latency pre-test value was 4.74±0.41 ms, post-test value was 5.04±0.42 ms, and there was no statistical difference between them (p>0.05). The wrist area amplitude pre-test value was 8.84±2.67 mV, post-test value was 9.45±2.17 mV, and there was no statistical difference between them (p>0.05). The wrist-area distance pre-test value was 282.0±21.0 mm, post-test value was 285.0±18.4 mm, and there was no statistical difference between them (p>0.05). Wrist area NCV pre-test value was 59.58±4.60 m/s, post-test value was 56.71±4.29 m/s, and there was no statistically significant difference between them (p>0.05).

The non-dominant hand elbow area motor ulnar nerve latency pre-test value was 4.07±0.36 ms, post-test value was 4.26±0.50 ms, and there was no statistical difference between them (p>0.05). Elbow area amplitude pre-test value was 9.58±1.70 mV, post-test value was 10.58±2.25 mV, and there was no statistical difference between them (p>0.05). The elbow area distance pre-test value was 241.0±15.2 mm, post-test value was 244.0±11.7 mm, and there was no statistical difference between them (p>0.05). Elbow area NCV pre-test value was 59.34±5.09 m/s, post-test value was 57.74±5.87 m/s, and there was no statistically significant difference between them (p>0.05).

The non-dominant hand above-elbow area motor ulnar nerve latency pre-test value was 1.76±0.23 ms, post-test value was 1.73±0.15 ms, and there was no statistical difference between them (p>0.05). The above-elbow area amplitude pre-test value was 9.69±1.97 mV, post-test value was 10.19±1.97 mV, and there was no statistical difference between them (p>0.05). The above-elbow area distance pre-test value was 105.0±5.3 mm, post-test value was 101.0±3.2 mm, and there was no statistical difference between them (p<0.05). The above-elbow area NCV pre-test value was 60.35±7.11 m/s, post-test value was 58.37±5.31 m/s, and there was no statistically significant difference between them (p>0.05).

4. Discussion and Conclusion

The present study investigates the effect of core training on the motor median and ulnar nerve conduction velocity (NCV) in basketball players. According to the study results, while there was no statistically significant difference in the dominant hand motor median and ulnar NCV measurements made after the core training, a statistical difference was found in the "distance" parameter in the non-dominant hand median and ulnar NCV measurement

While basketball branch mainly focuses on being strong on the field (20), it is also necessary to pay attention to the strengthening of the core region, which allows transferring the force generated from the lower extremities of the body to the upper extremities (15). In basketball, shooting is an act that compels the upper extremities (21). However, there is also a high risk of neurovascular injury to the shoulder and elbow as a result of strenuous activities involving the upper extremity (13). Looking at the studies on NCV, which has a positive relationship with physical performance, Hung et al. (2009) found that exercise had a positive effect on nerves and NCV, in particular (22). In their study of electrophysiological changes in the upper extremity nerve messages in female volleyball players, Bağçeci et al. (2011) found a statistical difference between the control group in terms of the median nerve NCV values of the right hand (23). Singh and Kaur (2015) found a statistically significant difference in the NCV values of female archers hands, holding and pulling the bow (24). While found a statistically significant difference between the NCV values in the elbow area of the dominant and non-dominant hands of disabled baseball pitchers and healthy pitchers (25), and between the NCV values in the elbow area of the dominant and non-dominant hands of healthy pitchers, they found no difference in the above-elbow area. In their study, Waghmare et al. (2015) found a statistical difference between the motor ulnar nerve NCV values of the dominant and non-dominant hands of table tennis players and the control group (26). Borges et al. (2013) found a difference between the motor median nerve values of handball players' dominant and non-dominant hands(27). What is common all these studies

is that the measurements were generally made in athletes in sports branches where the limbs located in the upper extremity are more active, such as throwing and hitting, and where the dominant arm is much more heavily used than the non-dominant arm. Therefore, investigation of the effect of both lateral and long-term chronic exercise on NCV indicates that the natural increase in strength has a positive relationship with NCV. This is also directly related to athlete profiles and applied training programs.

In the presented study, no statistical relationship was found between core training and dominant hand median and ulnar NCV ($p<0.05$) (Table 2). In the non-dominant hand, a statistical difference was found only in the above-elbow region "distance (mm)" value, while there was no difference in other parameters (Table 3). Similar to the study results, Altıncı (2015) found no statistical difference in NCV values of the dominant and non-dominant hands of volleyball players (17). Çolak et al. (2004) reported no statistical difference between motor median nerve NCV values of tennis players and sedentary people(18). Bamaç et al. (2014) found no statistical difference in NCV values in the elbow region of the dominant hands of basketball players and control group (13). These results may be due to active use of the non-dominant hand in many movements specific to the sports branch, despite the significant role of the dominant hand, especially in basketball and tennis branches. In other words, the relative closure of the gap in the strength differences between the two hands after many years of training was also reflected in the measurements made. Yet, we can state that there is a strong positive relationship between the strength and NCV (9). The training programs applied to athletes is the prominent factor determining this relationship.

As a result, it was found that 8-week core training had no statistically significant effect on both dominant and non-dominant hands of basketball players in terms of motor NCV values ($p>0.05$). We believe that this may be due to the stress and pressure that may occur in these areas, especially since basketball players use their wrist and elbow joints excessively. Moreover, although it is known that core training applied as an exercise shows its effect quickly on sedentary individuals, it may be recommended to extend the intensity and duration of the exercise in order to increase its effect on professional athletes. For a contribution to further studies, it can be recommended to investigate changes in NCV values in different exercise protocols and sports branches in order to identify the parameters and chemical changes that are believed to have an effect.

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References

1. Stoppel, W. L., Kaplan, D. L., & Black III, L. D. (2016). Electrical and mechanical stimulation of cardiac cells and tissue constructs. Advanced drug delivery reviews, 96, 135-155.
2. Kamijo, K.,Nishihira, Y., Hatta, A., Kaneda, T., Wasaka, T., Kida, T., & Kuroiwa, K. (2004). Differential influences of exercise intensity on information processing in the central nervous system. European journal of applied physiology, 92(3), 305-311.
3. Kashihara K, Maruyama T, Murota M, and Nakahara Y. (2009). Positive effects of acute and moderate physical exercise on cognitive function. J PhysiolAnthropol28:155–164.
4. Morgan, J. A.,Corrigan, F., &Baune, B. T. (2015). Effects of physical exercise on central nervous system functions: a review of brain region specific adaptations. Journal of molecular psychiatry, 3(1), 3.
5. Guo, L. Y.,Lozinski, B., &Yong, V. W. (2020). Exercise in multiple sclerosis and its models: Focus on the central nervous system outcomes. Journal of neuroscience research, 98(3), 509-523.
6. Çankaya, T. (2012). İzometrik, konsantrik ve eksantrik kontraksiyonlarla yapılan direnç egzersizleri sonrası toparlanma sürecinde kas hasarı ve emg cevaplarının incelenmesi. Doktora Tezi, Abant İzzet Baysal Üniversitesi Sağlık Bilimleri Enstitüsü Antrenörlük Eğitimi Anabilim Dalı, Bolu.
7. Erken, H. A., Erken, G., Çolak, R., & Genç, O. (2013). Exercise and DHA prevent the negative effects of hypoxia on EEG and nerve conduction velocity. High altitude medicine & biology, 14(4), 360-366.
8. Boonla, O.,& Prasertsri, P. (2018). Lipid Peroxidation, Nerve Conduction Velocity and Physical Performance among Male University Athletes. Journal of Exercise Physiology Online, 21(5).
9. Martinez-Valdes, E.,Farina, D., Negro, F., Del Vecchio, A., & Falla, D. (2018). Early motor unit conduction velocity changes to high-intensity interval training versus continuous training. Medicine&Science in

Sports &Exercise, 50(11), 2339-2350
10. Özbek, A.,Bamaç, B., Budak, F., Yenigün, N., Çolak, T. (2006). Nerve conduction study of ulna rnerve in volleyball players. Scand J MedSci Sports,16, 197–200.
11. Fleisig, G.S.,Barrentine, S.W., Escamilla, R.F. (1996). Biomechanics of over hand throwing with implications for injuries. Sports Med. 21(6), 421-437.
12. Soslu, R., Özer, Ö., & Çuvalcioğlu, İ. C. (2018). The Effects of Core Training on Basketball Athletes' Antioxidant Capacity. *Journal of Education and Training Studies*, *6*(11), 128-134.
13. Bamaç, B., Çolak, T., Çolak, S., Bayazit, B., Demirci, D., Meriç, B., Dündar, G., Selekler, M., Bahadır, T., Özbek, A. (2014). Evaluation of nerve conduction velocities of the median, ulnar and radial nerves of basketball players. *İnternational Sport Med Journal, Vol: 15 No:1*, 1-12.
14. Wirth, K.,Hartmann, H., Mickel, C., Szilvas, E., Keiner, M., &Sander, A. (2017). Core stability in athletes: a critical analysis of current guidelines. Sports medicine, 47(3), 401-414.
15. Cole, B. &Panariello, R. (2016). Basketball anatomy. Human Kinatics.
16. Borghuis, J.,Hof, A. L., &Lemmink, K. A. (2008). The importance of sensory-motor control in providing core stability. Sports medicine, 38(11), 893-916
17. Altıncı, E. E. (2015). *Voleybolcularda el bileği kas kuvveti ile sinir ileti hızlarının karşılaştırılması*, Doktora Tezi, Kocaeli Üniversitesi Sağlık Bilimleri Enstitüsü, Kocaeli.
18. Çolak, T.,Bamaç, B., Özbek, A., Budak, F., Bamaç, Y. S. (2004). Nerve conduction studies of upper extremities in tennis players. Br J Sports Med, 38, 632–635
19. Soslu, R., Özer, Ö., Güler, M., & Doğan, A. A. (2019). Is there any Effect of Core Exercises on Anaerobic Capacity in Female Basketball Players?. *Journal of Education and Training Studies*, *7*(3), 99-105.
20. Bennett, E. V., Scarlett, L., Hurd Clarke, L., &Crocker, P. R. (2017). Negotiating (athletic) femininity: The body and identity in elite female basketball players. Qualitative Research in Sport, Exercise and Health, 9(2), 233-246.
21. Chen, W. C.,Lo, S. L., Lee, Y. K., Wang, J. S., &Shiang, T. Y. (2005). Effects of upper extremity fatigue on basketball shooting accuracy. In ISBS-Conference Proceedings Archive
22. Hung, J-W.,Liou, C-W., Wang, P-W., Yeh, S-H., Lin, L-W., Lo, S-K ve Tsai, F-M. (2009). Effect of 12-week taichichuan exercise on peripheral nevre modulation in patients with type 2 diabetes mellitus. J Rehabil Med, 41, 924-929.
23. Bağçeci, A. M., Boşnak, M., Yiğiter, R., Yılmaz, M., Çakmak, E. A., Bağcı, C. (2011). The study of electrophysiological changes in nerve conduction of upper extremities in female volleyball players. *Gaziantep Tıp Dergisi, 17(2),* 51-56.
24. Singh, S. &Kaur, S. (2015). Study of motor nerve conduction velocities of upper extremity in the female rchers. International Journal of Physical Education, Sports and Health, 1(6), 31-33.
25. Wei, S-H.,Jong, Y-J., Chang, Y-J. (2005). Ulnar nerve conduction velocity in injured baseball pitchers. Arch Phys Med Rehabil, 86, 21-25.
26. Waghmare, V. S.,Shesha, S., Jiwane, R., Sadawarte, S. K., Rahule, A. S. (2015). Effect of table tennis as recreational sport on upper limb nerve conduction velocity. J ContMed A Dent, 3 (1), 29-32.
27. Borges, L. P. N. C.,Leitao, W. C. V. &Ferreira, J. O. (2013). Measurement of motor nerve conduction velocity in three different sports. Rev Bras Med Esporte, Vol: 19, No: 5, 328-331.

Dual CAR-Targeted Natural Killer Cell Lines Demonstrate Potent Cytotoxic Properties Towards Breast Cancer Cells

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Abstract

Reducing the incidence of side effects from T-cell and NK-cell immunotherapy with chimeric receptors requires precise targeting of effector cells to tumor cell populations. Most malignant neoplasms do not express unique tumor neoantigens; therefore, it may be necessary to use the recognition of a combination of several surface molecules for targeting. Recognition of antigen combinations using paired CARs requires the introduction of extended expression constructs into effector cells, which limits the use of lentiviral vectors as transduction vessels. To overcome this limitation, we tested paired CARs containing antigen-recognizing sequences based on camelid single-domain antibodies, which are characterized by relatively small size and high specificity and affinity properties. Paired CARs containing activating-co-stimulatory, or activating-inhibiting receptors were tested on cell cultures of triple-negative breast cancer, which conferred that this strategy allows targeting of immune cells, in particular linear natural killer cells, to highly malignant subpopulations of cancer cells.

Keywords: Breast cancer, natural killer cell lines chimeric antigen receptors,CAR, CD44, CD24, MSLN, immunotherapy.

1. Introduction

Among the methods of targeted therapy for malignant neoplasms, the use of exogenous effector immune cells is the most promising. T lymphocytes and natural killer cells can be targeted towards a specific type of tumor cells by ectopic expression of chimeric antigen receptors that recognize certain tumor antigens. This approach allows to achieve high selectivity of action and to reduce the unwanted effects of therapy on normal cells of the body (1).

One of the fundamental disadvantages of current CAR-T-cell or CAR-NK-cell therapy is its high cost: each patient requires to manufacture personalized cellular therapeutics. Autologous immune cells are isolated from the patient's blood, then cultured and expanded *in vitro*, after which the cells are transduced with vectors for CAR expression and selected, to expand the fraction of cells that express the transgene (2). This labor-intensive process limits the widespread use of this therapeutic approach. Production costs can be significantly reduced by utilizing stable natural killer and T-lymphocyte cell lines as carriers of CAR. These cell lines, established from the biopsy samples of patients with T-cell or NK-cell neoplasms, have unlimited proliferative potential and can retain the ability to be activated and exhibit cytotoxic properties against tumor cells (3). For example, natural killer cells of the NK-92 line are being actively evaluated as carriers of chimeric antigen receptors for the treatment of neoplasms (4). We were able to isolate and establish another line of natural killer cells, NKL-7, which can also be targeted against tumor cells with chimeric receptors.

The presence on the surface of a tumor cell of an unique protein molecule that is not found on normal cells of the body - a tumor neoantigen - is not a characteristic feature of most malignant tumors. More commonly, these tumor antigens are also present on some of the normal types of cells of the body, albeit in smaller quantities. Tumor cells can also be identified by a certain combination of surface antigens which is uncharacteristic for normal cells. Paired chimeric receptors that recognize combinations of two or more antigens can be used to accurately target cell-based immunotherapeutics. In this system, binding of one receptor from a pair causes incomplete activation of the effector cell, for example, by triggering signal transmission through the intracellular portion of CD3zeta. Binding of another tumor antigen by the second chimeric receptor in a pair activates costimulatory signals via CD28 and/or 4-1BB, which complements the signal from CD3zeta and leads to full activation of the effector function of the immune cell (5). To recognize tumor cells characterized by increased expression of one of the antigens and diminished levels of the second antigen, inhibitory CAR based on the intracellular domain of CD45 can be used as a second in a pair (6).

Genetic modification of immune cells with constructs for CAR expression can be carried out either by direct chemical transfection, electroporation, or by using viral vectors. Of the latter, one of the simplest and most effective methods is lentiviral transduction. Lentiviral vectors provide rapid and constant expression of the transgene and can transduce a significant fraction of the cell population after a single round of infection. The disadvantages of this approach include the limited capacity of the vector, which can hinder the introduction of paired chimeric receptors within a single construct. Traditionally, scFvs derived from monoclonal antibodies are used as antigen-recognition domains in the CAR (7). ScFv molecules are relatively large, and may also have a reduced ability to bind the target molecule compared to the natural form of the mAb. As an alternative scaffold for the antigen recognition, variable antibody domains of camelid single-domain antibodies (VHH-antibodies) can be used for construction of smaller CARs (8). VHH fragments are characterized by small size and high antigen binding characteristics even in the absence of antibody constant domains. Constructs for expression of paired antigen receptors based on this scaffold are relatively small and could be introduced into effector cells in a single lentiviral vector.

A malignant tumor is a heterogeneous structure that contains cells that differ in their antigenic composition, the ability for indefinite growth and invasion. Besides the bulk of "differentiated" cells that have limited proliferative potential, the tumor contains cancer stem cells (CSCs), which are responsible for the tumor relapse after surgery and chemotherapy. These cells are also directly involved in the formation of tumor metastases. A number of studies have shown that CSCs of many malignant breast tumors can be characterized by increased expression of CD44 (9), CD133 (10), and mesothelin receptors (MSLN) (11). Also, breast cancer CSCs are characterized by decreased expression of the CD24 receptor (12).

Previously, we selected VHH-fragments of alpaca antibodies that specifically recognize the CD44, CD24, CD133, and MSLN receptors. These VHH-fragments were utilized to construct lentiviral vectors for the expression of single, paired coactivating and paired activating-inhibiting chimeric receptors. In the present study, we evaluated the comparative antitumor efficacy of linear natural killer cells expressing various combinations of chimeric receptors against triple-negative breast cancer cell lines HCC70 and MDA-MB-468 (13) that possess some features of the common TNBC CSC phenotype.

2. Materials and Methods

2.1. Cell Cultures

All cells were cultured in an atmosphere containing 5% CO2 at 37°C. The HCC70 and MDA-MB-468 TNBC cell lines were obtained from the American Type Culture Collection (ATCC). MDA-MB-468 were cultured in RPMI 1640 medium (PAA, Austria); HCC70 were cultured in DMEM/F12 medium (PAA, Austria). The media were supplemented with 10% fetal bovine serum, 2 mM alanyl-glutamine (PanEco, Russia), 20 mM HEPES, and the antibiotics penicillin, and streptomycin. HEK-293T packaging cell line were cultured in DMEM/F12 medium (PAA, Austria) supplemented with 10% fetal bovine serum. Cultivation of NK-92 was performed in RPMI-1640 medium (PAA, Austria) supplemented with 20% of fetal calf serum and horse serum in equal proportions, 2 mM alanyl-glutamine (PanEco, Russia), 20 mM HEPES, 0.2 mM inositol, 0.1 mM 2-mercaptoethanol, 1 µM water-soluble hydrocortisone (Sigma-Aldrich, USA), 20 µM folic acid and recombinant IL-2 at a final concentration of 10 ng/ml. NKL-7 cell line was cultured in AIM-V media (Thermo, USA) with AlbuMAX, supplemented with 10% fetal bovine serum and 5 ng/ml of IL-15.

2.2. Plasmids and Constructs

For packaging of lentiviral vectors, we used packaging plasmid psPAX2 (contains lentiviral structural proteins) and pMD2-G (encodes vesicular stomatitis virus G protein). The plasmid was kindly provided by Didier Trono. For pseudotyping with measles glycoproteins, the plasmid pMD2-FΔ30 was used, which encodes a fragment of the F protein of the measles virus of the ESC vaccine strain with a cytoplasmic domain truncated by 30 amino acids. The plasmid construction was described previously (14). In combination with pMD2-FΔ30, the plasmid pCG-4AHcΔ24 was used, which was previously constructed from pCG-HcΔ18 provided by Jacob Reiser (Addgene plasmid # 84817; http://n2t.net/addgene:84817; RRID: Addgene_84817). Lentiviral vectors for CAR expression were previously constructed on the basis of pLSF-@CD20-119-tagRFP by either replacing the antigen recognition sequence for VHH@MSLN or VHH@CD133 for the generation of single CAR-expressing constructs, or by duplicating the CAR expressor sequence and splitting signaling endodomains between dual CARs (first CAR – CD28 and CD137 coactivation domains,

second CAR - CD3z domain); for activating-inhibiting CAR pair first CAR contained all three signaling domains and the inhibiting CAR had CD45 tyrosine phosphatase domain. Both CARs were expressed under the control of SFFV promoter with P2A cleavage sequence put between the first CAR sequence and the second CAR, followed by T2A and tagRFP fluorescent marker sequence for transgenic cell detection.

2.3. Lentivirus Production

Lentiviral particles was generated in HEK293T cell line. One day prior to the transfection, packaging cells were plated on 150-mm cultural dishes at $2.5x10^7$ cells per dish. The medium was changed to Opti-MEM (Gibco, United States) without the supplements immediately prior to transfection. The virus packaging plasmids and lentiviral vector construct were mixed in the lactate buffer (20mM sodium lactate, 150mM NaCl, pH=4) in the proportions of 8:8:7:1 (vector plasmid:psPAX2:pMD2-FΔ30:pCG-4AHcΔ24) in the amount of 45 ug total. Plasmid mixture was combined with linear PEI solution freshly prepared in lactate buffer which contained 225 ug of PEI 25 kDa (Polysciences, United States). The mixture was incubated for 10 min, diluted 5-fold in Opti-MEM and added to cells. The cultures were incubated for 3–4 h, and the medium was changed to complete DMEM/F12 supplemented with 10% serum and an antibiotic. Next day, the medium was changed to DMEM/F12 supplemented with Serum replacement solution and lipid mixture (Peprotech, USA). The virus-containing medium was collected after 48-h incubation and used to infect cells in further experiments.

2.4. Lentiviral Transduction of NK Cell Lines

Viral transduction was performed for 8-12 hours on NK-92 and NKL-7 cells in the concentration of at least $5x10^5$ per ml. Polybrene at a concentration of 8 µg/ml and all required supplements for the cultivation of each cell line, as well as BX795 at a concentration of 3 µM, were added to the medium containing the virus at the time of infection. After transduction, the medium was replaced with complete growth medium used for normal cultivation of each cell line. The efficiency of the transduction was assessed after 48 hours. Infectious viral titers and transduction efficiency were determined using a flow cytometry by detecting the size of tagRFP-positive cell fraction.

2.5. Co-Culturing and Assessment of Cytotoxic Effects

For co-culturing assay, the TNBC cell lines were seeded on 96-well plates with CAR-transduced NK cells in the ratio of 1:10 (tumor cell: NK cell). Control cultures contained only tumor cells without NK cells, or NK cells alone seeded in the same amount. Co-cultures were incubated for 48 hours, after which the media containing non-adherent NK cells was removed and the cytotoxicity was assessed by measuring the cell proliferation with homogenous luminescent assay CellTiter-Glo® (Promega, USA) according to manufacturers recommendations. Briefly, the cells were washed with PBS and the CellTiter-Glo® Reagent was added to each cell in the amount of 100 ul. The plate was incubated at 37C with shaking for 5 minutes and the luminescence was measured on the multimode microplate reader (Dynex, USA).

2.6. Analysis

When analyzing the results, the luminescence values reflecting the number of living cells for the control cultures were taken as 100% for each line. The percentage of luminescence for the experimental groups was calculated relative to the control wells, followed by subtracting the luminescence value of the wells with a single culture of natural killer cells. This calculation allowed to estimate the proportion of living tumor cells in co-culture and the reduction of tumor cell population compared to control wells.

3. Results

3.1. Natural killer cells lines NKL-7 and NK-92 can be efficiently transduced with paired-CAR lentiviral vectors

After transduction of both cell lines with concentrated stocks of lentiviruses expressing different CAR constructs, on the 4th day after transduction, the proportion of CAR-expressing cells was assessed using flow cytometry followed by sorting of tagRFP-positive cells (Fig. 1)

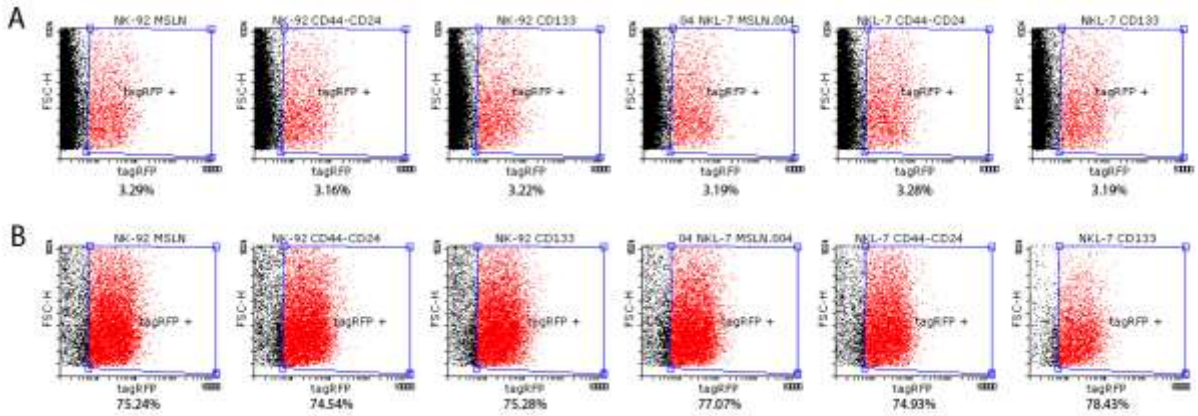

Figure 1. *A. The proportion of transduced cells on the 4th day after infection with viral stocks, and B. - 7 days after cultivation of the selected tagRFP-positive cell fractions*

Data suggests that both cell lines are moderately sensitive to transduction with concentrated stocks of lentiviral vectors pseudotyped with measles virus glycoproteins. A single transduction was sufficient to obtain fractions of CAR-expressing cells suitable for flow sorting. After sorting, the proportion of CAR-positive cells in each preparation exceeded 75%.

3.2. CAR-expressing natural killer cells inhibit growth of HCC70 tumor cells

The triple-negative breast cancer cell line HCC70, which possesses the $CD44^{+}CD24^{+/-}MSLN^{+}$ phenotype, was used to test the potential antitumor efficacy of NK-92 and NKL-7 natural killer (NK) cells that express single anti-MSLN chimeric receptors, or paired chimeric receptors against CD44-CD24 (activating-inhibiting) and CD44-MSLN (activating-coactivating).

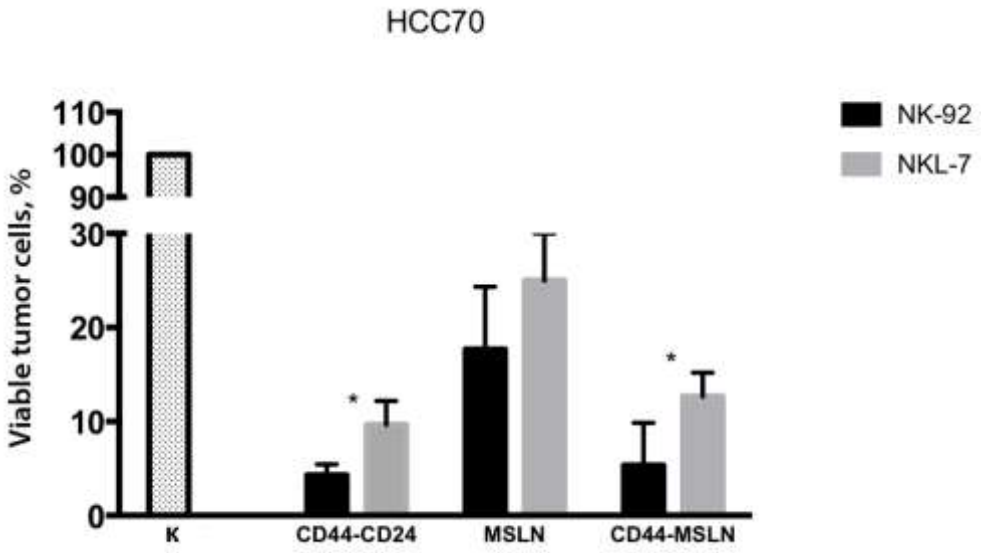

Figure 2. *The proportion of live HCC70 tumor cells after 48 hours of incubation with transgenic NK-92 and NKL-7 cells expressing chimeric receptors against MSLN or antigen combinations CD44-CD24 and CD44-MSLN. The control group (C) shows the survival of HCC70 tumor cells without the addition of natural killer cells. Results are presented as mean values with standard deviation, each value obtained from triplicate repetitions.*
** - differences are statistically significant between groups NK-92 and NKL-7, Kruskal-Wallis test ($p < 0.05$)*

The study of the antitumor effect of CAR-expressing natural killer cells on the HCC70 cell line showed that all three chimeric receptor constructs can mediate a pronounced cytotoxic effect (Figure 2). For CD44-CD24 paired CARs, the survival rate of tumor cells was 4.3% and 9.6%, respectively, when treated with transgenic NK-92 and NKL-7 expressing chimeric receptors against CD44-CD24. For the MSLN single CAR,

the sensitivity of tumor cells to CAR-expressing NK cells was the lowest. The survival rate in this experiment setup was 17.6% when co-incubated with NK-92 and 25% when co-incubated with NKL-7 expressing anti-MSLN CARs. For natural killer cells targeting a pair of CD44-MSLN tumor antigens, the cytotoxic effect was more pronounced and the survival of tumor cells decreased to 5% and 12.6% when treated with NK-92 and NKL-7, respectively.

3.3. CAR-expressing natural killer cells inhibit growth of MDA-MB-468 tumor cells

To test chimeric receptor combinations that contain antigen-recognition domains targeting CD133, a triple-negative breast cancer cell line MDA-MB-468, which has a $CD44^{+}CD24^{+/-}CD133^{+}$ phenotype, was selected. This cell line was used to test NK-92 and NKL-7 cells that were transduced with constructs with single anti-CD133 chimeric receptor, and paired chimeric receptors against the CD44-CD24 (activating-inhibiting) and CD44-CD133 (activating-coactivating) antigens.

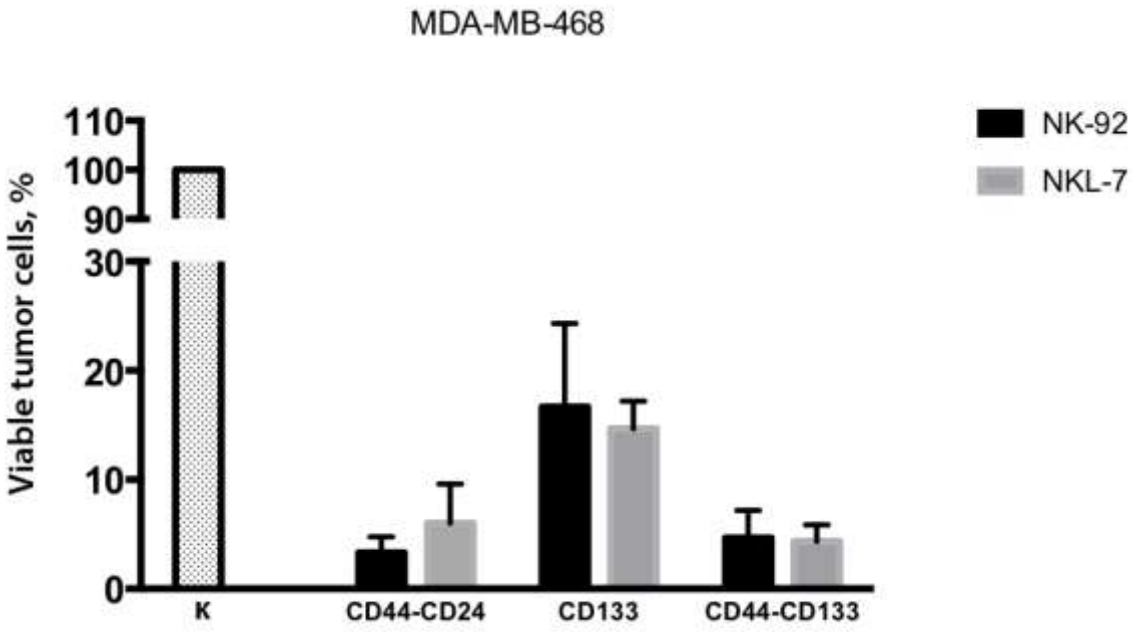

Figure 3. *The proportion of living tumor cells of the MDA-MB-468 line after 48 hours of incubation with transgenic NK-92 and NKL-7 expressing chimeric receptors against CD133 or antigen combinations CD44-CD24 and CD44-CD133. The control group (C) shows the survival of MDA-MB-468 tumor cells without the addition of natural killer cells. Results are presented as mean values with standard deviation, each value obtained from triplicate repetitions*

All six samples of CAR-expressing natural killer cells showed the pronounced ability to inhibit growth of tumor cells in culture, but with varying efficacy (Figure 3). When using NK-92 and NKL-7 cells expressing CARs targeted to CD44-CD24, the survival of tumor cells dropped to 3.3% and 6%, respectively. When MDA-MB-468 cells were co-incubated with natural killer cells targeting CD133, the cancer cell survival was 16.6% and 14.6% compared to control values. For CAR-expressing NK cells directed to CD44-CD133, MDA-MB-468 survival rate was about 4% both when co-incubated with NK-92 and when co-incubated with NKL-7. The use of natural killer cell lines directed against a pair of antigens proved to be more efficient than therapy targeted to single type of antigen. There were no statistically significant differences in the efficiency of therapy with different natural killer cell lines between NK-92 and NKL-7.

4. Discussion

When comparing the effect of natural killer cell lines with different CAR combinations on HCC70 tumor cells, it can be seen that within each group, the use of NK-92 turned out to be more efficient, with the CD44-CD24 and CD44-MSLN groups demonstrating statistically significant advantage in efficiency over NKL-7. When comparing the effects of different CARs it can be concluded that a single receptor for MSLN is less effective than paired CARs targeted to CD44-CD24 and CD44-MSLN. Considering that NKs expressing paired CARs to CD44-CD24 and CD44-MSLN demonstrate similar efficiency, and that the CAR to CD24 in the CD44-CD24 pair is inhibitory, while CAR to CD44 has a complete set of activating endodomains, it can be assumed that the CAR to CD44 is the main contributor to the development of cytotoxic action in both pairs of chimeric receptors.

For the MDA-MB-468 cell line, NK cells carrying paired CARs to CD44-CD24 and CD44-CD133 also exhibited a stronger cytotoxic effect than NKs with CARs to CD133. On this basis, it can be assumed that in this case as well, CAR to CD44 acts as the most efficient trigger of the antitumor effect of NK cell lines. Since the tumor population is heterogeneous, in the absence of one type of receptor on the surface of the tumor cell, transgenic natural killer cells can recognize the object when the second antigen is expressed. It should be noted, however, that paired coactivating CARs to CD133 and MSLN in this case rather act as modulators for more accurate targeting of NK to a specific subpopulation of cancer cells.

5. Conclusions

Testing of natural killer cell lines that express different variants of chimeric receptors on two breast cancer cell lines showed that natural killer cells expressing CARs against a pair of antigens have a more pronounced antitumor effect as compared to NK therapy with a single chimeric receptor. This effect can be explained both by an increase in the general immune signal transduction upon simultaneous activation of two receptors, and by an increased likelihood of recognition of a tumor cell by a natural killer. Among the tested NK cell lines, NK-92 cells targeting CD44-CD24, CD44-MSLN, and CD44-CD133, as well as NKL-7 cells against CD44-CD133 caused the 95% reduction of tumor cell population.

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References

1. Sadelain M. CAR therapy: the CD19 paradigm. J Clin Invest [Internet]. 2015 Sep 1;125(9):3392–400. Available from: https://www.jci.org/articles/view/80010
2. Tumaini B, Lee DW, Lin T, Castiello L, Stroncek DF, Mackall C, et al. Simplified process for the production of anti–CD19-CAR–engineered T cells. Cytotherapy [Internet]. 2013 Nov;15(11):1406–15. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1465324913005872
3. Suck G, Odendahl M, Nowakowska P, Seidl C, Wels WS, Klingemann HG, et al. NK-92: an 'off-the-shelf therapeutic' for adoptive natural killer cell-based cancer immunotherapy. Cancer Immunol Immunother [Internet]. 2016 Apr 11;65(4):485–92. Available from: http://link.springer.com/10.1007/s00262-015-1761-x
4. Chen Y, You F, Jiang L, Li J, Zhu X, Bao Y, et al. Gene-modified NK-92MI cells expressing a chimeric CD16-BB-ζ or CD64-BB-ζ receptor exhibit enhanced cancer-killing ability in combination with therapeutic antibody. Oncotarget [Internet]. 2017 Jun 6;8(23):37128–39. Available from: https://www.oncotarget.com/lookup/doi/10.18632/oncotarget.16201
5. Jensen MC, Riddell SR. Design and implementation of adoptive therapy with chimeric antigen receptor-modified T cells. Immunol Rev [Internet]. 2014 Jan;257(1):127–44. Available from: http://doi.wiley.com/10.1111/imr.12139
6. Rhee I, Veillette A. Protein tyrosine phosphatases in lymphocyte activation and autoimmunity. Nat Immunol [Internet]. 2012 May 18;13(5):439–47. Available from: http://www.nature.com/articles/ni.2246
7. Chen W, Yuan Y, Jiang X. Antibody and antibody fragments for cancer immunotherapy. J Control Release [Internet]. 2020 Dec;328:395–406. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0168365920304612

8. Xie YJ, Dougan M, Jailkhani N, Ingram J, Fang T, Kummer L, et al. Nanobody-based CAR T cells that target the tumor microenvironment inhibit the growth of solid tumors in immunocompetent mice. Proc Natl Acad Sci [Internet]. 2019 Apr 16;116(16):7624–31. Available from: http://www.pnas.org/lookup/doi/10.1073/pnas.1817147116
9. Zhang H, Brown RL, Wei Y, Zhao P, Liu S, Liu X, et al. CD44 splice isoform switching determines breast cancer stem cell state. Genes Dev [Internet]. 2019 Feb 1;33(3–4):166–79. Available from: http://genesdev.cshlp.org/lookup/doi/10.1101/gad.319889.118
10. Brugnoli F, Grassilli S, Al-Qassab Y, Capitani S, Bertagnolo V. CD133 in Breast Cancer Cells: More than a Stem Cell Marker. J Oncol [Internet]. 2019 Sep 16;2019:1–8. Available from: https://www.hindawi.com/journals/jo/2019/7512632/
11. Morello A, Sadelain M, Adusumilli PS. Mesothelin-Targeted CARs: Driving T Cells to Solid Tumors. Cancer Discov [Internet]. 2016 Feb 1;6(2):133–46. Available from: http://cancerdiscovery.aacrjournals.org/cgi/doi/10.1158/2159-8290.CD-15-0583
12. O'Conor CJ, Chen T, González I, Cao D, Peng Y. Cancer stem cells in triple-negative breast cancer: a potential target and prognostic marker. Biomark Med [Internet]. 2018 Jul;12(7):813–20. Available from: https://www.futuremedicine.com/doi/10.2217/bmm-2017-0398
13. Croker AK, Goodale D, Chu J, Postenka C, Hedley BD, Hess DA, et al. High aldehyde dehydrogenase and expression of cancer stem cell markers selects for breast cancer cells with enhanced malignant and metastatic ability. J Cell Mol Med [Internet]. 2009 Aug 2;13(8b):2236–52. Available from: http://doi.wiley.com/10.1111/j.1582-4934.2008.00455.x
14. Hamad A, Chumakov SP. Engineering a recombinant Herpesvirus saimiri strain by co-culturing transfected and permissive cells. Bull Russ State Med Univ [Internet]. 2019 Dec 31;(2019;6):37–44. Available from: https://vestnikrgmu.ru/archive/2019/6/6/abstract?lang=en

Sudden Cardiac Death of Athletes and Pre-Participation Screening: The Youth League Coach Perspective

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Abstract

The sudden cardiac death (SCD) risk of young athletes at competitive level is higher compared to non-athletes but sports are trigger in the presence of a cardiovascular anomaly rather than a risk factor itself. So, the pre-participation screening (PPS) is crucial but the health system in Turkey is still insufficient. It is important for that the coaches understand the importance of PPS and recognize the symptoms. The aim of this study is to evaluate the knowledge of the coaches on SCD and PPS. This is a descriptive online-survey study for the youth league coaches in Turkey. At the end of the survey, a bullet-point type info sheath was provided to the participants. Knowledge of the participants were evaluated by true/false (T/F) and multiple-choice questions. Number of correct answers to 6 T/F questions is calculated as the T/F score and was a major outcome. Scores greater than 4 accepted as successful. Knowing the timing and frequency of PPS was the other major outcome. There were participants 335 from 47 cities and 22 branches (16.42% female, mean age was 36.56). 50.15% claimed being educated on the subject. Both the T/F score, and success rate in T/F questions were higher for coaches from universities other than sports sciences which is surprising (p=0.001). Correct answer rate for the timing and frequency of PPS was higher for the coaches who had further education after high school (p=0.016). Referral rate even for the cardiac symptoms such as chest pain was less than 90%. Referral to a physician for possibly risky symptoms is low, showing the lack of awareness. Knowledge is better for coaches' form universities other than sports sciences. Education on SCD and PPS should be implemented at all stages of coach education and the higher education of the coaches should be supported.

Keywords: Sudden cardiac death, Pre-participation screening, Coaches' knowledge, Sports.

1. Introduction

Sudden cardiac death (SCD) is an unexpected death due cardiac causes that occurs within 1 hour of symptoms in a person without known cardiac disease.[10] SCD is the 85% of the sudden deaths in sport while the rest is traumatic.[22] Although SCD is possible at any age, it is more common at high school ages.[15] SCD of a young athlete is especially devastating as it could occur without a warning in a seemingly perfectly healthy person.[8]

Despite the study of Corrado et al which showed that the SCD risk of young athletes at competitive level is 2.5 times higher compared to non-athletes; sports is considered to be trigger in the presence of a cardiovascular anomaly rather than a risk factor itself.[7] So the pre-participation screening (PPS) is crucial to identify and restrict the risky athletes.

In Turkey, PPS could be performed at the primary health care setting both by family medicine specialists (FMSs) and by general practitioners (GPs), also at the sports medicine clinics and at cardiology clinics. There is a guideline, but there is no legal regulation for the process. So, it is extremely important that the families and coaches, and even the athletes are educated about SCD to realize the symptoms if there is any and to mind about the PPS.

Training and development of coaches in Turkey is undertaken by the Ministry of Youth and Sports, Sports Federations, colleges of physical education and sports of universities or coaching departments of Faculties of Sports Sciences working in coordination with each other.[16] Trainees who have graduated from these institutions or successfully completed the program are eligible to coach at certain levels. In addition, coaches are required to participate in different national and international development seminars each year in order to be active, to work in clubs and to increase their levels.

The content of the courses in the coaches education programs and the university curriculum of the universities, includes some courses related with sports medicine such as sports anatomy, sports physiology,

sports medicine, sports injuries and causes, and first aid.[2,3,11,16]

First Aid Course is compulsory in the trainer seminars organized by the federations of basketball, volleyball, tennis and gymnastics.[12,14] Only in Turkish Football Federation (TFF), it is expected to get "First Aid certificate" approved from Ministry of Health, Emergency Medical Professionals Association, Red-Crescent or provincial health directorates as a prerequisite for participating the TFF coaches training program.[13]

When the content of these courses and expected learning outcomes are evaluated, it is assumed that coaches will be able to analyze situations where an individual's life is in danger and to provide first aid for respiratory and circulatory problems.[25] On the other hand, analyzing the signs such as early fatigue to prevent SCD is a different perspective and requires education on the topic.

Adolescent athletes are the risky population and insufficiency of the health system on PPS is on the front burner. The coaches are the ones who have more than 5 minutes to observe and evaluate and athlete unlike the physician. Considering the possible influence of the coach on both the family and the athlete, warning from a coach could actually save a life; yet the studies with coaches in the literature are a few and incomprehensive. So, this study aims to evaluate the knowledge of the youth league coaches on SCD and PPS and take attention to the subject and inform the coaches about the basics of the topic.

2. Materials and Methods

This a descriptive survey study which aims to evaluate the knowledge of the youth league coaches on SCD ad PPS, take attention to the topic and inform about the basics of it. The study protocol was approved by the Middle East Technical University Human Research Ethics Review board (Approval number: 178-ODTÜ-2020)

2.1. Survey

The participants of the present study sampled randomly The survey was prepared online via software Qualtrics XM (Provo, UT, USA).

The survey consists of an informed consent and 3 parts following it. The first part questions the age, gender, specialty, experience years and the city they work along with the education status in a stepwise pattern. The second part consists of 6 true or false questions, and the number of correct answers to these questions is calculated as the T/F score. T/F scores 5 and 6 are taken as successful.

The third part questions what the coaches think about the timing and frequency of PPS in a multiple-choice question. Then the symptoms that require medical care is questioned in multiple choice & multiple answer type. The symptoms listed were based on the Turkish Medical Association (TMA) primary care pre-participation screening guideline, health information form of the Turkish Ministry of Health (TMoH) and the 14-element American Health Association (AHA) recommendations for the pre-participation cardiovascular screening of competitive athletes.[24] [18]

At the end of the survey there was a one-page info sheath with bullet points which includes the definition of SCD, important epidemiology on SCD and stats on PPS along with the explanation of why PPS is important and how could it prevent SCD.

2.2. Participants & Settings

The aim was to reach as many youth leagues coaches as possible, so non-probabilistic sampling was used. The online survey was distributed via WhatsApp, e-mail and social media with a snowball effect. The coaches older than 18 years that worked at the youth league in Turkey at any branch were included. The survey did not allow any participants younger than 18, anyone who was not graduated from high school or coaches has never worked in youth league; so these are excluded. The survey was active for 1 month (1st December 2019- 31st December 2019). Required sample size was calculated via G*Power 3.1 (GPower statistical power analyses, Düsseldorf, 2007). With alpha 0.05 and power being 0.95, 74 participants are required for regression analysis and 176 participants are required for t-test. 392 coaches participated to the study; 8 of them rejected the consent form and 49 did not completed the survey; remaining 335 were included.

2.3. Variables & Analysis

Demographics were used as independent variables.

The city was considered important to see whether coaching in a big city has an effect or not. Cities with population >2.500.000 were taken as big cities (İstanbul, Ankara, İzmir, Antalya).[23]

Work experience years were taken into account to see whether the knowledge is gained by education or by experience; asked in 5-year groups.

Level of education (high school, university, PhD) first analyzed in 5 groups (high school graduates, university students, university graduates, PhD students, PhD graduates). Then in dichotomous manner, coaches were grouped accordingly whether they had further education after high school or not. Type of high school was grouped as sports specific high school or else. University type was grouped to 5 first which are the 4 divisions in sports sciences (coaching, physical education -PE- teacher, recreation, sports management) and anything else. Then analyzed in dichotomous way as sports sciences or else.

Outcome measures were T/F score (number of correct answers to true or false questions), knowing the timing and frequency of PPS and knowing the important symptoms to refer.

StataMP13 (StataCorp. Stata Statistical Software: Release 13) was used for descriptive and inferential analyzes. Chi square, fisher exact test, t-test, and anova were used for univariant analysis when appropriate and logistic regression for multivariant analysis. $p<0.05$ was considered significant.

3. Results

Out of 335 participants, 278 (82.99%) are male, 55 (16.42%) are female and 2 (0.60%) didn't want to specify. The mean age is 36.56 (std 10.27, min 19, max 60).

There are participants from 47 cities, majority (57.31%) from Ankara (101, 30.15%), İstanbul (51, 15.22%), İzmir (23, 6.87%) and Antalya (17, 5.07) which are the 4 big cities in Turkey as shown in Figure 1. Further analysis was made accordingly whether the participant is from these 4 major cities or not.

Figure 1. *Cities that the participants work as youth league coaches. Each color represents a different geographical region of Turkey*

There are participants from 22 different branches, majority from basketball (116, 34.63%) and football (61, 18.21%) which are the two most popular sports in Turkey. Other branches are gymnastics, handball, tennis, swimming, table tennis, volleyball, athletics, climbing, archery, triathlon, water polo, judo, taekwondo, darts, fitness, kick box, ice hockey, skating, wrestling (from more common to less common).

There are 25 participants (7.46%) with work experience less than 1 year and 12 participants (3.58%) with more than 30 years. The work experience was 1-5 years for 90 (26.87%), 6-10 years for 72 (21.49%), 11-15 years for 61 (18.21%), 16-20 years for 39 (11.64%), 21-25 years for 24 (7.16%) and 26-30 years for 12 (3.58%).

3.1. Educational status and education on SCD and PPS

Educational status of the participants is summarized in Figure 2. Only 24 (7.16%) participants are from sports specific high schools. Only 26 (7.76%) are just high school graduates where 175 participants (52.24%) are university graduates (Table 1). 242 participants (78.32%) are from sports sciences departments.

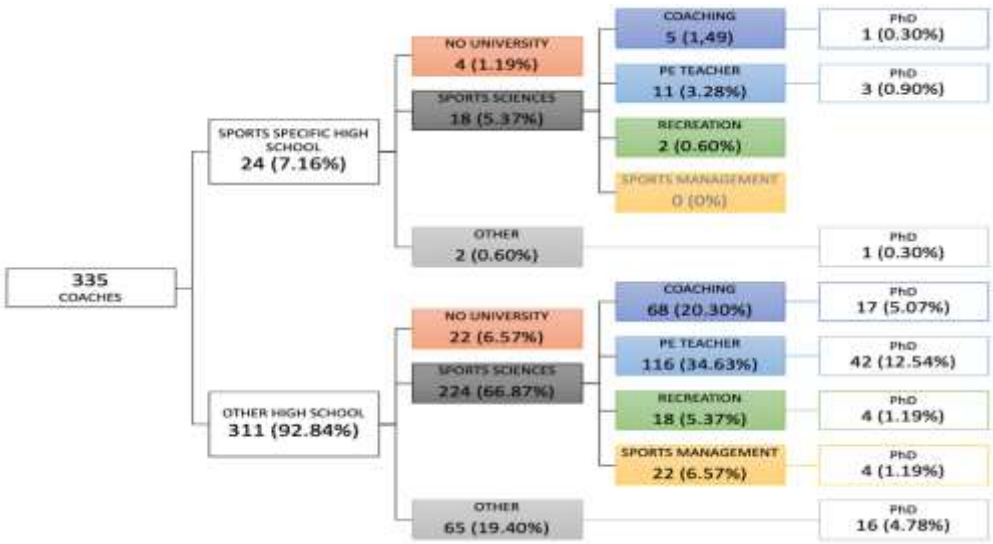

Figure 2. *Educational status summary of the participants. University students and graduates given togther. PhD students and gradutes given together. PE teacher: physical education teacher*

Being educated / informed about the SCD and PPS at any time was asked, there were 50.15% affirmative answers. Percent of being educated is only 38.46% for high school graduates, 51.43% for university graduates and 65.15% PhD graduates; p= 0.006 (Table 1).

3.2. PPS timing and frequency

Frequency and timing of the PPS was asked in a multiple-choice question and 95.82% of the coaches answered correctly. In univariant analysis, educational status was found to be a significant factor both in 5 groups pattern (p=0.036) and in dichotomous pattern (p=0.003). Percent of knowing correct timing and frequency is 84.62%% for high school graduates, 96.00%% for university graduates and 98.48% PhD graduates (Table 1).

Table 1. *Educational Status of the Participants with Rates of Being Educated on the Subject and Rate of Knowing the Timing & Frequency of PPS*

Educational Status	Frequency (Percent)	Educated On SCD And PPS		Knowing Timing And Frequency Of PPS	
High School	26 (7.76%)	10 (38.46%)		22 (84.62%)	
University Student	46 (13.73%)	14 (30.43%)	158 (51.13%)	44 (95.65%)	299 (96.76%)
University Graduate	175 (52.24%)	90 (51.43%)		168 (96.00%)	
Phd Student	22 (6.57%)	11 (50.00%)		22 (100.0%)	
Phd Graduate	66 (19.79%)	43 (65.15%)		65 (98.48%)	
Univariant P [a]		0.006*	0.215	0.036*	0.003*
Univariant P [b]		0.356	-	-	0.016*

Note. . SCD: Sudden Cardiac Death, PPS: Preparticipation Screening,

[a] Univariant p values are from chi-square test.

[b] Multivariant p value is from logistic regression.

* p<0.05

Educational status (further education after high school or not) was found to be a significant factor in

multivariant analysis too (p=0.016). No other factor was found to be significant. All p values for univariant and multivariant analysis are given in Table 2.

Table 2. *Univariant and Multivariant Analysis Results for Being educated on SCD and PPS, for Success in T/F Questions and for Knowing the Correct Timing and Frequency for PPS.*

	Education on SCD & PPS		Knowing Timing & Frequency of PPS		T/F Success Rate	
	Uni	**Multi**	**Uni**	**Multi**	**Uni**	**Multi**
Gender	0.401	0.249	0.842	0.428	0.159	0.377
Age	0.324	0.417	0.763	0.712	0.359	0.062
Branch	0.416	0.895	1.000	0.456	0.365	0.821
Big City	0.875	0.970	0.264	0.298	0.408	0.727
Experience Years	0.308	0.244	0.890	0.333	0.399	0.096
Educational Status						-[G]
5 Groups [A]	0.006*	0.356	0.036*	-	0.725	
Dichotomous [B]	0.215	-	0.003*	0.016*		
High School Type	0.093	-[E]	0.997	-[F]	0.941	0.630
University Type		-[E]		-[F]		
5 Groups [C]	0.299		0.874		0.003*	-
Dichotomous [D]	0.084		0.362		0.000*	0.001*
Education On Topic	-	-	0.270	0.473	0.966	0.987

Note 1. SCD: Sudden Cardiac Death, PPS: Preparticipation Screening, T/F: True or False,
Note 2. Uni: Univariant Analysis, Multi: Multivariant Analysis. Univariant P values are from chi square tests. Multivariant p value is from logistic regression.
Note 3. Gender and age were included for adjustment.
[a] 5 groups of educational status: high school graduate, university student, university graduate, phd student, phd graduate
[b] Dichotomous groups of educational status: no further education after high school (high school graduates), further education after high school (university and phd students and graduates)
[c] 5 groups of university type: 4 branches of sports sciences; coaching, physical education teacher, recreation, sports management; and any other university
[d] Dichotomous groups of university type: Sports sciences, any other university
[e] For education, high school type and university type were not included multivariant analysis due being subgroups of educational status.
[f] For knowledge on frequency and timing, high school type and university type were not included multivariant analysis due being subgroups of educational status.
[g] For success, educational status was not included in multivariant analysis due high school type and university type being subgroups of it.
* p<0.05

3.3. T/F scores

6 true false questions were given to the participants. The statements, correct answers and correct answer percentages are given in Table 3.

Table 3. *True or False Statements That Were Given to the Participants, Correct Answers and Correct Answer Percentages.*

	STATEMENT	COREECR ANSWER	CORRECT ANSWER PERCENTAGE (%)
1	The SCD risk of young athletes at competitive level is higher compared to non-athletes	TRUE	44.18
2	Sports is a risk factor for SCD.	FALSE	57.01
3	The most common cause of SCD in sports is trauma.	FALSE	49.25

4	PPS must be performed before each season.	TRUE	99.10
5	PPS is only for symptomatic athletes.	FALSE	98.21
6	PPS is more important for elite athletes.	FALSE	68.06

The mean score is 4.16 (std 0.96, min 1, max 6). Branch (p=0.204), working in a big city (0.852), work experience years (p=0.272), educational status (p=0.637), type of high school (p=0.133), or being informed about the subject (p=0.872) has no significant effect on the T/F score. On the other hand, type of university both in 5 groups (p=0.018) and in dichotomous manner (p=0.001) is a significant factor that affects the T/F score. Mean T/F score is higher for coaches' form universities other than sports sciences; 4.49 vs 4.05, p=0.001 (Table 3).

Table 4. *University Type of The Participants With Mean T/F Scores And Success Rate in T/F Questions.*

Unıversıty Type	**Frequency (Percent)**	**Mean T/F Score (Std)**		**Success Rate In T/F Questıons**	
Ss - Coachıng	73 (23.62%)	3.99 (0.94)	4.05 (0.95)	28.77%	32.23%
Ss – Pe Teacher	127 (41.10%)	4.09 (0.95)		33.86%	
Ss - Recreatıon	20 (6.47%)	4.00 (1.03)		30.00%	
Ss –Management	22 (7.12%)	4.05 (0.95)		36.36%	
Other	67 (21.68%)	4.49 (0.93)		58.21%	
Univariant P [a]		0.018*	0.001*	0.003*	0.000*
Univariant P [b]		-	-	-	0.001*

Note. T/F: True Or False, Ss: Sports Sciences, Pe: Physical Education, Std: Standard Deviation

[a] Univariant P Values Are From Anova For 5 Gorups Fashion, T-Test For Dichotomous Manner Of T/F Scores And Chi Square For Success Rate.

[b] Multivariant P Value İs From Logistic Regression.

* P<0.05

The scores 5 and 6 were taken as successful and 128 coaches (38.21%) were successful. In univariant analysis, type of university both in 5 groups (p=0.003) and in dichotomous manner (p=0.000) has a significant effect on success. 58.21% of the coaches from universities other than sports sciences was successful compared to 32.86% coaches from sports sciences departments (Table 3). University type was also found to be a significant factor in multivariant analysis (p=0.001). No other factor was found to be significant. All p values for univariant and multivariant analysis are given in Table 2.

3.4. Symptoms

In the last part of the survey, 19 symptoms that could be observed during effort were given from current guidelines, and the coaches were asked which ones should be referred to a physician. 4 symptoms were from the AHA 14- element screening guideline (chest pain / tightness, syncope, early fatigue) and were especially important. Referral percent is less than 90% for all of the symptoms, even for the ones that are known to be cardiac origin. Referral ratio for chest pain is the highest (84.48%), followed by palpitations (83.88%) and chest tightness (83.58%). For syncope the referral percentage is 78.51%, and for early fatigue it is as low as 52.54%. All questioned symptoms with referral ratios are given in Figure 3.

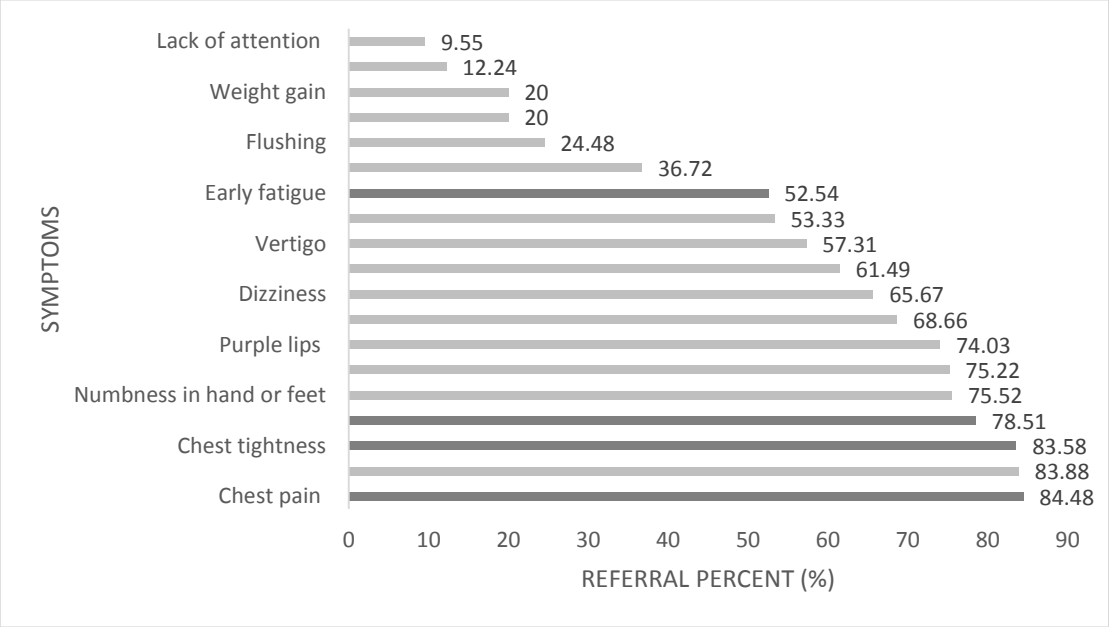

Figure 3. *Symptoms questioned in the last part of the survey. The darker colored 4 are from the AHA 14- element screening guideline*

4. Discussion

Sudden cardiac death (SCD) of an athlete is a rare but traumatic incident as it takes significant media attention. Also, it creates discussion in various communities as it has athletic, medical and legal aspects.[5,19] Risk of SCD is more for competitive young athletes compared to non-athletes, and the study of Corrado et al. which compares the pre and post screening era in Italy shows the significant effect of pre-participation screening (PPS) in reducing SCD almost 90%.[6,7] In Turkey, although there is a guideline for the PPS, there is no legal regulation.[24] Our previous study on the approach of primary health care physicians to SCD and PPS showed the lack of standardization and awareness on the subject.[9]

The aim of this study is to evaluate the knowledge of the youth league coaches on SCD and PPS as they are the ones who have the chance to observe the athletes during effort and they have an influence both on the athlete and the family. Considering the insufficiency in the health system, a warning from a coach could actually save a life. So, the survey included a bullet point style info sheath on the subject.

4.1. Results, Validity, Generalizability

The calculated sample size was 176 and there were 335 participants. Participants were from 47 different cities (there were participants from all 7 geographical regions, seen in Figure 1), all ages (from 18 to 60) and 22 different branches. So, it could be said that the snowballing effect was useful. Also, the distribution of the participants from the cities (more from major cities) and branches (more from popular branches) were coherent with the reality.

Out of 392 participants who started to survey, 8 rejected to give consent and 49 did not complete the survey. The median duration to complete the survey was 4.22 minutes and completion rate of the survey was 85.46%.

Being educated on SCD and PPS was both dependent and independent variable in the study. Overall ratio was 50.15%, which means that the half of the coaches were uneducated on the subject regardless of branch, work experience years, educational status, high school or university type according to the multivariant analysis. Moreover, being educated on the subject has no significant effect on T/F scores or knowing the timing & frequency of PPS. These proves the insufficiency/ inadequacy in education on the subject at all levels.

True or false statements were chosen carefully to be tricky. Apparently the first and third ones are the hardest ones. The statement "The SCD risk of young athletes at competitive level is higher compared to non-athletes" is true as the study of Corrado et al. proved.[7] Only 44.18% has answered this correctly. The third

statement "The most common cause of SCD in sports is trauma" answered 49.25% correctly, is false as almost 85% of the SCD are cardiac related.[22] These are tricky as the athletes are seemed and assumed to be the healthy ones in the community. The second statement "Sports is a risk factor for SCD." answered 57.01% correctly and tricky because although the risk is higher for the athletes, sports is considered to be a trigger in the presence of an underlying cardiovascular anomaly rather than a risk factor itself. The fourth and fifth ones "PPS must be performed before each season." and "PPS is only for symptomatic athletes." has high correct answer ratios (99.10% and 98.21 respectively), which is good as this shows that the coaches know at least the basics. The sixth statement "PPS is more important for elite athletes." is false as an underlying heart condition would manifest before, most likely at high school ages.[15] Although each PPS is important, the first one and the ones for the youth league are more important, which points out the importance of the youth league coaches.

T/F score was one of the major outcomes of the study and the one factor that has significant effect on it was the type of university. Both the T/F score, and success rate in T/F questions were higher for coaches from universities other than sports sciences which is surprising. The reason for this result might be the extra effort of coaches from disciplines to educate themselves on sports related topics with extra courses and reading.

Other major outcome was knowing the timing and frequency of PPS as it is important that the coaches should lead the athlete to PPS. The significant factor affecting this both in univariant and multivariant analysis was the education level. Correct answer rate was higher for the ones who had further education after high school which points out the importance of higher education in sports community.

Referral ratios for the possible symptoms of an underlying cardiovascular condition such as chest pain / tightness is less than 90%; which means missing 1 out of 10 athletes. The rate is as low as 52.54% for early fatigue and this shows that either the risk of SCD is underestimated by the coaches or the possible symptoms are not known.

4.2. Previous studies and contribution to literature

SCD is a hot topic so there are many up to date publications mostly focusing on the medical aspect. There are a few studies focusing on the athletic staff and their qualifications. For example, the study of Johnson et al. questions the application 3 best practice recommendations -emergency action plan (EAP), access to automated external defibrillator (AED), and coach training on cardiopulmonary resuscitation (CPR) and AED use- in high schools in Oregon. Study showed that only 11% implemented all 3 recommendations.[17] Similar to this, in the study of Schneider et al. school principals and sports managers from West Virginia are questioned on hiring standards for coaches. Apparently 31% reported 'never' when asked if all coaches were required to be certified in CPR and first aid.[21] The study of Cater et al. evaluates the perspective of the coaches and managers on the subject; shows that they are positive in manner but does not evaluate knowledge.[4]

From Turkey, there is a study which investigates the presence of EAP, AED and ambulance in Turkish football leagues (super-league and 1st, 2nd, 3rd leagues). Only 5.2% of the stadiums has AED, as it is not legally obliged and only 27.6% of the teams has CPR training programs.[20]

One similar study to ours, study of Adams et al. also questioned some symptoms and asked some open ended questions to secondary school coaches and concluded that they unaware of the potential causes of exertional heart stroke (EHS) or the symptoms associated with it, and they had higher perceived levels of self-confidence in management abilities than indicated by their perceived knowledge level.[1]

So, most of the present literature is on preparedness for an emergency, and there is not much from Turkey. This study is unique as it investigates the knowledge of the youth league coaches from Turkey on SCD & PPS in general and evaluates the ability of coaches to recognize risky athletes prior to an emergency. Also, the results are quantitative and both univariant and multivariant analysis were performed.

4.3. Limitations

Since non-probabilistic sampling is used, it can be assumed that already interested coaches are more likely to participate and therefore the survey results may look better than the reality. As this is a survey study, it should be remembered that it is not possible to validate the answers of the participants especially

for the symptoms part.

4.4. Implications & Further studies

Education on SCD and PPS should be at all levels including high school. Addition to education he coaches and even the sports managers, informing the athletes and the parents is critical. As the physician and coach perspectives are investigated, next step could be evaluating the approach of the athletes and their parents.

5. Conclusion

Informed Consent: Online informed consent was obtained from the participants.
Conflict of Interest: No conflict of interest was declared by the authors.
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References

1. Evéquoz D, Zuber M, Erne P. [Sudden cardiac death: definition, mechanisms and risk factors]. Praxis. 1996;85(7):188-96.
2. Thomas M, Haas TS, Doerer JJ, Hodges JS, Aicher BO, Garberich RF, et al. Epidemiology of sudden death in young, competitive athletes due to blunt trauma. Pediatrics. 2011;128(1):e1-8.
3. Futterman L, Lemberg L. Sudden death in athletes. American Journal of Critical Care. 1995;4(3):239-43.
4. DeFroda SF, McDonald C, Myers C, Cruz AI, Owens BD, Daniels AH. Sudden Cardiac Death in the Adolescent Athlete: History, Diagnosis, and Prevention. The American journal of medicine. 2019;132(12):1374-80.
5. Corrado D, Basso C, Rizzoli G, Schiavon M, Thiene G. Does sports activity enhance the risk of sudden death in adolescents and young adults? Journal of the American College of Cardiology. 2003;42(11):1959-63.
6. Göral M., Yapıcı AK., Koç H. Antrenör Eğitimi Dumlupınar Üniversitesi Sosyal Bilimler Dergisi. 1999;2.
7. Spor Eğitimi Dairesi Başkanlığı Kademelere Göre Müfredatlar http://sporegitim.sgm.gov.tr/: Spor Eğitimi Dairesi Başkanlığı; 2013 [
8. Marmara Üniversitesi Spor Bilimleri Fakültesi Antrenörlük Eğitimi https://sporbilimleri.marmara.edu.tr/2015 [
9. Gazi Üniversitesi Antrenörlük Eğitimi Bölümü Antrenörlük Eğitimi Bölümü Lisans Programı Ders Programı http://sporbilimleri-antrenorluk.gazi.edu.tr/2015 [
10. Türkiye Basketbol Federasyonu Eğitim Dersleri https://www.tbf.org.tr/antrenor-islemleri/egitim-dersleri2013 [
11. Türkiye Voleybol Federasyonu Antrenör Eğitim Talimatı http://www.tvf.org.tr/tvf-talimatlar/2013 [
12. Türkiye Futbol Federasyonu Teknik Adamların Eğitimi Talimatı https://www.tff.org/Resources/TFF/Documents/TALIMATLAR/Teknik-Adamlarin-E%C4%9Fitimi-ve-Siniflandirilmasi-Talimati.pdf2018 [
13. Yanardag M., Yılmaz İ. Sağlık ve İlkyardım Pegem Akademi; 2017.
14. Ülkar B, Ünal F, Ulutaş Y. Birinci Basamak Sağlık Hizmetlerinde Spora Katılım Belgesi Hazırlama Rehberi. Kolu TTBAH, editor. Ankara: Hermes Tanıtım Ofset Ltd. Şti.; 2018.
15. Maron BJ, Friedman RA, Kligfield P, Levine BD, Viskin S, Chaitman BR, et al. Assessment of the 12-lead electrocardiogram as a screening test for detection of cardiovascular disease in healthy general populations of young people (12-25 years of age): a scientific statement from the American Heart Association and the American College of Cardiology. Journal of the American College of Cardiology. 2014;64(14):1479-514.
16. TUIK. Türkiye İstatistik Kurumu Yıllara ve İllere Göre Nüfus Dağılımı: TUIK; 2019 [cited 2020 11 April 2020]. Available from: http://www.tuik.gov.tr/UstMenu.do?metod=temelist.
17. Chandra N, Bastiaenen R, Papadakis M, Sharma S. Sudden cardiac death in young athletes: practical challenges and diagnostic dilemmas. Journal of the American College of Cardiology. 2013;61(10):1027-40.
18. Oliva A, Grassi VM, Campuzano O, Brion M, Arena V, Partemi S, et al. Medico-legal perspectives on sudden cardiac death in young athletes. International journal of legal medicine. 2017;131(2):393-409.

19. Corrado D, Basso C, Pavei A, Michieli P, Schiavon M, Thiene G. Trends in sudden cardiovascular death in young competitive athletes after implementation of a preparticipation screening program. Jama. 2006;296(13):1593-601.
20. Dursun M, Bilir E, Kaymaz K, Sakarya S. Pre-participation screening of the athletes in Turkey: approach of primary care physicians. European Journal of Public Health. 2019;29(Supplement_4).
21. Johnson ST, Norcross MF, Bovbjerg VE, Hoffman MA, Chang E, Koester MC. Sports-Related Emergency Preparedness in Oregon High Schools. Sports health. 2017;9(2):181-4.
22. Schneider K, Meeteer W, Nolan JA, Campbell HD. Health care in high school athletics in West Virginia. Rural and remote health. 2017;17(1):3879.
23. Cater C, MacDonald M, Lithwick D, Sidhu K, Isserow S, McKinney J. Perspectives on pre-participation cardiovascular screening in young competitive athletes: U SPORTS. The Physician and sportsmedicine. 2018;46(4):509-14.
24. Özbilgin Ş, Kuvaki B, Hancı V, Ungur G, Tu Tu Ncu O, Koca M, et al. Preparedness for sudden cardiac arrest at sports arenas: A survey in Turkey. Anatolian journal of cardiology. 2016;16(10):818.
25. Adams WM, Mazerolle SM, Casa DJ, Huggins RA, Burton L. The secondary school football coach's relationship with the athletic trainer and perspectives on exertional heat stroke. Journal of Athletic Training. 2014;49(4):469-77.

Response of The Cardiovascular System of Adolescent Students of Specialized Universities in Tyumen to a Dosed Physical Load

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Abstract

After dosed physical load, 104 young men had a favourable type of response of heart rate and systolic blood pressure in the first minute of the recovery period. In 32 first-year students of Tyumen universities, hypotonic and hypertonic types of cardiovascular system reaction were detected, indicating low functional capabilities of central hemodynamics. This is due to the hypodynamia and hypokinesia that took place in connection with passing exams at school and entering University, as well as the emotional mood during the exams.

Keywords: adolescent students of universities, Martine-Kushelevsky test, cardiovascular system, hypodynamia and hypokinesia.

Introduction

Over the past decades, health deterioration of school leavers and University students is registered, which is a serious social and medical problem [1, 2, 6, 7, 25]. Thus, a study of the schoolchildren incidence in the Ulyanovsk region [11] showed that 59.4% of all students (8597 people) attend the main physical education group, 26.8% attend the preparatory group, 5.2 % attend the special group, and 8.6% of students are exempt from physical education lessons.

The presidential decree "On the All-Russian sports complex "Ready for Labour and Defense" set an ambitious goal: "to create an effective system of physical education aimed at developing human potential and strengthening the health of the population ", in particular students [3, 19].

The most important attention in our country is paid to the issues of restoring and preserving health of the population, including when doing physical education and sports [4, 20, 21, 22, 28].

In this regard, the modern higher school faces the problem of restoring and preserving the health of students, from the moment they enter the university until graduation. In the complex system for assessing the functional state of the body of students, the cardiovascular system (CVS) is assigned, both in a state of physiological rest and after dosed physical load [9, 10, 12, 13, 14, 15, 17, 26, 27, 29].

With a certain degree of confidence, thanks to load testing (only the Martinet-Kushelevsky test is meant), it is possible to estimate the functional capabilities of the central hemodynamics of students who have started physical education in a university environment for the first time. It should be noted that for monitoring and evaluating the functional state of the CVS in the practice of sports medicine, simple and informative indicators are used that characterize the cardiac function, as a single hemodynamic pump, and arterial vessels, i.e. the circulatory system as a whole[7, 16, 18, 23, 24].

We would like to elaborate on some indicators of central hemodynamics. So, the heart rate, systolic and diastolic blood pressure (mmHg) is studied in the article. For this purpose, functional tests are widely used, including the single-stage Martinet-Kushelevsky test.

The functional test, which is often called the Martinet test, is common knowledge among physical education teachers at school and coaches, and now it is referred to as the test with 20 squats in 30 seconds. It should be noted that this test is recommended only for beginners and low-trained athletes. The technique of performing the test consists in the fact that after a 5-minute rest in a sitting position, the subject's blood pressure (BP, mmHg) was measured three times and the pulse was counted with one-minute breaks. Then the subject did 20 deep squats in 40 seconds and sat down again. After that, his blood pressure was measured every minute, and his heart rate was calculated for 15-20 seconds. Normally, i.e., with a favourable (normotensive) type of CVS response to physical activity, blood pressure returned to the initial value in 4 minutes, and heart rate – in 3 minutes.

The Martinet test with 20 squats in 30 seconds improved by B.P. Kushelevsky is currently called the Martinet-Kushelevsky test. It should be especially noted that the test of 20 squats in 30 seconds should be carried out only in beginners and low-trained athletes. The criteria for its assessment are: heart rate, systolic and diastolic blood pressure, and the duration of their recovery to the initial values.

These indicators in a healthy person should return to the values that took place in the state of physiological rest in 4 minutes. If the recovery period lasts 5 minutes, such a CVS response to physical load should be considered favorable, but with a delayed recovery period.

The level of functional capabilities of central hemodynamics is estimated according to the recovery time of these indicators:

- from 1 to 30 seconds (16-18 points) - high;
- from 31 to 60 seconds (13-15 points) - above average;
- from 61 to 120 seconds (7-12 points) - average;
- from 121 to 150 seconds (4-6 points) - below average;
- from 151 to 180 seconds (1-3 points) - low.

In relation to the sample under consideration, we will make a number of judgments. To begin with, is the load in the form of 20 squats dosed? We emphasize that the Martinet-Kushelevsky test is widely used in the assessment of central hemodynamics in athletes of various ages, gender, physical development (meaning the type of constitution, length and weight of the body, length of the lower limbs, etc.), which cannot but affect its results. In this regard, you can get different results of the test, because the physical work done by a professional athlete or an unqualified athlete will not be the same.

Secondly, the term "squat" in no way regulates the measure of the knee flexion angle that the subject must do, which, of course, cannot affect both the time of the test and the quality of the performed squats.

Thirdly, the recovery period after the test can last from 60 to 240 or more seconds (4 min. 60 seconds – then we are talking about the normotensive type of CVS reaction to physical load), depending on the functional state of the CVS of the subject. Therefore, is a heart rate of 60 or even 240 seconds taken as the norm?

Fourthly, significant importance in the evaluation of the sample is attached to the nature of the subject's life activity before the test, i.e., his physical activity. In this regard, it should be taken into account that the test can be carried out at different times of the day (morning, afternoon or evening), in conditions of different illumination and air temperature in the office where the examination is carried out.

Materials and Methods

42 students were examined in the Northern Trans-Ural State Agricultural University (NTUSAU), 37 – in Tyumen State University (TSU), 31 – in Tyumen State Medical University (TSMU) of the Ministry of Health of the Russian Federation. At the Tyumen Industrial University (TIU) 26 students were examined.

When identifying age groups, the "Scheme of age periodization of human ontogenesis", adopted at the VII All-Union conference on problems of age morphology, physiology and biochemistry of the USSR Academy of Pedagogical Sciences (Moscow, 1965) was used.

All young men underwent a standard Martinet-Kushelevsky test. The results of the study were processed on a personal computer using modern electronic programs (STATISTIKA) [5]. The assessment of the significance of differences was carried out using t – criterion of Student.

The principles of voluntariness, individual rights and freedoms guaranteed by Articles 21 and 22 of the Constitution of the Russian Federation, as well as the Order of the Ministry of Health and Social

Development of Russia No. 774n of August 31, 2010 "On the Ethics Council" were observed. The study was conducted in compliance with the ethical standards set out in the Helsinki Declaration and the European Community Directives (8/609 EC) and informed oral consent of students.

Results and Discussion

After dosed physical load, 104 (76.47%) young men had a favourable (normotensive) type of heart rate response in the first minute of the recovery period, because it did not exceed 100% of the initial level (table 1).

Table1. *Central hemodynamics in adolescent students of specialized universities in Tyumen during the Martinet-Kushelevsky test (M±m)*

Indicator		University			
		NTUSAU	TSU	TSMU	TIU
heart rate (HR), rest, beats / min		76,6±1,8	75,2±1,7	79,2±2,0	75,4±1,6
systolic blood pressure (SBP), rest, mmHg		121,2±2,4	119,8±2,5	124,5±2,8	120,6±2,4
diastolic blood pressure (DBP), rest, mmHg		71,3±1,4	68,5±1,2	71,5±1,5	71,7±1,4
Recovery period after physical load	1 minute: HR SBP DBP	 138,5±2,5 149,2±2,6 71,0±1,5	 137,7±2,4 148,4±2,7 68,3±1,6	 139,9±2,6 150,1±2,6 71,1±1,4	 138,4±2,3 147,7±2,5 71,3±1,5
	3 minute: HR SBP DBP	 80,4±2,0 130,6±2,3 71,8±1,4	 79,2±1,8 128,3±2,2 71,7±1,5	 82,5±1,9 130,3±2,3 71,3±1,4	 79,7±1,7 128,0±2,2 70,8±1,3
	4 minute : HR SBP DBP	 77,8±1,7 123,1±2,3 71,6±1,3	 75,6±1,7 119,4±2,5 68,6±1,3	 79,3±1,9 122,2±2,6 71,1±1,4	 75,7±1,7 119,8±2,5 71,5±1,4

So, among first-year students of the Tyumen State Medical University, heart rate increased by 60.7 (56.61%) beats/min in relation to the initial value, among students of NTUSAU - by 61.9 (55.30%) beats/min, among students from TSU - by 62.5 (54.61%) beats/min, in TIU students - by 63.0 (54.48%) beats/min (Fig. 1). The heart rate practically conformed to the values of the initial level at 4th minute of the recovery period.

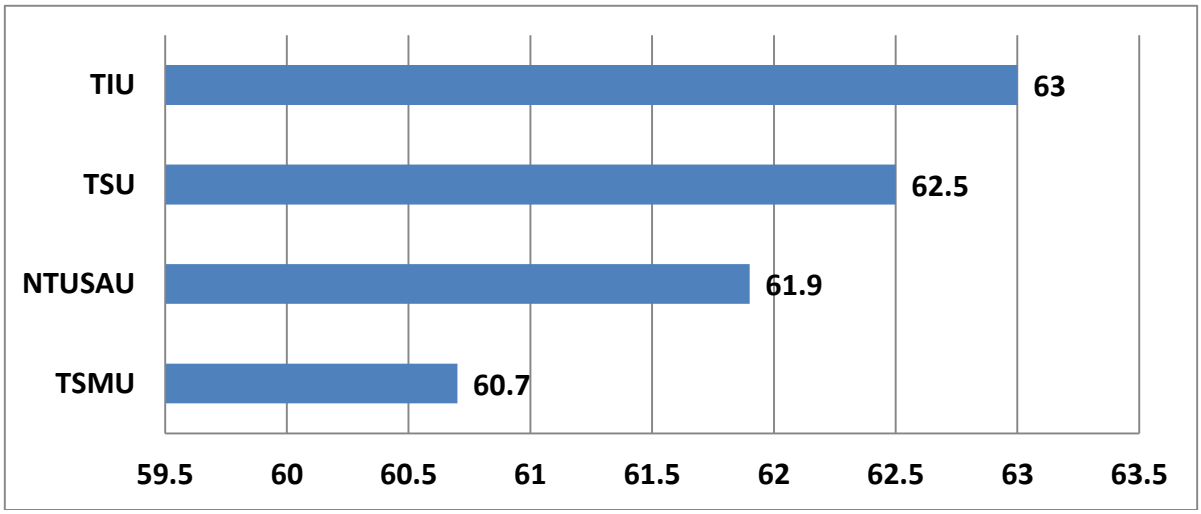

Fig. 1. *Heart rate values in young men of specialized universities in Tyumen at the first minute of the recovery period during the Martinet-Kushelevsky test*

When evaluating the recovery time of heart rate and SBP to the initial level, we should note that the functional capabilities of central hemodynamics in young men were low, since they did not exceed 3 points, because they were within 4 minutes.

The analysis of the SBP values showed that in all the young men it did not exceed the normative 35% increase from the level of the initial value. The increase in systolic blood pressure at the first minute of the recovery period in students of Tyumen State Medical University was 25.6 mmHg (20.65%) from the initial one, in TIU students - 27.1 mmHg (22.47%), in students of NTUSAU - 28.0 mmHg (23.10%), in TSU students - 28.6 mmHg (23.87%) (fig. 2). Systolic blood pressure did not significantly differ from the values of the initial level at the 4th minute of the recovery period ($p > 0.05$).

When assessing the recovery time of heart rate and SBP to the initial level, we should note that the functional capabilities of central hemodynamics in young men were low, since they did not exceed 3 points, because they were within 4 minutes.

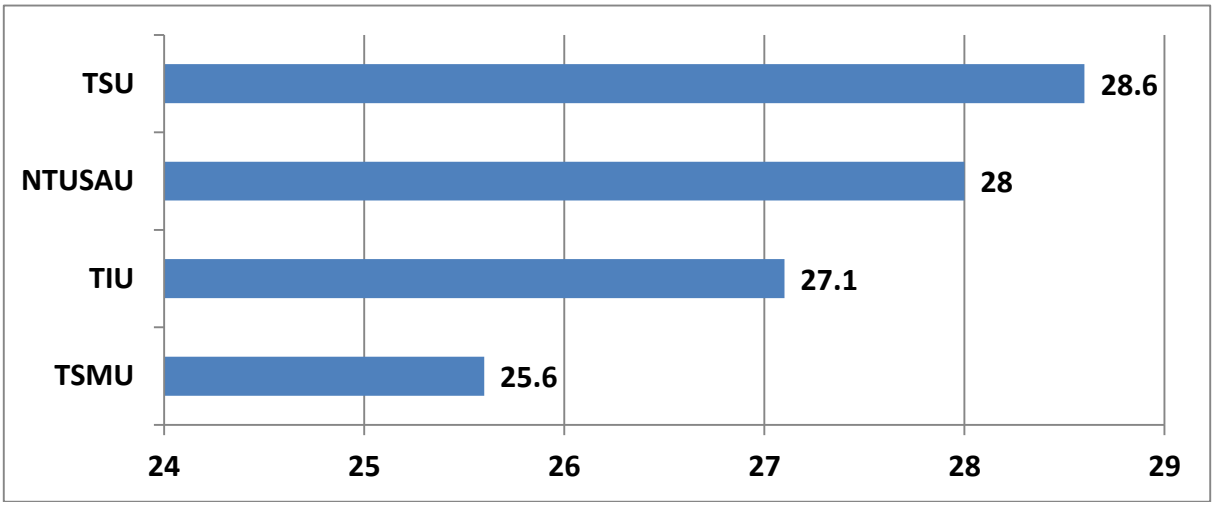

Fig. 2. *Values of systolic blood pressure in young men of specialized universities in Tyumen in the first minute of the recovery period during Martinet-Kushelevsky's test*

Diastolic blood pressure at 1st, 3rd and 4th minutes of the recovery period did not significantly change in comparison with the state of physiological rest ($p > 0.05$).

In 32 (23.53%) first-year students unfavourable responses during the Martinet-Kushelevsky test were revealed (Table 2). These students attended physical education classes in a special medical group.

Table 2. *Types of central hemodynamic responses to dosed physical load during a Martinet-Kushelevsky test in the first-year students of universities in Tyumen.*

University	Type of reaction				
	normotensive	hypotensive	hypertensive.	distonic.	consecutive.
NTUSAU	32	4	6	0	0
TSU	28	4	5	0	0
TSMU	24	3	4	0	0
TIU	20	2	4	0	0
total	104 (76,47%)	13 (9,56%)	19 (13,97%)	0	0

Based on the study, it can be concluded, firstly, that in 104 (76.47%) first-year adolescent students of specialized universities in Tyumen, heart rate after dosed physical activity did not increase by more than 100% of the initial value, and SBP after load did not exceed 35 mmHg, while DBP practically remained at the initial values. Thus, they had a normotensive (favourable) type of reaction of the cardiovascular system to physical activity.

Secondly, in 32 (23.53%) university students in Tyumen, hypotonic (13 - 9.56%) and hypertensive (19 - 13.97%) types of CVS responses to load were diagnosed, which can be interpreted as a decrease in functional capabilities of the organism due to a number of factors: hypodynamia and hypokinesia in connection with the passing of exams at school and entering the university and the emotional mood during the exams.

Conflict of interest. The authors have no conflict of interest to declare.

Research transparency. The study was not sponsored. The authors are responsible for submitting the final version of the manuscript for publication.

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References

1. Besedina, O.A., Lipatova E.E., Akhmadeeva L.R. Mental health of the graduates entrants: prerequisites for the formation of dysfunctional disorders of the nervous system. Electronic scientific and educational bulletin Health and education in the XXI century. 2018; 20(7): 48-52.
2. Bogdanova Yu.Z., Zharkova M.A., Khairullina N.G. On the improving health and familiarizing students and teachers of the agricultural university with a healthy lifestyle.
3. Bogdanova Yu.Z., Zharkova M.A. Actual possibilities of mass physical training, sports and familiarizing inhabitants of northern Trans-Ural to a healthy lifestyle.
4. Bogdanova Yu.Z., Zharkova M.A. On the digitalization of a university education and the possibility of distance foreign language learning of students of agrarian university. Modern Journal of Language Teaching Methods. 2018; 8(12): 185-191.
5. Glants, S. Medico-biological statistics. M.: Praktika; 1998. P. 459.
6. Itskovich, M. M. Research of the concept "health" and its cognitive content in school leavers. Special education. 2015; 3 (39): 25-34.
7. Katsubo E.A., Chevelev A.V., Kulbeda V.S. Assessment of the level of functional state of the cardiovascular system of GSMU students using the Martinet-Kushelevsky test. Actual problems of medicine: Proceedings of the Republican scientific and practical conference and the 26th final scientific session of the Gomel State Medical University (Gomel, 03-04 November 2016). 2017; 363-364.
8. Klimov V.M., Aizman R.I. Assessment of physical health of schools graduates going to the universities. Bulletin of Siberian medicine. 2016; 15(3): 41-47.
9. Kulikova S.V. Assessment of functional reserves of the body of students based on the results of the Martinet-Kushelevsky test. Innovative technologies in sports and physical education of the younger generation: Proceedings of the VII interregional scientific and practical conference with international participation. Moscow, April 20, 2017; 317-320.
10. Kulikova S.V. Assessment of functional reserves of the body of students based on the results of the Martinet-Kushelevsky test. Physical culture, sport, science and education: Proceedings of the first All-Russian scientific conference with international participation. Churapcha, March 29, 2017; 357-361.
11. Marchik L.A., Martynenko O.S. Attitude of schoolchildren and students to their own health and motivation for its maintenance and preservation. Formation of physical culture and health culture of students in the conditions of modernization of education: Proceedings of the All-Russian scientific and practical conference. Yelabuga Institute of Kazan (Volga region) Federal University. Yelabuga, 03-04 February 2017; 128-132.
12. Mikhailova S.V., Kuzmichev Yu.G., Zhulin N.V. Methods of assessment and self-control of physical health of students: manual. Arzamas: Arzamas branch office of Nizhny Novgorod State University, 2017. P. 174.
13. Mikhailova S.V., Kuzmichev Yu.G., Zhulin N.V. Evaluation of the functional state of students based on the results of the step test and the Martinet-Kushelevsky test. Electronic scientific and educational bulletin Health and education in the XXI century. 2016; 18(12): 36-39.
14. Panyukov M.V., Levkov V.Yu., Plotnikov V.P., Tchogovadze A.V., Davudi S.D., Tzoy S.V. The identification of physical capacities according the Martinet-Kushelevsky test and physical development in students with different sport specialization and students of group of general physical training. Russian

medical journal. 2013; 1: 39-41.
15. Prokopiev N.Ya. Sports medicine: approaches to the evaluation of Robinson's index and functional tests of Martinet-Kushelevsky. Strategy of formation of healthy lifestyle by means of physical culture and sports: experience, prospects: Proceedings of All-Russian scientific and practical conference with international participation. Tyumen, 2013; 116-119.
16. Romanova S.V. Reactions of cardiovascular system to Martinet-Kushelevsky's test among the healthy and hearing-impaired combatants. Scientific notes of the P.F. Lesgaft University. 2016; 7 (137): 116-121.
17. Saburtsev S.A., Volkova S.I., Zhizhenina L.M. Types of reactions of the cardiovascular system to the dosed physical load among the 5th year students of the natural-geographical faculty of the AF UNN of Lobachevski. Adaptation of students at all levels of education in the modern educational process: Proceedings of the XIV All-Russian scientific and practical conference with international participation. Arzamas, December 14-15, 2018; 57-60.
18. Sidorov S.P., Perkhurov A.M., Stefan O.S. The significance of correct implementation of the functional test method with 20 squats in assessing the state of the cardiovascular system of young athletes. Physical education in prevention, treatment and rehabilitation. 2009; 2 (29): 39-44.
19. The decree of the President of the Russian Federation No. 172 of March 24, 2015 "On All-Russian sports complex "Ready for Labour and Defense".
20. The decree of the President of the Russian Federation of 07.05.2018 "On the national goals and strategic objectives of the Russian Federation development for the period up to 2024".
21. The decree of the President of the Russian Federation of 25.04.2019 No 190 "About introduction of changes to the composition of the Presidential Council of the Russian Federation on development of physical culture and sports, approved by the decree of the President of the Russian Federation of July 18, 2018 No. 432".
22. The presidential decree of June 6, 2019 No 254 "On the strategy of healthcare development in the Russian Federation for the period up to 2025»
23. Prokopiev N.Ya., Kolunin E.T., Gurtovaya M.N., Mitasov D.I. Physiological approaches to estimating functional load tests in sports. Fundamental research. 2014; 2: 146-150.
24. Michaluk E.L., Syvolap V.V., Tkalich I.V., Atamanyuk S.I. Functional tests in sport medicine: positive and negative aspects of their conduct. Current issues of pharmaceutical and medical science and practice. 2010; 23(1): 93-96.
25. Shevyrdyaeva K. S., Lygina M.A. A study of student's orientation to maintain a healthy lifestyle and the degree of development of students' value attitudes towards health. News of higher educational institutions. Volga region. Humanities. 2017; 4 (44): 162-167.
26. Semizorov E.A., Prokopiev N.Ya., Gubin D.G., Solovieva S.V., Rechapov D.S. The Hildebrant Index in Adolescent Students While Studying at Various Universities.
27. Semizorov E.A., Prokopiev N.Ya., Durov A.M., Beketov B.N., Khromina S.I., Nazmutdinova V.I., Rechapov D.S. The Body Mass Index as an Indicator of the Physical Development of the Male Students Studying at Various Universities of Tyumen Region.
28. Semizorov E.A. Prokopiev N.Ya., Durov A.M., Solovieva S.V., Khromina S.I., Nazmutdinova V.I., Dergousova E.N, Rechapov D.S. and Albert L.N. The State of the Foot Archesin the Adolescent Students Studying at Different Universities of Tyumen
29. Zaynullina Yu.S. Study of cardiovascular system of students of Ufa. Bulletin of the Bashkir State Medical University. 2018; S2-1: 950-953.

Project Learning as a Means of Development of Schoolchildren's Cognitive Activity in Waldorf School

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Abstract

The article depicts the problem of project learning (types of projects, specific features and results of project learning) in Waldorf school as one of the schools, which are aimed at formation of creative, active, initiative and independent person who is able and willing to learn lifelong. The purpose of this article is to reveal project learning as a means of development of schoolchildren's cognitive activity in Waldorf school. A complex of methods has been used for this study, namely: theoretical methods (analysis and synthesis of scientific, educational and methodical literature for comparison of different views on the researched problem, definition of conceptual and categorical apparatus) and empirical methods (questionnaire, survey, observation, conversation, dialogue, study of the results of educational activities of schoolchildren to identify the level of development of their cognitive activity). The aim of project learning in Waldorf school is to form various general and special skills and abilities. The tasks of project learning in Waldorf school are: to create preconditions for the mental development of schoolchildren; to form basic habits; to strengthen schoolchildren's will and confidence in their abilities; to develop schoolchildren's independence in learning; to promote the development of creative abilities and imagination of schoolchildren; to awaken schoolchildren's active interest in learning and a sense of responsibility; to maintain schoolchildren's desire and create the conditions for lifelong learning; to develop communication skills, etc. Project learning in Waldorf school involves keeping schoolchildren's workbooks "by epoch", conducting schoolchildren's own research on various topics (often socially significant) and creation of game situations in the study of theoretical subjects and playing life situations. Project learning in Waldorf school enables schoolchildren to test themselves in various activities and contributes to the formation of practical skills, development of individuality, hard working, purposefulness and initiative, attention, memory and will.

Keywords: Project learning, Active-practical projects, Schoolchildren, Waldorf school, Cognitive activity, Workbooks.

1. Introduction

The formation of a person who is able to work effectively and learn lifelong is one of the priority tasks of modern educational system. Person's cognitive activity, his attitude to acquisition of knowledge and motives of cognitive activity are the most important condition and at the same time an indicator of the success of the process of forming an active, initiative and independent person who is willing and able to learn and strives for constant and active accumulation of knowledge.

School is extremely important for the development of human cognitive activity. This is caused by the psychological characteristics of younger students, which are characterized by almost inexhaustible cognitive abilities and willingness to learn new things. That is why teachers should use adequate pedagogical means aimed at preservation and further development of the natural curiosity of children, formation of their interest, independence and persistence in the learning process.

One of the ways to solve this problem is to turn to the theory and practice of schools, whose activities are aimed at ensuring the formation of an active and initiative person. Promising in this area is the understanding and creative use of experience of progressive schools, in particular the Waldorf school, which for almost 100 years has been fruitfully solving the problem of developing students' activity, forming creative abilities of a person, his ability to work with information, strong desire and ability to learn throughout life [12; 25; 48].

The purpose of this article is to reveal project learning as a means of development of schoolchildren's cognitive activity in Waldorf school.

2. Literature Review

The problem of project learning as a means of development of schoolchildren's cognitive activity in Waldorf school has been studied by modern scholar in some aspects. P. Kitaygorodskaya [17], O. Kobernyk [18], N. Matyash [27], M. Pavlova, J. Pitt, M. Gurevich, I. Sasova [32], E. Polat, I. Petrova, M. Bukharkina and M. Moiseeva [34], M. Romanovska [35], G. Selevko [36] and O. Ustymenko [43] investigated the specific feature of use of project activity in the learning process. N. Abashyna [2], O. Khudzey [16] and S. Shyshov [39] revealed different kinds of use of schoolchildren's project learning activity. L. Ivanova [13] characterized the stages of project learning and the role of teachers in it. I. Chechel [7] and P. Lerner [20] revealed different approaches in assessing the project learning. M. Haynes [11], M. Legutke and T. Howart [19] and I. Oliynyk [30] studied the use of projects in learning foreign languages.

Besides, M. Antoniuk [3], L. Aristova [4], N. Bibik [5], N. Boiko [6], I. Gavryshchak [8], I. Kharlamov [15], L. Lisina [21], N. Lobko-Lobanovskaya [22], V. Lozova [23], T. Shamova [37], G. Shchukina [38], I. Viktorenko [44] and D. Vilkeev [45] revealed the specific features of schoolchildren's cognitive activity and the conditions of development of it.

Moreover, N. Abashkina [1], V. Gebel and M. Glokler [9], S. Gozak [10], O. Ionova [12], F. Karlgren [14], O. Lukashenko [24], S. Luparenko [25], L. Lytvyn [26], O. Mezentseva [28], V. Novoselska [29], V. Partola [31], A. Pinskiy [33], R. Steiner [40; 41], B. Yerzhabkova and B. Skomorsky [47] and V. Zagvozdkin [48] studied the theoretical and scientific and methodological principles of schoolchildren's development in Waldorf school.

However, the problem of project learning as a means of development of schoolchildren's cognitive activity in Waldorf school has not been considered yet, which caused this study.

3. Method

According to the purpose of the article, certain methods have been used for conducting this study. They are: theoretical methods (analysis and synthesis of scientific, educational and methodical literature for comparison of different views on the researched problem, definition of conceptual and categorical apparatus) and empirical methods (questionnaire, survey, observation, conversation, dialogue, study of the results of educational activities of schoolchildren to identify the level of development of their cognitive activity).

4. Results

It is well known fact that schoolchildren (junior schoolchildren, in particular) have increased need for activity. Project learning in Waldorf school helps to meet this need of children. It means the use of active-practical projects which are certain types of work, small studies performed by schoolchildren in order to gain real experience of interaction with the world. Such projects activate a person, develop and support the activity of his will. Involving person's own willpower in learning strengthens his individual sense of "I" and develops a healthy self-confidence.

R. Steiner, the founder of Waldorf pedagogy, claimed that a person, who has normal finger mobility, has flexible thoughts and ideas. Due to practical activities in classes, it is possible to prepare a child for the inclusion of the will in the process of intellectual work [40].

The aim of project learning in Waldorf school is to form various general and special skills and abilities. The tasks of project learning in Waldorf school are: to create preconditions for the mental development of schoolchildren, based on a sense of reality; to form basic habits; to strengthen schoolchildren's will and confidence in their abilities; to develop schoolchildren's independence in learning; to promote the development of creative abilities and imagination of schoolchildren; to awaken schoolchildren's active interest in learning and a sense of responsibility for their work; to develop students' ability to use materials carefully; to encourage schoolchildren to illustrate objective processes clearly; to develop students' ability to plan work and adhere to their plan in implementation of it; to maintain schoolchildren's desire and create the conditions for lifelong learning; to develop communication skills, etc.

Needlework, housekeeping, work with metal, practical exercises in the study of theoretical subjects, drawing shapes, rhythmic recitation etc. facilitate this process. Moreover, project learning involves keeping workbooks "by epoch" (a big part of learning material studied during 2-4 weeks in main lessons) and conducting schoolchildren's own research on various topics.

In Waldorf school children have many opportunities to show their activity, creativity and talents. Keeping schoolchildren's workbooks is one of the methods that contributes to this. Schoolchildren's workbooks are small personal books that schoolchildren make while studying each subject. They make notes in them in each subject and write down the most significant ideas. Schoolchildren write down all they hear at lessons (after teacher's explanation schoolchildren write down what they remember and what impressed them deeply), illustrate the material being studied and make their additions, working with additional literature.

Through the artistic and figurative presentation of educational material and schoolchildren's own activities, students get acquainted with new knowledge. Then they independently write the text in workbooks and make appropriate drawings, which contribute to the deepening of the material. Then schoolchildren take home their workbooks with the impressions gained at school, written text and drawings, and at home students again experience the material learnt in class, depicting new or refining old drawings, supplementing their notes with their own thoughts, ideas, observations or additional information that children find on their own.

The next day, all the material studied in the previous lesson is repeated, the results of the previous school day are summed up, a short summary of the content is made, which is recorded in workbooks. At this learning stage, students do not make illustrations; letters, grammatical images, images of living plants and animals etc. have to be covered conceptually, by child's thinking.

Also, in English classes, schoolchildren draw each letter they study or a picture related to that letter, write words with it or the sounds it gives. Besides, in workbooks, students depict a fairy tale or story they hear from the teacher at the end of the lesson.

The paper in the workbooks is not lined, which helps younger students to keep the line and beautifully place the text on the page when learning to write. Also, teachers make sure that the children strive for accuracy and beauty in writing, and this contributes to the development of good handwriting. And at the end of the learning a big part of educational material, students receive not ordinary workbooks, but bright, interesting books that are their own achievement.

Working with schoolchildren's workbooks is an important means of mastering new material, and at the same time it gives students the opportunity to develop creative activity, independence and a variety of practical skills and abilities, as illustrations to texts, supplementing notes with self-found material are entirely schoolchildren's creativity.

So, workbooks give schoolchildren the opportunity to show an individual attitude to the subject. Drawing up workbooks is one of the effective means of developing children's cognitive activity as all schoolchildren try to make their workbooks the best and to record the most information in it. Workbook is also a means of expressing children's creative activity, because in them schoolchildren reflect their knowledge not only in words but also in the form of drawings, diagrams etc. In their workbooks, children write or depict information that they have obtained independently, so the compilation of workbooks is a means of forming independence and initiative, individuality and originality. The schoolchildren's activity, directed to the outside, contributes to the full perception of the environment, orientation in it and cognition of it.

Besides, schoolchildren carry out their own projects – research or pedagogical tasks on various topics (often socially significant). The topics of such projects can be different, for example: "Building a house", "Making toys", "Holidays", "Folk holidays", "Environmental protection", "My family", "My friends", "My house", "Housing and inhabitants", "My school", "My hobby", "The world around", "A man and an animal", "Fairy tales" and etc. These projects are carried out individually and in groups. Carrying out these projects direct schoolchildren to conduct various studies, the results of which were presented to the whole class and accompanied by a demonstration of hand-made demonstration materials (small products, drawings, music, postcards, calendars, cards, newspapers, etc.). Group solving of pedagogical tasks is especially encouraged, as the collaboration of "individuals who have joined their forces to accomplish a common task" [48] helps to improve interpersonal relationships in class and the emotional atmosphere of lessons. Schoolchildren help each other, jointly solve problems that arose, learn to communicate and work in a team and be responsible for the common task.

Thus, children work individually or in groups on their own small projects on a specific topic. For

instance, in the project "My Family", children glue photos or draw their relatives, the nearest and dearest, sign their names, ages, and professions and then talk about them in class. Such own activity of children always stimulate them, and they work on projects with pleasure, make cards for greeting friends or relatives, teach poems and songs devoted to them so as to tell them on holidays later.

Another joint project of primary schoolchildren is "Weather Chart Project" [46], which is carried out during the year. In order to do this, they draw a calendar, which consist of 12 pieces of paper (one piece of paper for each month). On these pieces of paper, a table is drawn, which the students hang on the wall and fill in every day of the year, drawing the weather of each day and the weather of the season in general and recording the air temperature. Similarly, during the school year, students describe one month on one piece of paper, but they are divided into groups to work on each month (schoolchildren draw up a calendar letter dedicated to the month in which they were born), make notes and drawings, which characterized certain month. And when that month comes, a calendar sheet is hung on the wall of the classroom and displayed to the whole class. Schoolchildren really enjoy the implementation of such a project, and they wait for "their" month and are happy to demonstrate their project.

Moreover, in classes schoolchildren often make different things that they use in real life. These are tasks for modeling, making applications, making toys, various household items, cooking simple dishes that are decorated by students to their own taste. For example, primary schoolchildren may have tasks to make a stove using a nut shell, cardboard, thin paper, a tube and following the teacher's instructions [42]:

Toy Raft

1. To make a raft, glue 4 walnut shells to a small cardboard rectangle.
2. Cut a sail from a piece of white paper.
3. Push a drinking straw or a twig through the sail.
4. Attach the straw to the raft with a small lump of Kooky Clay.
5. When the raft is finished, merrily, merrily, merrily float it down a stream!

In classes, children make toy boats, rafts, bird feeders, decorations for houseplants, cooked food, etc. Making real, useful things increase the activity of students; they always enjoy working on them and understand the meaning of new words directly in the process of the activity.

Moreover, creation of game situations in the study of theoretical subjects and playing life situations is of great importance for the development of children's own activity in learning. These tasks, which correspond to the child's age and spheres of learning, provide conditions in which children's thinking is not alienated from reality, but based on a sense of reality. They both help to awaken the child's activity and affect the development of his thinking, which is caused by the connection among tactile sensations, coordination of movements and the development of mental activity.

The implementation of active-practical projects allows schoolchildren to independently choose the topic of the project and perform it (select literature, paint, make notes and own observations, make things necessary for the project, express opinions etc.). For instance, in English lessons, schoolchildren ask teachers to perform additional tasks – to study the countries of the world, their capitals and local features. The children really enjoy this exercise, and they look for material, drawings, and at the end of the year do their own work – a small project in which students write the name of the country and depict what they associate this country with (for example, Egypt – the pyramids, France – Eiffel Tower, England – Big Ben, etc.). The development of educational independence is also facilitated by the use of workbooks, where younger students themselves, independently of the teachers and other students, record what they memorized from the teacher's story during the lesson, make independent notes using additional literature [25].

It is an interesting fact that in classes students often ask the teachers not to help them. They feel confident in the material studied and try to do everything themselves. In addition, schoolchildren like to imitate. As soon as one child recite a new verse on their own, all other students, even those who are not very active, try to recite it themselves, without the help of the teacher. Performing various tasks, almost all students do everything themselves, and the teachers only adjust their activities and help those who cannot cope with educational tasks on their own. Thus, project learning in Waldorf school contributes to the development of the children's independent thinking, ability to plan and organize their work [25].

The analysis of the dynamics of the degree of realization of schoolchildren's cognitive activity has shown the high effectiveness of project learning in Waldorf school, and this is due to the fact that it focuses

on age and individual characteristics of children, their needs and desires, creating conditions in which each child can realize himself, his needs and abilities, develop an individual pace and a way of assimilation of new material. Every effort and activity of a child is supported and encouraged, which ensures the formation of a positive attitude of a child to learning. Moreover, if a child does not want to perform a certain exercise, he is not punished or forced to work, but depending on his features, teachers encourage his activities (they change the type of educational work, play, perform an exercise in which a child feels confident or just give him a little rest). In our opinion, schoolchildren who do not participate in the game or do not perform tasks, but only observe them, still play and do the learning situation in their minds, solve problems and gradually become interested in the process of cognition, because they still have a highly developed ability to imitate.

The talks with schoolchildren and teachers has shown that younger students actively participate in the learning process, show interest in acquiring new knowledge and try to complete all tasks because they meet their interests in the learning process and satisfy their educational needs. Educational activities encourage children to show their abilities, achieve the goal and realize the desires and interests in educational activities in ways which are adequate to each child, contribute to the formation of certain personality traits (openness, perseverance, determination, etc.).

For instance, the implementation of the project "My Family in English lessons contributes to the development of schoolchildren's creative abilities. In particular, by performing and telling about their family, some students show high results in the application of acquired knowledge and continue to build new sentences correctly and even use grammatical constructions, which are not intended in their projects. This indicates that during the preparation of the project, learning the necessary words and grammatical constructions, students begin to "feel" the language, the peculiarities of its pronunciation and sentence construction. This encourages them to continue working more actively at lessons and use their knowledge in different situations.

So, the observation of the educational activity and analysis of the products of this activity have shown that project learning in Waldorf school encourages schoolchildren to show their abilities and talents and creatively apply the material studied, awakens the talents of each student and creates the best conditions for their development. In addition, the use of a large number of creative exercises contributes to the development of intelligence and imagination of younger students [12; 25].

5. Discussion and Conclusion

So, project learning in Waldorf school allows schoolchildren to test themselves in various activities and contributes to the formation of practical skills, development of individuality, hard working, purposefulness and initiative. Project learning is aimed at the formation of various practical skills and provided for group and individual solution of various pedagogical tasks, keeping workbooks and creation of game situations in the study of theoretical subjects and playing life situations. Active-practical projects help to identify schoolchild's own attitude to different school subject, the development of their aesthetic feelings and cognitive activity. When working on a project, schoolchildren carry all the material related to this research through themselves, and this provides a better acquisition of new knowledge.

The implementation of the projects helps students to enrich their vocabulary, as well as contributes to the development of attention, memory and will, as students focus on completing these tasks every day for a long period. At the same time, these projects draw the child's attention to the world around him, which helps him learn the "inside" of nature, experience its phenomena throughout the year and day, feel deep respect for people and everything that exists in the world. The active-practical projects give schoolchildren the opportunity to express themselves in different areas, to develop their individuality, inclinations and talents. The projects clearly show the level of creativity, independence of students and the level of development of their cognitive activity. The active-practical projects give schoolchildren the opportunity to independently understand the material being studied and to operate it freely.

So, the involvement of the practical aspects in the process of studying academic disciplines in Waldorf school contributes to the activation of thinking and own practical activities of students, creating an active working atmosphere in the classroom, which really stimulates the development of schoolchildren's cognitive activity, their attentiveness, perseverance and desire to learn new things.

References

1. Abashkina N. Organization of educational process at Waldorf school. Primary school 1993; 7: 41–45.
2. Abashyna N. Development of key life competencies through the method of projects. In: Shevtsova S., Iermakov I., editors. Method of projects: traditions, perspectives, life results. Kyiv : "Department"; 2003. p. 257-258.
3. Antonyuk M. Development of cognitive activity of 5-7 grades pupils of secondary school in the process of solving technical problems. PhD dissertation. Kyiv : Academy of Pedagogical Sciences of Ukraine. Institute of Pedagogy; 1993. 162 p.
4. Aristova L. Activity of schoolchildren teaching. Moscow: Education; 1968.138 p.
5. Bibik N. Formation of cognitive interests of junior schoolchildren. Kyiv : "VIPOL"; 1998. 200 p.
6. Boiko N. Didactic conditions of formation of cognitive interest in schoolchildren. PhD dissertation. Kharkiv : H. S. Skovoroda Kharkiv State Pedagogical University; 1998. 181 p.
7. Chechel I. The method of projects, or Attempt to relieve a teacher from duties of an all-knowing oracle. Head teacher 1998; 3: 11-16.
8. Gavryshchak I. Formation of cognitive activity of students in the educational process of gymnasiums of Galicia in the second half of the XIX century. PhD dissertation. Ivano-Frankivsk : Vasyl Stefanyk Precarpathian National University; 2000. 217 p.
9. Gebel V., Glokler M. Child. From infancy to adulthood: Book for parents, teachers and doctors. Kaluga: Duhovnoie poznanie; 2004. 680 p.
10. Gozak S. Hygienic assessment of Eurhythmy lesson at Waldorf school. Environment and health 2005; 1: 17-18.
11. Haynes M. Project management. Form idea to implementation. USA : Crisp Publication Inc.; 1989. 96 p.
12. Ionova O. Anthoposophically oriented approach to adults' education. Pedagogics and Psychology. Newsletter of the National Academy of Educational Sciences of Ukraine 2018; 4: 12-19.
13. Ivanova L. Projecting in teaching: didactic principles. Teacher 2004; 6: 11-15.
14. Karlgren F. Education for freedom. Moscow : Parsifal; 1998. 272 p.
15. Kharlamov I. How to activate the teaching of schoolchildren (Didactic essays). Minsk: Narodnaya asveta; 1975. 208 p.
16. Khudzey O. A method of projects in foreign preparation of students of the specialized schools with deep study of foreign languages. Bulletin of the National Academy of the State Border Guard Service of Ukraine 2015; 5. URL: file:///C:/Users/Сергей%20и%20Света/Downloads/Vnadped_2015_5_21.pdf
17. Kitaygorodskaya P. The use of project tasks at English lessons. Foreign languages in educational institutions 2003; 5.
18. Kobernik OM Theory and methods of psychological and pedagogical design of educational process in school. Kyiv : Scientific World; 2001. 199 p.
19. Legutke M., Howard, T. Process and Experience in the Language Classroom. London & New York: Longman Group UK Limited; 1991. 350 p.
20. Lerner P. Projecting as the main type of cognitive activity of schoolchildren (on the example of mastering the subject "Technology"). Head teacher 2003; 7: 6-10.
21. Lisina L. Development of cognitive activity of high school students in the process of studying the subjects of the physical and mathematical cycle: Abstract of PhD dissertation. Kyiv : M. P. Dragomanov National Pedagogical University; 2000. 20 p.
22. Lobko-Lobanovskaya N. Teaching Differentiation as a Method of Forming the Cognitive Activity of Schoolchildren. PhD Dissertation. Kharkiv : H. S. Skovoroda Kharkiv National Pedagogical University; 1991 .174 p.
23. Lozova V. A holistic approach to the formation of cognitive activity of students. Kharkiv: "RCNIT", H. S. Skovoroda Kharkiv National Pedagogical University; 2000. 175 p.
24. Lukashenko O. Problem of maintaining health in young learners in Waldorf pedagogy. Abstract of PhD dissertation. Kharkiv : H. S. Skovoroda Kharkiv National Pedagogical University; 2009. 20 p.
25. Luparenko S. Development of Junior Schoolchildren's Cognitive activity by Means of Waldorf School. PhD dissertation. Kharkiv: H. S. Skovoroda Kharkiv National Pedagogical University; 2008. 227 p.
26. Lytvyn L. Ideas of Waldorf pedagogy in Ukraine: monograph / Ed. S. O. Sysoieva. Kyiv: "Edelweiss"; 2012. 200 p.

27. Matyash N. Project method of teaching in the system of technological education. Pedagogy 2000; 4: 38-43.
28. Mezentseva O. Waldorf pedagogy in the world. Information collection for headmaster and head of kindergarten 2014; 20: 88-96.
29. Novoselska V. Aesthetic education of pupils in Waldorf schools. Abstract of PhD dissertation. Kyiv : Institute of Problems on Education of the Academy of Pedagogical Sciences of Ukraine; 2007. 20 p.
30. Oliynyk I. The use of project method at English lessons as one of the ways to form student's communicative competence. Kotovsk, 2012. 21 p. URL : http://www.nmc.od.ua/wp-content/uploads/2013/10/Oliynik.pdf
31. Partola V. The problem of forming the intellectual skills of junior pupils in the learning process of Waldorf school. Abstract of PhD dissertation. Kharkiv : H. S. Skovoroda Kharkiv National Pedagogical University; 2012. 20 p.
32. Pavlova M., Pitt J., Gurevich M., Sasov I. Method of projects in technological education: A guide for teachers. Moscow: "Ventana Graf"; 2003. 296 p.
33. Pinskiy A. Paideia. Moscow: Chastnaya shkola; 1997. 368 p.
34. Polat E., Petrova I., Bukharkina M., Moiseeva M. What is a project? Open lesson 2004; 5-6: 10-17.
35. Romanovska M. Method of projects in the educational process. Kharkiv : Vesta, Publishing House "Ranok"; 2007. 160 p.
36. Selevko G. K. Modern educational technologies. Moscow: Public education; 1988. 256 p.
37. Shamova T. Activation of the teaching of schoolchildren. Moscow: Pedagogy; 1982. 208 p.
38. Shchukina G. Pedagogical problems of the formation of students' cognitive interests. Moscow: Pedagogy; 1988. 208 p.
39. Shyshov S. Project method: problems and prospects. In: Method of projects in technological education of schoolchildren. St. Petersburg: Publishing house of Herzen State Pedagogical University of Russia; 2001. p. 7-15.
40. Steiner R. Modern spiritual life and pedagogy. Moscow: Parsifal; 1996. 208 p.
41. Steiner R. Spiritual renewal of pedagogy. Moscow: Parsifal; 1995. 256 p.
42. Toy Raft. English Learner's Digest 2003; 14: 8.
43. Ustymenko O. Types of projects for foreign language teaching. Young scientist 2016; 2(29): 347-352.
44. Viktorenko I. Formation of cognitive activity of junior schoolchildren in the process of organizing their communication with parents. PhD dissertation. Kharkiv : H. S. Skovoroda Kharkiv National Pedagogical University: 2002. 180 p.
45. Vilkeev D. Development of cognitive activity and independence of students in evening schools in the learning process. Kazan: Kazan University Publishing House; 1961.174 p.
46. Weather Chart Project. English Learner's Digest 2001; 19: 9.
47. Yerzhabkova B., Skomorsky B. Should we introduce a Waldorf school in Ukraine. Horizon 2002; 2: 152-156.
48. Zagvozdkin V. (Ed.) and others. Training Programs of Waldorf School. Moscow: Narodnoe obrazovanie; 2005. 528 p.

Examination of Eating Attitudes of Universities' Sports Department Students In Terms of Individual and Team Sports

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Abstract

Adequate and balanced nutrition habits positively affect the health and physical performance. The aim of this study was to examine the eating attitudes of universities' sports department students in terms of individual and team sports. The sample of the study consisted a total of 502 (288 male, 22.12±2.51 years, 179.59±7.71 cm and 75.23±9.9 kg; 214 female, 21.57±1.28 years, 170.89±8.87 cm and 61.7±7.53 kg) students who received education in the faculty of sports sciences. Study data were collected using the personal information form and the Eating Attitudes Test (EAT-26). It consists of three subscales characteristic of ED including (a) dieting, (b) bulimia and food preoccupation, and (c) oral control. The Independent sample t-test was used in the comparison of variables and the significance level was accepted as $p<0.05$. As a result of the data analysis, athletes engaged in individual sports were found to have a higher tendency of eating disorders (EDs) than athletes engaged in team sports. Besides, female athletes were found to have a statistically higher mean BMI value than male athletes. It can be said that female athletes had a higher risk of EDs compared to male athletes. Therefore, concepts such as eating disorder (ED) and sports nutrition should be clearly explained to both athletes and trainers and necessary precautions should be taken to minimize the affection of athletic performance and general health status.

Keywords: Athlete, Body Image, Diet, Eating Disorder, Sports Nutrition.

1. Introduction

Eating disorder (ED) is basically expressed as the reflection of various factors such as binge eating which is a disease of our age and induces obesity [1] or refusal of eating, vegetarianism, restriction of eating due to some psychological reasons, and late eating [2-5]. Although there are different types of classification, ED is evaluated under three main categories: "anorexia nervosa" which is defined as refusal/reduction of eating to maintain the lowest possible body weight; "bulimia neurosis" which is defined as the behaviors of self-vomiting after binge eating, using gastric emptying drugs or excessive exercising; atypical eating disorders (disorders that have not yet been defined) [6-9].

Being highly affected by environmental factors, one's desire to be perfect especially in youth and starting a friendship with the opposite sex [10] form one's nutrition which is the most important parameter for the maintenance of vital functions and health status [11, 12] in this period. Moreover, today, the broad use of social media, thus the prioritization of body image [13, 14] lead EDs to become more intense during youth (age of 14-19 years) and also prepare a basis for chronic diseases that may occur in later years [5, 16]. The tendency towards ED increases especially in women due to the desire to look slimner [17] and the risk of female athlete triad increases, as well [18, 19].

Adequate and balanced nutrition habits positively affect the health and physical performance; therefore, this topic should be taken seriously for athletes and trainers [20-22]. Nutrition research has been carried out for more than 200 years; however, the concept of "sports nutrition" has recently started to enhance its position as a discipline focused on increasing athletic performance and maintaining the health of athletes [23, 24]. "Sports nutrition", which is now involved as a basic factor in the preparation of training programs, has obliged obtaining information about eating attitudes/nutritional habits not only for trainers and nutritionists but also individuals [25].

Despite the perception that regular physical activity acts as a protection against eating-related disorders, it is seen in the literature that people who do sports show more ED symptoms than those who do not [26, 27]. Especially in individual athletes, the desire to win and the high level of competitive spirit lead the athlete to give more importance to all kinds of factors in achieving success [28]. Accordingly, the relationship between the concept of eating attitude, which directly affects athletic performance and success,

and individuals doing sports was considered as the main factor in our study. The main purpose of the present study was to examine the eating attitudes of universities' sports department students in terms of individual and team sports.

2. Method

2.1. Participants

The sample of this descriptive study consisted of 502 voluntary students in total, 288 male and 214 female students, who received education in the Faculty of Sports Sciences found in different regions of Turkey. The age, height, and body weights of the participants were determined as 22.12±2.51 years, 179.59±7.71 cm and 75.23±9.9 kg in males and 21.57±1.28 years, 170.89±8.87 cm and 61.7±7.53 kg in females. In this study, participants were told they must be 18 or older, have an exercise frequency of at least 3 times per week or be a professional athlete to take this study. After completing the study, participants were thanked for their participation.

In the study, the data were obtained through the survey method using the personal information form and the Eating Attitudes Test (EAT-26). A coordinator was determined for each university to ensure the coordination of the students who participated in the study and to control the data collection period.

2.2. Materials

2.2.1. The Eating Attitudes Test – EAT-26

EAT-26 was used to assess risk factors of ED. The scale consists of 26 questions and has been used in both clinical and non-clinical settings, among males and females as well as adults and adolescents. It consists of three subscales characteristic of ED including (a) dieting, (b) bulimia and food preoccupation, and (c) oral control. The dieting scale evaluates food restriction and obsession for losing weight. The bulimia and food preoccupation scale evaluates the use of binge-eating/induced vomiting conducts and thoughts about food. Finally, the oral control scale evaluates food intake self-control and the pressure of the environment to lose weight.

Items 1, 6, 7, 10, 11, 12, 14, 16, 17, 22, 23, 24, and 25 pertain to the diet scale, while the values obtained in items 3, 4, 9, 18, 21, and 26 account for the bulimia scale. The remaining items correspond to the oral control scale (2, 5, 8, 13, 15, 19, and 20). The answers and value for each item (except for items 1 and 25) include: never (0 points), rarely (0 points), sometimes (0 points), often (1 point), usually (2 points), and always (3 points). The answers and score for items 1 and 25 were inverted. A score of 20 or more (out of a total of 78) indicates a risk of developing or presenting an ED ([9, 30]. It has a high level of convergent validity, concurrent validity, and internal reliability [10, 31, 32]. Cronbach's alpha for the present study was found to 0.82

Questions on height and weight are also asked as part of the Eating Attitudes Test questionnaire, and these were used to determine body mass index (BMI) (kg/m2). BMI can be used to classify people into 4 referenced weight categories: underweight (14.50–18.49), healthy weight (18.50–24.99), overweight (25.00–29.99), and obese (> 30.00) (32, 33).

2.3. Data Analysis

The data were evaluated in the computer environment using the SPSS 23.0 statistics program. Numerical variables were given as mean and standard deviation (SD); categorical variables were given as a number (n). Cronbach's alpha for our study was found to be 0.827. In the comparison of variables, the Independent sample t-test analysis was used to interpret the difference between the two variables and the significance level was accepted as $p<0.05$.

3. Results

In Table 1, it was found that there was a significant difference between individual and team athletes in Dieting, Bulimia and Food Preoccupation and Oral Control subscales ($p<0.05$). Although the mean BMI subscale scores of the team athletes were higher, there was no statistical difference.

Table 1. *Participants' mean EAT-26 subscale scores and BMI values according to the type of sports.*

Variables	Sport Type	N	Mean	SD

Dieting	Team	223	19.40	7.47
	Individual	192	23.78	**6.73***
Bulmia and food preoccupation	Team	223	10.13	4.74
	Individual	192	12.18	**2.70***
Oral control	Team	223	7.74	3.89
	Individual	192	8.82	**2.66***
BMI (%)	Team	223	22.66	2.37
	Individual	192	22.47	2.18

*:<0.05

In Table 2, in the comparison between male athletes, it was found that individual athletes had statistically higher mean scores from Dieting, Bulimia and Food Preoccupation and Oral Control subscales compared to athletes engaged in team sports (p<0.05). Individual athletes were found to have a higher mean BMI value (p<0.05).

Table 2. *Mean EAT-26 subscale scores and BMI values of male athletes engaged in individual and team sports.*

Variables	Sport Type	N	Mean	SD
Dieting	Team	142	18.64	7.74
	Individual	146	24.01	**6.89***
Bulmia and food preoccupation	Team	142	9.32	5.02
	Individual	146	12.19	**2.41***
Oral control	Team	142	7.29	4.10
	Individual	146	8.90	**2.68***
BMI (%)	Team	142	23.56	1.89
	Individual	146	22.94	**2.07***

*:<0.05

In Table 3, in the comparison between female athletes, it was found that individual athletes had a statistically higher mean score from Dieting subscale compared to athletes engaged in team sports (p<0.05).

Table 3. *Mean EAT-26 subscale scores and BMI values of female athletes engaged in individual and team sports.*

Variables	Sport Type	N	Mean	SD
Dieting	Team	73	20.26	6.70
	Individual	46	23.04	**6.24***
Bulmia and food preoccupation	Team	73	11.41	3.80
	Individual	46	12.15	3.50
Oral control	Team	73	8.04	3.08
	Individual	46	8.59	2.59
BMI (%)	Team	73	20.96	2.37
	Individual	46	21.00	1.85

*:<0.05

In Table 4, it was determined that female athletes had higher mean scores from Dieting, Bulimia and Food Preoccupation and Oral Control subscales compared to male athletes; however, this difference was not statistically significant (p>0.05). Female athletes were found to have a statistically higher mean BMI value (p<0.05).

Table 4. *Athletes' mean EAT-26 subscale scores and BMI values according to the sex variable*

Variables	Gender	N	Mean	SD
Dieting	Male	301	21.36	7.78
	Female	114	21.58	6.70

Bulmia and food preoccupation	Male	301	10.78	4.17
	Female	114	11.61	3.74
Oral control	Male	301	8.10	3.54
	Female	114	8.13	2.82
BMI (%)	Male	301	23.24	2.00
	Female	114	20.91	**2.20***

**:<0.05*

4. Discussion and Conclusion

Although the concept of ED has been examined in studies carried out for many years, the number of studies especially on "EDs in athletes" has increased in recent years. However, most of the relevant studies have emphasized which methodological methods are used by athletes while approaching this situation [34, 35]. The type of sport is also directly associated with the ED. In some sport branches (running, wrestling, gymnastics), body fat ratio and weight control are the primary factors. Athletes engaged in these sports give more importance to nutrition attitudes than athletes engaged in other sports branches (mostly team sports) and even show behaviors such as prolonged fasting and drug use [36-38]. In terms of sex, it is known that female athletes more tend to have an ED compared to male athletes [27]. The aim of the present study was to examine the ED-related behaviors of athletes (students) engaged in different sports branches in terms of individual and team sports and examine the correlation between sex variable and EDs in the sample group consisting of athletes.

According to the study findings, dieting, bulimia and oral control subscale scores of the participants engaged in individual sports were found to be significantly higher compared to the participants engaged in team sports ($p<0.05$) (Table 1). Especially in the dieting subscale, the high score (>20) of those who were engaged in individual sports revealed the elimination of feeling of guilt due to eating by exercising and desire to remain slim [39]. In the study conducted by McDonald et al. [2019], it was pointed out that football players did not show signs of an ED since they could spend more time tracking and selecting food although they consumed a lot of food to meet their physical needs [38]. In the study conducted by Petrie [1996], the tendency towards ED increased among athletes involved in lean sports, in which weight control and fat ratio are important since they were more affected by the decisions of the trainers [40]. In another study which was conducted by Clifford and Blyth [2018] to examine the tendency towards orthorexia nervosa, which is also an ED, it was stated that the type of sports did not correlate with EDs [41]. However, they emphasized that this finding would not have a strong effect and that more symptoms of EDs were encountered especially in sports where weight control was required.

According to the analysis conducted for both men and women separately according to the team and individual sports, it was seen that the participants engaged in individual sports had higher scores from all subscales ($p<0.05$) (Table 2, Table 3). When both tables were examined, it was seen that the score was high (>20) only in the dieting subscale. All findings are consistent with the attitudes of individual athletes about EDs.

The sex parameter is among the most important factors that should be considered while explaining the ED behavior. In recent studies conducted on athletes, it has been seen that the rate of having an ED (contrary to popular belief) has increased to 45% especially in female athletes. The density of women population in branches such as running, swimming sports and gymnastics and the increasing interest of women in martial sports support these high rates mentioned [42]. In the present study, it was found that the mean dieting, bulimia and oral control subscale scores were higher in female athletes compared to male athletes; however, there was no statistical difference ($p>0.05$) (Table 4). However, in the dieting subscale, both male and female athletes were found to be at risk by revealing a high score (score =21.36). In the study conducted by Kong and Harris [2014], it was determined that female athletes competing in sports that give importance to fat ratio and weight control exhibited significantly more ED behaviors than other female athletes [27]. In the same study, it was emphasized that elite female athletes had significantly more ED symptoms than non-elite athletes (recreational). Likewise, in the study conducted by Findlay and Bowker [2009], it was reported that elite athletes had higher ED scores compared to recreational/non-competitive

athletes [43]. This reveals that athletes engaged in individual sports, especially female athletes, are at great risk of EDs due to concerns such as weight control, success/winning motive, and aesthetic appearance. In this context, it is an expected result that elite athletes will have an increased tendency towards EDs.

In the review study of Joy et al [2016], referring many literature studies, it was reported that female athletes engaged in sports with categories (rowing), aesthetic sports (gymnastics or figure skating) and sports in which low body weight is advantageous (cycling), had more ED symptoms [44]. In the study conducted by Prnjak et al. [2019], it was reported that male and female athletes did not show a statistical difference in diet-related behaviors [42]. However, it was emphasized that unexpected results were obtained in the study, stating that women were at risk especially due to social pressure and desire to remain slim. In the study conducted by Martinsen et al. [2014] to examine the effect of a 1-year-ED intervention program on sports high school students, it was reported that male students had significantly lower scores on factors such as remaining slim, physical dissatisfaction and dieting [18]. Although there was no statistical difference in the comparison between sexes in our study, females had higher scores in all subscales compared to males. This finding is similar to those obtained in most of the relevant studies. When Table 4 was examined, it was determined that male athletes had significantly higher BMI values compared to female athletes ($p<0.05$). This finding, which was in favor of female athletes, was remarkable since the sample group consisted of athletes from the same age group. BMI is an indicator of eating-related disorders or healthy eating [45)] The low BMI values, in favor of female athletes, support the tendency of women towards EDs. In the study conducted by Joy et al. [2016], it was stated that ED negatively affected athletic performance [44]. It was also suggested that the participation of females, who had anorexia nervosa, who had a BMI less than 16.5 and who exhibited 4 or more bulimia nervosa behaviors per day, in sports activities should be limited. In another review study which was conducted by El Ghoch et al. [2013], it was emphasized that low energy intake reduces both fat and fat-free weights and leads to electrolyte abnormalities, dehydration, and thus low sportive efficiency [46].

In summary, in our study, it was found that athletes engaged in individual sports had a higher tendency towards EDs compared to athletes engaged in team sports. This is consistent with the literature. It can be said that female athletes are at risk of EDs due to major reasons such as body image, aesthetic concerns and desire to remain slim. To minimize the affection of athletic performance and general health status, concepts such as ED and sports nutrition should be clearly explained to both athletes and trainers and necessary precautions should be taken. In this context, the role of nutritionists increases for both individual and team sports. Besides, some athletes may show ED symptoms in the break period in which they are away from training. To ensure the adaptation of these athletes to training, their physical performance trainers should be informed about this issue.

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References

1. Meany G, Conceição E, Mitchell JE. Bingeeating. Binge eating disorder and loss of controleating: effects on weight out comes after bariatric surgery. Europ Eat Dis Rev 2014; 22(2): 87-91.
2. Kadıoğlu M, Ergün A. Üniversite öğrencilerinin yeme tutumu. öz-etkililik ve etkileyen faktörler. Clin Exp Hth Sci 2015; 5(2): 96-104.
3. Leehr EJ, Krohmer K, Schag K, Dresler T, Zipfel S, Giel KE. Emotion regulation model in binge eating disorder and obesity -a systematic review. Neur & Biob Rev 2015; 4: 125-134.
4. Kessler RM, Hutson PH, Herman BK, Potenza MN. The neurobiological basis of binge-eating disorder.

Neur & Biob Rev 2016; 63: 223-238.
5. Cuesto G, Everaerts C, Leon LG, Acebes A. Molecular bases of anorexia nervosa, bulimia nervosa and binge eating disorder: shedding light on the darkness. J Neuro 2017; 31(4): 266-287.
6. Hrabosky JI, Cash TF, Veale D, Neziroglu F, Soll EA, Garner DM, Strachan-Kinser M, Bakke B, Clauss LJ, Phillips KA. Multidimensional body image comparisons among patients with eating disorders, body dysmorphic disorder, and clinical controls: a multisite study. Body Img 2009 2009; 6(3):155-63.
7. Golden, NH, Attia E. Psychopharmacology of eating disorders in children and adolescents. Pedi North Ame 2011; 58(1):121-38.
8. Sarıdağ Devran B. An Investigation of Dietary Habits, Eating Attitudes and Behaviours in Adolescents and Adults from Eastern Anatolia Region in Turkey. Başkent University, Institute of Health Science, Nutrition and Dietetic. Master Degree Thesis, Ankara, 2014
9. Fortes Lde S, Ferreira MEC, de Oliveira SMF, Cyrino ES Almeida SS. A socio-sports model of disordered eating among Brazilian male athletes. Appetite 2015; 92: 29-35.
10. Wahl CA, Harris BS, Langdon JL, Riggs AJ, Meyer BB. Goal orientation, motivational climate, and exercise as predictors of eating disorder risk factors among college students. J Ame Col Hlth. 2019; 1-8.
11. Langley-Evans SC. Nutrition in early life and the programming of adult disease: a review. J Hum Nut Diet 2015; 28: 1-14.
12. Lean MEJ. Principles of Humannutrition. Medicine, 2019.
13. Mabe AG, Forney KJ, Keel PK. Do you "like" my photo? Facebook use maintains eating disorder risk. Int J Eat Dis 2014; 47(5): 516-523.
14. Holland G, Tiggemann M. "Strong beats skinny every time": Disordered eating and compulsive exercise in women who post fitspiration on Instagram. . Int J Eat Dis 2017; 50(1): 76-79.
15. Stice E, Marti N, Shaw H, O'Neil K. General and program-specific moderators of two eating disorder prevention programs. Int J Eat Dis 2008; 41(7): 611-617.
16. Herpertz-Dahlmann B. Adolescent eating disorders: update on definitions. symptomatology. epidemiology. and comorbidity. Chi Adol Psyc Cli 2015; 24(1): 177-196.
17. Murray SB, Griffiths S, Mond JM. Evolving eating disorder psychopathology: conceptualising muscularity-oriented disordered eating. Bri J Psyc 2016; 208(5): 414-415.
18. Martinsen M, Bahr R, Børresen RUNI, Holme I, Pensgaard AM, Sundgot-Borgen J. Preventing eating disorders among young elite athletes: a randomized controlled trial. Med & Sci Spo & Exe 2014; 46(3): 435-447.
19. Bar RJ, Cassin SE, Dionne MM. Eating disorder prevention initiatives for athletes: A review. Europ J Spo Sci 2016: 16(3): 325-335.
20. Schroder H, Marrugat J, Vila J, Covas MI, Elosua R. Adherence to the traditional Mediterranean diet is inversely associated with body mass index and obesity in a Spanish population. J Nut 2004; 134(12): 3355-3361.
21. Beck KL, Thomson JS, Swift RJ, von Hurst PR. Role of nutrition in performance enhancement and post exercise recovery. J Spo Med 2015; 6: 259–267.
22. Kerksick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, Jäger R. et al. ISSN exercise & sports nutrition review update: research & recommendations. J Int Soc Spo Nut 2018; 15(1): 38.
23. Ozdogan Y, Ozcelik AO. Evaluation of the nutrition knowledge of sports department students of universities. J Int Soc Spo Nut 2011; 8(1): 11.
24. Müller A, Loeber S, Söchtig J, Te Wildt B, De Zwaan M. Risk for exercise dependence, eating disorder pathology, alcohol use disorder and addictive behaviors among clients of fitness centers. J Beh Add 2015; 4(4): 273-280.
25. Rossi FE, Landreth A, Beam S, Jones T, Norton L, Cholewa JM. The Effects of a Sports Nutrition Education Intervention on Nutritional Status, Sport Nutrition Knowledge, Body Composition, and Performance during Off Season Training in NCAA Division I Baseball Players. J Spo Sci & Med 2017; 16(1): 60.
26. Holm-Denoma JM, Scaringi V, Gordon KH, Van Orden KA. Et al. Eating disorder symptoms among undergraduate varsity athletes. club athletes. independent exercisers. and nonexercisers. Int J Eat Dis 2009; 42(1). 47–53.

27. Kong P, Harris LM. The sporting body: body image and eating disorder symptomatology among female athletes from leanness focused and nonleanness focused sports. J Psyc 2014; 149(2): 141-160.
28. Giannopoulou I, Noutsos K, Apostolidis N, Bayios I, Nassis GP. Performance level affects the dietary supplement intake of both individual and team sports athletes. J Spo Sci Med 2013; 12(1): 190.
29. Torres-McGehee TM. Green JM. Leeper JD. Leaver-Dunn D. Richardson M. Bishop PA. Body image, anthropometric measures. and eating-disorder prevalence in auxiliary unit members. J Athl Train 2009; 44: 418-426.
30. Rodríguez, AM, Salar NV, Carretero CM, Gimeno EC, Collado ER. Eating disorders and diet management in contact sports; EAT-26 questionnaire does not seem appropriate to evaluate eating disorders in sports. Nut Hos 2015; 32(4): 1708-1714.
31. Garner DM. Olmsted MP. Bohr Y. et al. The Eating Attitudes Test: Psychometric features and clinical correlates. Psyc Med 1982; 12: 871–878.
32. Mayo C. George V. Eating disorder risk and body dissatisfaction based on muscularity and body fat in male university students. J Am Coll Health. 2014; 62(6):407–415.
33. National Institute of Health Expert Panel. Clinical guidelines for the identification. evaluation and treatment of overweight and obesity in adults. Am J Clin Nutr. 1998; 68: 899–917.
34. Bratland-Sanda S, Sundgot-Borgen, J. Eating disorders in athletes: Overview of prevalence. risk factors and recommendations for prevention and treatment. Eur J Spo Sci 2013; 13: 499–508.
35. Thompson RA, Sherman R. Reflections on athletes and eating disorders. Psyc Spo Exe 2014; 15: 729–734.
36. Baum A. Eating disorders in the male athlete. Sports Med 2006; 36: 1–6.
37. Rousselet M. Guérineau B. Paruit MC et al. Disordered eating in French high-level athletes: association with type of sport. doping behavior. and psychological features. Eat Weig Disord 2017; 22(1): 61–68.
38. McDonald AH, Pritchard M, McGuire MK. Self-reported eating disorder risk in lean and non-lean NCAA Collegiate Athletes. Eat Weig Dis-Stu Anore Bul Obes 2019; 1-6.
39. Sancanuto C, Jiménez-Rodríguez D, Tébar FJ, Hernández-Morante JJ. Translation and validation of the diabetes eating problem survey to screen eating disorders in patients with type-1 diabetes mellitus. Med Cli 2017; 148(12): 548-554.
40. Petrie TA. Differences between male and female college lean sport athletes, nonlean sport athletes, and nonathletes on behavioral and psychological indices of eating disorders. J App Spo Psyc 1996; 8(2): 218-230.
41. Clifford T, Blyth C. A pilot study comparing the prevalence of orthorexia nervosa in regular students and those in University sports teams. Eat Weig Dis-Stu Anore Bul Obes 2019; 24(3): 473-480.
42. Prnjak K, Jukic I, Tufano JJ. Perfectionism. body satisfaction and dieting in athletes: The role of gender and sport type. Spo 2019; 7(8): 181.
43. Findlay L, Bowker A. 'The link between competitive sport participation and selfconcept in early adolescence: A consideration of gender and sport orientation. J Yout & Adol 2009; 38(1): 29–40.
44. Gooding HC, Walls CE, Richmond TK. Food insecurity and increased BMI in young adult women. Obes 2012; 20(9): 1896-1901.
45. Joy E, Kussman A, Nattiv A. 2016 update on eating disorders in athletes: A comprehensive narrative review with a focus on clinical assessment and management. Br J Spo Med 2016; 50(3): 154-162.
46. El Ghoch M. Soave F. Calugi S. et al. Eating disorders. physical fitness and sport performance: a systematic review. Nutr 2013; 5: 5140–60.

Problems of Implementation of The System of Resource-Based Learning of Future Teachers of Physical Culture

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Abstract

The problems of improving the professional training of future teachers of physical culture in the national pedagogical higher education institutions are of particular relevance in the context of higher education reform (HEI), the scarcity of many types of resources, as well as in an information-rich educational environment. The solution of these problems is possible under the condition of introduction of resource-based learning (RBL). Based on the analysis of scientific literature, the system of RBL for future teachers of physical culture was theoretically substantiated and developed, which contains the following subsystems: motivational, conceptual-targeting, structural-content, process-technological, diagnostic-effective. The problems of the introduction of the system of RBL of future teachers of physical culture, which contains the following subsystems, are analyzed. It is shown that the isolated problems, which were found out during the implementation of the system of RBL of future teachers of physical culture, made it possible to prepare and introduce into the educational practice of pedagogical institutions of higher education scientific and methodological support of the process of RBL of future teachers of physical culture; to improve the ways of cooperation with librarians, to intensify the activities of libraries and electronic libraries, to transform the role of a librarian into a teacher-librarian; to establish fruitful cooperation of post-graduate teachers with post-graduate students, with lecturers of other higher education institutions, to provide opportunities for networking to create a common open learning environment and to improve forms, methods and tools in the field-oriented higher education and the paradigm of «lifelong learning».

Keywords: resource-based learning, system, concept, open learning environment, methodological training.

1. Introduction

Currently, the problems of improving the professional training of future teachers in the national pedagogical higher education institutions (HEI) are of particular relevance in the context of higher education reform, the scarcity of many types of resources, as well as in an information-rich educational environment. The solution for these problems is possible by the introduction of modern didactic systems and models of the organization of the educational process, which takes into account the trends of increasing the role and volume of information, changes of priority vectors in the educational process for the use of Internet technologies, information resources, academic freedom, which necessitates the transition to resource-based learning (RBL). Among a wide range of components of quality assurance of professional training among future teachers of physical culture, the key component is information – the availability of the necessary information resources for organizing the educational process, especially the independent work of students, which is one of the leading tasks of national pedagogical education.

The RBL aimed to use a wide range of resources (HRs, teaching-methodological, material-technical, financial, informational), pedagogical innovations, and modern information and communication

technologies (ICT), active involvement of librarians in the pedagogical process and their orientation for lifelong learning [3, 16]. Scientists such as M. Butler, M. Hannafin, J. Hill, J. Greenhow, S. Dexter, B. Greene, S. Land, H. Niemi, E. Riedel, S. Hadjerrouit, Shu-Nu Chang, I. Sikstrom, M.-A. Westerlund and others, thoroughly research the implementation problems of RBL all of whom give great importance to the RBL and see the prospect of expanding educational opportunities with the full-scale transition of educational institutions to the RBL.

Scientists consider RBL as e-learning based on modern network technologies, which contributes to the development of the scientific potential in students (Leo Tan Wee Hin, R. Subramaniam) [12]; organic interaction of contact learning (directly «student-teacher») and virtual (H. Niemi) [14]; teaching that contributes to the creation of an informative and educational environment in HEI by attracting resources from libraries, research centers, other educational institutions in the region, the country, and the global educational community (M. Driscoll, M. Hannafin, J. Hill, D. Merrill, J. Van Merrienboer, M. Spector) [11]; web-based learning, the potential of which is as large as the World Wide Web's educational resources (S. Hadjerrouit) [10]; a pedagogical, project-based approach to studying in which students work with a wide range of learning resources (B. Greene, S. Land, M. Butler) [9, 13].

In agreement with the scientists, we treat RBL in higher education as a holistic dynamic process of organizing and stimulating student's independent cognitive activity with mastering the skills of active transformation of the informational environment, which implies its optimal use of human resources, material-technical, teaching-methodological, financial, informational resources by the «student-teacher-librarian» triad. The transformation of the informational environment means – the studying, analytical and synthetic analysis of the content of information, regrouping and changing its values and forms, preparation of its new forms (the secondary information), convenient for its later use. It should be noted that during the transformation of information, it is advisable to use the following methods of analysis: composition, decomposition, classification, abstraction, generalization, analogy, synthesis, systematization, integration, comparison [5, 15, 16, 18].

2. Materials and Methods

The aim of the study is to address the problem of fulfilling the system of resource-based learning of future teachers of physical culture and to outline the ways of their solution in the educational environment of pedagogical HEI.

Problems of implementation of the developed system of RBL for future teachers of physical culture are investigated on the basis of the following universities: University of Ukoopspilks «Poltava University of Economics and Trade», Poltava National Pedagogical University named after V. G. Korolenko, Ukrainian Medical Stomatological Academy.

The pedagogical university, pedagogical faculties, master's degree «Pedagogy of higher school», educational programs of preparation of teachers of physical culture (014 «Secondary education (physical culture)», 017 «Physical culture and sports») are selected for research. A coordinating committee for the implementation of the RBL was established (N. Kononets – project coordinator, M. Grynova, O. Mamon, O. Kropyvka, D. Sokolov). The interactive is organized through the site, video conferencing in Zoom, groups on Facebook. A series of narratives, focus group interviews (e-mail, video conferences, social networking) were conducted with university teachers. A total of 62 university teachers are involved in the discussion, who teach professional disciplines in educational programs for future teachers of physical culture. University librarians were involved in the discussion.

Research methods: analysis of scientific literature, synthesis, comparison, generalization and systematization of the obtained data in order to compare different views of scientists on the problem of RBL implementation, determination of structural components of system of RBL for future teachers of physical culture; modeling – to build a system of RBL for future teachers of physical culture; narrative method and focus group interviews – to identify and analyze problems in the implementation of the system of RBL for future teachers of physical culture.

3. Results and Discussion

Based on the analysis of scientific literature [1, 2, 4, 8–14, 16–21], *the system of RBL* for future teachers of physical culture was theoretically substantiated and developed, which contains the following subsystems: *motivational, conceptual-targeting, structural-content, process-technological, diagnostic-effective (Fig. 1).*

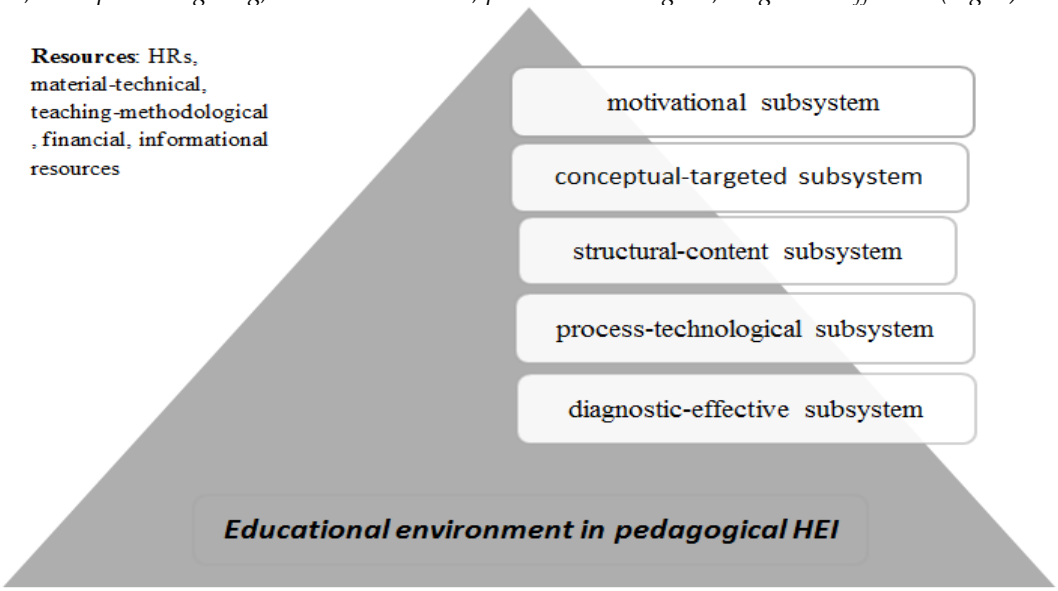

Fig. 1. *The system of RBL for future teachers of physical culture*

The motivational subsystem of the RBL system for future teachers of physical culture viewed as a unified system created to form a stable motive of professional activity among students. Therefore, the necessary conditions for the effective motivation of future teachers to study and successful professional activity in modern school are distinguished in three aspects:

– *content-technological:* facilitation of educational activity; introduction of personality-based, practice-oriented learning and leadership management paradigm; individualization of educational and professional activity; applying a competency approach (developing methodological, digital, leadership competencies); democratization of the educational process; kaizen technology, creating the image of a modern teacher, etc.

– *didactic:* diversification of forms for methods of teaching and students self-education (interactive methods, distance forms, virtual learning environment); provide students with the freedom to choose their subjects, methods of activity, information resources for learning; applying methods, forms and techniques in problematic, interactive and scientific research activities, as well as teaching methods that help to shape the professional competence of future teachers; remote and mobile learning; structuring and differentiation of training; application of the principle of accessibility and use of other principles of didactics and principles of RBL, etc.

– *psychological:* creating a strong interest in the profession of a teacher; developing intellectual abilities and leadership skills in students; teaching self-regulation, awareness of the immediate and ultimate goals of learning (short and far range perspectives), the theoretical and practical significance of the acquired knowledge, professional orientation during the education process, mental preparation for teaching as a profession, etc. [2, 3, 5].

The motivational subsystem is singled out to develope the motivation to study modern ICT; providing positive motivation for learning and future professional activity among teachers; teaching informational competences and information culture to future teachers during their studying at the university, and displaying the didactic tools that should be used in the educational process by modern universities aimed at creating conditions for success during educational activities (pedagogy of accomplishments). This subsystem is represented by educational events, workshops, training, seminars, webinars on the topic of modern ICTs in education, techniques in forming a contemporary teacher, and more.

The conceptual targeting subsystem includes the goal of the model (computer literacy, informational competences, future teacher's information culture, their lifelong learning orientation); social demand for

highly qualified teachers; the strategy of development of pedagogical HEI (HEI vision – a holistic system of training of competitive personnel of the region by the creative association of professionals of modern level; the mission of HEI- development of a system of education and science by training of highly professional specialists, approval of HEI as a leading pedagogical HEI in the region); RBL concept in higher education, its methodological approaches (resource, acmeological, student-centered, competent, systemic, cross-cultural, cloud-oriented, project), RBL principles (universality, autonomy and controllability, freedom of choice, self-regulation, continuity, individualization, information approach) [3].

The RBL means providing the student with the role of the explorer of the information environment, the teacher of the HEI with the role of tutor, giving the librarian of the HEI the role of the teacher-librarian, and giving freedom to choose the information resources for effective assimilation of knowledge by students, acquisition of skills and competencies outlined in the content of each discipline; improving the quality of teaching subjects (qualitative indicator and absolute success); self-regulation of an educational activity (students' ability to see the ultimate goal of the activity, to find ways to achieve it independently and to achieve its realization).

To implement the RBL concept in higher education institutions, the new types of the Web information resources such as resource-based learning in higher education https://rbl3.webnode.com.ua/ (Fig. 2) and an open group with the same name on a social network Facebook https: //www.facebook.com/groups/952957331728338/ (Fig. 3) was developed.

Fig. 2. *Screenshot of the main page of the site «Resource-based learning in higher education institutions».*

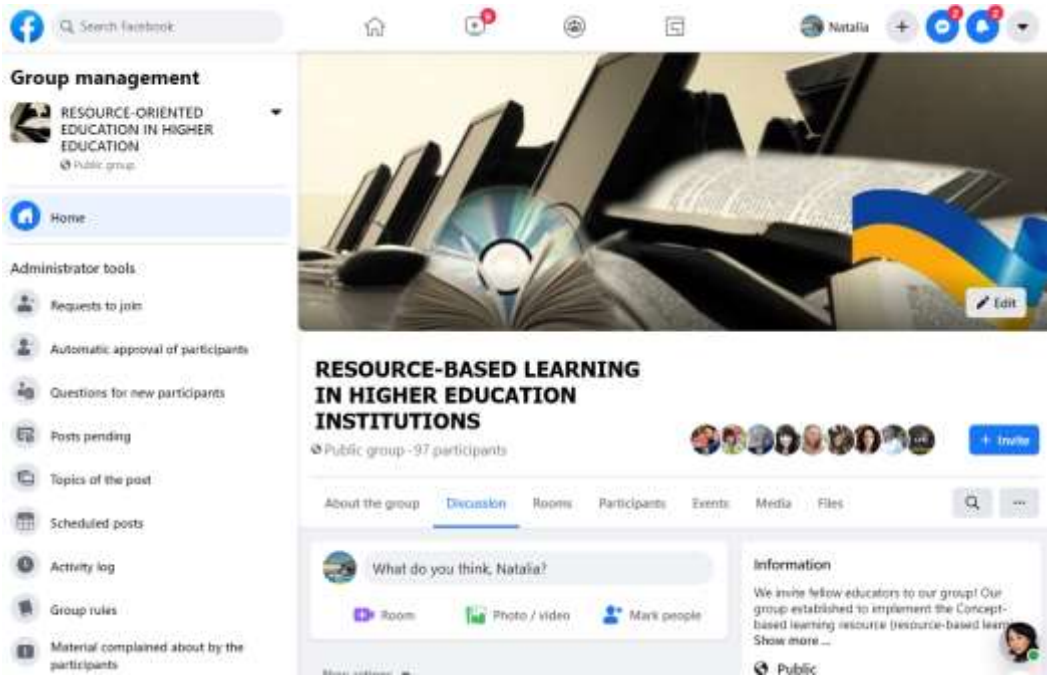

Fig. 3. *Screenshot of «Resource-based learning in higher education institutions» Facebook group*

The structural-content subsystem reflects the content of education of future teachers (educational programs), aimed at forming their information competence and information culture (programmed learning outcomes obtaining knowledge and understanding of the forms, methods, and means of teaching, new pedagogical technologies, and ICTs), as at clearly defined system of knowledge and practical skills that students must and can acquire over a certain time, allocated to study the discipline «Modern information technologies (in the field)» – fundamental and applied component that enriches the content of educational programs for future teachers with IT component, including the development and implementation of programs for the development of digital competence of the modern teacher and the study of innovative teaching methods in modern Ukrainian school (implementation of the Concept of the New Ukrainian School) [6].

Process – technological subsystem contains the technological support for the RBL process, the most favorable technologies for the successful formation of information competence and information culture of future teachers in the university's educational environment are – pedagogical technologies (web-quest technology, educational project web 2.0, mind mapping, cloud technologies, kaizen technology), forms of studying organization (lectures, video lectures, practical classes, binary classes, webinars, open classes), methods (case method, virtual design, interactive discussions, partial research and exploratory methods, the cinquain method, the virtual «Metaplan», visual reading, etc.) and learning tools (printed and online tutorials and textbooks, cloud, online resources, distance courses, virtual classes, etc.) all of the above considering studying of the discipline «Contemporary information technologies (in the field)» as a didactic project.

Diagnostic-effective subsystem monitors the effectiveness of the learning activities of students (the learning methods for students in the implementation RBL) [5].

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The project coordinator conducted methodological seminars «The concept of RBL in higher education», «RBL of students in tandem «teacher-librarian», «The essence and features of resource-based learning».

The method of narratives, focus group interviews with university professors made it possible to record the following results.

Several problems have been identified during the process of implementation in the RBL system for future teachers of physical culture.

Problem 1. The national practice in educating future teachers of physical culture lacks proper attention to the modern forms and methods of organizing student`s independent work.

To resolve this problem, a *virtual educational* environment was created at the Department of Pedagogical Skills and Management named after I. A. Zyazun in Poltava National Pedagogical University named after V. G. Korolenko, which contains the department's website – https://pedmasterpnpu.webnode.com.ua/, a Facebook group of the department – https://www.facebook.com/groups/2405840426302731/, distance learning courses, and virtual classrooms, online tutorials that promote motivation to learn, and serve as convenient resources for interactive independent work and collaboration with teachers.

It is important to note that in the process of RBL students as subjects of their development analyze the process of educational-cognitive and independent cognitive activity, gain experience, and outline plans for further self-improvement. Such education focused on acquiring the experience that recognized by students as everyday life necessities (experience in finding and processing information, problem solving and communication skills, etc.).

Problem 2. The subjective experience of the teacher developed stereotypes that conflict with the experience that is needed for the RBL students. The causes of stereotypes are:

– failure to take into account the subjective experience of students related to the learning process of their academic subject;

– advanced training courses and informational training in HEI did not create in the teacher the experience of focusing on the simultaneous use of a wide range of resources in the teaching process;

– the nature of teachers knowledge on a subject (subjective knowledge in the teacher's experience reflects the result, not the process of obtaining it);

– lack of experience in multivariate methodical creativity.

Given the reasons above, it is necessary to change the whole system of methodological preparation of the teacher to methodic activities for the implementation of RBL of students (objectives, nature, content, and organization).

Teacher's methodological activity on the organization RBLs of future teachers in pedagogical HEIs – is an activity in the organization of educational process in which students are subjects of learning and their development, which directs the student for independence in search for educational information resources, giving each student a vector of an individual educational trajectory.

Teacher methodological preparation is a process of teaching and self-training of the teacher of methodological activity. Methodological preparation within the framework of RBL and the theoretical aspect of its structure requires the formation of methodological thinking, which is considered as the basis in building the methodical competence in teacher. In contemporary conditions for educational modernization, two adequate stages of functioning for methodological thinking of teacher development are productive and creative levels of its functioning. The organization of modern methodological teacher training should solve the following two tasks: to form the methodological competence of the teacher to the organization of RBL of students and its open cognitive position. According to O. Tamozhniaia, methodological competence is considered because of methodological training of the teacher, which is expressed in the ability and

willingness (functional and personal) to effectively perform all kinds of professional activity determined by the functional structure of methodological thinking [8].

For a teacher to have the necessary experience, they must keep the status of *teaching methodological activity as resource-oriented.* Educators should be offered to be acquainted with different educational and methodological resources: manuals, textbooks for teachers, modern methodological literature, scientific publications, writings specialized in pedagogy and subject fields, educational online resources. This will allow one to compare the data, systematize, summarize, trace the methodological line of a particular topic in different educational manuals, and highlight it from different angles. As a result, the teacher will be able to offer students more effective methods of learning a particular topic, allowing them to choose the means to study the educational material. Thus, the teacher will be able to successfully carry out and improve their methodological activity, on condition of having the methodological competence and needs of improving their professionalism and pedagogical skills.

According to individual characteristics, teachers differently perceive and process the subject content, create their examples, reference notes, educational and methodological complexes (topics individual content); develop their methods of activity with its substantive content, individual own memory schemes, brochures, multimedia accompaniment, create electronic textbooks, pedagogical technologies for RBL students. Therefore, teaching provides different options on the topic of solving methodical problems, varieties of presentation forms, arranging of achievement of the set goals, and taking into account each teacher's vision of the educational process. With this resource-based approach, teachers in pedagogical HEIs should be allowed to create their original content and RBL technologies for future teachers and modern professionals.

Problem 3. Librarians in pedagogical HEIs are not prepared for pedagogical and teaching activities and, as a rule, have no pedagogical education.

According to S. Golovko, the fundamental social function of the library is to provide comprehensive information to its maximum extent [1]. It is estimated that the main task of any library in HEI serving as an information center is to assist students and teachers in the educational process. Without a good library, HEI will not be able to perform its educational and disciplinary functions at a high level. The library provides the information necessary for a successful existence in a modern information society where knowledge plays a crucial role; it instills in students a need for constant self-education, develops imagination, and stimulates creativity.

The research conducted on libraries shows that librarians are under-performing their educational and teaching functions and cooperation with faculty members is virtually absent. And this happening at the times when scientists have already shown that the cooperation between librarians and teachers helps to increase the level of literacy among students, it promotes the development of reading and memorizing skills, as well as developing the ability to use ICT [4].

Libraries have always met the needs of mankind in passing down thoughts, ideas, and statements from one generation to another. American librarians emphasize that libraries are designed to meet the challenges of time, expressing the need for consistency between changeable library policies and the librarians themselves. The librarian must meet the reader's expectations because the thought itself must forego the service. According to J. Whitehead, the librarian embodies the scientist, sociologist, psychologist, teacher, and historian at the same time [7].

During the organization of the RBL for future teachers in the pedagogical HEI, the library is transformed into a «library + laboratory» construct. For example, many universities in Ukraine have long installed computers with access to the World Wide Web in libraries. Librarian within the framework of RBL of future teachers can:

– *help students understand* that when they are in the library, a powerful toolkit for finding answers to a wide variety of questions can be at their disposal. And this toolkit goes beyond one major search engine – it gives access to high-quality databases, e-books, blogs, chats, entertainment, and scientific journals, newspapers, wiki, the primary sources, and media of all kinds;

– *continuously change* to organize the information world for teachers and students;

– *help students effectively access the materials* they need through websites and partnerships supported by the librarian;

– *create a model for students and teachers* of how they can organize their worlds of information and networking;

– *to help students in information research* and its critical evaluation, to understand the essence of authorship. This is required to evaluate the website firsthand before visiting it;

– *to teach students strategies* for effective search and find the data they need, to teach them ways and tricks of search, special techniques that give them search power;

– *to help students acquire knowledge from the information* they have gathered, help them in analyzing, summarizing, and finding its meaning. Therefore, they can not only answer their current question but also use the information in the future to solve different problems and make decisions;

– *help students to communicate and collaborate* by using the tools of their time, help them become storytellers, screenwriters and producers, networkers, and disseminators of new knowledge;

– *to help students identify and realize* that what they create must make sense and reach a targeted audience as well;

– *to teach students to be confident digital citizens,* to teach them to be good bloggers, twitter users, networkers.

Pedagogical seminars, workshops, masterclasses for librarians, schools of excellence, pedagogical consultations (which will be held by leading teachers in HEI), as well as methodical panoramas, subject weeks, methodical days (weeks), specialized scientific and methodological councils all of the above will help in solving the issue of active involvement of librarians in RBL of future teachers.

Methodological models for improving the professional training of library specialists built based on modules, which are logically completed parts of the educational material and accompanied by the knowledge and skills controls. The module contains cognitive and educationally professional parts. The first part forms theoretical knowledge, the second – professional skills, and tools based on the acquired knowledge. From our standpoint, the professionalism and pedagogical skills required from the teacher for the modular interpretation of the discipline should be combined focusing on maximizing the usage of various educational resources, which contribute to a more effective study of module topics and allow students to develop personality and creative aptitude. The librarian will then be able to help the teacher in selecting and listing educational resources for each module, especially about the print resources available in the library. Another librarian prerogative is introducing students to popular online libraries.

Problem 4. The methodological preparation of the «teacher-librarian» tandem should be continuous, which is currently lacking in the system of advanced training.

The need for continuity in the methodological preparation of the «teacher-librarian» tandem is explained by two reasons: the complexity of mastering by teacher and librarian of the RBL process and the need to focus on constantly changing students. Therefore, it is necessary to create such conditions that the teacher and the librarian constantly enrich their methodological experience in the implementation of the RBL among students, in other words, to become the subject of their development in their methodical activity. Thus, the continuous methodological preparation of the «teacher-librarian» tandem for the implementation of the RBL for future teachers of physical culture creates a process of continuous improvement of the subjective experience by teaching staff and the librarians in pedagogical HEI; this allows teachers to correspond their methodological actions with the subjective experience of mastering the subject matter by students. The success of this process is determined by ensuring that the teacher and the librarian become a subject of their development concerning their methodical activity and that the tasks of forming methodological competence and the open cognitive position of the teacher and librarian are solved. The teacher and the librarian show their level of preparation to carry out designing and analyzing specific pedagogical processes during the RBL of students.

The effectiveness of continuous methodological preparation in «teacher-librarian» tandem significantly increases if it carries out in a team of teachers. In that case, participants acquire a new methodological experience of solving specific methodological problems, oriented on different people, organization of communication in solve emerging problems, etc.

Practically effective seminars such as: «RBL as a way of providing innovative activity of the department», «Features of planning and analyzing resource-oriented classes implemented in teaching process», «Basic scientific approaches and principles of RBL», «The use of RBL in the teaching of professional

disciplines» are held regularly at the Department of Pedagogical Skills and Management named after I. A. Zyazun.

For example, the training of undergraduates, graduate students, teachers, and librarians within the framework of the scientific-methodological seminar «The essence and features of resource-based learning» was carried out in four main directions:

1) to learn to analyze educational texts not only from the subject's point of view but also from the student's position in the context of the RBL.

2) to master basic RBL techniques, taking into account its student orientation.

3) to form an open cognitive position.

4) to master the technique of conducting educational dialogue, which leads the student to the leading positions in the educational process.

The program of the scientific and methodological seminar is designed for 3 lessons. The first lesson is directed into mastering the basic concepts of RBL of future teachers: to form the basic RBL concepts, the basic skills of ICT in teaching, learning tools, RBL methods. The second lesson is to master the method of teaching students to find educational information among print, electronic and online resources. The third lesson is aimed at the designing of resource-oriented classes (education-methodological lesson cards, methodological recommendations, handouts).

The following principles of organizing the RBL for future teachers, based on the «teacher-librarian» tandem are:

1) the principles of subjectivity, which consists of the updating, accounting, and enrichment of the subjective methodological experience of the teacher and librarian;

2) the principle of continuity of methodological training, which provides for the formation of the teacher and librarian as a subject of their development about his methodical activity. The principle is implemented subject to the implementation of the RBL at all classes and the teacher's focus on its implementation in the educational process and specified in the tasks: formation of methodological competence of the teacher; his open cognitive position; mastery of the teacher and the librarian with the technique of dialogue, which leads the students to the leading positions in the pedagogical process;

3) the principle of creativity, which presupposes the formulation and solution of methodological tasks that require a creative search for a teacher with the help of a librarian;

4) the principle of corporate identity, which involves the use of the method of corporate subjective experience, it allows to increase the efficiency of work of teachers and librarians, enriching themselves at the expense of the experience of another; gain experience in solving methodological problems; to generalize the experience of solving methodological problems in the implementation of scientific and methodological research into the practice of college; to find fundamentally new solutions to theoretical and practical issues of RBL.

The proficiency of each methodological topic is divided into several stages:

1) updating the subjective experience of the teacher and librarian (often through surveys), which highlights its methodological problems;

2) studying the theory and approach for its administration (using educational and methodical literature), which allows teacher and librarian to substantiate its methodological actions and to combine the theory with practice;

3) in applying the theory for development or analysis of specific fragments of the lesson (under the guidance of the teacher);

4) independent group work on the development or analysis of specific segments of the lesson (often group work is leading by a singular homework);

5) correction and improvement of the group experience of teachers and librarians (carried out during the group work and after their presentation);

6) self-written or video work on the topic of developing the specific fragments of the lesson, followed by a teacher's examination (test with later self-analysis on the causes of methodological successes and failures, with ways of preventing methodological mistakes in the future);

7) correction and expanding of the individual experience of all teachers and librarians who completed the test task (through creating and operating with didactic materials);

8) summarizing.

These steps reflect the essence of the methodology of continuous improvement of the methodological mastery in "teacher-librarian" tandem in the mastering of any methodological topic.

The achievement of the following goals can be considered as the outcome of the methodological seminar:

1) attaining the methodological experience of implementing the RBL of future teachers of physical culture in the pedagogical HEI (gained knowledge written in specific didactic materials distributed to each student; publishing materials in the manuals for students and teachers);

2) lecturers prepared for conducting classes with teachers within the framework of improving pedagogical skills of teachers in HEI, as well as groomed for working with librarians;

3) each attendee of the seminar has increased their level of methodological competence, formed an open cognitive position; expanded their subjective experience, leading to teachers' and librarians' professional growth with the means of modern theory and teaching methods for students.

4. Conclusions

Based on the above, we note that taking into account the concept of RBL in higher education, methodological approaches (resource, acmeological, student-centered, competent, systemic, cross-cultural, cloud-oriented, project), the system of RBL of future teachers of physical culture was developed, which contains the following subsystems: motivational, conceptual-targeting, structural-content, process-technological, diagnostic-effective. The search for didactic conditions for the implementation in the RBL system of future teachers of physical culture made it possible to identify and analyze the problems of implementation of such teaching in pedagogical HEIs: 1) the deficiency of attention to modern forms and methods of organizing students independent work can be traced in the current national educational system of future teachers of physical culture; 2) the stereotypes in the subjective experience of the average teacher are contradicting with the experience that is necessary for the students of the RBL; 3) librarians of pedagogical HEI are not prepared for pedagogical and educational-methodological activity and lacking any pedagogical education; 4) the established system for professional development does not support the continuity of methodological preparation for the «teacher-librarian» tandem.

In summary, it should be noted that the isolated problems that were identified during the implementation of the system of future teachers RBL allowed us to prepare and implement in the educational practice in HEI the scientific and methodological support of the process of RBL of future teachers of physical culture; to improve the ways of cooperation with the librarians in HEI, to intensify the activity of libraries in HEI and electronic libraries, to transform the role of librarian into a teacher-librarian; to establish fruitful cooperation between teachers in department and postgraduate students with lecturers from other HEIs, to provide opportunities for networking to create a common open learning environment (creating electronic manuals, distance courses, virtual classes) and to improve the forms, methods and teaching tools including the RBL concept in schools of higher education and «lifelong learning» paradigm.

The study does not evaluate all of the aspects identified in this problem. Theoretical and practical results obtained during research form the basis for further examination of the problem in the aspects of improving the existing system, identifying the specific ways of organizing effective cooperation with Ukrainian and foreign libraries, with international higher education institutions providing training for future teachers of physical culture, exploring the directions of development in RBL within higher education institutions and creating the new-generation universities with the means of applying innovative technologies.

References

1. Holovko S. Y. Social and cultural functions in profession of a librarian // Library Science. 2004. Vol. 6. P. 32–38. [in Russian].
2. Hrynova M. V. Self-regulation of the education manager. Science and Education a New Dimension // Pedagogy and Psychology. 2013. Vol. 1 (6). P. 69–72. [in Ukrainian].

3. Hrynova M. V., Kononets N. V., Diachenko-Bohun M. M., Rybalko L. M. Resource-based learning of students in the health-saving educational environment. Information technologies and teaching aids. 2019. Vol. 72. (4). P. 182–193. [in Ukrainian].
4. Hromova O. Why schools need libraries? // Public education. 2006. Vol. 2 (1355). P. 136–141. [in Russian].
5. Kononets N. V. The concept of Resource-based learning in higher education // Origins of pedagogical skill : a collection of scientific works. 2018. Vol. 22. P. 103–107. [in Ukrainian].
6. The concept of a new Ukrainian school. Ministry of Education and Science of Ukraine. 2016. (accessed Nov. 25, 2019). [in Ukrainian].
7. Romanov P. S. Presentations of modern North American researchers on the nature, methodology and status of library science (based on English dissertations). Bibliosphere. 2007. Vol. 1. P. 45–51.
8. Tamozhniaia E. A. The system of methodological training of a geography teacher at a pedagogical university in the context of modernization of education : dissertation of the doctor of pedagogical sciences. Moskva, 2010. P. 1–491. [in Russian].
9. Barbara A. Greene, Susan M. Land. A Qualitative Analysis of Scaffolding Use in a Resource-based Learning Environment Involving the World Wide Web // Educational Computing Research. 2000. Vol. 23 (2). P. 151–179.
10. Hadjerrouit S. A conceptual framework for using and evaluating Web-based learning resources in school education // Journal of Information Technology Education. 2010. Vol. 9. P. 53–79.
11. Hill J. R., Hannafin M. J. Teaching and learning in digital environments : the resurgence of resource-based learning environments // Educational Technology Research and Development. 2001. Vol. 49 (3). P. 37–52.
12. Leo Tan Wee Hin, R. Subramaniam. E-Learning and Virtual Science Centers. 2005. P. 1–457.
13. Margaret Meg Butler. Resource Based Learning and Course Design. Law Library Journal, 2012, Georgia State University College of Law, Legal Studies Research Paper no. 2011–24, 2011.
14. Niemi H. Research-based teacher education for teachers' lifelong learning. Lifelong learning in Europe. 2008. Vol. 13 (1). P. 61–69.
15. Diachenko-Bohun M., Hrytsai N., Grynova M., Grygus I., Muszkieta R., Napierała M., Zukow W. Characteristics of Healthbreakers in the Conditions of Realization of Health-Safety Technologies in Education Structures.
16. Diachenko-Bohun M., Hrytsai N., Grynova M., Grygus I., Zukow W. The readiness formation of future biology teachers for healthcare-safety technologies realization in professional activity // Education and Information Technologies. 2019. Vol. 24 (1). P. 679–691.
17. Hrytsai N., Diachenko-Bohun M., Grynova M., Grygus I., Zukow W. Methodical Training System Enhancements of Future Biology Teachers at Pedagogical Universities // Journal of History Culture and Art Research. 2019. Vol. 8 (1). P. 30–38.
18. Novopysmennyi S., Diachenko-Bohun M., Hrytsai N., Grygus I., Muszkieta R., Napierala M., Hagner-Derengowska M., Ostrowska M., Smolenska O., Skaliy A., Zukow W., Stankiewicz B. Implementation of electronic health control technologies in higher education institutions // Journal of Physical Education and Sport. 2020. Vol. 20. P. 921–928.
19. Kononets N., Ilchenko O., Mokliak V. Future teachers resource-based learning system : experience of higher education institutions in Poltava city, Ukraine // Turkish Online Journal of Distance Education-TOJDE. 2020. Vol. 21 (3). P. 199–220.
20. Momot O., Zhamardiy V., Hrynova V., Gorlova L. and Sharlay N. Experimental Verification of the Effectiveness of Organizational and Pedagogical Conditions for the Education of the Future Teacher in the Health-Preserving Environment of the Institution of Higher Education.
21. Zaitseva Y., Taranenko I., Grynova M., Tkachenko A. and Mikheienko O. A Modern Approach to the System of Training for Organization of Physical Culture and Sports Work of Physical Education Teachers.

Recovery of Athletes with Visual Impairments through Modern Aspects of Physical Rehabilitation

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Abstract

The article has determined the inseparability of rehabilitation support from sports activities. This was achieved as a result of theoretical analysis of modern approaches to the training process of visually impaired people. Which actualizes the consideration of key theoretical provisions of the modern system of training athletes. It was investigated that the basis of formation of readiness of sportsmen for competitive activity is intellectual development, emotional maturity and socialization. It was found out that along with the development of the ability to maximize physical capabilities, it is necessary to improve the mechanisms of preparation for competitions for visually impaired athletes. This was formed in the aggregate of their technical and tactical, functional and psychological preparedness.

Keywords: educational process, sport activities, sports training, students, professional readiness.

1. Introduction

It was established, that the current state of health in Ukraine, as in most countries of the world is characterized by a progressive decline in national public health as an integrative indicator of physical and mental health of citizens. The relevance of the study lies in the fact that recently there has been a significant increase in the number of people with visual impairments. Increased congenital pathology of the visual system, eye strain due to working with displays, as well as radiation exposure, deterioration of environmental conditions and nutrition, reduction of physical activity, this is by no means a complete list of the causes of this phenomenon. Visual diseases lead to increased disability, reduced quality of life. In the case of pathology of vision in humans there is a whole set of motor disorders caused by decreased visual acuity, for instance: violation of binocularity, motor functions of the eye, field of view, etc. Timely correction of visual functions can also contribute to the correction of motor disorders.

Particular attention is paid to the problem of social and physical rehabilitation of athletes with visual impairments by means of adaptive physical education and sports in order to restore their health, their

involvement in socially useful activities. Complete recovery of such athletes and their return to previous professional activities is extremely rare. Given the undeniable urgency of the problem of physical and psychological rehabilitation of such athletes, it is worth considering, related to the definition of tasks and content of psychological training and the formation of the optimal level of readiness of athletes in the process of their professional training. In turn, the high intensity of modern training of athletes with visual impairments, special amounts of training and competitive loads require the creation of optimal pedagogical conditions for their effective functioning, as the main subjects of sports activities.

The problem of the health of people with visual impairments has been studied by many scientists (V. Zhamardiy, 2019–2020; O. Shkola, 2019–2020 et al.). A significant contribution to the development of certain aspects of psychological and pedagogical support for the training of athletes made by domestic and foreign scientists and practitioners, such as: H. Boyko, 2012; A. Porada, 2011 et al. In general, theoretical studies of the growth of scientific and technological potential and the role of innovation, as the main factors in the application of rehabilitation, began in the XVII century. Modern interpretations of rehabilitation programs are reflected in the research of following scientists: H. Boyko, 2012; O. Pohontseva, 2011; M. Romanyshyn, 2009 et al. However, the significant results obtained by Ukrainian scientists do not deny the need for further theoretical and applied research, related to the substantiation of scientific provisions on the use of rehabilitation technologies in sports training of persons with visual impairments, as the main factors in the formation of a healthy lifestyle of athletes.

Thus, today in Ukraine there is some experience of specialized research on certain problems of the use of rehabilitation tools in the restoration of the ability of athletes with visual impairments. Domestic theory and methodology, categorical and conceptual apparatus are in the stage of improvement. But the implementation of a thorough retrospective analysis of the use of rehabilitation technologies in sports, the periodization of rehabilitation programs still needs the attention of scientists.

2. Materials and Methods

The aim of the study is to analyze and summarize the theoretical and practical aspects, associated with the restoration of the ability of athletes with visual impairments in the shortest possible time.

The research was conducted in four stages. Dynamic observation and examination of 11 highly qualified swimmers was conducted, of which: 3 masters of sports of international class, 4 masters of sports, 4 candidates for master of sports. Age of athletes: from 17 to 23 years. Visual acuity of all examinations of athletes was in the range of 0,06–0,1 % for the better eye with correction. According to the tasks of the research, the studied athletes were divided into two groups by random sampling. The main group included 6 swimmers with visual impairments. The control group included 5 athletes without visual impairment. According to the classification criteria, all study participants are highly qualified athletes. Statistical processing of the obtained data was performed using a statistical package «Statgraphics Plus for Windows».

3. Results and Discussion

Social significance of further successful development of sports in Ukraine, rapid growth of sporting achievements, high level of competition of athletes at competitions of national and international levels lead to constant improvement of the system of training athletes with visual impairments.

Modern sport is developing in accordance with the general trends of Olympic sport, retaining its specific features, due to the psychic and functional capabilities of persons with various developmental disorders, such as: adaptation of competition rules; development and application of special sports equipment; use of Paralympic sports-specific diagnostic programs and functional classification of disorders; distribution of athletes for competitions within each individual functional class.

In sports for the disabled, rehabilitation support of sports activities is an integral part of the system of training people with visual impairments. This actualizes the consideration of key theoretical provisions of the modern system of training athletes. Sports training, in the general scientific sense, is considered as use of logically constructed system of sports training in combination with the means of theoretical, psychological, medical, organizational, material and technical, scientific and methodological support of the training process, that directly and indirectly affect the dynamics of the level of sportsmanship of athletes.

The modern system of training athletes consists of procedural and personalized components. The first combines training and competitive activities of athletes. Personalized component determines the features of interpersonal professional interaction of sports entities.

Improving the level of sportsmanship of visually impaired people depends on the effectiveness of their training activities, scientifically sound planning of its orientation and content. Modern training is considered as a specialized pedagogical process, built on the use of physical exercises in order to develop and improve qualities and abilities, which determine the athlete's readiness to achieve the highest performance in his competitive activities. The ability to achieve high results is due to a number of factors, which provide the formation of the optimal ratio of technical and tactical, functional and psychological components of the readiness of athletes. All this must be built in accordance with the requirements of a particular competitive discipline.

It is established that the survey of athletes with visual impairments requires increased attention to the verbal perception of the blind and partially sighted as a key channel for obtaining information. This can be explained by the fact that the stock of abstract verbal knowledge of the blind and partially sighted is insufficiently filled with adequate subject-specific content, and verbal-logical forms of cognition prevail over sensory ones. Taking into account the absence or significant weakening of visual control over motor activity causes compensatory strengthening of the functions of the preserved sensory systems and the dominance of muscular sensation in the control of movements.

Diagnostic examinations took into account the following features of working with blind and partially sighted athletes: the perception of the blind and partially sighted is qualitatively different from the perception of sighted people; initial contact with visually impaired athletes is established by touching the hand; during the research they paid attention to their own intonation of the voice and articulation, in particular, clarity and legibility of pronunciation, because athletes with visual impairments perceive information by voice; there should be no unnecessary noise in the room that will interfere with the verbal perception of information; prior to the study, the accuracy of the athlete's understanding of the instructions was checked; for blind athletes used the technique of listening to instructions and test tasks or recording them in Braille; the room where the visually impaired swimmers were tested was well lit; test materials were printed in large type; visually impaired people perform tasks more slowly than healthy athletes.

Therefore, a specific feature of working with visually impaired athletes is to take into account the peculiarities of their spatial perception.

Questionnaires of C.H. Spilberher's and Y.U. Khanin's were used to assess the level of anxiety, which allow to identify the level of personal and situational anxiety. The technique consists of two parts, one of which provides a study of personal anxiety while the second provides situational anxiety. Athletes were offered two questionnaires, each of which consisted of 20 statements and 4 types of answers. It was suggested to cross out the appropriate answer depending on how the subject feels normal and at the time of the diagnostic test.

The results of the study ranged from 20 to 80 %. The higher the rate, the higher the level of situational or personal anxiety: up to 30 % corresponds to low level of situational or personal anxiety (1 with impaired vision, 4 – without visual impairment); 31 – 44 % corresponds to moderate level (2 with impaired vision, 1 – without visual impairment); 45 % and higher corresponds to high level of situational or personal anxiety (3 with impaired vision, 0 – without visual impairment).

Training and competitive activities of athletes of high qualification with disorders of psychophysical development are associated with constant high functional and psycho-emotional loads, which have to be overcome by the main subjects of sports not only in the training process or during participation in competitions, but also in household, educational and other socially significant areas of activity. Thus, we believe that situations related to participation in sports activities determine the dynamics of nervous and mental stress of athletes. Conducting appropriate research allows you to take preventive measures to prevent negative effects on the result.

In accordance with the formulated principles, the defined purpose, tasks, conditions, specific subjects of influence we have offered an experimental technique of complex application of physical rehabilitation to restore the ability of highly qualified swimmers with visual impairments in sports for the disabled.

According to the program, during the three months of the experiment, the control and main groups trained simultaneously with the same load and followed the identical recommendations of the trainers on recovery.

Based on the load distribution in the pre-competition mesocycle, a set of following recovery procedures was used in the main and control groups of athletes: Vitrum ® Superstress and carbohydrates mixtures (main and control groups); sauna (main and control groups); hypoxic therapy (main and control groups); масаж (main and control groups); self-suggestion (main and control groups); Ice baths after each workout in the water (only for athletes of the main group).

Experimental study of the effectiveness of methods of applying physical rehabilitation methods in restoring the ability of swimmers with visual impairments was carried out at the formative stage of the pedagogical experiment. Before its start three weeks before the responsible start and two days before the competition, psychological diagnostic tests were performed, aimed at studying the level of anxiety of swimmers of the main and control groups.

Situational anxiety is subjectively characterized by emotional tension, feelings of anxiety, nervousness that arise in a particular situation. Situational anxiety is always accompanied by activation of the autonomic nervous system and causes psychosomatic symptoms: increase in heart rate, redness or pallor of the skin, increased sweating, tremor.

One of the signs of non-restored performance of athletes, as well as the existing feeling of concern for the outcome of the performance on the eve of the competition is an increase in situational anxiety. A comparative analysis of the dynamics of situational anxiety of athletes from the main and control groups showed the absence of significant differences in the studied indicators in swimmers with visual impairments on the eve of the competition (Table 1).

Table 1. *Comparative data on the dynamics of situational anxiety of athletes from the main and control groups with visual impairments*

Group	K_α (mean value)	Number of athletes with $K_\alpha > 0,7$ %	$\varphi_{emp.}$	$\varphi_{crit.}$	Difference
Control	43,57	100	-1,36	1,64	$\varphi_{emp.} < \varphi_{crit.}$ the variables are the same
Main	45,17	93,34			

Data analysis shows, that the average values of the levels of situational anxiety of athletes with visual impairments of the main and control groups at the stage of the observational experiment (K_α) showed a slight difference (1,6) between control group (43,57) and the main group of athletes with visual impairments (45,17). Comparison of values by Fisher's test showed that with a significant probability (0,95) the studied data sets of situational anxiety of swimmers from the main and control groups are the same : $\varphi_{emp.} = -1,36$; $\varphi_{crit.}$ (0,05) = 1,64; $\varphi_{emp} < \varphi_{crit.}$ (0,05).

The presence of appropriate differences was recorded at the formative stage of the pedagogical experiment. According to the results of psychodiagnostic research, held at the end of a three-week precompetition mesocycle 2 days before the competition, indicators of situational anxiety in swimmers of the control group were significantly higher than in athletes of the main group ($\varphi_{emp.}$.= 5,297; $\varphi_{crit.}$ (0,05) = 1,64; $\varphi_{emp.}$. > $\varphi_{crit.}$ (0,05), so variables are significantly different (Table 2).

Table 2. *Comparative data on the dynamics of situational anxiety of swimmers with visual impairments of the main and control groups on the eve of the competition*

Group	K_α (mean value)	Number of athletes with $K_\alpha > 0,7$ %	$\varphi_{emp.}$	$\varphi_{crit.}$	Difference
Control	47,87	97,06	5,297	1,64	$\varphi_{emp.} > \varphi_{crit.}$ the variables are different
Main	41,09	80,0			

The results of the study obtained after the test 4 × 50 m freestyle at the statement stage of the pedagogical experiment showed, that the vast majority of swimmers in the main and control groups had a high degree of fatigue. Data analysis by χ2-criterion showed, that the distribution of swimmers by degrees of fatigue in the main and control groups did not differ statistically significantly ($\chi 2_{emp.}$ = 0,148; $\chi 2_{crit.}$ 0,05 = 5,99; $\chi 2_{emp.} < \chi 2_{crit.}$ 0,05; degrees of freedom: n−1=2).

After the formative stage of the pedagogical experiment, significant changes in the test results of 4 × 50 m freestyle are noted, confirmed by calculations (according to the Student's t-test). The results of the dynamics of the test results 4 × 50 m at the end of the molding experiment show, that clear positive changes in the results of the passage of test segments are observed in both the main and control groups (Table 3).

Analysis of the test results with repeated loading of 4 x 50 m freestyle in the control and main groups of swimmers with visual impairments showed the presence of positive dynamics of recovery and approximation of the functional state of swimmers who participated in the study on the eve of a responsible start to the optimal sports form. This proves the effectiveness of the applied training effects, combined with a set of methods of physical rehabilitation, aimed at restoring the performance of swimmers in the pre-competition mesocycle of training in both the main and control groups (p < 0,05).

Table 3. *Comparative results of the 4 × 50 m freestyle test*

Pedagogical criteria	Test results ($\bar{x}$± S)															
	Test segments (4 × 50 m)															
	1 segment				2 segment				3 segment				4 segment			
	MG		KG		MG		KG		MG		KG		MG		KG	
	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after
Test results 4 × 50 m freestyle, s	0,2755±0,03	0,2464±0,04	0,2717±0,04	0,2483±0,02	0,2945±0,06	0,2848±0,01	0,2989±0,05	0,2898±0,07	0,3061±0,02	0,2984±0,05	0,3095±0,03	0,3171±0,07	0,3013±0,05	0,2893±0,06	0,3083±0,04	0,3016±0,02
p	< 0,05		< 0,05		< 0,05		< 0,05		< 0,05		< 0,05		< 0,05		> 0,05	
Ability to maintain a rational structure of movements, points	4,7±0,7	4,9±0,6	4,8±0,7	4,8±0,3	4,2±0,4	4,5±0,6	4,0±0,5	4,1±0,2	4,2±0,4	4,5±0,5	4,3±0,2	4,4±0,3	4,0±0,5	4,3±0,4	4,1±0,3	3,9±0,1
p	< 0,05		> 0,05		< 0,05		> 0,05		< 0,05		> 0,05		< 0,05		> 0,05	

Notes: MG – main group; *KG* – control group

However, the implementation of a detailed analysis of the dynamics of the results on each of the test segments in the athletes of the main and control groups showed, that the athletes of the main group showed a statistically significant higher resistance to fatigue than the athletes of the control group. According to the results of swimming 4 sections of the 4 x 50 m freestyle test in the main group of swimmers there was an increase in the speed of overcoming the distance from 0,3013 ± 0,05 s at the ascertaining stage up to 0,2893 ± 0,06 s on the molding ($p < 0,05$). Representatives of the control group did not show positive dynamics of results on the fourth segment of the test ($p > 0,05$). The corresponding results are recorded by the criterion of the ability of swimmers to maintain a rational structure of movements against the background of increasing fatigue.

4. Conclusions

Systematic holding of competitions of national and international levels in sports of invalids actualized attention of scientists to researches of new scientific problems, related to various aspects of correctional work with athletes with visual pathology in the system of their training. Increased attention of the state to the development of sports for the disabled, as a relatively new socio-cultural phenomenon, is based on the multifunctionality of its impact on the personality of athletes. Sport is one of the typical social models in the life of the individual and his place in society, it is an arena for self-affirmation, self-realization and public demonstration of one's own active life position, affirmation of the victory of the human spirit over the problems of existence.

In the course of the research the analysis of modern approaches to management of working capacity of highly skilled sportsmen was carried out. We conducted and an experimental study of the possibility of using methods of physical rehabilitation to restore the ability of athletes with visual impairments in sports for the disabled. Based on theoretical analysis and long-term experiment, an integrated assessment methodology of the effectiveness of the experimental method of restoring the ability of highly qualified swimmers with visual impairments has been developed. It can be used in the system of their preparation and participation in competitions. The results of practical implementation of the technique in the pre-competition period of training swimmers with visual impairments of high qualification allowed to confirm its effectiveness.

It was also established that when planning the content of training and participation of athletes in competitions, it is necessary to take into account the existing hygienic factors, that can have both positive and negative impact on the performance of athletes and the course of their recovery processes after training and competitive loads. The obtained results indicate the advantage of the experimental method of complex use of methods of physical rehabilitation to restore the performance of highly qualified swimmers with visual impairments in the pre-competition training period compared to the traditional methods.

Prospects for further research are associated with the monitoring of the recovery of athletes with visual impairments in the pre-competition and competitive periods of their training with the help of modern aspects of physical rehabilitation.

References

1. Balandin V. I. Psychological and pedagogical bases of forecasting in sports : dissertation abstract for the scientific degree of doctor of pedagogical sciences : specialty : 13.00.04 «Theory and methodology of physical education, sports training, health-improving and adaptive physical culture». St. Petersburg, 2000. 36 p. [in Russian].
2. Belikova N. O. Training of future specialists in physical rehabilitation for health care activities : theory and methodology : monograph. Kyiv, 2012. 584 p. [in Russian].
3. Boyko G. M. Psychological and pedagogical support of sports activities of swimmers with disorders of psychophysical development in Paralympic sports : monograph. Poltava, 2012. 360 p. [in Ukrainian].
4. Donchenko V. I., Zhamardiy V. O., Shkola O. M., Kabatska O. V., Fomenko V. H. Health-saving Competencies in Physical Education of Students // Wiadomości Lekarskie. 2020. Tom LXXIII, nr 1. P. 145–150.

5. Innovative processes in the development of technologies of mental training and psychodiagnostics in Olympic sports / P. V. Bundzen, K. G. Korotkov, V. I. Balandin [et al.] // Theory and practice of physical culture. 2001. № 5. P. 28–36. [in Russian].
6. Kiprych S., Donets O., Kornosenko O., Khomenko P., Zhamardiy V., Shkola O., Binetskyi D., Kasich N., Serhiienko V. and Bloshchynskyi I. Evaluation of Interconnection of Special Working Capacity and Response of Single Combat Sportsmen's Cardiorespiratory System at the Stage of Direct Training for Competition.
7. Kornosenko O., Denysovets T., Danysko O., Synytsya S., Voloshko L., Zhamardiy V., Donchenko V., Shkola O., Prystynskyi V. and Otravenko O. System of Preparation of Future Fitness Coaches' for Health-Improving Activity in the Conditions of Rehabilitation Establishments.
8. Korobeynikova L. H. Determinant of psychophysiological state in highly qualified athletes with different emotional characteristics // Psychology and medical and biological problems of physical education and sports. 2011. № 4. P. 94–98. [in Ukrainian].
9. Methodical recommendations for doctors of regional centers «Invasport», trainers and instructors in physical culture, carrying out medical control and leading health and sports work among athletes with visual impairments. Kyiv, 2014. 56 p. [in Russian].
10. Momot O., Zhamardiy V., Hrynova V., Gorlova L. and Sharlay N. Experimental Verification of the Effectiveness of Organizational and Pedagogical Conditions for the Education of the Future Teacher in the Health-Preserving Environment of the Institution of Higher Education.
11. Pohontseva O. V. Formation of readiness of future specialists in physical rehabilitation for professional activity in health centers : dissertation abstract for the scientific degree of candidate of pedagogical sciences : 13.00.04. Kyiv, 2011. 22 p. [in Ukrainian].
12. Porada A. M., Porada O. V. Medical and social rehabilitation and medical control : textbook. Kyiv, 2011. 295 p. [in Ukrainian].
13. Romanyshyn M. Ya. Professional training of specialists in physical rehabilitation to work with athletes : dissertation abstract for the scientific degree of candidate of pedagogical sciences : 13.00.04. Zhytomyr, 2009. 20 p. [in Ukrainian].
14. Shkola O., Zhamardiy V., Saienko V., Tolchieva H. and Poluliashchenko I. The Structure Model of Methodical System Usage Fitness-Technology in Student Physical Education.
15. Zhamardiy V. O., Donchenko V. I., Yemets A. V., Skrinnik Y. O. Physical Development by Means of Fitness Technologies as One of General Aspects of Student's Health // Wiadomości Lekarskie. 2019. Tom LXXII, nr 5 cz II. P. 1074–1078.
16. Zhamardiy V., Griban G., Shkola O., Fomenko O., Khrystenko D., Dikhtiarenko Z., Yeromenko E., Lytvynenko A., Terentieva N., Otravenko O., Samokish I., Husarevych O. and Bloshchynskyi I. Methodical System of Using Fitness Technologies in Physical Education of Students.
17. Zhamardiy V., Shkola O., Boichenko A., Prystynskyi V., Kornosenko O., Dmytrenko K., Kabatska O., Staroselska Y., Hordiienko O. and Postova S. Dynamics of Physical Fitness of Students during Powerlifting Classes.
18. Zhamardiy V., Shkola O., Otravenko O., Momot O., Andreieva M., Andrieieva O., Mudryk V., Slusarev V., Broslavska H. and Putiatina G. Dynamics of the Functional State of Students in the Process of Powerlifting in Higher Education.
19. Zhamardiy V. O., Shkola O. M., Okhrimenko I. M., Strelchenko O. G., Aloshyna A. I., Opanasiuk F. H., Griban G. P., Yahodzinskyi V. P., Mozolev O. M., Prontenko K. V. Checking of the Methodical System Efficiency of Fitness Technologies Application in Students' Physical Education // Wiadomości Lekarskie. 2020. Tom LXXIII, nr 2. P. 332–341.
20. Zhamardiy V., Shkola O., Tolchieva H., Saienko V. Fitness Technologies in the System of Physical Qualities Development by Young Students // Journal of Physical Education and Sport. 2020. Vol 20 (1), Art 19. pp. 142–149.

The Effect of Leisure Satisfaction on Job Satisfaction: A Research on Physical Education Teachers

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Abstract

The aim of this study is to investigate the effect of leisure satisfaction on physical education and sports teachers' job satisfaction. Data were obtained from physical education and sports teachers (N=230) working in public institutions in Turkey. First, an invitation message was sent to teachers including information about the study with electronic communication tools. Then, a questionnaire was sent to the teachers who agreed to participate in the study. The data were collected with two scales measuring leisure satisfaction and job satisfaction. The original form of the Leisure Satisfaction Scale (LSS) was developed by Beard and Ragheb (1), and adaptation studies into Turkish were done by Gokçe and Orhan (2) LSS consists of 24 items in its short form and 6 sub-dimensions: a) psychological, b) educational, c) social, d) physical, e) relaxation and f) aesthetic. JSS developed by Chang and Chang (3) and adapted to Turkish in sports sector by Yildiz (4) job satisfaction scale was used to measure job satisfaction. This scale, which has ten items, consists of internal and external satisfaction sub-dimensions. Descriptive analysis, reliability analysis, correlation, multiple regression analysis and hierarchical regression analysis were applied to the obtained data. Reliability of the scales was assessed using Cronbach's alpha. The values of Cronbach's alpha obtained for LSS (α=0.919) and JSS (α=0.790), indicating very good reliability scores and exceeding the 0.70 threshold cited in the literature. As a result of the hierarchical regression analysis, it was seen that leisure satisfaction had a significant and positive effect on physical education and sports teachers' job satisfaction.

Keywords: Leisure satisfaction, Job satisfaction, Physical education teachers.

1. Introduction

Job satisfaction is one of the most extensively evaluated and researched topics in management and organizational psychology (5). Working and organizational environment have an important place in the life of the individual. Employees spend most of their lives in the organization and planning activities related to the organization and transforming them into behaviour (6). The individual spends most of his / her time in business life. The level of satisfaction and pleasure that an individual obtains from work life affects their life outside of work to a large extent, and has a positive effect on the mental and physical health of the individual. This provides happiness in their family life and efficiency in the organization (7). The concept of satisfaction is explained as the state of meeting expectations, needs and requests. When leisure time activities are examined in terms of social, psychological, cultural and educational aspects, it is seen that they can directly affect work efficiency (8). Leisure includes voluntary activities that occur during times free from obligations like work and daily routines (9). Leisure includes watching television, pursuing hobbies, meeting friends, going to events and doing sports (10). Although it varies according to content and type, leisure time activities that satisfy essential needs such as belonging to a group, physical and mental development, self-expression play an important role in the socialization of individuals, the development of their social environment, and getting rid of the stress of work, daily life and monotony (11). Beard and Ragheb (1) defines leisure satisfaction as positive perceptions or emotions created or gained by an individual engaged in leisure time activities and choices. In other words, leisure satisfaction refers to how satisfied an individual is with their general leisure experiences and situations (1). Spector (12), on the other hand, defines job satisfaction as an employee's feeling about the job or attitude towards various aspects of the job. Job satisfaction is one of the essential needs for people to be successful, happy and productive. It is stated that besides personal characteristics such as age, gender, education level, job satisfaction is affected by organizational and environmental factors such as the content of the job, wage, management policy, working conditions (13). Life outside of work has an effect on how a person feels and acts at work. The improvement achieved during free time has an impact on how individuals experience the next work day and is crucial for

work engagement (14). Through participation in leisure activities, people build social relationships, acquire positive emotions, new skills and knowledge (15). Participation in leisure time activities can be used among working individuals as a means of dealing with work-related stress and improving their life quality (16,17). Participation in both physical and non-physical leisure activities has been shown to reduce depression and anxiety, procure positive moods and improve self-esteem and self-concept, facilitate social interaction, increase general psychological well-being and life satisfaction, and improve cognitive function (18). Hence it was concluded that individuals can contribute to physical, social, emotional and cognitive health through participation in leisure time activities (19). In today's societies, in the fast pace of life, the chance of individuals to use time which is the valuable resource in question effectively is decreasing. It is an undeniable fact that physical education teachers are very busy (lessons, extracurricular education activities, training and competition processes of school teams, etc.) and they need to manage their free time effectively and efficiently within this busyness (20). In situations such as the intense stressful work life brought by daily life, the individual needs regeneration and spare time for themselves. Individuals may experience problems such as depression, inefficiency in their business life, unhappiness and stress increase in the process where they cannot spare time for themselves from such situations (21). Therefore, considering that physical education teachers establish one-on-one relationships with students, support the student physically, mentally, and affectively and that the teacher should set an example in aspects of physical appearance and healthy life (22), it is also important for physical education teachers to increase their satisfaction and quality of life besides work by participating in leisure activities in terms of being a role model in society (23). Thus, a better understanding of the factors that contribute to physical education teachers' job satisfaction is also necessary to improve the quality of work life of physical education teachers. There are many studies in the literature dealing with the relationship between leisure satisfaction and other factors. However, it has been observed that there are very few studies examining the relationship between leisure satisfaction and job satisfaction (24–27). In this study, it is aimed to reveal the effect of leisure satisfaction on job satisfaction of physical education teachers.

2. Method

2.1. Study Group

Data in this study were obtained from physical education teachers working in state schools in Turkey. First, an invitation message was sent to teachers including information about the study with electronic communication tools. Then, a questionnaire was sent to the teachers who agreed to participate in the study. It was stated that the questionnaire forms sent back one week later were a total of 237. However 7 questionnaires were excluded from the study due to the extreme values of the data obtained. Thus, 230 forms were found suitable for the analysis to test the relationship between the determined variables.

2.2. Measurement Instruments

2.2.1 Leisure Satisfaction Scale

The original form of the Leisure Satisfaction Scale (LSS) was developed by Beard and Ragheb (1), and adaptation studies into Turkish were done by Gokçe and Orhan (2) The scale consists of 24 items in its short form and 6 sub-dimensions: a) psychological, b) educational, c) social, d) physical, e) relaxation and f) aesthetic. The short form, which has a 5-point Likert-type scale structure, is scored as (1) Almost Not Right at All - Almost Always True (5).

2.2.2. Job Satisfaction Scale

Developed by Chang and Chang (3) and adapted to Turkish in sports sector by Yildiz (4) job satisfaction scale was used to measure job satisfaction. Expressions in the job satisfaction scale ("1 = I do not agree at all", "2 = I disagree", "3 = uncertain", "4 = agree", "5 = totally agree") are 5-point Likert-type. This scale, which has ten items, consists of internal and external satisfaction sub-dimensions.

2.3. Data Analysis

Cronbach alpha coefficient was used to determine the reliability of the scales. In the next step, correlation analysis was conducted to determine the relationships between variables. The effect of independent variables on internal and external satisfaction, which are sub-dimensions of job satisfaction, was tried to be determined by multiple regression. The effect of leisure satisfaction on job satisfaction was tried to be determined by hierarchical regression.

3. Analysis and Findings

3.1. Sample Characteristics

Descriptive analysis showed that majority of the study participants were male (72.6%), married (73.5%), between the ages of 36-45 (39.1%), and held an undergraduate (75.7%). The number of physical education teachers with 4.001-5.000 TRY -income is 126 (54.8%) . In addition, in general, the concentration in the variable of "your working year" is 27.4% with between 1-5 years (Table 1).

Table 1. *Sample characteristics*

Variables		f	%
Gender	Female	63	27.4
	Male	167	72.6
Marital status	Single	61	26.5
	Married	169	73.5
Age	Less than 25	11	4.8
	26-35	87	37.8
	36-45	90	39.1
	46-55	34	14.8
	More than 56	8	3.5
Degree	Undergraduate	174	75.7
	Master	48	20.9
	Doctorate	8	3.5
Income (TRY)	Less than 4000	27	11.7
	4001-5000	126	54.8
	5001-6000	57	24.8
	More than 6001	20	8.7
Total number of years employed (year)	1-5	63	27.4
	6-10	52	22.6
	11-15	32	13.9
	16-20	33	14.3
	21-25	32	13.9
	More than 26	18	7.8

3.2. Test for Reliability

Since the validity analysis of both scales was performed several times by different studies before, only reliability analysis was performed in this study. Reliability analysis results yielded an excellent coefficient alpha score for the leisure satisfaction (α=0.919), and for the job satisfaction scale (α=0.790).

3.3. Correlation Analysis

Leisure time satisfaction sub-dimensions "Psychological (*r* = .298) " "Educational (*r* = .338) "Social (*r* = .368)" "Physical (*r* = .177) "Relaxation (*r* = .241)" and "Aesthetics (*r* = .227)" have a significant and positive relationship with job satisfaction at the p <0.01 level. The relationship between leisure time satisfaction and job satisfaction (*r* = .373; p <0.01) is significant and positive.

When looking at the relationships between the inner satisfaction and leisure time satisfaction sub-dimensions; "Psychological (*r* = .262)", "Educational (*r* = .306)", "Social (*r* = .346)", "Physical (*r* = .215)", "Relaxation (*r* = .210)" and "Aesthetics (*r* = .156)" they have a significant and positive relationship. When

looking at the relationships between the external satisfaction and leisure time satisfaction sub-dimensions; "Psychological (*r* = .251)", "Educational (*r* = .276)", "Social *(r* = .289)", "Relaxation (*r* = .204)" and "Aesthetics *(r* = .230)", they have a significant and positive relationship. Here, it is seen that the strength of the relationship between internal satisfaction and leisure time satisfaction sub-dimensions is higher than that between external satisfaction and leisure time satisfaction (Table 2).

Table 2. *Results of correlation analysis*

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Gender	1														
2. Marital status	.006	1													
3.Age	.020	.369**	1												
4.Degree	.141*	.018	-.015	1											
5.Income	.163*	.170**	.291**	.282**	1										
6.Total number of years	-.091	.316**	.817**	.008	.336**	1									
7.Internal satisfaction	.074	-.077	.036	.043	.034	.054	1								
8.Externalsatisfaction	.045	.055	-.118	.028	.180**	-.064	.473**	1							
9.Job satisfaction	.068	-.008	-.054	.041	.130*	-.011	.836**	.879**	1						
10.Psychological	-.040	.067	.059	-.124	.074	.190**	.262**	.251**	.298**	1					
11.Educational	.021	.022	-.077	-.144*	.000	.016	.306**	.276**	.338**	.614**	1				
12.Social	.075	.026	-.016	-.205**	-.100	.023	.346**	.289**	.368**	.476**	.622**	1			
13.Physical	-.024	.083	-.103	-.072	-.080	.036	.215**	.097	.177**	.525**	.565**	.441**	1		
14.Relaxation	.083	-.003	-.110	-.029	-.017	-.022	.210**	.204**	.241**	.374**	.415**	.353**	.512**	1	
15.Aesthetics	-.087	.086	-.098	-.063	-.122	-.015	.156*	.230**	.227**	.420**	.360**	.328**	.454**	.445**	1
16.Leisuresatisfaction	.008	.061	-.080	-.142*	-.056	.047	.336**	.307**	.373**	.756**	.804**	.723**	.773**	.709**	.684**

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

3.4. Multiple Regression Analysis Results on the Effect of Independent Variables on Internal Satisfaction

Regression analysis reveals how other variables react when one of the variables changes a unit. Therefore, when "Psychological", "Educational", "Social", "Physical", "Relaxation" and "Aesthetics" variables that have significant and positive relationship with internal satisfaction variable in correlation analysis enter multiple regression analysis together, only the "Social" variable has a significant and positive effect on the internal satisfaction variable (β = .235; p <0.05) (Table 3).

Table 3. *Multiple regression analysis results on the effect of independent variables on internal satisfaction*

Variables	B	SH	Beta	t	p
Psychological	.079	.086	.077	.923	.357
Educational	.085	.084	.096	1.022	.308
Social	.224	.077	.235*	2.898	.004*
Physical	-.013	.092	-.012	-.147	.883
Relaxation	.061	.066	.070	.925	.356
Aesthetics	-.012	.066	-.014	-.187	.852

Note: $R^{2=}$ .14; Adjusted R^2= .11; $F_{6,223}$=6.090; *p<.05

3.5. Multiple Regression Analysis Results on the Effect of Independent Variables on External Satisfaction

Regression analysis reveals how other variables react when one of the variables changes a unit. Thus, in the correlation analysis, the response of the variables "Psychological", "Educational", "Social", "Relaxation" and "Aesthetics", which have a significant and positive relationship with the external satisfaction variable,

has a significant and positive effect, on the external satisfaction variable of the "social" variable in the multiple regression analysis (ß = .170; p <0.05) (Table 4).

Table 4. *Multiple regression analysis results on the effect of independent variables on external satisfaction*

Variables	B	SH	Beta	t	p
Psychological	.128	.099	.108	1.294	.197
Educational	.146	.096	.142	1.520	.130
Social	.186	.088	.170	2.098	.037*
Physical	-.283	.105	-.228	-2.692	.008*
Relaxation	.100	.075	.101	1.326	.186
Aesthetics	.139	.076	.136	1.832	.068

Note: *R^2 = .14; Adjusted R^2= .12; $F_{6,223}$=6.305; *p<.05*

3.6. Hierarchical Regression Analysis Results on the Effect of Leisure Satisfaction on Job Satisfaction

At this stage, a two-step hierarchical regression analysis was applied where job satisfaction was the dependent variable, and control variables and leisure time satisfaction were independent variables. Analysis result shows that leisure satisfaction affects job satisfaction significantly and positively (ß = .395; *p* <0.001), and, that it has an explanatory power of 0.14. On the other hand, in the control variables, only income was found to have a significant effect on job satisfaction (ß = .395; *p* <0.05) (Table 5).

Table 5. *Hierarchical regression analysis results on the effect of leisure satisfaction on job satisfaction*

	Step 1			Step 2		
Independent variables	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Gender	.056	.812	.418	.024	.377	.707
Marital status	.003	.043	.965	-.039	-.590	.556
Age	-.162	-1.369	.172	.004	.037	.971
Degree	-.011	-.154	.878	.049	.751	.453
Income	.145	1.945	.053	.165*	2.389	.018
Total number of years	.077	.650	.516	-.074	-.652	.515
Leisure satisfaction	-	-	-	.395**	6.199	.000
F		1.159			6.650	
R^2		.030			.173	
Adjusted R^2		.004			.147	
Note: Standardized beta values were used. **p<0.001 *p<0.05						

4. Discussion and Conclusion

In our study, it was shown that the leisure satisfaction and job satisfaction (*r* = .373; p <0.01) have a significant and positive relationship, and leisure time satisfaction affects job satisfaction significantly and positively (ß = .395; *p*<0.05), and again, that it has an explanatory power of 0.14. Another substantial finding in this study is that when we look at the relationships between internal satisfaction and leisure satisfaction sub-dimensions, they have a significant and positive relationship. When looking at the relationships between the external satisfaction and leisure time satisfaction sub-dimensions; they have a meaningful and positive relationship. Here, it is seen that the strength of the relationship between internal satisfaction and leisure time satisfaction sub-dimensions is higher than that between external satisfaction and leisure time satisfaction. This obtained result shows similarities with the findings of the study of Baskonus (24) named "Analysis of the relationship between leisure satisfaction and job satisfaction levels of physical education teachers". In this study the fact that there is a positive and moderate relationship between the leisure satisfaction and job satisfaction levels of physical education teachers (*r* = .458; p <.05) has been determined. When the subscales of leisure satisfaction and job satisfaction are examined; it has been determined that there is a moderate relationship between the sub-dimensions of leisure satisfaction and the inner satisfaction of physical education teachers; and there is a low level relationship between the sub-dimensions of leisure satisfaction and the external satisfaction of physical education teachers.. Here, similar to our study, it is seen

that the strength of the relationship between internal satisfaction and leisure satisfaction sub-dimensions is higher than that between external satisfaction and leisure satisfaction. This result supports the Herzberg Theory. Accordingly, when the levels of internal and external satisfaction are compared, higher levels of internal satisfaction make employees reach satisfaction according to Herzberg Theory, while low level of external satisfaction decreases the level of general job satisfaction (28,29).

As a result of a research Dogan (25) conducted on academics; there is a positive and moderate relationship between leisure satisfaction and job satisfaction levels (R = 0.405), and leisure satisfaction levels explained 16% of the total variance on job satisfaction, and reached similar results. In a study conducted on university staff participating in sports recreation activities; despite the fact that the employees spend their free time mostly by participating in sports and social activities, it has been determined that their job satisfaction levels are low (30,31). Koc and Er (26), as a result of a research they conducted on academicians working at the faculty of sports sciences; determined that there is a positive and low level relationship between leisure satisfaction and job satisfaction. In a study they did with nurses, Lee and Kim (2019) showed that job satisfaction has a significant relationship with work stress (r =.-320, p <.001) and leisure satisfaction (r =.317, p <.001). They found that leisure satisfaction has a significant effect on the relationship between job stress and job satisfaction. Nurses who perceive higher satisfaction in their leisure time have found that they tend to be more satisfied with their job, even under stress. Pearson (27), in a study conducted on 189 full-time working adult men, determined that job satisfaction and leisure satisfaction positively affect psychological health. It can be said that participating in leisure time activities positively affects the quality of work life. Another finding obtained from this study is that it was determined that only income from the control variables had a significant effect on job satisfaction ($ß$ = .395; p <0.05). It can be said that the income obtained has an important place in the social lives of physical education teachers. In the researches, the income significantly affects participation in leisure activities (11,32–35) and life satisfaction (36–38). Another notable finding in this study is that social variable, one of the independent variables, was found to have a significant and positive effect on the internal and external satisfaction variables. While participating in leisure time activities plays a substantial role in coping with stress, burnout and mental fatigue, it can be said that it positively affects the individual himself, his relationships and socio-cultural adaptation (39). At the same time, it provides important benefits such as social and cultural interactions, an increase in self-esteem and sense of belonging and opportunities to meet others (40,41).

The studies mentioned above show that leisure satisfaction has a significant and positive effect on job satisfaction. According to our study findings mentioned above, it can be said that leisure satisfaction has a positive effect on physical education teachers' job satisfaction. As a result, it can be said that individuals, to minimize the adverse effects of unhealthy conditions arising from work environment, to protect their health or to be healthier, to regain the mental energy reduced by work and school life, participating in various positive activities related to sports, arts and culture in their leisure time; creating a qualified culture, raising good citizens, ensuring a successful teaching process is closely related to the correct use of leisure time (42).

References

1. Beard JG, Ragheb MG. Measuring leisure satisfaction. Journal of leisure Research. 1980;12(1):20–33.
2. Gokçe H, Orhan K. Serbest zaman doyum ölçeğinin Türkçe geçerlilik güvenirlik çalışması. Spor Bilimleri Dergisi. 2011;22(4):139–45.
3. Chang C-S, Chang H-H. Effects of internal marketing on nurse job satisfaction and organizational commitment: example of medical centers in Southern Taiwan. The Journal of Nursing Research. 2007;15(4):265–74.
4. Yildiz SM. İçsel pazarlamanın iş tatmini ve işten ayrılma niyeti üzerindeki rolü: Spor ve Fiziksel Etkinlik İşletmeleri Üzerine Ampirik Bir İnceleme. Ege Academic Review. 2014;14(1):137–46.
5. Altahayneh ZL, Khasawneh A, Abedalhafiz A. Relationship between organizational justice and job satisfaction as perceived by Jordanian physical education teachers. Asian Social Science. 2014;10(4):131–8.
6. Kul M, Guçlu M. Okul yöneticilerinin liderlik stilleri ile beden eğitimi öğretmenlerinin örgütsel bağlılıkları arasındaki ilişki. Uluslararası İnsan Bilimleri Dergisi. 2010;7(2):1021-1038.
7. Orucu E, Yumusak S, Bozkır Y. Kalite yönetimi çerçevesinde bankalarda çalışan personelin iş tatmini ve iş tatminini etkileyen faktörlerin incelenmesine yönelik bir araştırma. Celal Bayar Üniversitesi İİBF Yönetim

ve Ekonomi dergisi. 2006;13(1):39–51.
8. Yasarturk F, Bilgin B. Üniversitede öğrenim gören hentbolcuların serbest zaman tatmin ve yaşam doyum düzeylerinin incelenmesi. International Journal of Contemporary Educational Studies. 2019;4(2):50–60.
9. Stevens AB, Coon D, Wisniewski S, Vance D, Arguelles S, Belle S, et al. Measurement of leisure time satisfaction in family caregivers. Aging and Mental Health. 2004;8(5):450–9.
10. Rada C. Spending leisure time in Romania: The impact of sociodemographic factors. Revista de Psihologie. 2015;61(2):85–96.
11. Ardahan F, Lapa Yerlisu T. An examination of leisure satisfaction level of university students with regard to gender and income. Hacettepe J of Sport Sciences. 2010;21(4):129–36.
12. Spector PE. Job satisfaction: Application, assessment, causes, and consequences. Vol. 3. Sage publications; 1997.
13. Gencay ÖA. Beden eğitimi öğretmenlerinin iş doyumu ve mesleki tükenmişliklerinin bazı değişkenler açısından incelenmesi. Kastamonu Eğitim Dergisi. 2007;15(2):765–80.
14. Sonnentag S. Recovery, work engagement, and proactive behavior: A new look at the interface between nonwork and work. Journal of Applied Psychology. 2003;88(3):518–28.
15. Brajša-Žganec A, Merkaš M, Šverko I. Quality of life and leisure activities: How do leisure activities contribute to subjective well-being? Social Indicators Research. 2011;102(1):81–91.
16. Trenberth L, Dewe P. The importance of leisure as a means of coping with work related stress: An exploratory study. Counselling Psychology Quarterly. 2002;15(1):59–72.
17. Kemperman ADAM, Timmermans HJP. Influence of socio-demographics and residential environment on leisure activity participation. Leisure Sciences. 2008;30(4):306–24.
18. Haworth J, Lewis S. Work, leisure and well-being. British Journal of Guidance and Counselling. 2005;33(1):67–79.
19. Trenberth L. The role, nature and purpose of leisure and its contribution to individual development and well-being. British Journal of Guidance and Counselling. 2005;33(1):1–6.
20. Caz Ç, Tunckol MH. Beden eğitimi ve spor öğretmeni adaylarının zaman yönetimi becerilerinin incelenmesi. CBÜ Beden Eğitimi ve Spor Bilimleri Dergisi. 2015;8(2):23–9.
21. Erdemli E, Yasarturk F. Beden eğitimi ve spor öğretmenliği bölümü öğrencilerinin serbest zaman doyum düzeyi ve problem çözme becerileri arasındaki ilişkinin incelenmesi. MANAS Sosyal Araştırmalar Dergisi. 2020;9(3):1871–82.
22. Saracaloğlu SA, Certel Z, Varol RS, Bahadır Z. Beden eğitimi öğretmenlerinin özyeterlik inançları ve denetim odaklarının incelenmesi. Adnan Menderes Üniversitesi Eğitim Fakültesi Eğitim Bilimleri Dergisi. 2012;3(2):54–65.
23. Lapa Yerlisu T, Ağyar E, Bahadır Z. Yaşam tatmini, serbest zaman motivasyonu, serbest zaman katılımı: Beden eğitimi ve spor öğretmenleri üzerine bir inceleme (Kayseri ili örneği). SPORMETRE Beden Eğitimi ve Spor Bilimleri Dergisi. 2012;X(2):53–9.
24. Baskonus T, Ciris V, Soyer F. An analysis of the relation between levels of leisure satisfaction and job satisfaction of physical education teachers. Acta Kinesiologica. 2012;63(June):425–53.
25. Dogan M, Elci G, Gurbuz B. Serbest zaman doyumu, serbest zamanda sıkılma algısı ve iş tatmini ilişkisi: Akademisyenler üzerine bir araştırma. SPORMETRE Beden Eğitimi ve Spor Bilimleri Dergisi. 2019;17(1):154–64.
26. Koc M, Er Y. Leisure satisfaction and job satisfaction: A research on academics. African Educational Research Journal. 2020;8(2):329–41.
27. Pearson QM. Job satisfaction, leisure satisfaction, and psychological health. The Career Development Quarterly. 1998;46(4):416–26.
28. Koroglu Ö. İçsel ve dışsal iş doyum düzeyleri ile genel iş doyum düzeyi arasındaki ilişkinin belirlenmesi: Turist rehberleri üzerinde bir araştırma. Doğuş Üniversitesi Dergisi. 2012;2(13):275–89.
29. Alshmemri M, Shahwan-Akl L, Maude P. Herzberg's two-factor theory of job satisfaction. Life Science Journal. 2017;14(5):12–6.
30. Aydın E. Spor yapan üniversite personelinin iş doyum düzeylerinin belirlenmesi. Turkish Journal of Educational Studies. 2017;4(1):89–113.
31. Aydın E, Birol SŞ, Temel V. Sportif rekreasyon aktivitelerine katılan üniversite personelinin iş doyum ve

kaygı düzeylerinin belirlenmesi. KMÜ Sosyal ve Ekonomik Araştırmalar Dergisi. 2017;19(32):78–83.
32. Akgul BM, Ayyildiz T, Karaman M. Examination of leisure satisfaction levels of individuals participating in recreative activities through sports centers with regard to some variables. Niğde University Journal of Physical Education And Sport Sciences. 2014;8(3):278–87.
33. Demir ŞŞ, Demir M. Kamu kesïmïndekï yönetïcïlerïn serbest zaman etkïnlïklerïnï algılaması ve değerlendïrmesï. Manas Sosyal Araştırmalar Dergisi. 2014;3(3):61–76.
34. Russell R V. The importance of recreation satisfaction and activity participation to the life satisfaction of age-segregated retirees. Journal of Leisure Research. 1987;19(4):273–83.
35. Lee YG, Bhargava V. Leisure time: Do married and single individuals spend it differently? Family and Consumer Sciences Research Journal. 2004;32(3):254–74.
36. Cheung F, Lucas RE. When does money matter most? Examining the association between income and life satisfaction over the life course. Psychology and Aging. 2015;30(1):120–35.
37. Karaman M. Rekreasyonel amaçlı spor yapan bireylerin yaşam tatmini ve umutsuzluk düzeylerinin incelenmesi. Yüksek Lisans Tezi, Ankara; 2015.
38. Ozyer K, Irk E, Anaç S. İş tatmini ve yaşam tatmini ilişkisinde iş arkadaşlığının aracılık rolü. Cumhuriyet Üniversitesi İktisadi ve İdari Bilimler Dergisi. 2015;16(1):261–78.
39. Saltık Z, Akova O. Yakın açık alan rekreasyon aktivitelerinin iyi olma hali, psikolojik dayanıklılık, yenilenme deneyimi, yaşam doyumu ve iş tatmini üzerinde etkileri. Spor ve Rekreasyon Araştırmaları Dergisi. 2019;1(1):1–20.
40. Siegenthaler KL. Health benefits of leisure research update. Parks and Recreation. 1997;32(1):24–31.
41. Tekin A. Rekreasyon. Ata Ofset Matbaacılık, Ankara. 2009.
42. Tekin G, Amman TM, Tekin A. Serbest zamanlarda yapılan fiziksel egzersizin üniversite öğrencilerinin depresyon ve atılganlık düzeylerine etkisi. Uluslararası İnsan Bilimleri Dergisi. 2009;6(2):148-159.

Model of Pedagogical System for Teaching Students Motor Actions in Powerlifting

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Abstract

During the implementation of the tasks of experimental work we developed model of pedagogical system for teaching students motor actions in powerlifting, which includes the purpose, tasks, stages, methodological support, as well as principles, patterns, pedagogical conditions required for formation of special skills and abilities. The model was based on the structure of physical education with the teaching, educational and health-improving functions. The developed model is based on the principles of environmental compliance, consciousness and activity, regularity and gradualness, repetition and clarity, as a necessary condition for successful learning. Introduction of a model of pedagogical system of learning motor actions in powerlifting in physical education process contributes to the acquisition of special knowledge, skills and abilities by students.

Keywords: methodical, model, powerlifting, students, physical fitness, physical education.

1. Introduction

The problem of preserving and strengthening the health of the younger generation has always attracted the attention of public figures such as: sports coaches, scientists, cultural figures, educators. The practical significance of its solution is related to the implementation of the provisions of following legal documents: «Concepts of physical education in the education system of Ukraine», Target comprehensive program «Physical education is the health of the nation», which are designed to carry out propaganda work on the involvement of children and youth in active forms and methods of physical training, achieving sports results. In today's conditions, the urgency of this problem is due to socio-cultural, scientific, pedagogical, organizational and managerial factors.

Modern lifestyle encourages young people to physical perfection. Healthy lifestyle, the formation of a beautiful athletic physique is relevant to modern youth. Encouragement to this are the standards of beauty of ancient Greece, for instance: Hercules, Pythagoras, Platon and modern handsome athletes: V. Virastyuk, A. Krymov, V. Naleykin, O. Solovyov, O. Shepel. Classes in the gym, under the guidance of a coach allow you to become strong. They led to creation of a separate sport namely the powerlifting. Powerlifting (from eng. powerlifting: «power» – strength, power and «lifting» – raise, pick up, elevate) it is a relatively young sport, the essence of which is to overcome the maximum weight during the performance of three exercises: squats with a barbell on shoulders (squat); barbell press lying on a horizontal bench (bench press), and barbell lifting while standing (deadlift). The amount of points scored for the exercises determines the qualification of the athlete. This sport is gaining more and more popularity every year, as evidenced by the dynamics of participation of athletes in competitions. Participation in trainings and competitions of not only men, but also women is considered to be an indicator of the development of power triathlon. It has also recently become popular to hold competitions using a single exercise namely the bench press, which is recognized both among amateurs and among professional athletes [17, 18, 19, 22, 23, 28, 29, 30].

Analysis of data from scientific and methodological and special literature shows that, that the problem of forming special skills and abilities of students in the process of powerlifting classes is studied in the

following main areas: development of methods for training highly qualified athletes in powerlifting; research of features of youth sports in powerlifting; identification of means and methods of recovery during powerlifting classes; use of powerlifting in physical education process; improving the technique of competitive exercises in powerlifting; substantiation of features of women's powerlifting.

2. Materials and Methods

The aim of the study is to develop and experimentally test the model of pedagogical system of training students of motor actions in powerlifting in physical education process.

General scientific and special research methods were used to achieve the set goal and solve the problems, interconnected and consistently applied throughout the study: *theoretical (for the formation of theoretical and methodological foundations of the study):* analysis and generalization of philosophical, sociological, psychological, pedagogical, valeological literature; study of educational programs; regulatory and legislative documents; methodical recommendations and textbooks on psychological and pedagogical disciplines; study of the experience of physical education departments in the development of powerlifting in higher education institutions; *empirical* (*to determine the general health of students):* methods of collecting information (questionnaires, surveys, pedagogical testing and observation of students' educational and training activities), analysis of learning outcomes, interviews, methods of expert assessments, self-assessment, generalization of independent characteristics; *experimental (for the analysis of the basic ways of research of complex indicators):* ascertaining, formative, control stages of pedagogical experiment using the Diary of physical self-improvement in powerlifting, visual aids; *statistical (to assess the statistical significance of differences in the status and dynamics of changes in health indices):* descriptive statistics, determination of statistical significance of differences between groups by the Student's method and correlation analysis by the Pearson method.

The pedagogical experiment was carried out on the basis of Poltava National Pedagogical University named after V. G. Korolenko, which was attended by twelve study groups of students (a total of 294 people, including 161 – boys and 133 – girls) from historical, natural, psychological-pedagogical, physical-mathematical and philological faculties. All students were divided into control and experimental groups by the method of even distribution of groups. According to the schedule, physical education classes in all groups were held once or twice a week in the morning. Students of control groups were engaged in the curriculum for higher education institutions [14]. Students of experimental groups were engaged in the developed author's technique of formation of special abilities and skills in powerlifting. Training sessions, as part of compulsory and independent classes, were held three times a week in powerlifting and two classes, which included running and swimming. The duration of training sessions in groups was 90 minutes. The effectiveness of the proposed method was evaluated by the results of control tests. At the beginning of the school year (September), physical training tests were conducted and the level of special physical training in powerlifting in control and experimental groups was assessed. Control tests were conducted at the end of the school year (May-June). Students who dropped out of the experimental and control groups during their studies were not included in the statistical processing and were not replaced by others.

3. Results and Discussion

In the course of realization of tasks of experimental work, the model of pedagogical system of training of motor actions in powerlifting was developed, which includes the purpose, tasks, stages, methodological support, as well as principles, regularities, pedagogical conditions of formation of special abilities and skills. The introduction of this model in physical education process will help students to acquire special knowledge, skills and abilities (Fig. 1).

The model of the educational process is a reference idea of student learning, its construction in the conditions of specific educational institutions. It determines the purpose, basics of organization and conduct of the educational process. Its main components should be following components: target, stimulating and motivational, semantic, procedural, control and regulating, evaluative and effective and subject to subject components [1, 13, 14, 22, 24, 27].

The model is an image of the system of formation of special knowledge, motor skills and abilities of students in the process of powerlifting classes. According to D.S. Mazokha, the purpose of learning is the

expected end result of purposeful activity of the teacher and cognitive activity of students. It is an intermediate path to the harmonious spiritual development of the individual [7]. The objectives of the training sessions are mastering the system of scientific knowledge, formation of special skills, worldview, moral views and beliefs, ideals, needs, values, behaviors and activities, selection of loads of different orientation depending on the volume and intensity of physical activity [5, 10, 21, 26].

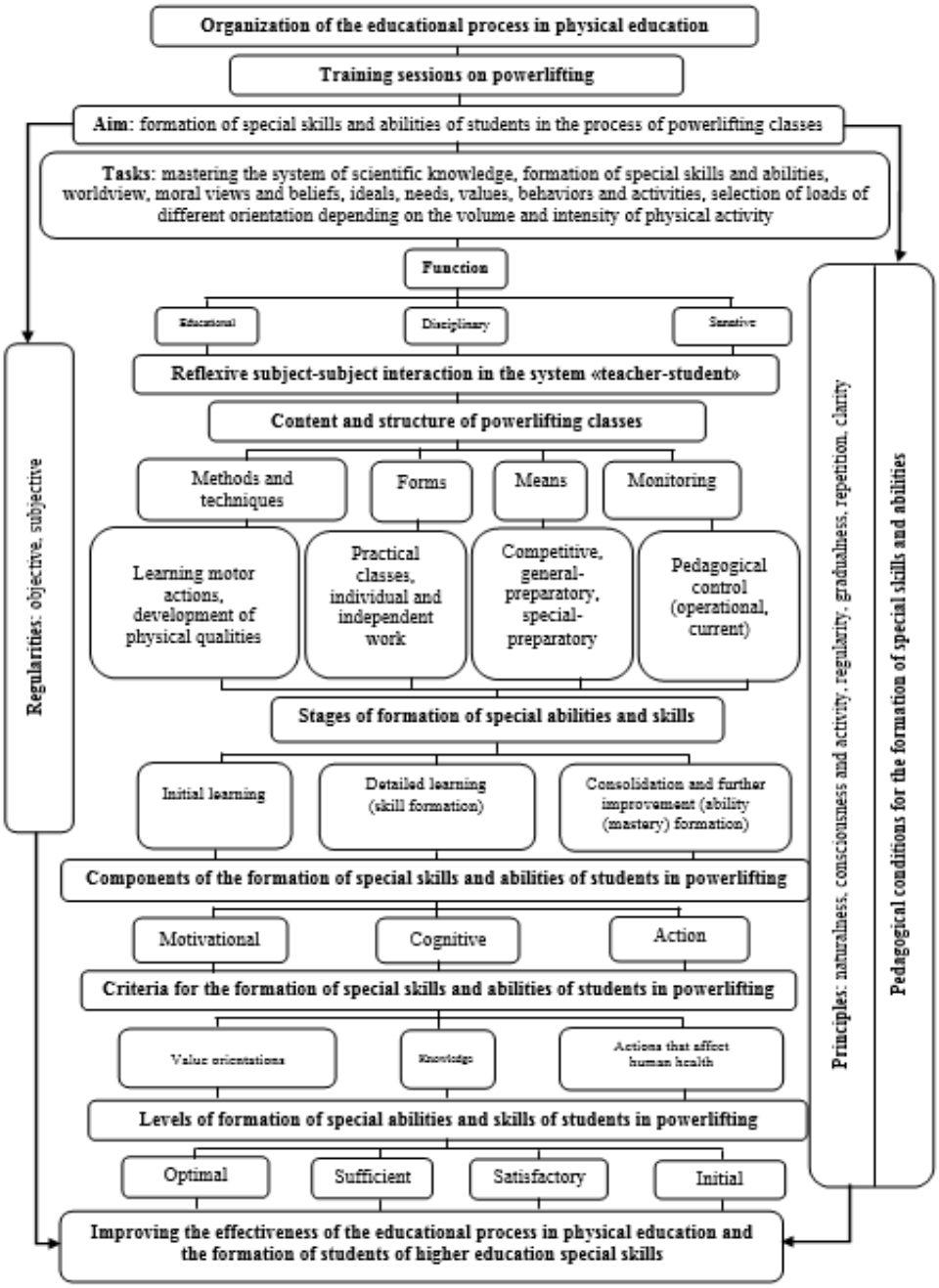

Fig. 1. *Model of pedagogical system of training students of motor actions in powerlifting*

The model was based on the structure of physical education with the solution of educational, upbringing and health functions. All three functions are interconnected, and this is provided by the specifics of training sessions, the content of training, the use of methods, forms and means of training, control and

analysis of results. The principles of teaching are guiding provisions, normative requirements for the organization and conduct of the didactic process, which have the form of general instructions, rules and norms and follow from its laws, which are sustainable pedagogical phenomena based on the recurrence of facts, educational activities and is the theoretical basis of the principles of learning. Among them there are objective and subjective patterns of learning. The first are inherent in the learning process in its essence. The latter are dependent on the teacher and his activities [2, 4, 6, 20, 25].

The objective laws used in the process of powerlifting include: 1) educational and developmental nature of powerlifting training sessions; 2) conditionality of training by social needs and interests of students; 3) interdependence of efficiency of training sessions on powerlifting on pedagogical conditions; 4) interdependence of education on age, sex and individual characteristics of students; 5) the interdependence of the effectiveness of powerlifting classes on the level of physical fitness of students; 6) purposeful interaction of the trainer-teacher and the student.

Subjective patterns are: 1) concepts can be mastered only when the educational and training activities of students are properly organized; 2) skills are formed only under the condition of organizing the reproduction of operations and actions underlying them; 3) mastering of the content of educational material is facilitated by systematic repetition of this content and its introduction into the system of already mastered content; 4) mastering complex ways of performing the exercise depends on mastering the previous simple ways; 5) use of varied tasks by the trainer-teacher, involving the application of acquired knowledge during powerlifting classes, transfer of acquired knowledge and related actions to a new situation; 6) interdependence of methods, means and forms of education on its content and tasks; 7) the interconnection of the components of learning ensures effective learning outcomes, education and development.

The developed model is based on the principles of conformity to nature (naturalness), consciousness and activity, regularity and gradualness, repetition and clarity, as a necessary condition for successful learning.

The principle of conformity to nature is aimed at conducting powerlifting classes taking into account age, gender and individual characteristics, level of physical development and physical fitness, compliance of physical activities with the strength and capabilities of students. Without accounting of age, gender and individual characteristics, level of physical development and physical fitness, it is impossible to determine the load or identify the most effective means of training, improve technical skills. Assessment of students' functional capabilities, their relationship with model characteristics and development on this basis of the program of development of physical qualities of youth by means of powerlifting or complexes of training influence is done through the implementation of the principle of naturalness.

The principle of consciousness and activity involves educating students in a positive attitude to powerlifting classes, understanding the purpose of these classes and specific tasks on the way to achieving it, development of a lasting interest in systematic and purposeful physical improvement. It also requires a thoughtful attitude to learning, understanding the material being studied, assessment of their strengths and capabilities, critical attitude to their actions during the training process. The student's ability to self-analyze basic powerlifting exercises is important, as well as ability to choose rational exercises for training, determining the optimal physical activity.

Research shows that the conscious attitude of students to work not only improves its quality, but also effectively affects performance. With a high level of motivation, students are able to withstand much greater stress on the psyche and vegetative system of the body than in the case of a passive attitude to classes [12].

The implementation of student activity depends on the organizational forms of training and methods of forming special skills and abilities. If there are elements of competitions, a variety of exercises, the staffing of the group with equal students by their strength, then the effectiveness of the training process increases. The activity of those involved in training is related to understanding the social essence of sports, its importance as a means of promoting health, harmonious and spiritual development.

The principle of regularity and gradualness stands for the regularity and regularity of powerlifting classes, gradual and consistent study of methods, options and types of athletic exercises, thereby providing the necessary link between the various aspects of the training process and its content. It provides for compliance with three main rules: from simple to complex; from easy to difficult; from the known to the

unknown. The implementation of this principle involves a sequence of learning exercises that provides the formation of special skills and abilities.

The principle of repetition is based on the physiological position of the need for repeated effects for the formation of conditioned reflex connections, for the emergence of appropriate changes in the organs and systems of the body of students in order to improve their functionality. Only repetition of the exercise for many times allows to form and consolidate special knowledge, skills and abilities and to increase sports results.

The principle of clarity involves the use of tools and techniques of training, which provide an understanding of the essence of the exercise being studied, and helps to create a correct idea of the technique of its implementation. It is implemented through the use of technical teaching aids with visual and auditory indications. The use of these tools in the training process of powerlifting is especially important for improving the technique of performing exercises. An important factor for the full implementation of the principle of clarity is attending competitions and training sessions of outstanding athletes in powerlifting.

Increasing the level of formation of special skills and abilities of students in the process of powerlifting classes is achieved in the case of compliance with such pedagogical conditions: development of students' positive attitude and motivation for powerlifting classes; clear awareness of the purpose and objectives of training sessions; selection of optimal training means and methods of development of strength qualities taking into account individual psychophysiological capabilities of the body of students; conscious desire for self-improvement; providing the necessary technical equipment and sports equipment; intensification of independent work of students and taking into account the sensitive period of development of their strength qualities; ability to self-esteem, self-analysis and self-control.

In the process of powerlifting classes, three periods were identified, which had the appropriate stages. At the first period there was an initial study of motor action. On the second period in-depth detailed learning was carried out. This corresponded to the period of mastering motor action at the skill level. At the third stage there was a consolidation and further improvement of motor action. This corresponded to the stage of mastering motor action at the ability (mastery) level.

Optimization of physical education was implemented using a system of pedagogical actions presented according to the logic of the developed model. Its structural units were humanistic and professional actions of the trainer-teacher by means of the corresponding methods and methodical receptions, means and forms of organization of educational classes.

Learning optimization is the selection of the best options for specific conditions in order to obtain the best results [9, 16]. In the course of training, we used mainly practical methods of teaching in all its forms. By definition, S.I. Prysyazhnyuk, teaching methods are forms of mutual practical activity of a student and a teacher, aimed at solving health, educational and training tasks using the means of physical culture and sports [11]. Here are the most commonly used training methods in powerlifting. *The method of using the word.* It is impossible to conduct a training session without explaining the exercise by a coach or teacher, without a verbal remark on the elimination of errors in the technique of its implementation. *Method of using visual aids.* Showing movies, demonstration of memorized exercises for high-class athletes, use of visual aids. *Method of exercise disassembly.* The exercise is divided into components or phases. Athletes master each of them separately and only then they master the whole exercise. The method is used not only in the learning process, but also in training, when you need to correct or improve the details of the exercise. *The method of holistic exercise.* This method can be used when teaching simple exercises and exercises similar to those previously studied. Also used to train athletes with good coordination. *Combined method.* This is the most effective method, which combines the method of exercise disassembly and the method of holistic exercise. *Method of repeating the exercise*. Repeated exercises with a barbell, weights, dumbbells, exercise machines and exercises in other sports. *Method of programmed learning.* Teaching students the optimal training program. Use of monthly, weekly training plans. *Method of using technical means.* Mostly three types of information are used: visual, sound, tactile. *Game method.* Carrying out of games for increase of emotionality of educational employment, for rest, physical development. *Method of testing knowledge, skills and abilities.* Used in the process of estimates, competitions, tests, daily observations [12].

In each of the above methods of workload, the duration of work and rest corresponded to the state of health and type of disease of students. The method of determining individual limits of physical activity

intensity has gained considerable use during powerlifting training sessions, according to the energy capabilities of the student's body.

The main methods of formation of motor skills included a holistic and disassembly method. The first was used in the study of relatively simple movements, as well as at the final stage (consolidation) of mastering complex movement. The purpose of its application is to teach the student to perform the exercise completely, sometimes after explanation and demonstration by the teacher. The disassembly method was used during the study of all complex movements. The peculiarity of this method of teaching is the division of the exercise into separate elements or phases, which were studied in parts. Students study and master each of them separately, and then after combining them together, perform the exercise as a whole.

The development of each physical quality was carried out through such *methods*.

Strength: 1) maximum effort method – lifting the heaviest load; 2) method of repeated efforts – repeated lifting the load «to refusal» at a slow pace; 3) method of dynamic efforts – repeated strength exercises with maximum speed.

Endurance: 1) method of long, continuous, uniform exercise – running at a moderate speed for at least 10 minutes; 2) variable method – running with small accelerations (100–200 m); 3) method of interval training – run of segments of 150–600 m with submaximal (heart rate – 165–180 beats/min) speed with rest intervals between loads sufficient to reduce the heart rate to 120 beats/min; 4) «circular training» method – strength exercises for the development of major muscle groups, performed sequentially (in a circle) at specially equipped «stations».

Speed: 1) method of repeated exercises – repeated run of short (up to 30 m) segments with the maximum speed; 2) method of repeated-progressive exercise – gradual increase in speed in each run with the maximum result; 3) method of alternating exercise – running a short distance with varying speeds from low to high.

Flexibility: 1) method of slow movements – slow turns, inclines, diversion with limited amplitude without load and with load; 2) method of swinging movements – performing movements with a large amplitude; 3) method of elastic movements – performing jerky movements with incomplete amplitude (spring forward tilts); 4) method of forced muscle stretching – performing movements with maximum amplitude with the help of a partner or with a load.

Agility: 1) method of repeated exercise – formation of motor skills by repeated repetition of its elements until the emergence of automatism in performance; 2) method of alternating exercise – application of the formed motor skill in unusual conditions.

The main means of learning used to develop motor skills included various types of exercise. Physical exercises are motor actions that are performed consciously, in accordance with the laws of physical education [3]:

– general preparatory exercises were used to increase general physical fitness, improving the motor and functional capabilities of the body, improving efficiency, development of basic physical qualities of students;

– special preparatory exercises – for the predominant development of those muscle groups and physical qualities that are crucial for mastering specific motor skills, as well as to learn technical and tactical techniques. The impact of special exercises depends on the conditions of their implementation (identity to competitive needs, intensity, duration, emotional background);

– approaching exercises – motor actions, close in structure to the movement studied.

Teaching aids allowed students not only to supplement the deficit of physical activity, providing additional physical activity, but also to relieve fatigue, were a means of the most complete rest. Teaching aids are sources or special devices that help teachers to carry out the educational process [8].

The main forms of physical education classes were practical powerlifting classes as part of the physical education curriculum, as well as individual and independent powerlifting classes, which allowed to implement all the tools and methods of the developed model. The most specific feature of this form of training is that the powerlifting classes were led by a trainer-teacher. In the system of classes used educational, education-training and training variants. The training was aimed at learning new material, techniques of exercises, means of physical fitness. The education-training variant was aimed at learning new

material, as well as repeating what has already been learned. The training was aimed at improving the technique of exercises as a whole or separately.

Powerlifting classes consisted of preparatory, main and final parts and were determined by changes in the functional state of the body of students during exercise. The main parameters of physical activity (frequency and duration of classes, capacity and nature of the means used) were determined according to the level of health and physical fitness of students.

In the preparatory part of training sessions in powerlifting the tasks of optimal preparation of students for the main task were solved. The purpose is to increase the activity of the main functional systems of the body of students. The task was to organize those involved, mobilize attention, explain the content of the lesson, prepare the body for the next job. The means, used at this stage, included drill exercises and general developmental exercises.

The preparatory part of the lesson is important for students. The preparatory part, or warm-up, provided warming up of an organism, its preparation for the basic physical activity. Exercises in this part of the training provided a gradual increase in heart rate, increase in body temperature, preparation of the musculoskeletal system for gradual physical activity and increased blood circulation in the muscles, increased mobility in the joints. To achieve this, slow running and gymnastic exercises were performed for all muscle groups and all parts of the body.

A special part of the warm-up was aimed at improving coordination skills, creating an energy basis, preparing the body to perform the following complex movements and more intense training load. The selection of warm-up exercises according to the coordination mechanism corresponded to the peculiarities of the main part of powerlifting training sessions. For this purpose, the inclusion of aproaching exercises was provided. The duration of the preparatory part of the lesson ranged from 25 minutes to 10–20 % of the total lesson time.

The main part involved solving the main tasks of the lesson. The work performed improved the level of special physical fitness of students, study and improvement of motor actions. In the main part of training sessions on powerlifting tasks which were directed on development of the basic functional systems (cardiovascular, respiratory, muscular) of an organism, physical, motor qualities, study or improvement of exercise techniques, formation of special skills and abilities were solved. Depending on the conditions, place and time of the training session, several types of sports training could be decided. In the case of a difficult (complex) purpose of the training session, the planned sequence of physical exercises was used. Particular attention was paid to the dynamics of physical activity and the nature of the complexity of physical exercises. In this part of the exercise, the exercise helped to increase the heart rate to the level of the «target zone», which was aimed at developing special functional training.

The main part of the lesson mainly implements the pedagogical principles of individualization, accessibility, consistency, dynamism [3]. Means used at this stage included: general and special training exercises with weights (barbells, dumbbells, exercise machines). Exercises in other sports (gymnastics, athletics, moving games). The means of the main part of the lesson during powerlifting classes varied in content, volume of intensity, depending on the level of preparation of students, the period of study or training. The duration of the main part of the lesson was 50 minutes.

In the final part of training sessions on powerlifting the tasks directed on switching of an organism to a restorative mode of functioning and creating conditions for the deployment of recovery processes were solved. This was achieved by gradually reducing the intensity of the exercises performed, reducing the heart rate to a level close to the one observed at the beginning of the lesson, switching to actions that give the effect of active recreation, using relaxation, breathing and other exercises that helped to intensify the recovery process. The task here was to achieve gradual reduction of training load, analysis of the work done by students, summarizing the lesson, homework.

The complex ended with exercises for breathing, relaxation, flexibility, performed at a slow pace. Flexibility exercises alternated with relaxation exercises. They contributed to the rapid recovery of the body and prepare it for further activities. Means for achieving this effect included slow running, walking, breathing exercises, relaxation exercises, various heights. The duration of the final part of the lesson was 15 minutes. At the end of each final part, we performed an analysis of the performed training work,

connected it with the performance of tasks at this stage of training, determined the content of powerlifting classes for each student.

Clear, competent, methodologically and scientifically sound organization of the process of physical education determined its result. The effectiveness of the whole process depended on the effectiveness of each of its components. The main component of each part of the lesson was the right music. Music is an emotional stimulus to movements, an active component of exercise. Musical rhythm was an important and indispensable means of developing the rhythm of the movements of the exercise studied.

When planning physical activity, we used a well-known classification of loads, which consists of five zones of intensity [11]:

1. Low intensity zone (20–30 %). In this area, the work is performed for a long period of time. Physiological functions of the body are not stressed, heart rate does not exceed 100–120 beats/min.

2. Moderate intensity zone (50 % of maximum physical activity). In this mode the general endurance, flexibility, coordination of movements develops. Heart rate during exercise reaches 130–160 beats/min. Exercise in this area helps to establish the interaction between the functions of the cardiovascular, respiratory and musculoskeletal systems.

3. The zone of high intensity (about 70 % of the maximum physical activity) contributes to the greatest stress of physiological functions. The use of high-intensity exercise in combination with moderate intensity promotes the development of fast and overall endurance. Heart rate reaches 150–170 beats/min. Exercise in this zone contributes to the development of aerobic and anaerobic capacity of the body of students.

4. Zone of submaximal intensity (80 % of maximum physical activity). It corresponds to the mode of exercise, in which the work of the heart muscles and other physiological systems is provided by anaerobic energy sources. Duration of physical activity for 50 s, and for more trained students up to 60–80 minutes.

5. Zone of maximum intensity (100 % of maximum physical activity) corresponds to the performance of physical exercises with maximum speed, maximum pace and effort. Exercise in the zone of maximum intensity is used in the absence of painful changes in the body, which may be contraindications to their implementation.

An important role in the formation of special skills and abilities belonged to pedagogical control. Pedagogical control was considered as a means of diagnosis, correction of educational activities, which allowed to objectively assess the level of health, general and special physical fitness of students, the technique of performing various physical exercises. According to T. Yu. Krutsevych, pedagogical control in teaching physical exercises is the activity of a teacher and those involved, aimed at obtaining information in the process of developing motor skills and skills that can be used to manage the learning process [7].

Pedagogical control allowed to check the effectiveness of powerlifting classes, which was determined by the components of the expected end result: improving the level of physical health, general and special physical and functional fitness, level of formation of special abilities and skills, correction of indicators of a physical condition of an organism of students. The teacher exercised direct pedagogical influence on the student through the use of appropriate methods, means and forms of organizing and conducting training sessions on powerlifting.

4. Conclusions

Development and implementation of a model for teaching students motor actions in powerlifting to solve educational, training and health-improvement functions are appropriate for the following reasons: a) powerlifting, weightlifting, athletics are the most popular power sports among students of higher educational institutions; b) the nature of training places high demands on the development of functional systems and functions of the body of students, which allows for regular training sessions to get a positive training effect; c) training classes in power sports contribute to the formation of students' special skills and abilities, needs for normal motor mode, habits for a healthy lifestyle.

Based on the study of issues related to improving the effectiveness of physical education process and the formation of special skills and abilities of students, it was found that:

1) Conducting training sessions on powerlifting, it is necessary to adhere to the basic didactic and methodological provisions of psychological and pedagogical science, namely principles and patterns of learning motor actions in powerlifting.

2) It is necessary to use the organizational and methodological support of powerlifting classes, taking into account the age, gender and individual personalities of students.

3) Exercise should be dosed to suit physical health, physical development, general and special physical fitness of students, and should take into account the importance of the basic technical elements in each powerlifting exercise.

4) It is promising to monitor the quality of education on the basis of a modular rating system for assessing students' knowledge, which should be a prerequisite for learning activities in higher educational institutions.

5) It is beneficial to use pedagogical control tools to work on the technique of performing exercises during powerlifting classes, one of which can be «diary of physical self-improvement in powerlifting».

6) Teachers should form a clear positive motivation for powerlifting classes in students.

These theoretical and methodological provisions and the model of the pedagogical system of teaching students motor actions in powerlifting formed the basis of developed methods of forming special skills and abilities of students of higher educational institutions in the process of powerlifting classes.

References

1. Donchenko V. I., Zhamardiy V. O., Shkola O. M., Kabatska O. V., Fomenko V. H. Health-saving Competencies in Physical Education of Students // Wiadomości Lekarskie. 2020. Tom LXXIII, nr 1. P. 145–150.
2. Fitsula M. M. Pedagogy : a textbook. Kyiv, 2006. 560 p. [in Ukrainian].
3. Glazirin I. D. Fundamentals of differentiated physical education. Cherkasy, 2003. 352 p. [in Ukrainian].
4. Griban G., Prontenko K., Zhamardiy V., Tkachenko P., Kruk M., Kostyuk Y., Zhukovskyi Y. Professional Stages of a Physical Education Teacher as Determined Using Fitness Technologies // Journal of Physical Education and Sport. 2018. 18 (2), P. 565–569.
5. Kiprych S., Donets O., Kornosenko O., Khomenko P., Zhamardiy V., Shkola O., Binetskyi D., Kasich N., Serhiienko V. and Bloshchynskyi I. Evaluation of Interconnection of Special Working Capacity and Response of Single Combat Sportsmen's Cardiorespiratory System at the Stage of Direct Training for Competition.
6. Kornosenko O., Denysovets T., Danysko O., Synytsya S., Voloshko L., Zhamardiy V., Donchenko V., Shkola O., Prystynskyi V. and Otravenko O. System of Preparation of Future Fitness Coaches' for Health-Improving Activity in the Conditions of Rehabilitation Establishments.
7. Krutsevich T. Yu. Theory and methodology of physical education. Kyiv, 2003. Volume 1. 424 p. [in Russian].
8. Mazoha D. S., Opanasenko N. I. Pedagogy : a textbook. Kyiv, 2005. 232 p. [in Ukrainian].
9. Maksimyuk S. P. Pedagogy: a textbook for university students. Kyiv, 2009. 670 p. [in Ukrainian].
10. Momot O., Zhamardiy V., Hrynova V., Gorlova L. and Sharlay N. Experimental Verification of the Effectiveness of Organizational and Pedagogical Conditions for the Education of the Future Teacher in the Health-Preserving Environment of the Institution of Higher Education.
11. Prisyazhnyuk S. I. Physical education : a textbook for university students. Kyiv, 2008. 503 p. [in Ukrainian].
12. Sheiko B. I. Powerlifting : study guide. Moscow, 2005. 544 p. [in Russian].
13. Shkola O., Griban G., Prontenko K., Fomenko O., Zhamardiy V., Bondarenko V., Bezpaliy S., Andreychuk V., Tkachenko P., Bloshchynsky I., Zhukovskyi Y., Novitska I. Formation of Valuable Orientations in Youth during Physical Training.
14. Shkola O., Zhamardiy V., Saienko V., Tolchieva H. and Poluliashchenko I. The Structure Model of Methodical System Usage Fitness-Technology in Student Physical Education.
15. Vikhlyaev Yu. N. Methodical instructions for training students of the group of sports improvement (on the example of cyclic sports) : [methodical development]. Kyiv, 1981. P. 21–27. [in Russian].
16. Vizitey N. N. Sociology of sports : lecture course. Kyiv, 2005. 248 p. [in Russian].
17. Zhamardiy V. O. Analysis of approaches to determining the essence of skills and abilities in the educational and training activities of students // Electronic scientific journal «Scientific Bulletin of Donbass». Pedagogical sciences. Lugansk, 2013. № 1 (21). [in Ukrainian].

18. Zhamardiy V. O. Criteria and levels of formation of special skills and abilities of students of higher educational institutions in the process of powerlifting classes // The origins of pedagogical mastery : collection of scientific works of Poltava National Pedagogical University named after V. G. Korolenko. Series : Pedagogical sciences. Poltava, 2013. Issue 11. P. 130–135. [in Ukrainian].
19. Zhamardiy V. O. Determining the criteria and indicators of the level of formation of special skills and abilities of students of higher educational institutions in the process of powerlifting classes // Bulletin of Chernihiv National Pedagogical University named after T. G. Shevchenko. Series : Pedagogical sciences. Physical education and sports. Chernihiv, 2013. Issue. 112. Vol. 1. P. 129–133. [in Ukrainian].
20. Zhamardiy V. O., Donchenko V. I., Yemets A. V., Skrinnik Y. O. Physical Development by Means of Fitness Technologies as One of General Aspects of Student's Health // Wiadomości Lekarskie. 2019. Tom LXXII, nr 5 cz II. P. 1074–1078.
21. Zhamardiy V., Griban G., Shkola O., Fomenko O., Khrystenko D., Dikhtiarenko Z., Yeromenko E., Lytvynenko A., Terentieva N., Otravenko O., Samokish I., Husarevych O. and Bloshchynskyi I. Methodical System of Using Fitness Technologies in Physical Education of Students.
22. Zhamardiy V. O. Model of formation of special abilities and skills of students of higher educational institutions in the process of powerlifting classes // The origins of pedagogical mastery : collection of scientific works of Poltava National Pedagogical University named after V. G. Korolenko. Series : Pedagogical sciences. Poltava, 2014. Issue. 13. P. 101–104. [in Ukrainian].
23. Zhamardiy V. O. Research of approaches to the organization of physical education classes // Scientific journal of the National Pedagogical University named after M. P. Dragomanov. Series № 15 : Scientific and pedagogical problems of physical culture (physical culture and sports). Kyiv, 2013. Issue. 4 (29). P. 366–371. [in Ukrainian].
24. Zhamardiy V., Shkola O., Tolchieva H., Saienko V. Fitness Technologies in the System of Physical Qualities Development by Young Students // Journal of Physical Education and Sport. 2020. Vol 20 (1), Art 19. pp. 142–149.
25. Zhamardiy V. O., Shkola O. M., Okhrimenko I. M., Strelchenko O. G., Aloshyna A. I., Opanasiuk F. H., Griban G. P., Yahodzinskyi V. P., Mozolev O. M., Prontenko K. V. Checking of the Methodical System Efficiency of Fitness Technologies Application in Students' Physical Education // Wiadomości Lekarskie. 2020. Tom LXXIII, nr 2. P. 332–341.
26. Zhamardiy V., Shkola O., Ulianova V., Bilostotska O., Okhrimenko I., Okhrimenko S., Griban G., Prontenko K., Bloshchynskyi I. Influence of Fitness Technologies on the Student Youth's Physical Qualities Development // Revista Dilemas Contemporáneos : Educación, Política y Valores. Año : VII, Número : Edición Especial, Artículo no. : 49. Período : Octubre, 2019.
27. Zhamardiy V., Shkola O., Bezpaliy S., Kalynovskyi B., Vasylenko O., Ivanochko I., Dovgan N., Malynskyi I., Danylenko O., Griban G., Prontenko K. Modern Fitness Technologies in the Physical Education of Students // Revista Dilemas Contemporáneos : Educación, Política y Valores. Año : VII, Número : Edición Especial, Artículo no. : 81. Período : Noviembre, 2019.
28. Zhamardiy V., Shkola O., Boichenko A., Prystynskyi V., Kornosenko O., Dmytrenko K., Kabatska O., Staroselska Y., Hordiienko O. and Postova S. Dynamics of Physical Fitness of Students during Powerlifting Classes.
29. Zhamardiy V., Shkola O., Otravenko O., Momot O., Andreieva M., Andrieieva O., Mudryk V., Slusarev V., Broslavska H. and Putiatina G. Dynamics of the Functional State of Students in the Process of Powerlifting in Higher Education.
30. Zhamardiy V. O. Special knowledge of powerlifting as a factor in improving the educational and training activities of students // The origins of pedagogical mastery : collection of scientific works of Poltava National Pedagogical University named after V. G. Korolenko. Series : Pedagogical sciences. Poltava, 2012. Issue. 10. P. 101–104. [in Ukrainian].

Correlation between Agility and Speed in Elite Underwater Hockey Players

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Abstract

The correlation between in-pool agility and sprint tests has not been established in underwater sports. The purpose of this study was therefore to investigate the correlation between in-pool agility tests [T-test (Tt), Modified T-test (MTt] and in pool sprint tests [25m (S25m), 50m (S50m)] in national level male elite underwater hockey players. This study was conducted on 25 male national level underwater hockey athletes. Tests were underwent in pool with ambient temperature of 25°±1o Celsius degrees and water temperature of 27° Celcius degrees. Agility tests and sprint tests were performed on separate days at least 24 hours apart. Tt was performed on the surface of the water and MTt was performed underwater using underwater video recording and signaling apparatus. The descriptive values were expressed as mean and standard deviation. Normal destribution of data examnined using Shapiro–Wilk and Levene tests. The Pearson's linear correlation test was applied to calculate the correlation. The significance level was set to $P<0.05$. There was a positive strong correlation existed between Tt and Mt, value of correlation was $r=0.900$, $p=0.000$. The Pearson's test shows significant positive high correlation between Tt and S50m, value of correlation was $r=0.600$, $p=0.002$. In contrast, MTt showed no significant correlation with S50m. The Pearson's test also showed significant positive moderate correlation between Tt and S25m, value of correlation was $r=0.580$, $p=0.002$. MTt was significantly correlated with S25m ($r=0.512$, $p=0.009$). The results of this study revealed moderate to stong correlation between in-pool agility and sprint tests.

Keywords: Underwater, Hockey Players, Speed, Agility.

1. Introduction

The relationship between agility and speed has been examined by only few studies in recent years in various sport branches and in different level of athleticism. None of these studies has examined swimming related sports (Sporiš, et al, 2011; Negra, 2017).

Swimming performance is related to different variables such as agility and speed (Hue, et al, 2006; Poujade, 2002; Tsekouras, 2005; Zamparo, 2005). Underwater water hockey was described as a relatively new sport that started in Germany which played in three-dimensional swimming pool. (Scheufler, et al, 2013).

It was stated that the score in underwater hockey will depend on the speed and technique of the athletes to score. (Gaviria and Septiembre, 2019). Performance characteristics of underwater hockey players have not been not well documented. Ozgur et al (2017), were among the first to report in underwater hockey regarding athletic performance. Individuals in sports performance field seek alternate, easy to apply tests to determine and develop physical attributes that can support to athletic performance. Sports performance tests are common methods to evaluate athletic abilities and provide valuable information regarding several athletic abilities and is useful for talent identification. Also provides data regarding the effects of intense exercise and help to develop individualized exercise prescriptions. One of the most popular performance test is the agility Tt. Tt assesses 4-way agility without loss of speed and balance. The test is easy to administer, using only very little testing apparatus and preparation (Smith et al., 2002; Gabbett et al., 2007; Melrose et al., 2007; Miller et al., 2006; Pauole et al., 2000). Agility is essential for many sports, challenging stability, and usually related to sports injuries. It is also defined as to maintain or control body during rapid changing of direction. Its' definition has evolved into that change of direction speed or programmed agility (Armstrong et al., 2018; Souhail et al., 2011; Farrow et al., 2005; Gabbett et al., 2009a; Gabbett et al; 2009b; Souhail et al; 2010). There is no commonly recognized definition of agility. However, agility was also defined that it comprised of two main components; perceptual and decision-making factors and change-of-direction speed. During attacking and defending, agility requires the ability to anticipate opponent's movement patterns and react accordingly. (Young, 2015).

In many sports including swimming and also in recreational activities agility, leg speed and power are

essential variables for success in performance (Harman et al., 1990; Hoolahan, 1990; Semenick, 1984). In accordance with many sports swimming also needs agility. Swimmers from all level will need control and rapid movements. Agility can be developed in time using proper training methods. In order for a swimmer to move fast in water, agility is crucial. Specifically, in underwater hockey most of the techniques requires agility.

The qualities that distinguish swimming from other sports are the prone position of the body, controlled breathing caused by water and the forces applied due to the fluctuant environment. (Aspenes and Karlsen, 2012.)

Qualities like agility, maximal speeed and acceleration assummed to be higly related due to similar determinants. Sports performance assessment has been on the focus for a long time however, examining the relationships between tests in underwater sports are lacking. Such assesment could provide valuable informaion regarding most efficient way of designing and management of testing procedures. (Sporiš, et al., 2011). Therefore, the purpose of the study was to establish the relationship between commonly used agility (T-tset, Modified T-test) and sprint tests (25m sprint, 50m sprint) in underwater hockey.

2. Method

2.1. Participants

25 male national underwater hockey players volunteered to the study.

2.2. Materials

Anthropometric Measures and Body Composition

The same researcher conducted height, weight and body fat percentage measurements. Body fat measurements were conducted using skinfold caliper.

Swimming Performance (Sprint) and Agility Tets

All tests were performed in a 25m pool. Water temperature was kept between 25 and 28 degrees.

The in-pool T-test (Figure:1)

The test was used to assess agility with change of direction (Pauole et al., 2000; Roozen, 2004). The protocol was explained to subjects then subjects underwent 2 familiarization trials. Each subject performed test 2 times and the final scores was averaged.

2.3. Procedure

Test Procedure

The subject starts at mark A.

Swims to mark B and touches the mark with right hand.

Turn left and swims to mark C and touches to mark with left hand.

Swims to the right to mark D and touching it using right hand.

Then swims back to mark B touching with the left hand,

Swims back to mark A.

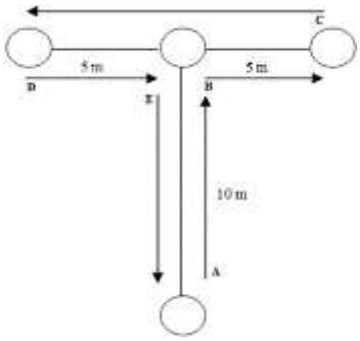

Figure 1.

The in-pool Modified T-test

The test was performed using the same protocol of the T-test with the exception of, the test was underwent in underwater. Subjects have started their heads above surface, using first signal head goes

underwater and immediately after that, second signal starts the test. Both tests conducted by the same researcher group using video recording, surface and underwater signaling apparatus.

Sprint Tests 25 meter and 50 meter

Performance in the 25 and 50 m front crawl were measured in a maximum effort and start was given when the swimmers were in the water to avoid the effect of diving technigue. The subjects completed 2 times 25m maximal effort swims. The results were averaged. Subjects used their preferred stroke. Times were recorded to a tenth of a second. Active recovery used between sprints.

2.4. Statistical Analysis

Data were analyzed using SPSS 21.0 for Windows (SPSS, Inc, Chicago, IL, USA). Data were presented as descriptive statistics. The significance level was set at $p \leq 0.05$. The results are expressed as mean ± SD. The distribution of the variables were normal.The correlation between MTt, Tt and Sprint Tests (S25m, S50m) were calculated by Pearson Correlation test.

3. Results

The descriptive data of subjects performance tests descriptives are shown in Table 1 and 2.

Table 1. *Descriptives of Physical Attributes*

	n	*Min*	*Max*	*Mean*	*± SD*
Age (years)	25	17.00	23.00	21.0800	1.60520
Height (cm)	25	165.50	192.00	178.5480	6.40378
Weight (kg)	25	62.50	125.50	82.4000	12.96370

Table2. *Descriptives of Tests*

	n	*Min*	*Max*	*Mean*	*± SD*
Tt (sec)	25	0:00:20.80	0:00:26.74	0:00:23.19	0:00:01.720
MTt (sec)	25	0:00:27.22	0:00:37.50	0:00:32.22	0:00:02.619
S50m (sec)	25	0:00:27.36	0:00:36.68	0:00:31.77	0:00:02.463
S25m (sec)	25	0:00:11.43	0:00:15.42	0:00:13.53	0:00:01.049

Table 3. *Pearson's (r) correlations test statistics*

	Body fat (%)	*Tt (sec)*	*MTt (sec)*	*S50m (sec)*	*S25m (sec)*
BMI	0.706**	0.054	-0.155	0.227	0.272
	p=0.000	p=0.798	p=0.458	p=0.275	p=0.189
Body fat (%)		0.209	0.076	0.546**	0.553**
		p=0.316	p=0.717	p=0.005	p=0.004
Tt (sec)			0.900**	0.600**	0.580**
			p=0.000	p=0.002	p=0.002
MTt (sec)				0.472*	0.512**
				p=0.017	p=0.009

The Pearson Correlation Analysis showed strong relations between MTt and Tt (r=0.900, p= 0.000). Body fat showed moderate correlations (r=0.553, p= 0.004; r=0.546, p= 0.005) with S25m and S50m respectively. There were a moderate and strong correlations between Tt and sprint tests S25m and S50m respectively (r=0.580, p= 0.002, r=0.600, p =0.002). In addition, a moderate relation between MTt and S25m (r= 0.512, p=0.009) and S50m (r= 0.472, p=0.017) (Table 3).

4. Discussion and Conclusion

Very few studies, if any, have examined the relationships between agility and speed in underwater hockey and only a few more studies examined same parameters in other sports like Australian Football soccer, basketball, handballand rugby (Ozgur et al, 2017; Negra, 2017; Pauole et al, 2000; Spaniol et al, 2010;

Asadi, 2016; Vescovi, 2008; Little et al, 2005; Baker, 1999; Young et al, 1996).

In this study we decided to undergo a modified version of ground based T-test that includes underwater execution of the test. It was decided to resemble the underwater performance nature of the mentioned sport. Among of the most stand out results in this present study was that the Pearson analysis showed significant strong correlation between MTt and Tt. This result indicates that in order to assess agility in underwater hockey MTt and Tt can be used interchangable. Considering the test procedures using the most easy one to administer would save valuable sources and time.

The Pearson test also showed moderate and strong significant correlation between between Tt and sprint tests S25m and S50m respectively (r=0.580 , p= 0.002; r=0.600 , p= 0.002). Addition to that there was a moderate relation between MTt and S25m (r= 0.512, p= 0.009) and S50m (r=0.472, p= 0.017). It can be derived from the results that 25m sprint time was a stronger indicator of performance in underwater hockey players since it was correlated both MTt and Tt results. Ground based Tt was stated to be valid to measure leg speed than either leg power or agility and Tt displays a mixing of leg speed, power, and agility for performance and the results of the present study are in accordance with this statement. T-test appears to be measure speed parameter of the underwater players besides their agility. However further studies need to calculate the prediction percentage of speed in T-test variability in underwater hockey players (Pauole, et al, 2000). Although not in swimming related sports but in accordance with these findings, relationship was found between, ground based agility and sprint tests (R 2 = 72%) in soccer and handball group, respectively. Addition to that strong significant correlations were found between agility and sprint tests (r, 0.85, p, 0.001) (Negra, 2017). Supporting these findings a significant correlation also reported between 10m sprint and zig zag test in male soccer players (Little and Williams, 2005) and a significant correlation between Tt and 20m sprint (r=0.77) in basketball players (Asadi, 2016). Consistent with the aforementioned results, Baker and Young, W also indicated significant correlations between agility and sprint in rugby and in Australian football respectively. Also consistent with these studies Pauole found significant relatıons between Tt and 40 yard sprint time in college men and women. In literature there are also a few studies indicating contrast results regarding same parameters and their relationships. It was reported that there was no significant relation between agility and sprint in soccer and basketball (Buttifant et al, 1999; Chaouachi et al, 2009). The explanation for this difference in results could be the differences between testing managements and experience of the athletes regarding testing procedures. The outcomes of the present study supports the notion that in-pool agility and sprint test results could be used interchangeably to identify the performance level of male elite underwater hockey players. Therefore, these tests could be highly recommended to assess agility in male elite underwater hockey players. In addition, it appears that agility and speed variables indicate the same physical attribute in underwater hockey players. In light of the present study, it may be suggested using very few performance tests as possible when it comes to talent identification and profiling performance of athletes. It can also be stated that further studies could investigate the correlations between ground based agility and sprint tests with in-pool tests in underwater hockey and in closely related sports. In conclusion, the results of this study showed a significant correlation between in-pool MTt & Tt and S25m test resu lts in elite male underwater hockey.

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References

Armstrong, R., & Greig, M. The Functional Movement Screen and modified Star Excursion Balance Test as predictors of T-test agility performance in university rugby union and netball players. Physical Therapy in Sport, 2018, 31:15-21.

Asadi, A. Relationship between jumping ability, agility and sprint performance of elite young basketball players: A field-test approach. Revista Brasileira de Cineantropometria & Desempenho Humano, 2016, 18(2), 177-186.

Aspenes, S.T., & Karlsen, T. Exercise-Training Intervention Studies in Competitive Swimming. Sports Med., 2012, 42(6), pp.527-543.

Baker, D.A. A comparison of running speed and quickness between elite professional and young rugby league player. Strength & Conditioning Coach, 1999, 7(3), 3-7.

Buttifant, D., Graham, K., & Cross, K. Agility and speed of soccer players are two different performance parameters. Journal of Sports Science, 1999, 17: 809-816.

Chaouachi, A., Brughelli, M., Chamari, K., Levin, G.T., Abdelkrim, N.B., Laurencelle, L., & Castagna, C. Lower limb maximal dynamic strength and agility determinants in elite basketball players. The Journal of Strength & Conditioning Research, 2009, 23(5), 1570-1577.

Farrow, D., Young, W., & Bruce, L. The development of a test of reactive agility for netball: a new methodology. Journal of Science and Medicine in Sport, 2005, 8(1), 52-60.

Gabbett, T., & Benton, D. Reactive agility of rugby league players. Journal of science and medicine in sport, 2009, 12(1), 212-214.

Gabbett, T., & Georgieff, B. Physiological and anthropometric characteristics of Australian junior national, state, and novice volleyball players. The Journal of Strength & Conditioning Research, 2007, 21(3), 902-908.

Gabbett, T., Kelly, J., Ralph, S., & Driscoll, D. Physiological and anthropometric characteristics of junior elite and sub-elite rugby league players, with special reference to starters and non-starters. Journal of Science and Medicine in Sport, 2009, 12(1), 215-222.

Harman, E.A., Rosenstein, M.T., Frykman, P.N., & ROSenStein, R.M. The effects of arms and countermovement on vertical jumping. Med Sci Sports Exerc, 1990, 22(6), 825-833.

Hermassi, S., Fadhloun, M., Chelly, M.S., & Bensbaa, A. Relationship between agility T-test and physical fitness measures as indicators of performance in elite adolescent handball players. Педагогика, психология и медико-биологические проблемы физического воспитания и спорта, 2011, 5: 125-131.

Hoolahan, P. Agility. NSCA J. 1990, 12(3):22–24.

Hue, O., O. Galy, S. Blonc, and C. Hertogh. Anthropometrical and physiological determinants of performance in French West Indian monofin swimmers: a first approach.Int. J. Sports Med. 2006, 27: 605-609.

Little, T., Williams, A. G,. Specificity of acceleration, maximum speed, and agility in professional soccer players. J Strength Cond Res 2005; 19(1): 76-89.

Melrose, D.R., Spaniol, F.J., Bohling, M.E., & Bonnette, R.A. Physiological and performance characteristics of adolescent club volleyball players. Journal of strength and conditioning research, 2007, 21(2), 481.

Miller, M.G., Herniman, J.J., Ricard, M.D., Cheatham, C.C., & Michael, T.J. The effects of a 6-week plyometric training program on agility. Journal of sports science & medicine, 2006, 5(3), 459.

Negra, Y., Chaabene, H., Hammami, M., Amara, S., Sammoud, S., Mkaouer, B., & Hachana, Y. Agility in young athletes: is it a different ability from speed and power?. Journal of strength and conditioning research, 2017, 31(3), 727-735.

Ozgur, T,. Ozdemir, C,. Aksoy, M,. Odabas-Ozgur, B,. Ozen S. "The Relationships between physical fitness variables and somatotype in Youth Underwater Hockey Player" The International Balkan Conference in Sport Sciences (IBCSS), 21-23 May 2017, Bursa Turkey.

Pauole, K., Madole, K., Garhammer, J., Lacourse, M., & Rozenek, R. Reliability and Validity of the T-Test as a Measure of Agility, Leg Power, and Leg Speed in College-Aged Men and Women. Journal of Strength and Conditioning Research, 2000, 14(4), 443-450.

Poujade, B., C.A. Hautier, and A. Rouard. Determinants of the energy cost of front crawl swimming in children. Eur. J. Appl. Physiol. 2002, 87:1-6.

Scheufler, O., Kamusella, P., Tadda, L., Radmer, S., Russo, S., & Andresen, R. High incidence of hamate hook fractures in underwater rugby players: diagnostic and thera peutic implications. Hand Surgery, 2013, 18(3), 357-363).

Semenick, D. Anaerobic testing: practical applications. NSCA J. 1984, 6(5):44–73.

Smith, D.J., Norris, S.R., & Hogg, J.M. Performance evaluation of swimmers: Scientific tools. Sports Med., 2002, 32(9), pp.539-554.

Souhail, H., Castagna, C., Yahmed Mohamed, H., Younes, H., & Chamari, K. Direct validity of the yo-yo intermittent recovery test in young team handball players. The Journal of Strength & Conditioning Research, 2010, 24(2), 465-470.

Spaniol, F., Flores, J., Bonnette, R., Melrose, D., & Ocker, L. The relationship between speed and agility of professional arena league football players. The Journal of Strength & Conditioning Research, 2010, 24:1-9.

Sporiš, G., Milanović, Z., Trajković, N., & Joksimović, A. Correlation between speed, agility and quickness (SAQ) in elite young soccer players. Acta kinesiologica, 2011, 5(2), 36-41.

Sporiš, G., Milanović, Z., Trajković, N., & Joksimović, A. Correlation between speed, agility and quickness (SAQ) in elite young soccer players. Acta kinesiologica, 2011, 5(2), 36-41.

Tsekouras, Y.E., S.A. Kavouras, A. Campagna, et al. The anthropometrical and physiological characteristics of elite water polo players. Eur. J. Appl. Physiol. 2005, 95(1):35-41.

Vescovi, J.D., & Mcguigan, M.R. Relationships between sprinting, agility, and jump ability in female athletes. Journal of sports sciences, 2008, 26(1), 97-107.

Young, W., Hawken, M., & McDonald, L. Relationship between speed, agility and strength qualities in Australian Rules football. Strength Cond Coach,1996, 4(4), 3-6.

Young, W.B., Dawson, B., & Henry, G.J. Agility and change-of-direction speed are independent skills: Implications for training for agility in invasion sports. International Journal of Sports Science & Coaching, 2015,10(1), 159-169.

Zamparo, P., Bonifazi, M., Faina, M., Milan, A., Sardella, F., Schena, F., & Capelli, C. Energy cost of swimming of elite long-distance swimmers. European Journal of Applied Physiology, 2005, 94(5-6), 697-704.

Investigation of the Effectiveness of Body Protectors Used in Karate Kumite Competitions

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Abstract

This study aimed to examine the effectiveness of impact protection of body protectors, which are mandatory to be used in Karate Kumite competitions. The research was conducted on three different body protectors approved by the World Karate Federation (WKF) for use in official competitions. Testing was performed both with high- and low-energy impacts applied on the body protectors using a specially designed setup, and the average values of acceleration, force, pressure, impulse, and impact area were calculated.

The three body protectors differed in their ability to suspend both low- and high-energy impacts ($p<0.05$). For low-energy impacts, the three different brands of body protectors (A, B and C respectively) decreased impact acceleration by 4.98% (A), 5.37% (B), 7.23% (C); impact force by 22.56% (A), 30.91% (B), 54.71% (C); impact pressure by 19.10% (A), 26.86% (B), 20.57% (C), and impact impulse by 37.07% (A), 41.31% (B), 66.02% (C). For high-energy impacts, acceleration decreased by 5.34% (A), 6.75% (B), 11.23% (C); impact force by 27.81% (A), 5.15% (B), 25.33% (C); pressure by 28.52% (A), 14.47% (B), 22,56% (C); and impulse by 28.67% (A), 5.68% (B), 20.20% (C). In conclusion, the significant differences between the different body protectors may result in the ineffective suspension of applied impact during the competition, especially during high energy contacts. The manufactures have to provide sport-specific solutions for the nonlinear and inadequate suspension behavior of these body protectors.

Keywords: Karate, Kumite, Injury, Protective equipment.

1. Introduction

Karate is a combat sport employing fighting techniques such as punching, kicking, and dropping down the opponent, provided that they are controlled. Although these techniques must be applied in a controlled manner, under competition conditions the bodies of the athletes may be exposed to great impacts. To prevent injuries to athletes and to reduce the impact in uncontrolled collisions and attacks, body protectors were officially introduced to protect the chest area in addition to materials such as mouthguards, gloves, and foot protectors since 2012 (1).

In the adult category of karate competitions, punching or kicking techniques are considered at the right distance if applied anywhere between skin contact and 5 cm distance to the face, head or neck areas. In the Youth competitions, it is forbidden to touch the face and neck by any hand technique, whereas for face-level kicks light skin contact is allowed. Scoring distance has been increased to 10 cm in the Youth categories. While the Karate Game Rules strictly cover the face area, for the abdominal area only a general statement has been formulated: 'Trained adult athletes should be able to withstand very strong blows to muscle areas such as the abdominal area' (1). This reveals the importance of body protectors to be used as a safety mechanism against uncontrolled blows applied to the vulnerable body parts.

Karate techniques are intended to reduce the impact of a possible stroke by controlling the magnitude of force during an attack. A karate athlete can knock down his opponent with a single blow. The athlete may accomplish this by impacting with a linear thrust (lower speed, higher mass) or a punch/kick technique applied with an angular stroke (lower mass, higher speed) (2). The impact intensities measured in studies on karate techniques were in the range of 942N-9787 N (3;4;5;6;7;8;9;10;11).

Such studies on injury biomechanics and impact kinetics help to develop specific methods and pieces of equipment to prevent injuries (12).

In this context, injury biomechanics focuses on developing ways of reducing or eliminating structural damage occurring during impact by comprehension of injury mechanisms and impact kinetics (13). The

application of this strategy to sports has led to changes in the game rules, playing surfaces, equipment, and PPE (Personal Protective Equipment). While rules, pitches, and equipment, in general, remain unchanged, the design and function of PPE have been continuously improved (14).

The purpose of this study was to examine the effectiveness of impact protection of body protectors, which are mandatory to be used in Karate Kumite competitions.

2. Method

2.1. Materials

A special experimental setup has been constructed to provide standard impacts. The test platform consisted of the following parts:

1.Highly elastic steel spring with one end fixed to a specially designed steel construction (Picture 1f),

2.Prosthetic foot to imitate an athlete's foot (Eu no: 42; Prosthetic foot, OttoBock, Germany) (Picture 1d),

3.XSENS accelerometer placed on top of the prosthetic foot to measure the acceleration of the striking foot (Picture 1c),

4.Arc Systeme trigger mechanism that stabilizes the initial voltage so that the system can make similar impacts in repeated measurements (Picture 1g),

5.Dragon brand sandbag fixed to the wall at its lower and upper points (Picture 1e),

6.15x22 cm wide and 8 mm thick wooden surface covered with 3 mm thick EVA
(Ottobock, Germany) that can imitate the human sternum and skin. (Picture 1b),

7.Special purpose Tekscan F-Socket sensor system on the wooden surface coated with EVA. (Picture 1a).

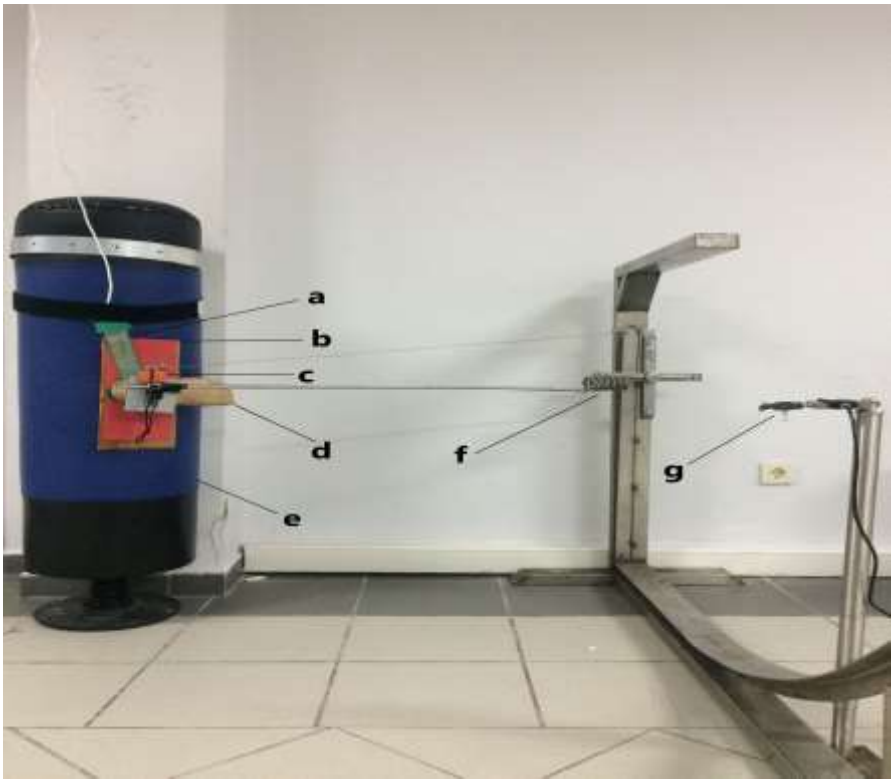

Figure 1. *Hitting trials*

2.2. Procedure

Recording and evaluating data from the test platform;

1.The data of the F-Socket system have been recorded by special software (F-socket research 6.51; 500Hz). The impact and impulse time data felt on the front of the chest (over the sternum) were obtained from this system.

2.In a study was reported that static and dynamic calibrations show similar behavior. For this reason, F-Socket systems have been put into operation after static calibration and test studies as recommended by the manufacturers (15).

By using the specially designed test setup, the hitting speed was kept constant and the strokes were made with the sole of the foot to simulate the yoko geri (side kick) and ushiro geri (back kick) techniques in karate (Picture 1d).

First, trial hits were made on the sandbag from different distances using a steel spring system. The data obtained provided standard strokes for each investigation. Then, without using a body protector, hits were made directly on the sensor to ensure the hitting standard. Finally, body protectors were worn on the mannequin, and strokes were applied to test the ability of the protectors to absorb different intensity impacts.

The study was completed in the same way for all three brands of body protectors as mentioned in the following:

1) A total of 4 sets of low intensity and 4 sets of high intensity hit tests were performed;
2) Between each set a pause of 3 minutes was introduced;
3) Each set consisted of 12 hits;
4) Maximum 15 seconds was between each hit;
5) For each body protector, the rate of absorbing the impact has been checked.

For each body protector trial the following comparisons were made:

1) The three protector brands were compared for the low-intensity impact measurements;
2) The three protector brands were compared for the high-intensity impact measurements;
3) For each protector brand, the change in effective suspension of impact was examined as the hit intensity increased.

2.3. *Analysis of the Data*

The parameters used in research on body protectors generally include the following variables: Force, rate of increase of force, deformation, rate of deformation, contact time, pressure, energy absorption, and/or rate of energy absorption. It is more appropriate to speak in terms of "impact intensity", which refers to a positive correlation with the risk of injury, measured using any mechanical variable (ie higher density means higher injury potential). It is important to collect data on as many variables as possible in a given effect and to establish a reliable correlation with injuries caused by using any of these variables (14). In the present analysis, the impact intensity has been evaluated by calculating acceleration, force, pressure, impulse, and contact area.

The normality of the data was evaluated with the Shapiro-Wilk test, and it was observed that the data showed a normal distribution. One Way Anova test was used to compare the means of suspension data of the three WKF approved body protectors. The significance value was $p<0.05$.

3. Results

Table 1. *Average of Measurement Values of Low-Intensity Strokes*

Variables	Without Protector	Brand A	Difference %	Brand B	Difference %	Brand C	Difference %	*p*
Acceleration (m/s^2)	16,89±0,63	16,05±0,66	%4,98	15,98±0,62	% 5,37	15,67±0,60	%7,23	P<0,05
Force (kg)	43,41±1,53	33,63±2,37	%22,56	30,00±1,81	%30,91	19,67±0,95	%54,71	P<0,05
Pressure (kg/cm^2)	0,98±0,02	0,79±0,05	%19,10	0,72±0,06	%26,86	0,78±0,04	%20,57	P<0,05
Impulse (kg*s)	0,29±0,02	0,18±0,01	%37,07	0,17±0,02	%41,31	0,10±0,01	%66,02	P<0,05

When the low-intensity impact applied on WKF approved protectors are examined, the three body protectors differ in terms of reducing the acceleration, force, pressure, and impulse values of the strokes (p<0,05).

***Table 2**. Average of Measurement Values of High-Intensity Strokes*

Variables	Without Protector	Brand A	Difference %	Brand B	Difference %	Brand C	Difference %	*p*
Acceleration (m/s^2)	19,58±0,98	18,54±0,80	%5,34	18,26±1,02	% 6,75	17,38±1,24	% 11,23	P<0,05
Force (kg)	80,15±1,57	57,81±11,43	%27,81	75,96±1,32	%5,15	59,79±2,27	%25,33	P<0,05
Pressure (kg/cm^2)	1,50±0,08	1,07±0,08	%28,52	1,28±0,03	%14,47	1,16±0,08	% 22,56	P<0,05
Impulse (kg*s)	0,45±0,01	0,34±0,05	%23,52	0,42±0,03	%5,97	0,36±0,02	% 19,72	P<0,05

When the high-intensity impact applied on WKF approved protectors are examined, the three body protectors differ in terms of reducing the acceleration, force, pressure, and impulse values of the strokes (p<0,05).

***Table 3**. The difference in force between low and high-intensity impacts applied to the protectors.*

Variables	Without Protector	Brand A	Difference %	Brand B	Difference %	Brand C	Difference %
Low-impact (kg)	43,41±1,53	33,63±2,37	%22,56	30,00±1,81	%30,91	19,67±0,95	%54,71
High-impact (kg)	80,15±1,57	57,81±11,43	%27,81	75,96±1,32	%5,15	59,79±2,27	%25,33
P	P<0,05	P<0,05		P<0,05		P<0,05	

Significant differences were measured between the suspension-force values of low and high-intensity impact for all three brands of the body protectors (p <0.05), but only for brand A the suspension was higher during high-intensity impact.

***Table 4**. Average of Measurement Values of Contact Area of Strokes*

Contact Area	Without Protector	Brand A	Brand B	Brand C	*p*
Low impact (cm^2)	44,29±1,70	42,71±2,28	40,93±5,38	25,34±1,04	P<0,05
High impact (cm^2)	53,24±2,45	53,62±8,91	59,19±0,98	51,54±2,50	P<0,05

Impact intensity	Bare sensor (cm²)	Brand A (cm²)	Brand B (cm²)	Brand C (cm²)
Low				
	44,29	42,71	40,93	25,34
High				
	53,24±2,45	53,62±8,91	59,19±0,98	51,54±2,50

Figure 2. *Comparison of Contact Areas of Strokes with low and high-intensity impact*

The 3 different WKF approved body protectors differ in terms of the contact area in low-intensity strokes applied ($p < 0.05$). The brand A body protector decreased contact area on average by 3.56%, brand B by 7.58%, and brand C by 42.79% during low-intensity impacts.

The 3 different WKF approved body protectors differ in terms of the contact area in high-intensity strokes applied ($p < 0.05$). The brand A body protector decreased contact area on average by 0.16%, brand B by 10.58%, and brand C by 3.71% during high-intensity impacts.

5. Discussion and Conclusion

Despite vital organs are embedded in the chest and abdomen, little research has been done on the design and performance of body protectors. Most of the research has focused on the prevention of Commotio Cordis (CC) due to its potentially lethal effects. By three mechanisms body protectors may reduce energy transfer to the chest:

1) Spreading the impact load over a larger area of the chest, lowering the local impact pressure and reducing chest deflection;

2) Absorbing some portion of the kinetic energy of the action;

3) To reduce the speed of the impact by increasing the mass of the chest (16).

Preventive measures for chest injuries were developed by taking into account the worst-case scenario which may cause VF (Ventricular fibrillation). As an exemplary experiment, baseball players throw the ball at a speed of 40 miles to the center of the chest onto the heart. It has been demonstrated that the risk of a heart attack is high after such shots. Softer baseballs and chest guards have been designed and developed to protect against this situation. These measures are thought to reduce the amount of energy transferred to the heart, which reduces CC (17).

In a study examining the effect of leg strength on technical speed and strike in Taekwondo, left ankle acceleration was measured as 17.88 m/s² and right ankle acceleration as 19.14 m/s² with an accelerometer during the dollyo chagi technique (18). In our study, the acceleration of low-intensity impacts was measured as 16.89 m/s², and the acceleration of high-intensity impacts as 19.54 m/s², which is of similar magnitude. During low-intensity hits, protector A decreased acceleration by 4.98%, protector B by 5.37%, and protector C by 7.23%; during high-intensity hits, these figures were 5.34% (A), 6.75% (B), and 11.23% (C), respectively.

In a study of black belt karate athletes aged between 30 and 50 years, who had participated in at least one international competition and had an average training history of 20 years, the applied linear (gyaku tsuki, yoko back) and circular (mawashi geri, uraken uchi) karate techniques were examined whether they could cause serious injuries, and how much a chest protector would be able to reduce the impact. Karate

techniques applied without using protective equipment affected the 25% injury level (mean velocity = 1.1382 ± 0.4423 m/s). When a chest protector was used, this effect decreased by an average of 16.23%, slightly below the velocity 1.0 m/s (mean = 0.9535 ± 0.4575 m /s, $p < 0.05$), which is regarded as the limit to serious injury. The Mawashi back technique produced higher velocities (average: 1.3778 ± 0.4674 m/s) than all other techniques. This was followed by gyaku zuki (mean: 1.0122 ± 0.3923 m/s), yoko back (mean: 0.9538 ± 0.4976 m/s) and uraken uchi (mean: 0.8189 ± 0.2986 m/s) (19). During high-intensity impact, the three different WKF approved body protectors employed in the present study reduced impact force by 27.81%, 5.15%, and 25.33%, impact pressure by 28.52%, 14.47%, and 22.56%, impact impulse by 28.67%, 5.68%, and 20.20%, respectively.

While determining the rate of absorption of the incoming impact by the electronic body protectors used in Taekwondo, the transmission rate of the impact onto the front of the chest increased disproportionately as the stroke level increased in the heavy-weight classes (24.67% - 68.09%). For these reasons, it has been concluded that the thickness of the electronic body protectors used in Taekwondo should be adjusted to the weight class (20).

The two stroke force levels used in the present study had an average of 43.41 kg and 80.15 kg.

Conclusions

The findings in the present study denote the need of increasing the protection properties of WKF-approved body protectors to reduce the risk of serious injuries in the branch. Further favorable changes would be the introduction of technical restrictions on hits onto the body in the referee rules booklet, and additionally making a change in the rules for each athlete to meet with their weight class in team Kumite matches. We believe that it may be appropriate to place sensors on protectors to account for the nonlinear and inadequate suspension behavior of individual body protectors.

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References

1. WKF. Kata and Kumite Competition Rules 2020.
2. Kreighbaum E, Barthels KM. (1990). Biomechanics: A qualitative approach for studying human movement (4th edn.). Allyn and Bacon. DOI: 10.1080/00336297.1986.10483843
3. Nakayama M. (1966) Dynamic Karate, Kodansha International, Palo-Alto.
4. Walker J. D. (1975). Karate Strikes. American Journal of Physics. (10), p:845-849.
5. Gray L. (1979). Force and impact determinations of certain karate kicks. Journal of Biomechanics, 12(8), 636-637. DOI: 10,1016 / 0021-9290 (79) 90136-2
6. Schwartz, M. L. , Hudson, A. R. , Fernie, G. R. , Eng, P. , Hayashi, K. , & Coleclough, A. A. (1986). Biomechanical study of full-contact karate contrasted with boxing. Journal of Neurosurgery, 64, 248-252. DOI: 10.3171/jns.1986.64.2.0248
7. Voigt, M. A. (1989). Telescoping effect of the human hand and forearm during high energy impacts. Journal of Biomechanics, 22(10), 1095. DOI: 10.1016/0021-9290(89)90498-3
8. Chiu, H. & Shiang, T. (1999). A new approach to evaluate karate punch techniques. 17 International Symposium on Biomechanics in Sports
9. Girodet P, Vaslin P, Dabonneville M, Lacouture P. (2005). Two-dimensional kinematic and dynamic analysis of a karate straight punch. Comput. Methods Biomech. Biomed. Eng, 8, 117–118. DOI: 10.1080/10255840512331388533
10. Gulledge J, Dapena J. (2008). A comparison of the reverse and power punches in oriental martial arts. Journal of sports sciences. 26, 189-96. DOI: 10.1080/02640410701429816
11. Aguiar de Souza, V. & M. Marques, (2017). A. Relationship between age and expertise with the maximum impact force of a reverse punch by shotokan karate athletes. Arch Budo-13, 252. AoBID: 11561
12. Mcintosh AE. (2005). Impact Injury In Sport. IUTAM Symposium on Impact Biomechanics s. 231-246. Netherlands: Springer.
13. Viano DC, Lau IV. (1988). A viscous criterion for soft tissue injury assessment. Biomech 21(5) p:387-399.

DOI: 10.1016/0021-9290(88)90145-5
14. Tsui, F.. (2011). Determining impact intensities in contact sports (Version 1). Loughborough University. https://hdl.handle.net/2134/8187
15. Nacy, S.M., Tawfik, M.A., & Baqer, I.A. (2013). Static and Dynamic Calibration for FlexiForce Sensor Using a Special Purpose Apparatus. Innovative Systems Design and Engineering, 4, 30-40.
16. Viano, David C. MD, PhD, Cynthia A. PhD; Cheney, Angela K. BA; Janda, and David H. MD. Evaluation of Chest Protectors. The Journal of Trauma: Injury, Infection, and Critical Care : December 2000- Volume 49, Issue 6, p 1023-1028
17. Link MS, Maron BJ, Wang PJ, Vanderbrink BA, Zhu W, Estes NA. (2002). Reduced Risk of Sudden Death From Chest Wall Blows (Commotio Cordis) with Safety Baseballs. Pediatrics, 109, 873-8778. DOI: 10,1542 / peds.109.5.873
18. Kala C. Taekwondo'da bacak kuvvetinin teknik sürate ve vuruşa etkisinin incelenmesi. M.Ü. Sağlık Bilimleri Enstitüsü, Yüksek Lisans Tezi, 2018, İstanbul
19. Smith P, Viano DC, Faust D, Faust L. (1993). Thoracic injury effects of linear and angular karate impact. En Biomechanics in Sports XI., Hamill, J, Derrick T, Elliott E. (Eds.), Amherst, MA: International Society of Biomechanics in Sports.
20. Ramazanoglu N. (2013). Transmission of Impact through the Electronic Body Protector in Taekwondo. International Journal of Applied Science and Technology, 3: 1.

Basic Preparation of a Tourist for Sports and Fitness Hike

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Abstract

The purpose of the article is to study the impact of basic tourist preparation on the quality of tourist hike, namely: the formation of route selection skills, the use of tactics to overcome it, the formation of skills to overcome obstacles, cook under the conditions of hike, work in team. The authors analyzed the content of sports and fitness tourism, revealed its features and benefits. The study involved 65 students of Khmelnytskyi of Humanitarian-Pedagogical Academy (Ukraine), who were part of the experimental group (EG) - (n = 32) and the control group (CG) - (n = 33). Students of the experimental group were engaged in the program of basic preparation of the tourist for sports and fitness hike, students of the control group were engaged in the traditional system of education. To obtain the necessary information, we used general scientific research methods: analysis of scientific and methodological sources, surveys, questionnaires, expert evaluation method, pedagogical experiment, statistical data of pedagogical observation, factor analysis. The results were evaluated by experts - teachers of the Department of Theory and Methods of Physical Culture and Valeology of Khmelnytskyi Humanitarian-Pedagogical Academy (n = 11), who conducted a comparative analysis of theoretical, practical, physical and special training of students of experimental and control groups. The study confirmed the need for targeted basic preparation of tourists for sports and fitness hike. According to experts, such training allowed students of the experimental group compared to the control group to achieve better performance in: improving the skills of the bivouac + 2.33 ± 0.12 points ($p < 0.001$); development of skills to navigate the terrain + 2.05 ± 0.09 points ($p < 0.001$); improving cooking skills under the conditions of tourist hike + 1.99 ± 0.19 points ($p < 0.001$); development of teamwork skills + 1.33 ± 0.15 points ($p < 0.01$); improvement of technique of overcoming obstacles + 1.15 ± 0.08 points ($p < 0.01$); formation of knowledge of the basics of tactics of passing the distance + 1.04 ± 0.16 points ($p < 0.01$).

Keywords: basic preparation, sports and fitness tourism, students, hike.

1. Introduction

Sports and fitness tourism in Ukraine is developing as an important component of the tourism industry. In fact, it is one of the most accessible mass forms of active recreation, learning and exploring the world around us. Sports and fitness tourism is aimed at strengthening the health of tourists, improving their mood, combining with nature, as well as the development of physical, moral and intellectual qualities of a person who hikes. At the same time, sports and fitness tourism promotes the development and dissemination of active forms of recreation, and therefore has recreational, cognitive, educational, economic and other functions.

Sports and fitness tourism is a type of tourist recreational activity, the main feature of which is an active way of movement (hiking). It aims to get acquainted with nature, culture, history of the territory of hike, restoration of physical, mental, spiritual strength of a person, improvement of tourist knowledge, skills and abilities of active rest and recreation [1]. Therefore, hiking today is especially widespread and in demand.

In sports and fitness tourism, the active mode of movement is defined as movement on the ground,

relying only on the own muscular strength, without the use of any motor vehicles.

2. Literature Review

The problem of organizing and preparing young people for sports and fitness tourism hikes has been studied by many researchers. Yerko, A. P. (2013) [2], Herashchenko, Ya. M., & Omelchenko, H.A. (2013) [3] devoted their works to the study of the classification of directions of tourist work, determination of peculiarities and characteristic features of sports and fitness tourism. Theoretical and methodological foundations, history and prospects of youth tourism in Ukraine and in the world considered in their works Abramov, V. V. (2013) [4]; Bohatyriov, K. O. (2014) [5]; Bozhko, L. D. (2017) [6]; Volkova, II, & Kondakova, H. O. (2014) [7]. The study of organizational, legal, logistical problems of preparation for a tourist hike were considered in the works of Mozolev O. (2020) [8]; Ostapchuk, V. (2017) [9]. The works of Volkova, I., & Naumenko, Yu. (2015) deal with the study of the peculiarities of the development of recreational and fitness tourism in Ukraine and its influence on the restoration of the vital forces of the young person's body. (2015). [10]. The development of local lore in tourist hikes was studied by Parfinenko, A. Yu. (2015) [11], Chornenka, N. V. (2012). [12]. The research of Mozolev O., Halus O., Bloshchynskyi, I., Kovalchuk R. (2019) [13] deals with the problem of training qualified specialists in the field of physical culture and tourism. The development of students' motivation for active physical exercises and their preparation for hiking is considered in the works of Mozolev, O., Shorobura, I., Zdanevych, L., Hutsal, L., Marusynets, M., & Kravchuk, L. (2020). [14]. The works of Hrokhov, H. P. (2016) [15]; Konokh, A. A. (2018) [16]; Mozolev O. (2020) [17] are devoted to the issues of preparation of leaders and members of the tourist group for hikes of various complexity. The requirements for special physical training of students necessary for the successful conduct of tourist hikes are considered in the works of Zenin, I. V. (2016) [18]; Macri, A., & Vasile, A. (2018) [19]; Cirillo, J., Finch, J. B., & Anson, J. G. (2017) [20]; Zhamardiy, V., Shkola, O., Okhrimenko, I., et al (2020) [21]. The issue of organizing active recreation of young people in a tourist hike is covered in the works of Leuciuc, F. (2019) [22]; Bloshchynskyi, I., Kovalchuk, R., Balendr, A., et al (2019) [23]; Paunescu, M., Grigore, V., Mitrache, et al (2018) [24]. Current trends in the development of sports and fitness tourism in Ukraine are considered in the works of Mulyk, K. V. (2015) [25]; Tsiukalo, L. Ye. (2016) [26]; Pavliuk O.S., et al (2017) [27].

3. Method

3.1. Participants

The research work was carried out on the basis of Khmelnytskyi Humanitarian-Pedagogical Academy (Ukraine). The study involved 65 students, who were divided into: experimental group (EG) - 32 students majoring in specialty "Tourism" and the control group (CG) - 33 students, which consisted of students from other specialties. The groups were divided according to the requirements of representativeness. The main indicator was the same initial level of tourist readiness of students.

Experts were 11 teachers of the Department of theory and methodology of physical culture and Valeology of the Khmelnytskyi Humanitarian-Pedagogical Academy. The study was conducted between March and July 2020.

3.2. Materials

The purpose of the article is to study the impact of basic tourist training of students on the quality of organization and conduct of sports and fitness hike.

To obtain the necessary information, we used general scientific methods of the theoretical level of research, namely: analysis of scientific and methodological sources, surveys, questionnaires, expert evaluation method, pedagogical experiment, statistical data of pedagogical observation, factor analysis.

The analysis of scientific and methodological sources was used to study the current state of views of scientists on the development of youth sports and fitness tourism, to determine the requirements for the organization of educational tourist hikes. Surveys and questionnaires were conducted to determine the level of theoretical knowledge of students, to establish the level of psychological readiness of students to hikes, to determine the level of practical skills needed in a hiking trip. The pedagogical experiment was conducted to test the effectiveness of the developed content of classes on basic preparation of tourists for sports and fitness hike. The method of expert assessment was used to determine the level of preparedness of tourists for hiking; to establish the time frame for overcoming the route and individual obstacles, setting up a bivouac

and setting up a tent, to determine the level of skills to work in the team, to comply with hygiene requirements and safety measures. Statistical methods were used to analyze the pedagogical experiment using Student's t-test. Methods of factor analysis were used for quantitative and qualitative processing of the obtained experimental results.

3.3. Procedure

The basic preparation of the tourist for the sports and fitness hike took place over 4 months and included three stages:

1. Theoretical and psychological training (3-4 weeks). The task of the stage is to provide the necessary theoretical knowledge, to form practical skills and abilities to organize walking sports and fitness tourist hike; psychological preparation for overcoming the difficulties that arise in the tourist hike; tactical and technical preparation for the organization of the tourist hike. The classes are theoretical-cognitive and psychological-communicative in nature.

2. Training stage (10-12 weeks). The task of the stage is purposeful training of special professional skills of a tourist, establishing communication with members of a tourist group and formation of team cooperation skills, improvement of actions with special inventory and equipment, training of first aid skills. The classes are educational in nature.

3. Control and comparison stage (1-2 weeks). The task of the stage is to check the effectiveness of the developed content of classes on basic preparation of tourists for sports and fitness hike. The classes are control-verification and comparative-corrective in nature.

At the first stage, the main attention was paid to the formation of basic theoretical knowledge in pedagogy, psychology, conflictology, which are necessary for the organization of tourist hike, exercise control over physical load, development of skills in providing emergency medical care. The peculiarity of the theoretical and developmental stage in the preparation of tourists was a comprehensive combination of knowledge of tourist local lore, geography, topography, pedagogy, psychology, physical culture, life safety, basics of emergency medical care.

Psychological training was a mandatory part of the general preparation for the tourist hike. Each person, preparing for the hike, is guided by certain considerations, personal motives. The desire to take part in a tourist hike arouses his or her natural interest and expectation of fuller satisfaction of the hopes. If the intended plan for some reason is not implemented, there is frustration, accompanied by a complex of negative emotions. Going on a journey, a person hopes to see something new, interesting, unusual, gain new knowledge, increase experience, improve their technical skills. The tourist sets himself or herself the task to test own abilities in overcoming obstacles, the ability to emerge victorious from difficult situations. Psychological preparation of the tourist also included the formation of skills of communicative cooperation with other members of the tourist hike, the development of teamwork skills, overcoming possible conflict situations.

Tactical and technical preparation is one of the most important aspects of preparation for the hike. It includes the choice of place, time, duration and complexity of the tourist hike, mastery of the tactics of getting over the route, the ability to apply techniques to overcome obstacles, knowledge of the rules of organization and conduct of sports and fitness hikes. In classes on tactical and technical preparation of tourists, students carried out: preliminary determination of the way of the group's movement and the order of its actions on different sections of the route; drawing up a schedule that corresponds to the conditions of the area, the strength of the group and the purpose of the hike; establishment of physical activity at different stages; choice of equipment and rational set of food; carried out the development of alternative routes; identified communication capabilities and checkpoints.

At the second stage, the main attention was paid to the development of practical skills. The classes were focused on improving the physical and functional capabilities of students, the development of endurance, strength, agility, the formation of new motor skills. There is general physical and special preparation of the tourist. By means of general physical training, various development of physical capabilities and strengthening of human health, expansion of functional capabilities of the body as the basis of efficiency and stimulation of recovery processes are achieved. Special preparation of tourists covered such areas of activity as: the ability to navigate the terrain, the development of coordination skills in overcoming

natural obstacles, pitching tents, bivouacs, carrying suitcases, organization of life in the natural environment. Particular attention was paid to the options for developing and choosing the optimal hike route, the formation of skills in using a map, compass and other means of orientation. Special preparation of tourists was based on the principles of consistency, systematicity, complexity, objectivity, continuity, specialization, safety.

During the hike a person has to cover long distances for a long time with significant physical activity, which varies according to the complexity of the terrain, pace, weather conditions, the weight of the backpack. Therefore, special attention was paid to the level of physical, psychological, moral and volitional readiness of tourists, their observance of safety measures during the hike, the formation of first aid skills.

At the third stage, control and comparative analysis of the level of preparedness of students of the experimental and control groups in the process of carrying out three-days hiking was done. The group of experts set the following requirements for the organization of tourist groups' activities:

- groups of tourists with the definition of responsibilities of hike participants were formed;
- place of the beginning and the end of the walking trip was determined;
- restrictions on overcoming the distance within one day were determined;
- requirements for the bivouac and cooking were defined;
- time limits for overcoming certain sections of the route were determined;
- sanitary and hygienic requirements for hiking were established.

During the hike, the experts evaluated the actions of students of the experimental and control groups in choosing the optimal route, knowledge of the rules of organization of sports and fitness hikes, mastery of tactics of going through the route, the ability to apply techniques to overcome obstacles, the ability to act in the team, psychological state of travel participants, adherence to the demands of pitching the bivouac and cooking, compliance with sanitary and hygienic rules. (Table 1)

Table 1. *Assessment of the criteria of the formedness of theoretical knowledge, the level of psychological preparedness and practical skills of tourists*

Sl.No.	Criteria of the formedness of knowledge and skills of the tourist	Levels of formedness of knowledge and skills of the tourist				
		High	**Sufficient**	**Medium**	**Low**	**Elementary**
		deep, systematic knowledge; independent assessment of situations, creative approach to performing tasks	performing tasks in standard situations, is able to draw conclusions and correct mistakes	a person performs tasks on the model, has the basic skills of hiking	fragmentary knowledge and skills, initial ideas about the organization of hiking	fragmentary theoretical knowledge about the implementation of hiking
1.	knowledge of the rules of hiking	5	4	3	2	1
2.	choice of the optimal route	5	4	3	2	1
3.	ability to navigate the terrain	5	4	3	2	1
4.	tactics of going through the distance	5	4	3	2	1
5.	technique of overcoming obstacles	5	4	3	2	1
6.	ability to work in a team	5	4	3	2	1

7.	psychological sociability	5	4	3	2	1
8.	skills of pitching bivouac	5	4	3	2	1
9	skills of cooking under the hiking conditions	5	4	3	2	1
10	compliance with sanitary and hygienic requirements	5	4	3	2	1

4. Results

Theoretical, psychological, physical and special training of students plays a key role in the overall preparation of tourists. Going on a hike, the tourist determines the purpose and tasks associated with testing their capabilities in overcoming certain distances, natural obstacles, the ability to cooperate with other participants of the hike, the ability to organize their activities and recreation in the natural environment, the ability to overcome difficult natural and everyday situations. Achieving high results is impossible without continuous professional-applied training and skills development. The main content of training is directly related to the development of psychological resilience, the ability to work in a team, the development of physical qualities and special skills of the tourist with the simultaneous improving the functional abilities of the body and improving health.

The results of the experts' assessment of the criteria of the formedness of theoretical knowledge, the level of psychological preparedness and practical skills of tourists of the experimental and control groups during the three-days hike are presented in Table 2.

Table 2. *The results of the experts' assessment of the criteria of the formedness of theoretical knowledge, the level of psychological preparedness and practical skills of tourists.*

Sl.No.	Assessment criteria	Experimental group		Control group		Difference
		No.1 (n=16)	No.2 (n=16)	No.1 (n=16)	No.2 (n=17)	
1.	knowledge of the rules of hiking	4,22	4,34	3,46	3,18	+ 0,96±0,12
2.	choice of the optimal route	4,28	4,56	3,67	3,75	+ 0,70±0,14
3.	ability to navigate the terrain	4,35	4,48	2,76	2,58	+ 2,05±0,09
4.	tactics of going through the distance	4,25	4,40	3,12	3,44	+ 1,04±0,16
5.	technique of overcoming obstacles	4,37	4,52	3,23	3,37	+ 1,15±0,08
6.	ability to work in a team	4,14	4,27	2,73	3,12	+ 1,33±0,15
7.	psychological sociability	4,23	4,46	3,50	3,76	+ 0,72±0,13
8	skills of pitching bivouac	4,10	4,24	1,72	1,96	+ 2,33±0,12
9	skills of cooking under the hiking conditions	4,02	4,14	1,90	2,28	+ 1,99±0,19
10	compliance with sanitary and hygienic requirements	4,22	4,38	3,24	3, 46	+ 0,95±0,11

The analysis of the results of the experts' assessment of the criteria of the formedness of theoretical knowledge, the level of psychological preparedness and practical skills of students of the experimental and control groups showed higher level of development of hiking skills of students of the experimental group. The experts identified changes in the following indicators: improvement of bivouac pitching skills + 2.33 ± 0.12 points ($p < 0.001$); ability to navigate the terrain + 2.05 ± 0.09 points ($p < 0.001$); improving cooking skills in terms of tourist hiking + 1.99 ± 0.19 points ($p < 0.001$); development of the ability to work in a team + 1.33 ± 0.15 points ($p < 0.01$); improvement of obstacle overcoming technique + 1.15 ± 0.08 points ($p < 0.01$); knowledge of tactics of going through the distance + 1.04 ± 0.16 points ($p < 0.01$); knowledge of the rules of hiking + 0.96 ± 0.12 ($p < 0.05$); compliance with sanitary and hygienic requirements + 0.95 ± 0.11 points ($p < 0.05$); psychological sociability + 0.72 ± 0.13 points ($p < 0.05$); choice of the optimal route + 0.70 ± 0.14 points ($p < 0.05$).

The comparative analysis of the expert' assessment of the indicators of the preparedness of tourists of the experimental and control groups for sports and fitness hike is presented in Fig. 1.

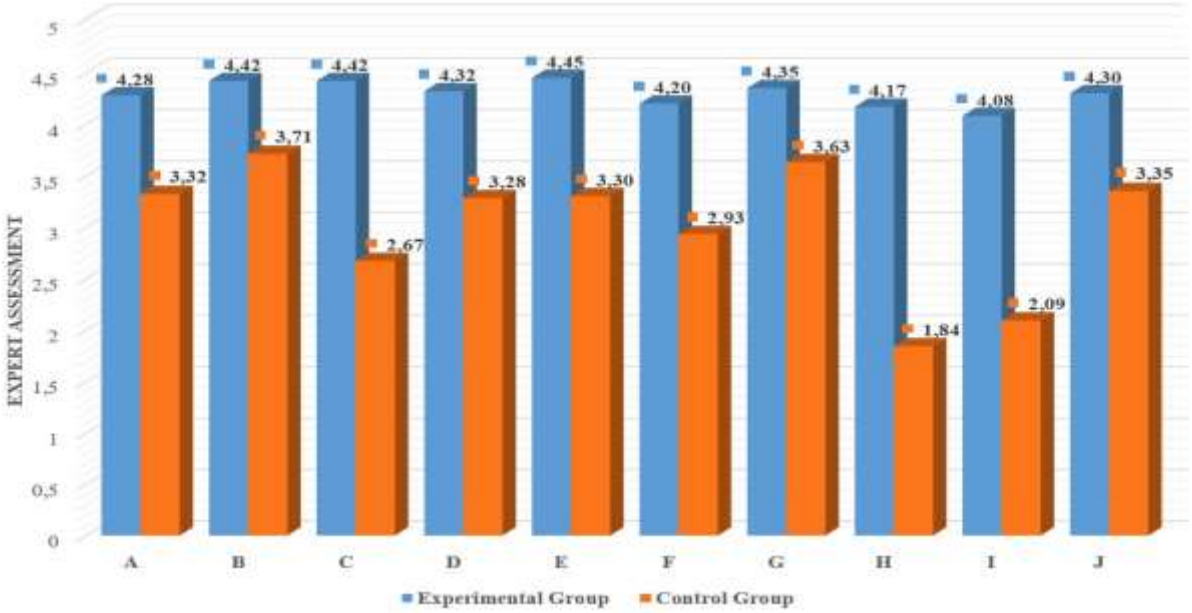

Figure 1: *Experts' assessments of indicators of readiness of tourists of experimental and control groups for sports and fitness improving travel*

Where:

a) Knowledge of the rules of hiking.
b) Choice of the optimal route.
c) Ability to navigate the terrain.
d) Tactics of going through the distance.
e) Technique of overcoming obstacles.
f) Ability to work in a team.
g) Psychological sociability.
h) Skills of pitching bivouac.
i) Skills of cooking under the hiking conditions.
j) Compliance with sanitary and hygienic requirements.

5. Discussion and Conclusion

Discussion. Analysis of the results of our research confirms the views of Herashchenko Ya.., Omelchenko, H., Volkova, I., Mulyk, K. on the priority importance of recreational and emotional-entertaining effect of sports and fitness tourism in the lives of young people [3; 10; 25]; the views of Zenin, I.

Macri A., Vasile A., Tsiukalo, L. on the development of moral-volitional, communicative and physical qualities of a person [18; 19; 26]; the views of Shchur Yu., Dmytruk, O., Bozhko, L., Parfinenko, A. on the aesthetic and local lore attractiveness of tourist hike [1; 6; 11].

According to the results of our research were expanded: research data of Mozolev O., Shorobura I., Zdanevych L., Hutsal L. on improving the methods of preparation, organization and conduct of students hikes [14]; the data from the research by Leuciuc F. on the positive impact of purposeful training activities on the level of tourist preparedness of students during one academic semester [22]; research data of Hrokhov H. Zhamardiy V., Shkola O., Okhrimenko I., Pavliuk O. on the need to use non-traditional methods of physical education in preparing students for hiking [15; 21; 27].

The authors determined that the basic preparation of a tourist for sports and fitness hike forms the skills of navigating the terrain, teamwork, organization of life and recreation in the natural environment.

Conclusion. Sports and fitness tourism requires the formedness of a set of interrelated theoretical and technical knowledge, sufficient level of basic psychological, physical, tactical-technical preparedness, the ability to organize the vital activity of the tourist group in the natural environment outside of civilizational services.

Basic preparation of a tourist for a sports and fitness hike is the basis of the general preparation of a tourist. It allows to prepare a person to overcome the difficulties of tourist hiking, develops the ability to act in a team, develops motor skills. It is the basic preparation that allows tourists to feel confident in their abilities, to make adequate decisions, to act correctly under the new conditions, to navigate unfamiliar terrain, to overcome natural obstacles, to organize own life and recreation.

The research showed that the classes on the formation of basic theoretical knowledge of a tourist, psychological and physical preparation has a significant impact on the development of special skills needed during tourist hiking. The basic preparation of a tourist allowed the students of the experimental group in comparison with the control group to use their knowledge more rationally in the choice of tactics of going through the distance, overcoming natural obstacles, navigate the terrain, camping, cooking.

The group of experts identified the most significant changes in the students of the experimental group compared to the control group in the following indicators: improving the skill of pitching the bivouac + 2.33 ± 0.12 ($p < 0.001$); the ability to navigate the terrain + 2.05 ± 0.09 ($p < 0.001$); improving cooking skills under the conditions of tourist travel + 1.99 ± 0.19 ($p < 0.001$); development of the ability to cooperate in a team + 1.33 ± 0.15 ($p < 0.01$); improvement of technique of obstacle overcoming + 1.15 ± 0.08 ($p < 0.01$); knowledge of the basics of tactics of going through distance + 1.04 ± 0.16 ($p < 0.01$).

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References

1. Shchur, Yu. V., & Dmytruk, O. Yu. (2003). *Sports and recreation tourism*. Alterpres.
2. Yerko, A. P. (2013). The concept of sports and health tourism and its characteristics. Scientific Bulletin of the Eastern European National University named after Lesia Ukrainka, Lutsk: SVNU Publishing house, 2, 76–84.
3. Herashchenko, Ya. M., & Omelchenko, H.A. (2013). Sports and fitness tourism in the life of young people. *Bulletin of Zaporizhzhya national University* [Physical education and sport, Zaporizhzhia: ZNU], *1*, 26-32
4. Abramov, V. V. (2013). *About the concept of development of sports and recreation tourism in Ukraine. Tourism and local history*. Sole proprietorship Lukashevych.
5. Bohatyriov, K. O. (2014). Prospects for the development of youth tourism. Modern trends in tourism development. *VP "MF KNUKIM"*, *3*, 10-14.
6. Bozhko, L. D. (2017). Youth and student tourism: current development trends. *Culture of Ukraine, 58*, 166-175.
7. Volkova, I. I., & Kondakova, H. O. (2014). Development of sports and fitness tourism in Ukraine. *Bulletin of V. N. Karazin Kharkiv National University*, *4*, 151–156.
8. Mozolev, O. M. (2020). *Organization of youth sport and fitness tourism*. Publishing house of KhHPA
9. Ostapchuk, V. (2017). Modern features of sports tourist hiking in Ukraine. *Recreational geography and*

tourism, *2*, 93–100.
10. Volkova, I., & Naumenko, Yu. (2015). Development of recreational and health tourism in Ukraine. *Bulletin of Lviv University. Series of international relations*, *40*, 50-66.
11. Parfinenko, A. Yu. (2015). *The tourist country studies* (Textbook-2nd ed.). Znannia.
12. Chornenka, N. V. (2012). Current trends in the development of youth tourism. *Geography and tourism*, 2, 66–72.
13. Mozolev, O., Halus, O., Bloshchynskyi I., & Kovalchuk, R. (2019). Human resources management of educational development in sphere of physical culture and sports in Ukraine: comparative analysis (1992-2016). *Journal of Physical Education and Sport*, 1, 185-192. https://doi.org/10.7752/jpes.2019.1028
14. Mozolev, O., Shorobura, I., Zdanevych, L., Hutsal, L., Marusynets, M., & Kravchuk, L. (2020). Influence of Physical Fitness of Students on the Quality of Leisure Organization in a Sports and Health Tourism. Revista Romaneasca pentru Educatie Multidimensionala, 12(2), 117-131. https://doi.org/10.18662/rrem/12.2/269
15. Hrokhov, H. P. (2016). Sports and health tourism as means of students' health preservation. *Problems of engineering and pedagogical education*, *54-55*, 142–148.
16. Konokh, A. A. (2018). Optimization of functional readiness of students engaged in active tourism during the summer training camp. *Basics of sports tourism in recreational activities*, *Kharkiv: KhSAFC*, *2*, 54-60.
17. Mozolev O. (2020). Preparation of youth for sports and recreation tourism. Conference of Management of Islamic Education Leadership in The Era of Revolution 4.0, Universities Muhammadiyah Sidoarjo, Indonesia, Vol 6 303–305.
18. Zenin, I. V. (2016). Features of physical training of tourists. *Fundamentals of sports tourism in recreational activities*, *3*, 29–36.
19. Macri, A., & Vasile, A. (2018). Particularities of the use of non-specific means of physical education and sports at young people. *Journal of Physical Education and Sport*, *5*, 2039 – 2042. https://doi.org/10.7752/jpes.2018.5303
20. Cirillo, J., Finch, J. B., & Anson, J. G. (2017). The impact of physical activity on motor preparation in young adults. *Neuroscience Letters*, *638*, 196-203. https://doi.org/10.1016/j.neulet.2016.12.045.
21. Zhamardiy, V., Shkola, O., Okhrimenko, I., Strelchenko, O., Aloshyna, A., Opanasiuk, F., Griban, G., Yahodzinskyi, V., Mozolev, O., Prontenko, K., (2020). Checking of the methodical system efficiency of fitness technologies application in students' physical education. *Wiadomości Lekarskie*, 73 (2), 332–341. doi: 10.36740/WLek202002125.
22. Leuciuc, F. (2019). Effect of a One-Semester Conditioning Activities on Physical Fitness of the Students. *Revista Romaneasca pentru Educatie Multidimensionala*, 11(4), 136-146. https://doi.org/10.18662/rrem/162
23. Bloshchynskyi, I., Kovalchuk, R., Balendr, A., Aloshyna, A., Bahas, O., Mozolev, O., Prontenko, K., Tomkiv, I., Bychuk, O., & Prontenko, V. (2019). Conceptual Basis of Organization of Volleyball Team Training.
24. Paunescu, M., Grigore, V., Mitrache, G., Predoiu, A., & Predoiu, R. (2018). Quantitative and Qualitative in Measuring Quality of Life in Sports. *Revista Romaneasca pentru Educatie Multidimensionala,* 10(1), 95-108. https://doi.org/10.18662/rrem/21.
25. Mulyk, K. V. (2015). *Sports and health tourism in the system of physical education of schoolchildren and students*. Self-employed person Brovin A.V.
26. Tsiukalo, L. Ye. (2016). Sports and recreation tourism in the system of physical education of students. *Pedagogical Sciences: theory, history, innovative technologies*, *3*(47), 451–458.
27. Pavliuk O.S., Chopyk T.V., Antoniuk, O.V., Chopyk, Ye.O., Soltyk O.O., Biliński J. (2017). Pedagogical Technology of Physical Education Teachers' Professional Self-Improvement. Science and education. 4, 101-106. https://doi.org/: 10.24195/2414-4665-2017-4-17

Influence of Physical Education Classes on the Level of Health and Fitness Competencies of Students

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Abstract

After Ukraine gained independence in 1991, the country underwent a complete reorganization of all aspects of life, and accordingly, the education system. There is an urgent need to restructure the system of physical education, especially at higher education institutions (HEI), which has accumulated a large number of unresolved problems in the field of physical education of young students in a short period of historical independence. The article forms a new scientific direction that defines a comprehensive solution to the problem of introducing the methodology for students' physical education, which provides guaranteed achievement of the projected results in the discipline "Physical Education" into the educational process of agricultural HEI, namely: knowledge, skills, physical qualities, general and special physical fitness, motivational and value-based attitude to a healthy lifestyle and one's own health, the acquisition of physical culture and health competencies by students. One of the criteria for the effectiveness of the methodology for physical education is the formed health and fitness competencies of students. The purpose of the article is to study the effectiveness of classes conducted according to the developed methodology for physical education for students to acquire health and fitness competencies. The results of the research showed high efficiency of the methodology for physical education, in comparison with the traditional system: the motivational, cognitive, and activity components in the experimental groups revealed the vast majority of students with high and sufficient levels of readiness for physical activity, and in control groups – with average and low levels.

Keywords: physical education, methodology, health and fitness competencies, student.

1. Introduction

The socio-historical and economic development of each country is aimed at changing the physical, moral, and spiritual capabilities of people in the right direction and the system of organizational measures that determine and regulate the development of physical education in society and education. The development of the system of physical education at higher education institutions (HEI) is determined by the needs of society and its individual members and is defined by the level of development of material production, social ideas about its purpose, objectives, means, content, and methods. At the same time, the

system of physical education at the HEI of Ukraine is in a deep crisis and has not been able to meet the needs of physical development and physical fitness of young students during the years of Ukraine's independence. The level of health of students and the quality of educational and sports activities at HEI suffered irreparable harm. Despite numerous scientific studies, recommendations of government agencies, and industry experts, involved in improving physical education at domestic educational institutions, no drastic changes have been made. Physical education teachers of HEI have been guided in their activities by the Instruction on the Activities Organization and Content of Physical Education Departments of Higher Education Institutions and the All-Union Basic Curriculum for Higher Education Institutions for more than ten years after Ukraine has gained independence. It is known, the feature of this university discipline was the predominance of utilitarianism, the dominant development of physical qualities, motor skills, and abilities in the days of totalitarianism [1, 2].

Therefore, the system of physical education in Ukraine was in a deep crisis and could not meet the needs of physical development and physical fitness of young students. The process of teaching physical education in the first years of Ukraine's independence was stagnant. The number of teachers and hours allotted for compulsory and optional classes has decreased, the number of sick students and students with disabilities has increased, sports clubs have ceased to function in a number of HEIs, and the number of competitions and funds for equipment and uniforms has decreased. Many leading Ukrainian specialists in the field of physical education and sports changed their profession and went abroad to work. The analysis of the state of sports, health and fitness activities at HEI shows its complete decline. This is conditioned by a number of both objective and subjective factors in the development of the existing system of physical education. On the way to building Ukraine as an independent state, many difficulties had arisen, which negatively affected all aspects of life - social, economic, spiritual, and cultural. Therefore, the modern system of physical education has experienced a period of finding strategic solutions for its development, which has prompted the beginning of methodical understanding and reform of the subject "Physical Education", development of new pedagogical technologies, which have a new perspective on tasks, content, and methods of teaching, other approaches to students, interpretation of their needs and interests [3, 4].

Only a comprehensive solution to the problem of theoretical and methodical principles of improving the system of physical education of young students will be able to ensure guaranteed achievement of the projected results in the discipline "Physical Education", namely: knowledge, skills, physical qualities, general and special physical fitness, motivational and value-based attitude to a healthy lifestyle and one's own health, the acquisition of health and fitness competencies by students.

2. Literature Review

The transformation of goals and objectives of the discipline "Physical Education" to meet modern requirements related to the restructuring of the national education system in the direction of its integration into the European educational space should be based on two philosophical principles, namely: 1) the principle of epimelia (from the Greek – self-care), which implies that the motivation for rational human behavior is, first of all, self-care and self-change, in the case of physical education – care for one's own health and following the general principles of a healthy lifestyle; 2) the principle of kalokagathia (from the Greek – beautiful and good), which emphasizes that the education should be aimed at forming the harmony of body and soul, the creation of a physically and spiritually perfect personality [5]. To keep physical education as a discipline at HEI, it should be considered not as an additional academic burden on a student, but as a means, positively influencing the activation of mental activity, the restoration of intellectual and physical performance [6, 7]. The use of physical education in the education process significantly increases mental activity. If we study the physiological load curve, the greatest effect occurs in the middle of the class, when emotional factors are used (games, relay races, functional music, etc.). Planned and rational use of physical exercises in the educational activities of the HEI students has a positive effect on mental development and intellectual activity [8, 9].

Currently, physical education of the HEI students is characterized by: 1) the lack of a specific social requirement of employers for the physical readiness of graduates and, as a consequence, incomprehension of the expediency of physical education by the HEI direction and students, inefficient management of this process; 2) insufficient humanistic and professional orientation of the process of physical education; 3)

ineffective theoretical and methodical training of students on personal physical culture; 4) a limited range of practical components that provide a set of functions of physical culture; 5) low efficiency of didactic content of practical sections of the curriculum on physical education; 6) the inadequacy of the organization forms of the process of physical education to the modern mentality and motivational maturity of students; 7) the lack of proper effective conditions for its effective functioning (sufficient personnel, scientific, methodological, medical, equipment, and financial support); 8) insufficient motivation of students to their own physical education and its improvement; 9) the lack of a scientifically sound model of further development of the system in the near and distant future in the country [10, 11].

Along with the organizational aspects of physical education in Ukraine, there was a continuous process of development of theoretical, methodological, psychological and pedagogical, physiological and hygienic, and valeological principles of improving physical education as a university discipline [12, 13]. At the same time, the theoretical and methodological developments of Ukrainian scientists in the field of physical education and sports were not inferior to the achievements of foreign scientists. There was a large amount of special literature (mostly translated) and journals, which revealed the problems of physical activity and the health industry, pointed to promising ways to radically restructure the system of physical education, bringing it into line with real human needs [14, 15]. Due to the high scientific potential of Ukraine in the field of physical culture and sports, scientific achievements in the field of physical education of young students are an opportunity to improve the quality of physical education without high expenses. Thus, it is necessary to take a number of organizational measures at the state level, namely: 1) to develop modern physical education curricula for the HEI students, which should have a focus on health, take into account the interests and preferences of students, meet the material, climatic, natural, and regional traditions, take into account the features of future professional activity; 2) to coordinate state programs with curricula and instruction letters of ministries and departments; 3) to achieve the implementation of state programs in physical education; 4) to involve scientists in the development of new methodologies for physical education in various sectoral HEI, which would be adequate to current trends in social development, aimed at implementing active forms of interaction between the subjects of educational and health-improving processes.

An analysis of literature sources [1, 3, 9, 16, 17] showed that currently the theoretical and methodological foundations of the system of physical education of students in such aspects studying, personality, activities, development, regulation, self-regulation, etc., often and most dramatically face the need to identify and cover their functioning. Almost every teacher often faces the fact that it is impossible to provide qualified and high-quality help for a student, using the same tools, one specific method – almost no real education applies just one approach. On the other hand, every teacher knows from experience that one should teach a student according to a certain scheme or model. Such a model is a model of the methodology for physical education of the students of agricultural universities with its structural components.

The aim of the study is to investigate the effectiveness of classes conducted according to the developed methodology for physical education for students to acquire health and fitness competencies.

3. Method

To achieve the aim of the study, a pedagogical experiment was organized. The main pedagogical experiment was carried out at the Polissia National University in 2013-2019, which involved sixteen student groups (369 people, including 195 males and 174 females) of economic, agronomic, environmental, agricultural management, technological faculties and the faculty of agricultural mechanization. All students were divided into control and experimental groups by the method of even distribution. Thus, the experimental groups included 188 students (105 – males, 83 – females), the control groups, respectively, 181 students (92 – males, 89 – females). According to the schedule, physical education classes in all groups were held once or twice a week in the first part of the day. The purpose of the experiment was to substantiate and introduce a model of the methodology for physical education of agricultural students into the educational process of the experimental group students. The students of the control groups were engaged in the classes conducted according to the curriculum of "Physical Education" traditional for higher educational institutions of Ukraine of III-IV accreditation levels.

In order to identify the effectiveness of the methodology model for the physical education of students, the criteria as signs that indicate the degree of high-quality health and fitness training of young students were identified. The efficiency of the methodology was assessed by the formed health and fitness competencies and the levels of students' readiness for health and fitness activities during their professional work in the agricultural sector. The aim of the pedagogical experiment was to establish how the developed methodology ensures the achievement of the goals of physical education of students in comparison with the traditional one. Thus, the experiment was comparative.

The methods of the research:

- *theoretical*: 1) the method of conceptual and comparative analysis, which compared the existing theoretical approaches to solving the issues of the current state of the physical education system at HEI on the basis of generalization of philosophical, methodological, psychological, pedagogical, and educational literature, archival materials, innovative experience, as well as generalization of many years of our own experience;

2) the method of structural and system analysis made it possible to systematize and generalize information about the object under study and create a model of the methodology for physical education of the students of agricultural universities and identify patterns and features of its functioning based on quantitative and qualitative analysis of pedagogical experiments;

3) the method of modeling, on the basis of which the theoretical principles of the educational and health-improving process in physical education were substantiated and introduced in higher agricultural educational institutions of Ukraine;

- *empirical:* questionnaires and surveys, pedagogical observations, testing, self-assessment, and credit rating were used to confirm the importance of factors that determine the features and trends of physical education at HEI and to diagnose physical fitness, professionally applied physical fitness, and the level of mastery of health and fitness competencies by students;

- *pedagogical experiment* (ascertaining, formative) was conducted in order to verify the effectiveness of the developed model of the methodology for physical education of the students of agricultural universities;

- *the methods of statistical data processing* were used for the correct processing of the obtained results and their display in tabular forms.

4. Results and Discussion

The original model of the methodology for physical education of the students of agricultural universities combines a set of components of a holistic pedagogical process – from goals to the end result – and focuses on the personality of the future specialists in agriculture who has competencies and a high level of skills in health and fitness activities and sports. The functioning of the methodology for physical education of students is conditioned by the following factors: 1) social requirements for the training of specialists for the agricultural sector; 2) the purpose and objectives of the modern system of physical education; 3) the principles and content of physical and professionally applied physical readiness for professional activities. In contrast to the traditional methodological system, which is based mainly on improving the level of physical fitness and taking an exam on physical education by students, the new system is based on the principle of "*physical education and physical activity throughout life*".

The model of the methodology for physical education of the students of agricultural universities is based on the following provisions:

1) the educational process of physical education is designed as a methodology that has its own purpose, objectives, content, methods, forms, and means of students' training;

2) the discipline "Physical Education" is mandatory in the curriculum of agricultural universities throughout the period of study at a HEI, is considered in the unity of content and procedural components of the training of future farmers;

3) one of the leading principles of the methodology for physical education of the students of agricultural universities is comprehensive training aimed at solving socio-economic problems and problems in rural infrastructure and the agricultural sector, namely: a) ensuring the educational level of rural youth in terms of a healthy lifestyle and its implementation in life; b) prevention of bad habits (alcohol, drugs, smoking); c) rational use of free time and active leisure; d) improving the psychological climate in the

production teams and increasing the activity of young people in the public life of the village, its consolidation in the agricultural sector;

4) the content of physical education is the fundamental knowledge of the basics of anatomy and physiology, hygiene and ecology, biochemistry and the basics of nutrition, psychology and pedagogy of sports, ethics, and aesthetics, etc.;

5) the content of practical material includes traditional and non-traditional means of physical education;

6) methods, forms, and means of physical education, both traditional and innovative, must be adequate to the activities of the specialist of the agricultural sector.

From the standpoint of a systematic approach, a sound model of the methodology for physical education of the students of agricultural universities consists of the following components: purpose, objectives, content, principles, methods, forms, tools, control and evaluation measurements, and tests (Table 1). In the methodology, these components are subordinated to the goals of formation and development of the student's personality through training (the process of physical education), which provides a fully developed personality as a subject of life.

Table 1. *The components of the methodology for physical education of the students of agricultural universities*

Methodology components	Meaning
Aim	Meeting the needs of the students of agricultural universities and society as a whole in the formation of a spiritually and physically developed personality and helping to improve one's living standards
Objectives	1. Strengthening the health, increasing vital functions, and resistance of the body to the effects of adverse environmental factors. 2. Promoting the proper formation and comprehensive development of the organism, physique, disease prevention, ensuring good physical condition. 3. Improving the functional capabilities of the body for the required level of physical fitness (development of physical qualities) and working capacity. 4. Mastering the system of motor skills and practical skills that ensure a safe living and psychophysical readiness for professional activity. 5. The formation of a system of knowledge on physical culture and a healthy lifestyle to use it during the study, work, family life, etc. 6. The formation of motivational and value-based attitude to physical culture, a healthy lifestyle, physical and spiritual self-improvement. 7. Gaining experience in the creative use of sports, health and fitness activities to achieve personal and professional goals. 8. The formation of worldview, aesthetic, and moral education (beautiful movements, aesthetic ideal, muscular pleasure, etc.)
Content	Theoretical section Practical section Professionally applied physical training Independent work Methodical preparation
Principles	1) humanistic orientation and democratization of the pedagogical process; 2) the priority of the needs, motives, and interests of the individual; 3) harmonious and comprehensive development of the individual for labor and socially important activities; 4) health orientation; 5) connection of physical education with vital activity (educational, labor); 6) general methodical principles: consciousness, activity, accessibility, individualization, systematicity, consistency, clarity; 7) specific principles of physical education: alternation of activities and rest, a gradual increase of pedagogical influences, the adaptive balance of activities dynamics, a progression of training activities, cyclic classes, age, gender and general adequacy of the physical education directions

Methods	1. Aimed at mastering knowledge: story, conversation, description, characteristics, explanation (accompanying, instruction). 2. Aimed at mastering motor skills: segmented and holistic studying. 3. Aimed at the development of physical qualities (physical and professionally applied physical training): steady, alternating, repeated, interval, game, competitive, circular
Forms	Classes: theoretical (lectures, consultations), practical (special, general physical education, training, professionally applied, treatment and rehabilitation-orientated, methodical, collective, and individual). Extracurricular activities: in different sports groups, independent health-improving and sports activities, hiking, sports competitions, morning hygienic gymnastics, introductory, preventive and restorative gymnastics, sports breaks, physical activity breaks, micro-breaks, etc.
Means	Traditional and non-traditional means of physical education taking into account sports interests, future professional activity, state of health, individual features, level of students' physical fitness, supply maintenance, ecological and meteorological environment (except means connected with risk to health and life that do not meet ethical requirements and form violence and cruelty)
Control and evaluation measurements, tests	Tests on physical training, tests on professionally applied physical training, a credit-unit system of assessment of the knowledge, skills in physical education, and physical fitness state of students

The methodology for physical education presupposes the understanding of the system as a multidimensional multistage structure with many parameters, as a complex internally integrated social organism that can be analyzed and explained; as a set of developing and interacting elements, properties, and relationships. The main features of systematicity include integrity, purposefulness, and structuring, i. e. the composition of elements, internal division, ordering, classification; the relationship between external and internal; the integration of individual elements and connections. The essence of the methodology for physical education is the hierarchical dependence of the following subsystems: 1) didactic and methodical principles of physical education aimed at comprehensive and professionally-oriented training; 2) the unity of general physical and special training for future professional activity; 3) the content, structure, and functions of physical education considered in the context of professionally applied physical training of agricultural students; 4) the whole process of physical education, along with professional tasks, aimed at maintaining and strengthening the health of students and their acquisition of skills and abilities to maintain a healthy lifestyle, active leisure, and involvement of others.

The functioning of each of these subsystems is aimed at achieving the main goal of physical education - to meet the needs of the students of agricultural universities and society as a whole in the formation of spiritually and physically developed personalities. The category "competence" occupies one of the first places in designing and organizing the educational process at HEI. The concept of "competence" is interpreted as a complex integrated characteristic of the individual, associated with a set of knowledge, skills, attitudes, and experience, which make it possible to effectively conduct activities or perform certain functions, ensuring problem-solving and achieving certain standards in profession or type of activity. From the standpoint of personality-oriented health and fitness education, the competency approach provides a dialectical combination of personal, activity, and social factors in the system of health and fitness activities of future agricultural specialists. In the field of physical education of future agricultural specialists, *the competence* can be considered a complex system of personal education, which contains motivational and value-based orientations to a healthy lifestyle; emotional and volitional components that ensure the readiness of a specialist for physical self-improvement and self-development through the means of physical culture and sports; the availability of systematic health and fitness knowledge, subjective experience, skills, and abilities to solve health and fitness issues in the social infrastructure of the village or in the production team.

Semantic and systemic analysis of the competence approach to educational activities in physical education and physical culture and health activities in agricultural universities allowed identifying the components of physical culture and health competence of future agricultural specialists. The basic idea is that the health and fitness competencies of agricultural students provide the process of self-development and self-improvement, maintaining health, a high level of physical fitness and efficiency, a healthy lifestyle, the ability to involve others in professional activities. The *health and fitness competencies* of future agricultural specialists include:

- *designing competence* – the ability to design one's own motor activity, lifestyle, maintain good health, high physical fitness and efficiency, and the ability to communicate it to others;

- personal (individual psychological) competence – the ability to establish interpersonal relationships: "student – teacher", "student – team of students", "future agricultural specialist – co-workers", "agricultural specialist – management and administrative apparatus" ;

- *managerial competence* – knowledge, skills, and abilities to organize and manage sports, health and fitness activities in the field of production and in the village matters;

- *methodical competence* is characterized by the level of theoretical knowledge in the field of sports, health, and fitness activities, skills to perform physical exercises and physical activities, knowledge of life safety and first aid, maintenance of a healthy lifestyle in the family or team. The methodical competence of agricultural specialists in the field of physical education and sports is considered as a result of the methodical training of a graduate of an agricultural university, who must be able and ready to perform basic health and fitness functions, determined by the functional structure of methodical thinking. This is a crucial component of physical culture and sports competence (readiness) of an agricultural specialist, which characterizes the development level of methodical competence and methodical thinking, which are necessary for productive, creative, and practical solving of physical culture and health problems in different living conditions. The success of an agricultural specialist in solving the problems of health and fitness activities in the agricultural sector is the criterion for assessing one's methodical competence;

- *reflexive competence* is related to the ability to perform self-analysis and self-assessment of the health and fitness activities, physical development, physical fitness, efficiency, physical activity and set new sports or health and fitness tasks for oneself and colleagues.

The analysis of approaches to the study of health and fitness activities in other spheres of human life shows that the *competency approach* combines the leading ideas and principles of the implementation of the activity, personality-oriented, personal activity, acmeological, and andragogical approaches. The competence approach integrates the principles of the activity approach, as competence is directly manifested in the activity and is associated with the identification, acceptance, and solution of many problems and tasks; the *personality-oriented approach* is aimed at the individual, one's needs, capabilities, goals, values, and the formation of physical, aesthetic, and spiritual traits of the individual; the principles of the *acmeological approach* are considered as an indispensable attribute or readiness that determines the desire of the individual to carry out health and fitness activities; *andragogical approach* is based on encouraging a student to acquire knowledge, skills, and abilities on one's own, to follow a healthy lifestyle, construction and correction of one's own health and fitness activities, flexible adaptation to changing conditions of professional activity.

The methodical system also has *functional components* (organizational, designing, communicative, gnostic, constructive) of the system of physical education of future agricultural specialists, which act as stable basic connections of structural components and ensure the functioning of educational, health and fitness activities of students. The functional components of the pedagogical system are stable basic connections of the main structural components: between the initial state of the structural elements of the system and the expected final result. Structural and functional elements of the pedagogical system are the most significant elements that determine the achievement of the expected final result, which must be laid down in the system itself and in all its subsystems so that the final and intermediate results are positive.

The components of the methodical system also include the *semantic structure* (components), *organizational structure*: subjects (teachers) and objects (students), as well as the results of their interaction. The interconnected and interdependent activity of the subjects and objects of the methodical system is determined by the tasks of physical education. Each of the elements of the function and semantic structure of

the methodical system is, in essence, a relatively independent subsystem, which has its purpose, objectives, content, patterns, principles, methods, forms, and means, as well as the results that characterize it. This model of the methodical system also allows clarifying the relationship between the terms "learning technology" and "pedagogical system". Learning technology is a subsystem of the pedagogical system and affects only the qualitative characteristics of all other subsystems.

Having scientifically substantiated the theoretical bases of the formation methodology for physical education of students, having revealed levels of its functioning, motivation-oriented, organizational and semantic, procedural activity and diagnostic blocks were introduced into the structure of the original model.

The motivation-oriented block of the methodology model for physical education of agricultural students is system-forming, it defines the functions of all other components of the system and includes the purpose and hierarchy of tasks, functions, structure of physical training, a system of skills, the main of which is to promote the training of harmonious highly-qualified specialists in the agricultural area through the formation of students' motivation for a conscious attitude to the process of physical education and its means. The partial tasks are:

1) the formation of motivational and value-based attitude to one's own health, a healthy lifestyle, means of physical culture and sports, physical activity, etc.;

2) increasing the level of physical fitness and efficiency;

3) the formation of psychophysical professionally applied qualities, skills, and abilities;

4) mastering the technique and methods of improvement in one of the sports or motor activity;

5) mastering the knowledge, skills, and abilities of life safety. At this level, the introduction of the methodology in the educational process of physical education is projected.

In the motivation-oriented block, it is possible to distinguish the following functions of physical education: *general pedagogical* (educational, upbringing) and *specific* (organizational, health-improving, preventive, restorative). *The educational function* is aimed at meeting the needs of students in the acquisition of special theoretical knowledge, professionally significant, organizational, and methodical skills, i. e. mastering a certain amount of knowledge in the field of physical culture and sports, a healthy lifestyle, etc.

The function of upbringing includes, first, the formation of health and fitness orientation of the individual; secondly, the formation of motivational and value-based attitude to physical education; third, the formation of an idea about the importance of systematic physical improvement in ensuring a high level of efficiency and improving professionally applied physical qualities. *The organizational function* implies organizing classes in the pedagogical process of physical education, which affect the successful solving of the objectives of the educational process. It should be noted that classes are held with different contingents, in different conditions and with different orientations, each lesson has its own content and form. *The health-improving function* includes the improvement of physical abilities, special qualities, health promotion, and improvement of anthropometric and morphofunctional indicators, and in general - physical performance. *The preventive function* of physical education is aimed at the prevention of injuries, it includes a set of organizational and methodological measures aimed at improving physical education. *The restorative function* of physical education is achieved through the use of physical culture provided that the following principles of class organization and conducting are considered: individualization, regularity, gradualness, accessibility, focus on certain amounts and intensity of physical activity. Preventive and health-improving classes are aimed at preventing diseases, restoring physical performance, and endurance.

The organizational and semantic block consists of fundamental laws, concepts, health and fitness technologies aimed at improving health, physical fitness and efficiency, training students on the basis of continuity, acceptability, and complementarity of the physical education process. It is based on general didactic and partly didactic principles, and also meets the criteria for the selection of means and forms of physical education. The content of the educational process helps to achieve the goals and objectives of physical education. The purpose and content of the discipline "Physical Education" for agricultural universities are implemented in the educational process within the semantic component of the methodology model, which includes methods, forms, and means of physical education. Knowledge, skills, and abilities are reflected in teaching methods. An intensive creation of "developmental formations" and, first, the motive of educational activity - health and fitness interests is achieved with the help of the technology of forming

meaningful generalizations of educational material, following from the abstract to the concrete, as well as specially organized educational activities.

The block of procedural activity includes the introduction of developed methods, used organizational forms and means of physical education. It provides students with the acquisition of theoretical knowledge, the formation of physical culture and sports skills. The basis of this block is an educational and methodical complex in the "Physical Education" discipline (lectures, practical classes, consultations, independent classes, manuals, methodical recommendations, sets of tasks, tools for self-preparation, test sets, evaluation criteria for students in physical education). The technology of teaching physical education reveals the conditions of the methodical system functioning, determines the ways of its implementation (design) in the educational process in accordance with the set goals.

The diagnostic and reflexive block of the methodology provides regular monitoring and diagnostics of the formation level of the students' knowledge, practical skills, abilities, and level of physical fitness. This block involves monitoring and evaluating the effectiveness of physical education in terms of the application of methodologies that establish levels of development (poor, low, medium, above average, high). It is implemented through a credit rating system for assessing knowledge, skills, physical fitness, professional physical training, and independent work and a system of tests that allow checking the formation of motivation-oriented, organizational and semantic, and procedural activity components of the methodology.

The introduction of the methodology in the process of physical education in the experimental groups affected the overall level of the motivational component significantly, in comparison with training according to the traditional system (Table 2). Thus, a high level of health and fitness competencies formation in the experimental groups was 22.5 %, sufficient – 32.4 %, medium – 30.1 %, and low only 15.0 %. Regarding control groups, 7.4 % of subjects were observed to have a high level of health and fitness competencies formation, 17.9 % – sufficient, 29.0 % – medium, and 45.7 % – low.

Table 2. *The level of formed health and fitness competencies in the motivational component of future agricultural specialists after the pedagogical experiment (%)*

Competency level	Experimental group	Control group	Difference in %
High	22.5	7.4	15.1
Sufficient	32.4	17.9	14.5
Medium	30.1	29.0	1.1
Low	15.0	45.7	30.7

Monitoring in the cognitive direction during training according to the methodology for physical education revealed a positive dynamics of acquired knowledge and skills necessary for the organization of health and fitness activities during professional activities, in comparison with the traditional system of the educational process organization. The analysis of average indicators of the formation level of knowledge and skills was carried out according to the following indicators: 1) general theory and methods of health-improving physical culture; 2) organizing and conducting sports competitions and health and fitness events; 3) competition refereeing; 4) maintenance of a sports base and its equipment supply. Thus, a high level of knowledge and skills was 19.1 % in the experimental group and 6.8 % in the control group. The sufficient level of acquired knowledge and skills accounted for 29.5 % in the experimental group and 18.5 % in the control group. The average level of knowledge and skills was also the best in the experimental groups – 33.5 %; in the control group, it was 26.5 %. A large difference was observed in low-level indicators, where significant differences were found between students in the experimental groups – 17.9 % and in control groups at the level of 48.2 % (Table 3). The general formation level of the cognitive component of the health and fitness activity of future agricultural specialists had a positive dynamic during the introduction of the methodology for physical education. Moreover, physical education had a positive effect on the formation of worldview and the general cultural level of students.

Table 3. *The level of formed health and fitness competencies in the cognitive component of future agricultural specialists after the pedagogical experiment*

Competency level	Experimental group	Control group	Difference in %
High	19.1	6.8	12.3
Sufficient	29.5	18.5	11.0
Medium	33.5	26.5	7.0
Low	17.9	48.2	30.3

The results of the study on the activity component showed the improvement of results in the experimental group in terms of the acquisition of special knowledge, skills, abilities to control fitness and health, to apply the means and methods of physical education for the development of physical qualities in the process of life correctly, to carry out the planning of health and fitness activities in work collective. At the same time, just 24.3 % of students in the experimental groups and only 8.0 % of students in the control groups had a high level of readiness to introduce means of physical culture and sports while at work. The students of the experimental groups also prevailed in terms of a sufficient level of knowledge and skills – 31.2 % and 19.1% – in the control groups. The number of students with an average level accounted for 33.5 % in the experimental group, and 27.8 % in the control group. A low level recorded in the experimental and control groups was 11.0 % and 45.1 % respectively, which indicated the high efficiency of the methodology for physical education of agricultural students (Table 4). It should also be noted that the quality of knowledge, skills, and abilities of students in the experimental groups was improved every year during the introduction of physical education means, which was carried out with a teacher-researcher.

Table 4. *The level of formed health and fitness competencies in the activity component of future agricultural specialists after the pedagogical experiment*

Competency level	Experimental group	Control group	Difference in %
High	24.3	8.0	16.3
Sufficient	31.2	19.1	12.1
Medium	33.5	27.8	5.7
Low	11.0	45.1	34.1

The results obtained in this study expand the conclusions of many scientists [2, 7. 14. 17, 18] and complement them.

5. Conclusions

The analysis of theoretical research data and experimental work highlighted the general patterns of functioning of the methodology for physical education of the students of agricultural universities. Its leading feature was that students who had studied only according to the developed methodology for educational process organization adapted to it better than those who had gained knowledge, skills, and abilities through the traditional technologies. This was confirmed by the positive dynamics of the health and fitness competencies formation in comparison with the traditional system. This was evidenced by the analysis of the dynamics at which the high level of agricultural specialists' readiness for health and fitness activities, which was assessed by three components (motivational, cognitive, and activity), was higher in the experimental group than in the control one.

The results of the pedagogical formative experiment show that the methodology for physical education of students, implemented in the process of physical education, improves the quality of the students' physical education, which is revealed by a set of health and fitness competencies required in professional activities. Experimental work, determining the effectiveness of the developed model of methodology for the students' physical education confirms the efficiency, functionality, and adaptability of the presented model to be used in the system of physical education of agricultural higher education institutions of Ukraine.

Prospects for further research are aimed at improving the model of the methodology for physical education and studying ways to transform it into physical education for the HEI students of other specialties.

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References

1. Azhyppo, O., Pavlenko, V., Mulyk, V., Mulyk, K., Karpets, L., Grynova, T., & Sannikova, M. (2018). Direction of teaching the subject of physical education by taking into account opportunities of institution of higher education and interests of student youth. *Journal of Physical Education and Sport*, 18(1), 222-229. doi: 10.7752/jpes.2018.01029.
2. Griban, G., Prontenko, K., Yavorska, T., Bezpaliy, S., Bublei, T., Marushchak, M., et al. (2019). Non-traditional means of physical training in middle school physical education classes.
3. Arefiev, V., Tymoshenko, O., Malechko, T., Domina, Zh., Bezkopylny, O., Dutchak, Yu., et al. (2020). Methodology of differentiation of health-improving classes in physical education for primary school students.
4. Shkola, O., Griban, G., Prontenko, K., Fomenko, O., Zhamardiy, V., Bondarenko, V., et al. (2019). Formation of valuable orientations in youth during physical training.
5. Tymoshenko, O., Arefiev, V., Griban, G., Domina, Zh., Bublei, T., Bondar, T., et al. (2019). Characteristics of the motivational value-based attitude of students towards physical education. *Revista Dilemas Contemporáneos: Educación, Política y Valores*. Año: VII, Número: Edición Especial, Artículo no.: 11, Período: Octubre, 2019.
6. Prontenko, K., Griban, G., Medvedeva, I., Aloshyna, A., Bloshchynskyi, I., Bezpaliy, S. et al. (2019). Interrelation of students' motivation for physical education and their physical fitness level.
7. Griban, G., Prontenko, K., Yavorska, T., Bezpaliy, S., Bublei, T., Marushchak, M., et al. (2019). Non-traditional means of physical training in middle school physical education classes.
8. Zhamardiy, V., Griban, G., Shkola, O., Fomenko, O., Khrystenko, D., Dikhtiarenko, Z., et al. (2020). Methodical system of using fitness technologies in physical education of students.
9. Prontenko, K., Bublei, T., Marushchak, M., & Bondar, T. (2020). A computer program for evaluation of children's fitness at football classes. *Information Technologies and Learning Tools*, 77 (3), 90-100. doi: https://doi.org/10.33407/itlt.v77i3.3277.
10. Prysiazhniuk, S., Oleniev, D., Tiazhyna, A., Popov, M., Hunchenko, M., Parczevskyy, Yu., et al. (2019). Formation of heath preserving competence of students of higher educational institutions of information technologies specialties.
11. Zhamardiy, V., Shkola, O., Ulianova, V., Bilostotska, O., Okhrimenko, I., Okhrimenko, S., et al. (2019). Influence of fitness technologies on the student youth's physical qualities development. *Revista Dilemas Contemporáneos: Educación, Política y Valores*. Año: VII, Número: Edición Especial, Artículo no.: 49, Período: Octubre, 2019.
12. Kolokoltsev, M., Iermakov, S., & Prusik, K. (2018). Motor skills and functional characteristics of students of different somatotypes. *Physical Education of Students*, 22(1), 31-37. doi: 10.15561/20755279.2018.0105.
13. Pasichnyk, V., Pityn, M., Melnyk, V., Karatnyk, I., Hakman, A., & Galan, Y. (2018). Prerequisites for the physical development of preschool children for the realization of the tasks of physical education. *Physical Activity Review*, 6, 117-126. https://doi.org/10.16926/par.2018.06.16.
14. Griban, G., Dovgan, N., Tamozhanska, G., Semeniv, B., Ostapenko, A., Honcharuk, N., et al. (2020). State of physical fitness of the students of Ukrainian higher educational institutions.
15. Griban, G., Vasylieva, S., Yahupov, V., Svystun, V., Khurtenko, O., Starchuk, O., et al. (2020). The role of physical education in the professional activity of teaching staff. *International Journal of Applied Exercise Physiology*, 9(5), 56-65. Retrieved from http://www.ijaep.com/index.php/IJAE/article/view/975.
16. Nosko, M., Sahach, O., Nosko, Yu., Griban, G., Kuznietsova, O., Bohuslavskyi, V., et al. (2020). Professional development of future physical culture teachers during studying at higher educational institutions. *International Journal of Applied Exercise Physiology*, 9(5), 44-55. Retrieved from

http://www.ijaep.com/index.php/IJAE/article/view/975.
17. Bloshchynskyi, I., Kovalchuk, R., Balendr, A., Aloshyna, A., Bahas, O., Mozolev, O., et al. (2019). Conceptual basis of organization of volleyball team training.
18. Prontenko, K., Bondarenko, V., Bezpaliy, S., Kyslenko, D., Lisnichenko, Yu., Ollo, V., et al. (2020). Physical training as the basis of professional activities of patrol policemen. *Baltic Journal of Health and Physical Activity*, 12 (1), 41-53. doi: 10.29359/BJHPA.12.1.05.

Characteristics of Volitional Qualities of Successful Students

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Abstract

Educational activity of students is carried out due to certain individual-psychological characteristics, among which volitional qualities take the leading place. The aim of our study is to determine the psychological profile of successful students concerning volitional qualities. The objectives of the research were: to classify successful students into certain types by studying their individual psychological strategies of behavior during educational activity; to define gender differences in the degree of development of goal-directed, self-regulating, self-organizing and morally-directed groups of volitional qualities, as well as not oriented on a goal, braking, not regulating, not organizing and antimoral involuntary groups of qualities between successful students of different types. To identify gender differences, we conducted a survey of an equal number of male and female respondents. Thus, 556 students (278 male and 278 female), of the fourth year of study between the ages of 21 and 22 participated in the scientific research. The study distinguished and characterized such types of successful students as an erudite, researcher, balanced, swot, demonstrative, rebel, and quiet. The research found that different types of students have goal-directed, self-regulating, self-organizing, encouraging, and morally-directed volitional qualities developed to a different extent. The study determined gender differences in the indicators of encouraging and morally-directed volitional qualities of successful students.

Keywords: volitional qualities, successful students, educational activity.

1. Introduction

At the present stage, training of competent specialists, who will be able to begin performing professional duties seamlessly and be mobile in the labor market after graduating from a higher educational institution, is of great importance for the education system. Therefore, the process of preparing of young students is essential for getting competitive specialists. It should be noted that most of scientists devoted a great deal of attention to the various aspects that determine the success of studying: the creative work of students at higher educational institutions (Matraeva, Rybakova, Vinichenko, Oseev & Ljapunova, 2020); the students' self-confidence and independence in thematic studying (Asrial & Arsil, 2020); professional motivation (Batilani, Belem, & Both 2018; Prontenko et al., 2019); methodical support and the forms of training organization (Pânişoară, Pânişoară, Sandu & Chirca, 2016; Zhurat, Davydyuc & Olinynyk, 2019). A number of scientific papers are devoted to the issues of mobility and competitiveness of young people in the labor market (Bondarenko et al., 2020; Blynova, Popovych, Bokshan, Tsilmak & Zavatska, 2019; Popovych, 2014; Artiles, 2011; Berliner, 2006; Ostapovich et al., 2020; Popovych & Blynova, 2019).

The competitiveness of young students is possible only under the condition of the purposeful process of knowledge acquisition. Like any kind of activity, educational activity is determined and conditioned by certain individual psychological characteristics of its subjects, among which the volitional processes, states, and qualities occupy a leading place. It should be mentioned that there are many scientific developments in the substantiation of theoretical positions of will, volitional activity, volitional processes, states, and qualities nowadays (Buzoev, 2018; Polyanskaya, Fisenko, & Kulakova, 2018; Clarke, Crowe, Oades & Deane, 2009;

Hoegl, & Parboteeah, 2003; Shamionov, Grigor'yeva & Grigor'yev, 2019; Zakharova, Yashkina, Ozhiganova & Smirnova, 2019; Griban & Dzenzelyuk, 2005).

The question of the degree of development of the volitional qualities of different types of successful students was of great interest to us. A lot of educators and psychologists dealt with the issues of the typology of the students of higher education institutions. For example, they distinguish the next types in terms of academic performance: low-performing, medium-successful, highly-successful, and disharmonious (Ledovskaya, 2010); according to the varieties of their behavioral strategies during the studying activity: an erudite, researcher, balanced student, swot, demonstrative student, rebel, and quiet student (Tsilmak, 2019). Some researchers identified a student character model on the basis of forming a character in the educational process (Marini et al., 2019; Soroka, Kalaur & Balendr, 2019).

Analyzing the scientific works, we came to the conclusion that a specially organized study of the groups of volitional qualities of different types of students had never been conducted. And the establishment of the degree of development of volitional and involuntary qualities of different types of successful students had never been the subject of scientific research.

The aim of scientific research was to determine the psychological profile of successful students concerning volitional qualities.

The objectives of the research were:

1) to classify successful students into certain types by studying their individual psychological strategies of behavior during educational activity;

2) to define gender differences in the degree of development of goal-directed, self-regulating, self-organizing and morally-directed groups of volitional qualities, as well as not oriented on a goal, braking, not regulating, not organizing and antimoral involuntary groups of qualities between successful students of different types.

2. Method

To identify gender differences, we conducted a survey of an equal number of male and female respondents. Thus, 556 students (278 male and 278 female), of the fourth year of study between the ages of 21 and 22 participated in the scientific research. The study was conducted in 2017-2019 at higher educational institutions of Ukraine (Odessa, Mykolaiv, Vinnytsia, Kharkiv, Kyiv).

The study consisted of five stages. The first stage included the selection of a group of excellent students who are motivated to achieve a positive studying result, willing to learn new, to expand their own knowledge (successful students). In order to carry out the selection, we analyzed "Academic Success Journals" and conducted conversations with excellent students.

The second stage involved the study of individual psychological strategies of the behavior of successful students during their educational activities and their classification. Thus, we monitored these students during their studying activities, defining their behavioral strategies and recording the opinions of group mates about them.

The third stage included interviews with the students to check the correctness of their type classification. At this stage, we prepared brief characteristics of different types of successful students and asked each student to identify oneself the type that characterizes one the most. During this phase, we supplemented the characteristics we prepared and selected the most common and frequent ones.

The fourth stage involved an anonymous survey on the types of successful students according to the questionnaire "Volitional and Involuntary Qualities". The questionnaire consisted of 25 volitional qualities (goal-directed, encouraging, self-regulating, self-organizing and morally-directed groups) and involuntary qualities (not oriented on a goal, braking, not regulating, not organizing and antimoral groups). Thus, these groups included the following dyads (Tsilmak, 2015):

a) goal-oriented (not oriented on a goal): purposefulness (thoughtlessness); persistence (flexibility); eagerness (inertia); initiative (non-initiative);

b) encouraging (braking): decisiveness (indecision); courage (cowardice); valor (fearfulness); bravery (timorousness);

c) self-regulating (not regulating): patience (quick temper), firmness (intemperance); self-control (the lack of control); self-mastery (confusion); self-management (mismanagement);

d) self-organizing (not organizing): neatness (negligence); carefulness (carelessness); organization (the lack of organization); conformity to plan (the lack of conformity to plan); consistency (inconsistency); perseverance (the lack of perseverance); thoroughness (superficiality); scrupulousness (the lack of scrupulousness); diligence (the lack of diligence), discipline (indiscipline);

e) morally-directed (antimoral): boldness (desperation); heroism (cowardness).

The successful students had to estimate each of these qualities by their degree of development and manifestation. The respondents were offered to estimate using three grades, namely: 1) high (constant quality, which is present always); 2) middle (moderately developed quality, which is situationally conditioned and which does not appear always); 3) low (not constant quality, which is manifested very rarely, in extreme cases) and bipolar, i.e. equivalent to the degree of the development and manifestation of opposite qualities).

The prerequisites for the survey were: a person's desire to participate in the survey; the adequacy of self-assessment of one's own degree of development of volitional and involuntary qualities during educational activities.

Rules of the survey were: to point out those qualities that are revealed during the educational activity of the respondents; respondents could skip any of the suggested qualities if they did not have it developed.

The survey took us 10 minutes. The survey was conducted in the first half of the day according to the requirements for sociological research. The survey conditions were the same for all respondents; all successful students completed this survey once. The students put finished questionnaires into boxes with the names of certain types of successful students ("Erudite", "Researcher", "Balanced student", "Swot", "Demonstrative student", "Rebel" and "Quiet student").

The research was anonymous; it was conducted in compliance with ethical principles and with the voluntary consent of students in accordance with the requirements and provisions of the Student Code of Honor and Dignity, adopted by the work collective of the National University "Odessa Law Academy" from 16.04.2015. The members of the university community are guided by the principles of academic freedom in acquiring knowledge and spreading information, conducting scientific research, as well as the principles of academic honesty – asserting honesty, fairness, respect, responsibility, compliance with ethical principles and rules established by law in scientific activity to establish confidence in the results of scientific (creative) achievements.

The fifth stage included the statistical processing of the results of the anonymous survey and the construction of psychological profiles of different types of successful students concerning the groups of volitional qualities. We used mathematical statistics methods to process quantitative indicators of empirical data obtained during our scientific research and to form psychological profiles of different types of successful students.

3. Results

According to the results of studying individual psychological behavior strategies of successful students (n=556) during the educational activity and defining their common typical forms, we determined such types as "Erudite", "Researcher", "Balanced student", "Swot", "Demonstrative student", "Rebel", and "Quiet student" (Table 1).

Consider their characteristics and describe their psychological profile by the groups of volitional qualities. Therefore, an erudite is a very knowledgeable person who has a very good phenomenal and encyclopedic memory. The group mates characterize one as a "Walking Encyclopedia", "Scholar", "Genius", "Know-It-All", "Fount of Knowledge". This type of student has a desire for new knowledge. Such a student is thoughtful, sensible, deliberative, and one's knowledge is persistent, grounded, deep, and broad in many fields of science. In classes, one behaves confidently, defends and substantiates one's own positions and thoughts, responds when asked or when controversial and problematic situations arise.

In our study, the total number of people of the "Erudite" type was 6 (which accounts for 1% of the total number of respondents), four of them (1.4%) were male and two of them (0.7%) were female. According to the average indicators of the degree of the development and manifestation of volitional qualities of successful students of the "Erudite" type, we established the same indicators of both males (n=4) and females (n=2) regarding 1) a high degree of the development of such volitional qualities as purposefulness,

persistence, eagerness, initiative, decisiveness, firmness, patience, self-control, self-mastery, self-management, neatness, carefulness, organization, conformity to plan, consistency, perseverance, thoroughness, scrupulousness, diligence; 2) the middle degree of the development of such qualities as decisiveness, courage, bravery, valor, boldness, and heroism. The respondents did not deny that they had involuntary and bipolar qualities, as well as volitional qualities developed at a low level. The goal-oriented, self-regulatory, and self-organizing volitional qualities of both female and male respondents were developed and revealed at a high level while encouraging and moral-directed volitional qualities – at the middle level.

Table 1. *The ratio of successful students of different gender by the types of volitional qualities manifestation (n=556)*

The types of successful students	Males (n=278)		Females (n=278)		Totally (n=556)	
	Number of students	%	Number of students	%	Number of students	%
Erudite	4	1.4	2	0.7	6	1
Researcher	49	17.6	54	19.4	103	19
Balanced	181	65.1	173	62.2	354	63.7
Swot	4	1.4	9	3.2	13	2.3
Demonstrative	21	7.6	25	9	46	8.3
Rebel	5	1.8	2	0.7	7	1.3
Quiet	14	5	13	4.8	27	4.9
In total	278	100	278	100	556	100

Researcher is a type of successful student who likes to investigate, takes the study of academic subjects very thoroughly (especially the subjects, in which one is very interested), reads additional literature. Such a student has critical thinking developed. One's knowledge is deep, broad, and sustainable, however, mainly only in a specific field of science. In classes, one behaves thoughtfully, confidently, defending and substantiating one's own answers and positions, owing to additional reading. This type of student always tries to get to the heart of a studied topic.

In the course of the scientific research, we determined that 103 respondents belonged to the "Researcher" type (that accounts for 19% of the total number of respondents), 49 of who (18%) were males, and 54 (19%) – females. According to the average indicators of the development and manifestation of the volitional qualities of "Researcher", we determined that both males and females had the same indicators regarding the high degree of development of such volitional qualities as purposefulness, persistence, firmness, initiative, eagerness, patience, self-control, self-mastery, self-management, neatness, carefulness, organization, conformity to plan, consistency, perseverance, thoroughness, scrupulousness, diligence. However, the indicators of the degree of development of encouraging and morally-directed qualities differed between males and females. The respondents denied that they had involuntary and bipolar qualities, as well as volitional qualities developed at a low level. The goal-oriented, self-regulatory, and self-organizing volitional qualities of both male and female respondents have a high level of development and manifestation, and encouraging and moral-directed volitional qualities have either high or middle level.

Balanced is the type of successful student who does not have any leaps in studying. Such individuals study the educational material calmly, think the answers over, and substantiate their conclusions. The knowledge of such students is thorough, persistent and deep in some fields of science; while knowledge in other areas is superficial and unstable. In classes, they behave sensibly, deliberately. They answer only when asked or when they have a personal interest in the topic.

In the process of scientific research, 354 students (which accounts for 63.7% of the total number of respondents) were referred to the "Balanced" type, among them 181 (65.1%) were male, and 173 (62.2%) – female. According to the average indicators of the development and manifestation of the volitional qualities of the "Balanced" type, we found that males (n=181) and females (n=173) had the same indicators regarding the high degree of development of such volitional qualities as purposefulness, persistence, eagerness, initiative, firmness, patience, self-control, self-mastery, self-management, neatness, organization, conformity to plan, consistency, perseverance, diligence. Both males and females of the "Balanced" type had a high

degree of the development and manifestation of goal-oriented and self-organizing volitional qualities (except such as carefulness, thoroughness, and scrupulousness). The encouraging volitional qualities had a high and middle degree of development and manifestation in males, and even low in females. The respondents (n=354) denied that they had involuntary and bipolar qualities.

Swot is the type of a successful student who bones up on the material. Such students study something not to know, but to get a positive grade. They are characterized by the specificity of thinking. Such students cannot deviate from the topic and think over the content and sense of given information. They consider that given information is absolutely correct. Their knowledge is superficial, field-specific, not persistent (they learn, answer, and forget the information if it is not useful). In classes, they jabber, if they go wrong, they start to tell from the beginning or look down on the notebook and continue the answer. Among the successful students, 13 respondents were identified to belong to the "Swot" type (accounting for 2.3% of the total number of respondents), 4 of them (1.4%) were males, and 9 (3.2%) – females. Both males (n=4) and females (n=9) had such qualities as purposefulness, persistence, eagerness, firmness, patience, self-control, self-mastery, self-management, organization, carefulness, conformity to plan, consistency, perseverance, diligence, and discipline developed at a high level. It was defined that the initiative, boldness, and heroism of both males and females were revealed at a low level during their educational activities. The respondents also indicated that they had some involuntary qualities developed. Thus, in particular, they noted that they (n=13) had 1) indecision at a high level of development and manifestation (50% of males (n=4) and 66.7% of females (n=9)) and at the middle level (50% of males (n=4) and 33.3% of females (n=9)); 2) cowardice at a high level of development and manifestation (as indicated by 50% of males (n=4) and 77.8% of females (n=9)) and at the middle level (50% of males (n=4) and 22.2% of females (n=9)); 3) fearfulness at a high level (as indicated by 50% of males (n=4) and 33.3% of females (n=9)) and at the middle level (50% of males (n=4) and 66.7% of females (n=9)); 4) timorousness at a high level (as indicated by 75% of males (n=4) and 100% of females (n=9)) and at the middle level (25% of males (n=4)).

Demonstrative is a bright type of successful students, who likes to demonstrate one's knowledge and skills. Such students try to know more in order to impress and surprise others. Their knowledge is often superficial, unstable. In classes, they behave very actively, vividly, demonstratively. They cannot restrain themselves when they know the answer, especially when a quick answer is needed.

We identified that among the successful students, 46 people (accounting for 8.3% of the total number of respondents) belonged to the "Demonstrative" type, 21 of them (7.6%) were males, and 25 (9%) – females. All males (n=21) and females (n=25) indicated that they had a high degree of development of all groups of volitional qualities (goal-oriented, encouraging, self-regulating, self-organizing and morally-directed). The respondents denied that they had involuntary and bipolar qualities. This is due to the fact that this type likes to boast and take credit for positive characteristics in order to be in the center of events and look better than others.

Rebel is the type of successful students, who is assertive and somewhat aggressive, who reacts adversely to criticism, to prove that one knows more. Such students have the spirit of competitiveness developed. Their behavior can be called compensatory. They want to have some knowledge and receive positive grades in order to prove to someone that they are either the best, or the strongest, or smarter than others. Sometimes they try to get an advantage over a teacher and can create some conflicts. They know educational material. Their knowledge of the subject of study is deep.

Thus, we determined that 7 students belonged to the "Rebel" type (accounting for 1.3% of the total number of respondents), 5 of who (1.8%) were male, 2 (0.7%) – female. We found that both males (n=5) and females (n=2) had the same volitional qualities developed at a high level such as purposefulness, persistence, eagerness, initiative, decisiveness, courage, valor, and bravery. All males indicated that they had a high level of the development and manifestation of such volitional qualities as boldness and heroism, while one female student (n=2) indicated that she had a high degree of the development and manifestation of boldness and heroism, and another one stated that she had these qualities developed at the middle level. Other students of the "Rebel" type indicated that these qualities had high, middle, and low levels of development and manifestation. There were also some students who stated their qualities were bipolar (i.e., their manifestation depends on the situation and circumstances). Thus, in particular, it was determined that 1) only females (n=2) had patience - quick temper; 2) only males (n=5) had self-control - the lack of control, self-

mastery - confusion, self-management - mismanagement, neatness - negligence, carefulness - carelessness, organization - the lack of organization, conformity to plan - the lack of conformity to plan, consistency - inconsistency, thoroughness - superficiality, scrupulousness - the lack of scrupulousness; 3) both males and females had perseverance - the lack of perseverance, firmness - intemperance.

Quiet is silent, patient type of students, who prefers to keep silence rather than respond. Such students know educational material; however, they are shy to answer because they are unsure of themselves. They react adversely to criticism. Their knowledge of the material can be both deep and superficial. They do not always read additional literature. In classes, they prefer to keep silence rather than to show their knowledge.

Thus, the "Quiet" type included 27 successful students (which accounted for 4.9% of the total number), 14 of them (5%) were male, and 13 (4.8%) – female. It was found that males (n=14) and females (n=13) had the same indicators concerning 1) the high level of development of the next qualities: a) volitional qualities – purposefulness, persistence, eagerness, firmness, patience, self-control, self-mastery, self-management, perseverance, thoroughness, and discipline, b) involuntary qualities – non-initiative, indecision, cowardice, fearfulness, timorousness; 2) the low level of development of boldness and heroism. The majority of females (n=13) had such qualities as carefulness, organization, conformity to plan, and consistency developed and revealed at a high level, and most of the males (n=14) – at the middle level. Most males and most females had such volitional qualities as neatness, thoroughness, and scrupulousness at the middle level of development and manifestation. The respondents denied that they had bipolar qualities.

4. Discussion

Thus, a predominantly high level of development and manifestation of the goal-oriented volitional qualities of successful students indicated that during their educational activities such students are motivated to acquire knowledge and increase their own level of competence. During the educational process, 1) purposefulness lets to move intentionally towards a deliberately set goal; 2) persistence lets to overcome external and internal obstacles and achieve results; 3) eagerness lets to make efforts to achieve a specific result over and over again; 4) initiative lets to initiate independent endeavors in the context of improving the level of competence.

Regarding the encouraging volitional qualities of successful students, it should be noted that during the educational process, 1) courage allows a person to overcome feelings of anxiety, fear, confusion and to prove oneself, 2) valor allows a person to take a justified risk for a meaningful purpose; 3) bravery enables a person to defend one's own valid point of view, even if it differs from the point of view of others; 4) decisiveness a) pushes individuals to the process of cognition; b) activates students during classes; c) encourages to give an answer; d) allows individuals to test their own level of knowledge, skills, and experience; e) lets to apply a set of knowledge, abilities, and skills for solving educational tasks in an active way without hesitation and doubt.

During the educational process, self-regulating volitional qualities (firmness, patience, self-control, self-mastery, and self-management) allow individuals a) to restrain and suppress impulsive, inconsiderate emotional reactions; b) to overcome physical and mental stress; c) to overcome negative feelings and emotions; d) to solve problematic issues independently.

The following self-organizing volitional qualities are necessary during the educational process: 1) neatness that lets to show neatness in solving educational tasks; 2) carefulness, allowing individuals to follow a clear algorithm of actions when solving educational tasks; 3) organization that enables students to allocate their own time resource; 4) conformity to plan that lets to follow internal and external plans of actions; 5) consistency – enables to study the educational material consistently; 6) perseverance – allows individuals to study complex disciplines carefully and patiently; 7) thoroughness – allows students to be attentive to details; 8) scrupulousness – lets to carry out educational tasks accurately; 9) diligence – allows individuals to study honestly; 10) discipline – enables students to do everything on time, follow the obligations and created plan.

Concerning the moral-directed volitional qualities, it should be noted that during the educational process, 1) boldness allows students to take responsibility and to solve difficult tasks without hesitation; 2) heroism allows individuals to take risks for the common purpose and to achieve the goal.

The results obtained complement and extend the findings of many studies (Barel & Tzischinsky, 2018; Maciuszek, Polczyk & Tucholska, 2019; Ren, Schweizer & Xu, 2013; Shvets, et al., 2020; Tsilmak, Okhrimenko, Barko, Protsenko & Gerashchenko, 2020; Voloshenko, Dzhezhik & Azarkina, 2020; Zelenskiy, Popova, Sokolovskyi & Stashchak, 2018).

5. Conclusions

1. Due to the observation of the individual psychological strategies of successful students' behavior during their educational activities, the survey of the students, the study of the opinions of their classmates, we classified the successful students by the corresponding types (erudite, researcher, balanced, swot, demonstrative, rebel, and quiet). Thus, the type "Erudite" involved 6 people (1% of the total number of respondents (n=556)). They were notable for phenomenal and encyclopedic memory, thirst for new knowledge, erudition, thoughtfulness, sensibleness, reasonableness. Their knowledge was stable, grounded, deep and broad in many fields of science.

The "Researcher" type included 103 (19%) individuals. They were distinct in the desire to explore, to find out the nature of the object and the subject of the study. Their knowledge was deep, broad, and sustainable, however, mainly only in a specific field of science.

The "Balanced" type involved 354 (63.7%) students, who were distinguished by certain educational stability. They thought the answers over, substantiated their conclusions. Their knowledge in some fields of science was thorough, persistent and deep; while knowledge in other areas was superficial and unstable.

The number of respondents who belonged to the "Swot" type was 13 (2.3%). They were notable for learning material by heart in order to receive a good grade but not to know it. Their knowledge was superficial, field-specific, not persistent (they learned, answered, and forgot the information if it was not useful).

The "Demonstrative" type involved 46 (8.3%) respondents, who were distinguished by demonstrating their knowledge and skills in a very bright and theatrical way, trying to impress and surprise others. Their knowledge was often superficial and unstable.

The number of students belonging to the "Rebel" type accounted for 7 (1.3%). They were distinct in assertive and somewhat aggressive behavior. They could create some conflicts, defending their opinion, reacted adversely to criticism. Such students had the spirit of competitiveness developed; they tried to assert themselves, to prove that they knew more. Their knowledge of the subject of study was deep.

The "Quiet" type included 27 (4.9%) respondents, who were noted for silence, calmness, the desire to remain silent rather than respond. They knew educational material; however, they were shy to respond because they were afraid to shame themselves and to show self-doubt. Their knowledge of educational material was either deep or superficial.

2. Analyzing the gender differences among the types of successful students, it should be noted that the total number of the types of respondents of a different gender does not have significant differences. In particular, it was distinguished twice more males who belonged to "Swot", 2.9% more males, belonging to "Balanced", and 1.1% more males in the group "Rebels". Whereas more respondents belonging to the "Swot" type were distinguished among females (by 1.8%). This is due to the fact that choosing a particular behavior strategy during the educational activity; all students achieved academic success, despite their individual psychological differences. This fact underlines the objectivity of the evaluation of the students' knowledge by scientific and pedagogical staff, and also confirms the proper substantiation of receiving higher education.

3. According to the results of the scientific research, it was stated that certain types of successful students (both male and female) mostly have goal-oriented, self-regulating and self-organizing volitional qualities developed at a high level. This is explained by the fact that goal-oriented volitional qualities a) allow individuals to achieve successful results during the educational activity; b) underlie personal goal setting; c) are interdependent. During the educational process, self-regulating volitional qualities allow individuals a) to restrain and suppress impulsive, inconsiderate emotional reactions; b) to overcome physical and mental stress; c) to overcome negative feelings and emotions; d) to solve problematic issues independently. And self-organizing volitional qualities allow students a) to plan and organize their own educational activities; b) to carry out the educational tasks carefully, thoroughly, scrupulously and on time;

c) to take the fulfillment of educational tasks thoughtfully; d) to achieve high successes, etc.

At the same time, gender differences in the indicators of encouraging and moral-directed volitional qualities of successful students are noted. It should be emphasized that during the educational process, encouraging volitional qualities a) push a person to actions, activities (inactivity); b) activate and stimulate a person to achieve certain results; c) are interdependent; d) allow individuals to achieve positive results of educational activity. Morally-directed volitional qualities are not particularly important for the educational activity.

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References

1. Artiles, A. J. (2011). Toward an interdisciplinary understanding of educational equity and difference: The case of the racialization of ability. *Educational Researcher*, 40, 431-445. Retrieved from https://www.academia.edu/1492780/
2. Asrial, S., & Arsil, H.S. (2020). Attitudes, self-confidence, and independence of students in thematic learning. *Universal Journal of Educational Research*, 8(1), 162-168. doi: 10.13189/ujer.2020.080120
3. Batilani, T. G., Belem, I. C., & Both, J. (2018). Different profiles in terms of motivation and concerns of physical education students. *Movimento*, 24(2), 619-632. doi: 10.22456/1982-8918.74947
4. Barel, E., & Tzischinsky, O. (2018). Age and sex differences in verbal and visuospatial abilities. *Advances in Cognitive Psychology*, 14(2). 51-56. doi: 10.5709/acp-0238-x
5. Berliner, D. C. (2006). Our impoverished view of educational research. Teachers College Record, 108(6), 949-995. Retrieved from https://www.researchgate.net/publication/252363027_Our_Impoverished_View_of_Educational_Research
6. Blynova, O.Ye, Popovych, I.S., Bokshan, H.I., Tsilmak, O.M. & Zavatska, N.Ye. (2019). Social and psychological factors of migration readiness of Ukrainian students. *Revista ESPACIOS*, 40(36), page 4. Retrieved from https://www.revistaespacios.com/a19v40n36/in194036.html
7. Bondarenko, V., Okhrimenko, I., Minenok, A., Donets, I., Danylchenko, V., Khudiakova, N., et al. (2020). Professionally important psychophysiological qualities of patrol police officers.
8. Buzoev, A.S. (2018). Formation of the volitional sphere of students by means of physical education. *Baltic Humanitarian Journal*, 7(3), 163-165. Retrieved from https://cyberleninka.ru/article/n/formirovanie-volevoy-sfery-studentov-sredstvami-fizicheskoy-kultury
9. Clarke, S.P., Crowe, T. P., Oades, L.G., & Deane, F.P. (2009). Do goal-setting interventions improve the quality of goals in mental health services? *Psychiatric Rehabilitation Journal*, 32(4), 292-299. https://doi.org/10.2975/32.4.2009.292.299
10. Griban, G.P., & Dzenzelyuk, D.O. (2005). Vplyv vol'ovykh yakostey studentiv na pokaznyky vykonannya testiv z fizychnoyi pidhotovlenosti [*The influence of field qualities on the work on the study of physical fitness*]. Moloda sportivna nauka Ukraíni, 9(4), 173-177. [in Ukrainian].
11. Hoegl, M., & Parboteeah, K.P. (2003). Goal setting and team performance in innovative projects: on the moderating role of teamwork quality. *Small Group Research*, 34(1), 3-19. Retrieved from https://doi.org/10.1177/1046496402239575
12. Ledovskaya, T.V. (2010). Individual'no-tipologicheskiye osobennosti studentov vuza s raznymi pokazatelyami uspeshnosti uchebnoy deyatel'nosti [*Individually typological characteristics of university students with different indicators of educational activity success*]. Portal psikhologicheskikh izdaniy PsyJournals.ru. Retrieved from http:// psyjournals.ru/authors/55862.shtml. [in Russian].
13. Maciuszek, J., Polczyk, R., & Tucholska, K. (2019). Direct and indirect relationships between life satisfaction, values, and time perspectives: Research on a sample of Polish students. *Advances in Cognitive Psychology*, 15(2). 133-142. doi: 10.5709/acp-0263-0
14. Marini, A., Maksum, A., Satibi, O., Gusti Yarmi, E., & Muda, I. (2019). Model of student character based

on character building in teaching learning process. *Universal Journal of Educational Research*, 7(10), 2089-2097. doi: 10.13189/ujer.2019.071006
15. Matraeva, A., Rybakova, M., Vinichenko, M., Oseev, A., & Ljapunova, N. (2020). Development of creativity of students in higher educational institutions: assessment of students and experts. *Universal Journal of Educational Research*, 8(1), 8-16. doi: 10.13189/ujer.2020.080102
16. Ostapovich, V., Barko, V., Okhrimenko, I., Yevdokimova, O., Ponomarenko, Y., Prontenko, K., et al. (2020). Psychological profile of successful criminal police officer.
17. Pânişoară, G., Pânişoară, I., Sandu, C., & Chirca, R. (2016). The status of positive psychology strengths within the Romanian school in the digital society. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 7(4), 5-22.
18. Polyanskaya, E., Fisenko, O. & Kulakova, V. (2018). Strong-willed character traits in students' career orientation in the labor market and self-realization. *European Research Studies Journal*, 21(Special Issue 2), 606-613. doi: 10.35808/ersj/1287
19. Popovych, I. (2014). Social expectations – a basic component of the system of adjusting of social conduct of a person. *Australian Journal of Scientific Research*, 2(6), 393-398. Retrieved from http://ekhsuir.kspu.edu/handle/123456789/3281
20. Popovych, I. S., & Blynova, O. Ye. (2019). The Structure, Variables and Interdependence of the Factors of Mental States of Expectations in Students' Academic and Professional Activities. *The New Educational Review*, 55 (1), 293-306. Retrieved from doi: 10.15804/tner.2019.55.1.24
21. Prontenko, K., Griban, G., Medvedeva, I., Aloshyna, A., Bloshchynskyi, I., Bezpaliy, S. et al. (2019). Interrelation of students' motivation for physical education and their physical fitness level.
22. Ren, X., Schweizer, K., & Xu, F. (2013). The sources of the relationship between sustained attention and reasoning. *Intelligence*, 41, 51-58. doi: 10.1016/j.intell.2012.10.006.
23. Shamionov, R.M., Grigor'yeva, M.V., & Grigor'yev, A.V. (2019). Volevyye kachestva kak prediktory znachimosti sotsial'noy aktivnosti studentov [*Volitional qualities as predictors of the importance of students' social activity*]. Sotsial'naya psikhologiya i obshchestvo, 10(1), 18-34. doi:10.17759/sps.2019100102. [in Russian].
24. Shvets, D., Yevdokimova, O., Okhrimenko, I., Ponomarenko, Y., Aleksandrov, Y., Okhrimenko, S., & Prontenko, K. (2020). The new Police training system: psychological aspects. *Postmodern Openings*, 11(1Supl1), 200-217. https://doi.org/10.18662/po/11.1sup1/130
25. Soroka, O., Kalaur, S., & Balendr, A. (2019). Diagnostics of leadership qualities of specialists of "Man-Man" type of professions in military and civil higher education institutions: Psychological and pedagogical approach. *Revista Romaneasca pentru Educatie Multidimensionala*, 11(4 Supl. 1), 264-277. doi:10.18662/rrem/189.
26. Tsilmak, O.M. (2019). Etalonnyy psykholohichnyy profil' vol'ovykh yakostey slidchoho [*Reference psychological profile of the will of the investigator*]. Studiya sotsial'noho prava, 2 (4), 22-26. doi: 10.32518/2617-4162-2019-2-22-26. [in Ukrainian].
27. Tsilmak, O.M. (2015). Profesiyno-psykholohichnyy vidbir suddiv za kryteriyem – vol'ovi yakosti [*Professional and psychological selection of judges by criterion – volitional qualities*]. Pivdennoukrayins'kyy pravnychyy chasopys, 3, 213-215. [in Ukrainian].
28. Tsilmak, O., Okhrimenko, I., Barko, V., Protsenko, O., & Gerashchenko, O. (2020). Psychological profile of unsuccessful university students. *Revista Romaneasca pentru Educatie Multidimensionala*, 12(2), 267-289. https://doi.org/10.18662/rrem/12.2/278
29. Voloshenko, M., Dzhezhik, O., & Azarkina, A. (2020). The method of forming the health-saving competence of pedagogical universities' students. *Revista Romaneasca pentru Educatie Multidimensionala*, 12(1), 198-208. doi: 10.18662/rrem/209
30. Zakharova, A.V., Yashkina, Ye.M., Ozhiganova, M.V. & Smirnova, I.A. (2019). Razvitiye volevykh kachestv studentov tekhnicheskogo vuza sredstvami fizicheskogo vospitaniya [*Development of volitional qualities of students of a technical university by means of physical education*]. Sovremennyye problemy nauki i obrazovaniya, 2. Retrieved from http://www.science-education.ru/ru/article/view?id=28648. [in Russian].
31. Zelenskiy, R., Popova, O., Sokolovskyi, V., & Stashchak, M. (2018). Formation of emotional-volitional

culture of future policemen in the course of vocational training. *Revista Romaneasca pentru Educatie Multidimensionala*, 10(2), 198-209. https://doi.org/10.18662/rrem/56

32. Zhurat, Y., Davydyuc, N., & Olinynyk, M. (2019). Psychological and pedagogical factors of activating the masters students cognitive interests to the study of foreign languages. *Revista Romaneasca pentru Educatie Multidimensionala*, 11(1), 312-324. https://doi.org/10.18662/rrem/113

Police Training or Police Education: View on the Matter

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Abstract

In any transformational processes taking place in society, the problem of the law enforcement system's unhindered functioning plays a key role. In the light of recent high-profile events related to the activities of the police and other law enforcement agencies of Ukraine, the issue of the high-quality training of police officers has become extremely important. Different views on the course of police reforming, on the possibility or impossibility of forming a reliable specialist – a police officer in a short time are widely discussed in society. That is why it will be useful to attract the positive experience of foreign countries, which will lead to increased interest in studying trends and dynamics of the police system, finding new, flexible, and effective approaches to ensure certain changes and innovations. The paper presents an analysis of the results of reforming police training systems in foreign countries (USA, Europe, and Asia). The material for the study was the doctrines and views of modern scientists on the models and areas of the police institutes' improvement; statistics characterizing the results of the reforms. It was determined that in modern psychological and legal practice, there are at least three approaches to assessing the need to increase the level of police officers' training. It was emphasized that reforming the law enforcement system makes new demands not only on the personality of the police officer but also on the educational conditions of personality formation. It was argued that the content and technology of new police education should be aimed at creating such psychological conditions for the personality development of future professionals, which will ensure the formation of professional competence and actualization of the personal potential of police officers. Particular attention was paid to the consideration of reforms in the structure of the National Police in post-crisis situations. The question of the need to conceptualize the qualification requirements for a police officer and the creation of a modern model of police education was raised.

Keywords: police training, police education, police officer, professional competence.

1. Introduction

The content of education, including vocational education, reflects the state of society, the transition from one state to another. Nowadays it is a transition from the industrial society of the XX century to the post-industrial (or information) XXI century. The development and functioning of educational processes are determined by all factors and conditions of society's existence: economic, political, social, cultural, and others (Ievdokimova, 2017). Reforming the police training system is one of the most important and difficult tasks of social transformation in any environment. Moreover, it is particularly difficult to reform the police in post-crisis situations, when the implementation of the reform involves much more than just a technical solution or external changes in the activities of police educational institutions. Any changes in the field of police training inevitably have serious consequences both for the results of police officers' professional activities and for the public assessment of the results of their work (Ostapovich, et al., 2020; Shvets, et al., 2020).

In addition, transformations in the law enforcement area are a challenge for the mental and psychological resources of police officers, their ability to perform their functions in a transformational

society (Aleksandrov, Okhrimenko, & Drozd, 2017; Bondarenko, et al., 2020; Prontenko, et al., 2020). At the same time, the study of foreign experience in the functioning of police education is of great importance, especially of those countries where the police have a long history and enjoy a deservedly high reputation. Although police training systems abroad are significantly different from domestic ones and function in other ways, it can still be argued that objective preconditions for constructive thinking and creative application of their experience are actual.

Despite the fact that the psychological aspects of the professional development of law enforcement agencies are a common subject of scientific research, the problem of forming the personality of a police officer in the context of vocational education is especially relevant today. Reforming the law enforcement system makes new demands not only on the personality of the police officer but also on the educational conditions in which such a personality is formed. The content and technologies of the new police education should be aimed at creating such psychological conditions for the personality development of future professionals, which will ensure the formation of professional competence and actualization of the personal potential of specialists in this field. At the same time, the question about the model of a professional which will determine the concept and specifics of police training arises. There is no doubt that in the context of reforming, such a concept in general, and the impact of education on the personality of a police officer, in particular, outlines a number of controversial issues that can not be resolved on the basis of domestic research, which is currently at the initial stage.

2. Literature Review

In the global context, the problem of police education and the impact of its various forms on the formation of the police personality does not lose its relevance. Thus, reviewing the Police Academic Education Program, C. Paterson (2015) argues that police education is a major issue in the process of cultural changes and reforms. Such statements encourage serious consideration of the experience of foreign researchers and analysis of their scientific achievements in order to use the psychological support of professional training of police officers in our country.

The link between education and police activities has long been studied by law enforcement professionals. As noted by R.C. Trojanowicz and T.G. Nicholson (1976), among police and criminal justice officials, the need for increased academic requirements for those willing to serve in the police has long been urgent. One of their main arguments was that the level of intelligence of a police officer should be at the same level as that of the average citizen, or even exceed it. Another argument was that the desire to "professionalize" the police considers a degree that corresponds to four years of college as a mandatory requirement.

Research on the benefits of higher education of police officers on the example of the United States can be divided into two distinct groups. The first group includes 1970s research on the impact of higher education on police officers' relations. Police officers educated at the university were less authoritarian (Parker, Donnelly, Gerwitz, Marcus, & Kowalewski, 1976), less cynical (Regoli, 1976) than those who did not study at a university, and the higher the level of education is, the more sensitive to changes the value system of police officers becomes, which provides them with more ethical professional behavior (Guller, 1972). Research has also shown that it is not criminology or criminal justice courses that have led to a more ethical and cultural attitude towards the population, but the experience of studying at the university as a whole (Roberg, & Bonn, 2004).

The investigations by another group of authors, which appeared in the early 2000s, suggest some doubts about education at the university by the future police officers. For example, S. Owen and K. Wagner (2008) found that police officers who had studied criminal justice showed a higher level of authoritarianism than those who had studied other disciplines. B. Bjerregaard and V.B. Lord (2004), who took the influence of education on the attitude to ethics in criminal proceedings as a basis, came to somewhat similar conclusions. This view has been supported by other researchers who have identified a correlation between police education levels and significant changes in their value system (Bufkin, 2004; Hays, Regoli, & Hewitt, 2007).

In addition, it should be noted that the determination of the potential value of higher police education is hampered by the lack of appropriate criteria for its mastery. In this perspective, it is worth noting the lack of clarity of the purpose of practice-oriented education. That is why the study of the special education of

specialists, the development and determination of the professional training indicators of police officers from the perspective of positive foreign experience is an urgent theoretical and applied problem.

The aim of the research is to study the results of the reforms of police training systems carried out in foreign countries (USA, Europe, and Asia) in the context of the further use of positive experience and prevention of possible mistakes.

3. Method

The material of the research was the doctrines and views of modern foreign researchers on the models and directions of the police institutes improvement; analytical and statistical data characterizing the results of the reforms. The comparative analysis, systematization, and generalization of scientific research data on the outlined issues were used as basic research methods. Particular attention was paid to the current experience of improving police bodies in different countries, as well as to considering reforms in the police structure in post-crisis situations.

The study was performed in accordance with the requirements of the Code of Ethics of Kharkiv National University of Internal Affairs, which was developed on the basis of Ukrainian and world experience of ethical rule-making, expert recommendations, taking into account the proposals of the structural units of the university. This document was approved by the Academic Council of the Kharkiv National University of Internal Affairs (Protocol № 13 of 24.12.2019) and put into effect by the order of the Rector of the University (Order № 875 of 27.12.2019). According to its provisions, members of the scientific community are guided in their activities by the principles of autonomy, independence in spreading knowledge and information, conducting research, and applying the results. The principles of defending honesty, justice, respect, responsibility, observance of ethical principles, and rules of creative activity are taken into account in order to establish trust in the results of scientific achievements.

4. Results

Police officers face more serious challenges in today's world. General training, including tactical training, which is traditionally present in academies, is no longer sufficient. Police officers need more than mechanical skills or the ability to memorize mechanically. Currently, according to American researchers (Hudson, 2014), higher-level training, which would include problem-based learning, the formation of critical thinking and interpersonal communication skills, is required. Improving the level of training can help to reduce public order violations and prepare police officers to interact with people of all segments of the population better. Recent events in the United States confirm this position.

At the same time, P.J. McDermott and D. Hulse (2012) point out that traditional teaching at the academy does not promote problem-solving skills. Instead, they propose an approach to teaching and education in which an instructor first provides the training material and then evaluates its mastery. This position is really rational because police officers have a duty to maintain social order and build public relations. At that time, young police officers, who are just beginning to perform their professional duties, are deprived of problem-solving skills.

Most police academies use a behavioral style of studying in which information is provided through a lecture, and a cadet is expected to apply this information in practice. According to some researchers (Sereni-Massinger, & Wood, 2016), 90% of studying at the academy is aimed at solving problems with the expectation of their understanding. Learning, based only on a reproducible approach, does not provide learners with opportunities to improve problem-solving skills through the use of critical thinking. The training focused on problem-solving, critical thinking, and interpersonal communication will provide modern law enforcement with a set of professional skills that will help cope with the events that arise in the daily activities of police officers more effectively.

Critical thinking is essential for any professional because it gives improved results not only for the individual with critical thinking but also for those who this professional serves. The application of cognitive skills in the decision-making process also helps to achieve a mutually desirable result for both a law enforcement officer and society.

Interpersonal communication skills are usually not included in the curriculum, although these skills should be aimed at de-escalating conflict situations (Fedorenko, Dotsenko, Okhrimenko, Radchenko, &

Gorbenko, 2020). Emotional intelligence is considered an important aspect of the ability to control one's emotions. At the same time, as some researchers point out (Sereni-Massinger, & Wood, 2016), emotional intelligence programs work if they are taught and managed by competent instructors. However, many instructors are not competent enough because they are not experts in the empirical training of emotional intelligence. Much of police education consists mainly of the use of firearms, tactical training, and arrest methods. In our opinion, little attention is paid to training that focuses on problem situations and provides a basis for considering human behavior in terms of critical thinking, emotional intelligence, interpersonal communication, and conflict resolution. Professional development of transferable skills and an appropriate educational component are needed for today's police to be properly trained for the service.

In addition, increasing educational requirements are emphasized, demonstrating that educated police officers have certain desirable characteristics that their less-educated colleagues lack (Smith, & Aamodt, 1997). Indeed, in comparison with less-educated colleagues, police officers with higher education are less authoritarian and dogmatic, more cautious; have better communication skills, and are characterized by a more positive attitude to the problems cooperating with the community.

In addition, European researchers T. Feltes and R. Peace (2006) underline the importance of conceptualizing requirements and point out that models of police education should include clear goals; socially-oriented content of educational programs; an appropriate method to facilitate the transition from law enforcement to public cooperation. In this view, it can be stated that the transition to police cooperation with the public should be accompanied by reforming police education, aimed at improving the quality of police activities. For example, in the Netherlands, the police use a dual education and training system to facilitate a clear link between theory and practice (Peeters, 2013). This provides a common basis with police agencies for the training of police officers, formulating the professional requirements of different police functions when educational institutions determine the curriculum and training requirements appropriate to the profession.

It should be noted that quite often researchers distinguish the concepts of "training" and "education" in relation to police training. We believe that police education seeks to encourage officers who actively interact with different segments of society to think more flexibly. The lack of special police education programs to support this cultural transition explains the delay between innovations in law enforcement and their application in practice.

In democratic societies, the police exist in a political dimension that recognizes the importance of social justice, social cohesion, honesty, equality, and human rights. R. Roberg and S.Bonn (2004) argue that education (rather than training) is necessary for the development of these values, and therefore it is effective to distinguish between these concepts as it supports and increases police productivity, responsibility, and professionalism. Therefore, it should be noted that the evidence-based relationship between higher education and law enforcement provides a platform for agreement on what the main task of the police is and how to address it, as well as what benefits to consider.

The requirements for democratic foundations of police activities (professionalism, responsibility, legality) provide a potential basis for understanding how a focus on police education can contribute to the training and development of police officers at all levels of the police hierarchy and the recognition of the practical benefits of "values" as engines of police reforms. As recognized by D. Cox (2011), reforming police education and training requires a clear conceptualization of police "values" that can be manifested in all three ways of the police subculture.

Scientists in the United States and Europe are not the only ones emphasizing the need to create a clear model of police education and to define its central principles. For example, researchers from Thailand S. Chatthong, M. Kovitaya, and M. Kongjaroen (2014) point out that the Thai police have been always criticized, which led to the creation of a reform plan. In their opinion, an important component of these changes should be the formation of professional police thinking. There is some agreement on what characterizes effective professional police thinking and what actions should be applied in the training model. Thus, in particular, we can conclude that four key characteristics are preferred in today's policing: ethical behavior, trust, communication, and the ability to think critically, creatively, and strategically. In addition, creating joint plans for the future, generating commitment to the organization, caring for subordinates, and solving problems are important for the work-related consciousness.

Another example of Asian research on police education is the work of L. Cao, L. Huang, and I. Sun (2006), who note that Taiwan's police training system has undergone significant changes during the transition to democracy. This system is a dichotomy in which the Police College provides training for low-ranking police personnel, while the Central Police University is responsible for training senior police officers. A reflection of Taiwan's police reform rejects police education as a closed system, as well as includes more social sciences in the police education curriculum.

As for police training in India, it does not involve the study of the humanities and social sciences. J. Scott, D. Evans, and A. Verma (2009) criticize the training of Indian police officers and argue that calls for reform are generally ignored. India understands the importance of studying the social sciences, but prefers technical skills. The studies on the impact of such a higher education model on police constables in India showed negative results and that higher education police officers had stricter assessment systems and were less interested in protecting citizens' rights and therefore indifferent to legal boundaries.

5. Discussion

The problem of police education can also be developed in a rather unexpected psychological aspect. In an analytical review of the impact of education on the quality of police activities, C.W.Telep (2011) indicates that even when education does not have a statistically proven impact on police performance, it can still be useful for raising educational standards. Even if the efficiency of work does not change, raising educational standards can lead to increased authority and respect for this area of socionomic activity. And, indeed, the requirement of education will help to overcome the misconception that the work of a police officer is characterized by simple tasks that anyone can handle. In this context, attention should be paid to the opinion of R. Roberg and S. Bonn (2004), who argued that the main goal of education should be to abolish the idea that is too common in our society, that if a person does not want to charge oneself with becoming someone of a virtuous profession in the eyes of society, one can always become a police officer. Although the police have large discretion, a lot of responsibilities, and work independently, just like teachers, they also make decisions that affect the lives of citizens, just like prosecutors and judges. However, while these professions require higher education, police lag behind in this context.

Scholars often view education, in particular obtaining a bachelor's degree after four years of study, as a means of improving police relations and executive discipline (Owen, & Wagner, 2008; McDermott, & Hulse, 2012; Telep, 2011). E.A. Paoline, W. Terrill, and M. T. Rossler (2015) support this idea and note that both proponents and opponents of higher police education have not clearly defined the exact characteristics that a police officer with higher education will bring to this field. In fact, this should have promised a more professional police approach, as police officers with higher education should be more open in their belief system and less dogmatic and focused on the use of punishment, less authoritarian, more inclined to accept and understand ethnic issues, more friendly to legal restrictions at work.

Researchers also note that on the basis of mastering educational programs, police officers must have certain psychological qualities: a high level of intellectual performance, emotional stability, honesty, openness, etc. (Barko, Okhrimenko, Ostapovich, Medvediev, & Sprynchuk, 2020; Shvets, et al., 2020). In addition, the negative effects of education were noted. For example, police officers with higher education were less satisfied with their work (Barko, Okhrimenko, Medvediev, Vagina, & Okhrimenko, 2020). Therefore, high-quality education can outline both positive consequences and individual miscalculations. However, the relationship between mastering educational programs and further professional activities is still visible.

Although modern works have corrected some of the shortcomings of previous research on the impact of education on a number of work-related factors connected with the police officers' perception of their role, leadership, organization, and job satisfaction, they have shown mixed results (Paoline, Terrill, Rossler, 2015). In addition, multidimensional analytical models tend to explain little of the differences in attitudes demonstrated by police officers, suggesting other factors.

6. Conclusions

Thus, all things considered, it can be argued that in modern psychological and legal practice, there are at least three approaches to assessing the need to increase the level of education of police officers. The first

group of scholars has a rather negative attitude towards educated police officers, saying that, for example, police officers with higher education are usually more demanding of working conditions, less satisfied with their work, more cynical about police activity, and give lower marks to their organization.

The second approach is based on the position that there is no significant difference in the attitude to work of educated police officers and their less-educated colleagues; there is no substantial difference in levels of professionalism, stress, acceptance or rejection of the military model of police organizations, etc.

Finally, the vast majority of American and European researchers consider that "the level of intelligence of a police officer should be at the same level as that of an average citizen, or exceed it." The representatives of this approach convincingly raise the question of the need for at least four years of police training, arguing that in comparison with their less-educated colleagues, police officers with basic education are less authoritarian and dogmatic; are more cautious; have better communication skills and are characterized by a more positive attitude to the problems of interaction with the population.

Determining the potential value of higher police education in Ukraine is hindered by the lack of appropriate modern criteria for training, as well as the lack of clarity of the ultimate goal of practice-oriented education. Therefore, the issue of conceptualization of qualification requirements for law enforcement professional and the creation of a modern model of police education, which should contain clear goals, socially-oriented content of educational programs, and an appropriate psychologically, justified and psychologically developed method to facilitate the transition from law enforcement to the cooperation with the public is becoming even more relevant. Instead, the study of the positive experience of the police provides an opportunity to understand the problems of the formation of the domestic police better and therefore to develop more effective measures for its development and improvement.

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References

1. Aleksandrov, D. O., Okhrimenko, I. M., & Drozd, O. Yu. (2017). Osoblyvosti profesiyno-psykholohichnoyi adaptatsiyi pratsivnykiv Natsional'noyi politsiyi Ukrayiny do pravookhoronnoyi diyal'nosti [Features of professional-psychological adaptation of Ukrainian National police officers for law enforcement activities]. *Science and Education*, 11, 35-45. doi: 10.24195/2414-4665-2017-11-4. [in Ukrainian]. Retrieved from: https://scienceandeducation.pdpu.edu.ua/ doc/2017/11_2017/4.pdf.
2. Barko, V., Okhrimenko, I., Medvediev, V., Vagina, O., & Okhrimenko, S. (2020). Professional psychological profile of a modern patrol officer as the basis of efficient official activities. *Postmodern Openings*, 11(3), 01-19. https://doi.org/10.18662/po/11.3/197.
3. Barko, V., Okhrimenko, I., Ostapovich, V., Medvediev, V., & Sprynchuk, S. (2020). Professional psychological potential of a modern police manager as the basis for the formation of an effective managerial system.
4. Bjerregaard, B., & Lord, V. B. (2004). An examination of the ethical and value orientation of criminal justice students. *Police Quarterly*, 7, 262-284.
5. Bondarenko, V., Okhrimenko, I., Minenok, A., Donets, I., Danylchenko, V., Khudiakova, N., Okhrimenko, S., Alexandrov, D., Vakulyk, O., Rozhnova, T., Verbovskyi, I., Horokhova, L., Griban, G., Bloshchynskyi, I., & Prontenko, K. (2020). Professionally important psychophysiological qualities of patrol police officers.
6. Bondarenko, V., Okhrimenko, I., Tverdokhvalova, I., Mannapova, K., & Prontenko, K. (2020). Formation of the professionally significant skills and competencies of future police officers during studying at higher educational institutions. *Revista Românească pentru Educație Multidimensională*, 12(3), 246-267. https://doi.org/10.18662/rrem/12.3/320.
7. Bondarenko, V., Okhrimenko, I., Yevdokimova, O., Sydorchuk, N., Dzhezhyk, O., Boichuk, I., Kalashnik, N., Kozlovets, M., Slyusar, V., Pavlenko, V., Biruk, N., Verbovskyi, I., & Bloshchynskyi, I. (2020). Professional skills and competencies of the future police officers.
8. Bufkin, J. (2004). Criminology/criminal justice master's programs in the United States: searching for

commonalities. *Journal of Criminal Justice Education*, 15, 239-620.
9. Cao, L., Huang, L., & Sun, I. (2016). Development and reform of police training and education in Taiwan. *Police Practice and Research*, 17 (6), 531-542.
10. Chatthong S., Kovitaya M., & Kongjaroen M. (2014). The elements of a learning model to enhance service mind of Thai police officer. *Procedia-Social and Behavioral Sciences*, 152, 880-888.
11. Cox, D. (2011). Educating police for uncertain times: the Australian experience and the case for a normative approach. *Journal of Policing, Intelligence and Counter-Terrorism*, 6 (1), 3-22.
12. Fedorenko, O., Dotsenko, V., Okhrimenko, I., Radchenko, K., & Gorbenko, D. (2020). Coping Behavior of Criminal Police Officers at Different Stages of Professional Activity. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 11(2), 124-146. https://doi.org/10.18662/brain/11.2/78.
13. Feltes, T. (2002). Community-oriented policing in Germany. *Policing: An International Journal of Police Strategies and Management*, 25 (1), 48-59.
14. Guller, I. (1972). Higher education and policemen: attitudinal differences between freshman and senior police college students. *The Journal of Criminal Law, Criminology and Police Science*, 63 (3), 396-401.
15. Hays, K., Regoli, R., Hewitt, J. (2007). Police chiefs, anomia and leadership. *Police Quarterly*, 10 (1), 3-22.
16. Hudson, D. Building trust between communities and local police. The WHITE HOUSE: site 01.12.2014. Retrieved from https://www.whitehouse.gov/blog/2014/12/01/building-trust-between-communities-and-local-police.
17. Ievdokimova, O. O. (2017). Professional training of law enforcers in the context of a systematic approach. *Fundamental and Applied Researches in Practice of Leading Scientific Schools*, 21 (3), 88-93.
18. McDermott, P. J., & Hulse, D. (2012). Interpersonal skills training in Police Academy curriculum. FBI Law Enforcement Bulletin. Washington, D. C.: *Federal Bureau of Investigation*, 81 (2), 16-20.
19. Ostapovich, V., Barko, V., Okhrimenko, I., Yevdokimova, O., Ponomarenko, Y., Prontenko, K., Antonova, O., Sydorchuk, N., Sokolovskyi, O., & Bloshchynskyi, I. (2020). Psychological Profile of Successful Criminal Police Officer.
20. Owen S., & Wagner, K. (2008). The specter of authoritarianism among criminal justice majors. *Journal of Criminal Justice Education*, 19(1), 30-53. http://dx.doi.org/10.1080/10511250801892748.
21. Parker, L., Donnelly, M., Gerwitz, D., Marcus, J., Kowalewski, V. (1976). Higher education: its impact on police attitudes. *The Police Chief*, 43 (7), 33-35.
22. Paoline, E. A., Terrill, W., & Rossler, M. T. (2015). Higher education, college degree major, and police occupational attitudes. *Journal of Criminal Justice Education*, 26 (1), 49-73.
23. Paterson, C. A. (2015). Review of Police – academic educational collaborations. Collaborative Policing: Police, Academics, Professionals, and Communities Working Together for Education, Training, and Program Implementation. *CRC Press*, 119-137.
24. Peace, R. (2006). Probationer training for neighborhood policing in England and Wales. *Policing*: *An International Journal of Police Strategies and Management*, 29 (2), 335-346.
25. Peeters, H. (2013). Constructing comparative competency profiles: the Netherlands experience. *International Perspectives on Police Education and Training. Routledge*, 2013. 90-114.
26. Prontenko, K., Bondarenko, V., Bezpaliy, S., Kyslenko, D., Lisnichenko, Yu., Ollo, V., Aloshyna, A., Bychuk, O., Smirnov, V. (2020). Physical training as the basis of professional activities of patrol policemen. *Baltic Journal of Health and Physical Activity*, 12(1), 41-53. doi: 10.29359/BJHPA.12.1.05.
27. Regoli, R. M. (1976). The effects of college education on the maintenance of police cynicism. *Journal of Police Science and Administration*, 4, 340-500.
28. Roberg, R., Bonn, S. (2004). Higher education and policing: where are we now? *Policing: An International Journal of Police Strategies and Management,* 27 (4), 469-486.
29. Scott J., Evans D., & Verma A. (2009). Does higher education affect perceptions among police personnel: a response from India. *Journal of Contemporary Criminal Justice*, 25 (2), 214-236.
30. Sereni-Massinger, C., & Wood, N. (2016). Linking educational institutions with police officer training programs. *Journal of Education and Learning*, 10 (2), 139-146.
31. Shvets, D., Yevdokimova, O., Okhrimenko, I., Ponomarenko, Y., Aleksandrov, Y., Okhrimenko, S., & Prontenko, K. (2020). The new police training system: Psychological aspects. *Postmodern Openings*, 11(1Supl1), 200-217. https://doi.org/10.18662/po/11.1sup1/130.

32. Smith, S. M., Aamodt, M. G. (1997). The relationship between education, experience, and police performance. *Journal of Police and Criminal Psychology*, 12 (2), 49-73.
33. Telep, C. W. (2011). The impact of higher education on police officer attitudes toward abuse of authority. *Journal of Criminal Justice Education*, 2 (3), 392-419.
34. Trojanowicz, R. C., Nicholson, T. G. (1976). A comparison of behavioral styles of college graduate police officers. *The Police Chief*, 43 (8), 56-59.

The Interconnectedness of Motivational Orientation and the Type of Behavior in a Conflict Among the Beginning Sportsmen and Amateurs

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Abstract

The article presents a theoretical review of the features in the behavior of the beginning sportsmen and amateurs in stressful situations, their reaction to stress, along with the interrelation of overcoming the emerging conflicts with the motives of the personality behavior. It is considered, the influence of achievement motivation on the behavior strategies of students going in for sports professionally and amateurs in a conflict situation. The hypothesis of the research: the level of motivation has an influence on the formation of the strategy of students' behavior going in for sports professionally and amateurs in a conflict situation.

Keywords: Motivation, Behaviour, Conflict, Rivalry, Adaptation.

Research Methods

1. K.Thomas questionnaire, which is designed to study the personal predisposition to conflict behavior, the identification of certain styles of conflict resolution. 2. The questionnaire of the T.Ehlers - diagnostics of personality to identify the motivation for success.

Introduction

There is a general consensus that in the modern world, leading a healthy lifestyle is gaining popularity. Sport is becoming an integral part of our life. For professional athletes, sport becomes the meaning of life. [22; 24; 26]The main goal of students engaged in professional sports and at the same time studying at Universities not related to the training of professional sportsmen is not only winning places, gaining recognition in their surroundings and at the world level but also mastering the chosen specialty. Physical exercises, purposefulness in sports achievements, sports activities should provide students with a high level of training in their chosen profession and as a result, form a high motivation to succeed both in sports and study. It is no coincidence, that sports exercises are considered by a number of specialists as a model of activities to constantly overcome critical situations. In this regard, studies of the characteristics and dynamics of the course, as well as the mechanisms of mental states of students professionally engaged in sports in various conditions of their professional activities, are of particular relevance. Life in the modern big city implies overcoming critical situations daily and as a result increased conflict and aggressiveness of people in a modern society, especially in the youth student environment. In this case, the research subject is seen as particularly relevant as an opportunity to identify mechanisms that contribute to reducing the conflict of future sportsmen.[23; 25]

Literature Review

There are some recent studies explicitly proposing different types of motivational orientation and the type of behavior in a conflict among the beginning sportsmen and amateurs. Ilyin E. P. studies conflict among sportsmen in detail in his writings, he analyzed their psychophysiological features in everyday life and in stressful situations, their reaction to stress and problems in relationships with the team, with the coach, rivals and the people around them [2].

Kozlov V.V. describes the following types of personalities in the conflict [3]:

1. Permanent - conflict personalities. For these people, conflict is a constant feature of their behavior and follows from their character.

2. Situational - conflict personalities. People of this type do not enter into conflict unnecessarily, when there is no other way out of the situation.

Thomas K. identifies five types of behavior in a conflict situation [9]:

* confrontation (rivalry)
* cooperation;
* compromise
* avoidance;
* adaptation (assignment).

The overcoming of the arising conflicts is connected with motives of personality behavior [5, 17]. The detailed characteristics of the motives of human behavior was given by Platonov Y.P. In the process of growing up, many leading motives of behavior eventually become so characteristic of a person that they turn into the features of his or her personality. These include the motive of achievement and the motive of avoiding failure.

Achievement motivation as a stable characteristics of a personality was first identified by G. Murray. The motive of achievement - a steady desire to do something quickly and well, to reach a certain level in some cases. In the process of further research of this motive by such scientists as D. McClelland and H. Heckhausen, two independent motivational tendencies were identified: the desire for success and the desire to avoid failure.

G. Murray states, that people having achievement motivation are characterized by achieving a high level, competing with others, increasing their own self-esteem thanks to the successful application of their abilities.

D. McClelland saw in the achievement motivation the manifestation of an unconscious desire for perfection [6]. According to D. McClelland, people who have a strong need for achievements prefer to rely on their own strength and strive for self-improvement. They tend to work on tasks that require a lot of effort but are not unsolvable. From the point of view of D. McClelland, achievement motivation can develop in adulthood primarily, by means of the study. As L. Jewell underlines "In addition, it can develop in the context of a labor activity when people directly feel all the benefits associated with achievements."

H. Heckhausen believes that achievement motivation is essentially an attempt of a person to increase or maintain as high as possible his/her abilities to those activities to which the criteria of success can be applied, that is, they can either achieve success or fail [10].

The theory of achievement motivation developed by J. W. Atkinson, H. Hekhausen and other scientists has demonstrated that there are at least three principal motivational vectors that determine to a decisive extent the nature of the interdependence of an activity and achievement motivation: individual subjective ideas about the probability of personal success and the complexity of the task facing the individual; the degree of importance for the subject of this task and, in this regard, the strength of the desire to support and increase self-esteem; the tendency of this particular person to adequately ascribe to himself/herself, other people and circumstances the responsibility for success and failure.

In Russian psychology, achievement motivation and the related topic of the level of aspiration was studied by M. S. Magomed-Eminov, T. O. Gordeeva, T. V. Kornilova, N. G. Korchagina, I. M. Paley, etc.

T. O. Gordeeva explains achievement motivation as an activity achievement motivation. The achievement activity is a type of activity characterized by the presence of a deliberate transformation of the subject of the surrounding world, oneself, other people and relationships with them. Therefore, the basis of such activities is the desire to do something as well as possible, and as soon as possible. Such a desire can be defined as the desire for progress. It began to develop actively due to the introduction of new innovative technologies [18, 19].

In the surveys of M. S. Magomed-Eminov, the motivation of achievement is considered as a functional system that combines both affective and cognitive processes, regulating the process of activity in the situation of achievement throughout its implementation.

The image of a successful person is clearly associated with the presence of motivation to succeed, and perseverance, whether it is politics, business or sports. N. G. Korchagina in her article: "The Role of self-

esteem and motivation in the development of conflict personality" writes that the motivation in achieving the goal is conflictogenic in situations where the goals of the individual are different from the goals of the other people [14]. People who find themselves in such a situation face a choice: to abandon their goal or to enter into an open confrontation. In the professional activities, people also face the fact that success in achieving the goal is not without conflict with those who or what prevents it [20, 21].

The achievement motivation in applied research was associated with various parameters, but basically, of course, with success in a particular field. This trend is not spared sports. For instance, L. P. Dmitrienko discovered and described the following fact: highly trained sportsmen have a more pronounced achievement motivation for success than the sportsmen of an average qualification.

As it has been pointed out above, achievement motivation by its nature is quite conflictogenic. Moreover, according to N. G. Korchagina, such needs can be conflictogenic as:

* motivation for actively-defensive behavior;
* self - affirmation;
* goal achievement;
* communication [14].

Echoes of these needs can partly be found among the motives that stimulate, from the point of view of an American psychologist B. J. Cretti [4]. Such motives are:

* desire to fight and overcome obstacles, change circumstances and achieve success;
* commitment to excellence;
* social status improvement;
* the need to be the part of a sports team, group, etc.;
* receiving material incentives.

Sportsmen in their professional activity and life, certainly, deal with conflicts [1; 8; 13; 16]. In modern sports, there are quite high requirements for the physical and mental abilities of sportsmen. Training and competitions are often accompanied by a conflict interaction and aggression [8]. The conflict of sportsmen appears to be an interesting subject for study due to the fact that sport and motivation achievement both and separately are conflict-prone, but in the professional sports activity there is a connection of these factors.

Method

1. Participants

The participants of the present study, sampled randomly the interconnectedness of motivational orientation and the type of behavior in a conflict. The research was carried out among the students of Plekhanov Russian University of Economics (PRUE) between 20 and 24 years old, along with the students of Moscow City University, Financial University under the Government of the Russian Federation, Synergy University, I. M. Sechenov First Moscow State Medical University (Sechenov University). The target group was 90 people (45 of whom are engaged in sports professionally and 45 are amateurs).

2. Materials

The teaching materials used in the current study are: descriptive surveys, questionnaires, professional literature analysis and classroom observation checklists.

3. Procedure

First of all, the participants of both groups were administered a pre-test to examine the motive of the personality orientation for success. Secondly, questionnaires by K. Thomas and T. Ehlers were conducted to understand the differences in the types of behavior in a conflict situation of the respondents who are engaged in sports professionally and amateurs. Finally, to establish the link between the level of motivation for success and the type of behavior in a conflict situation, Pearson correlation coefficient was calculated.

Results

As the result of diagnostics of students on the methodology of the T. Ehlers, there has been identified the motive of the personality orientation for success of the respondents engaged in sports professionally **(Fig.1)** and amateurs **(Fig.2)**.

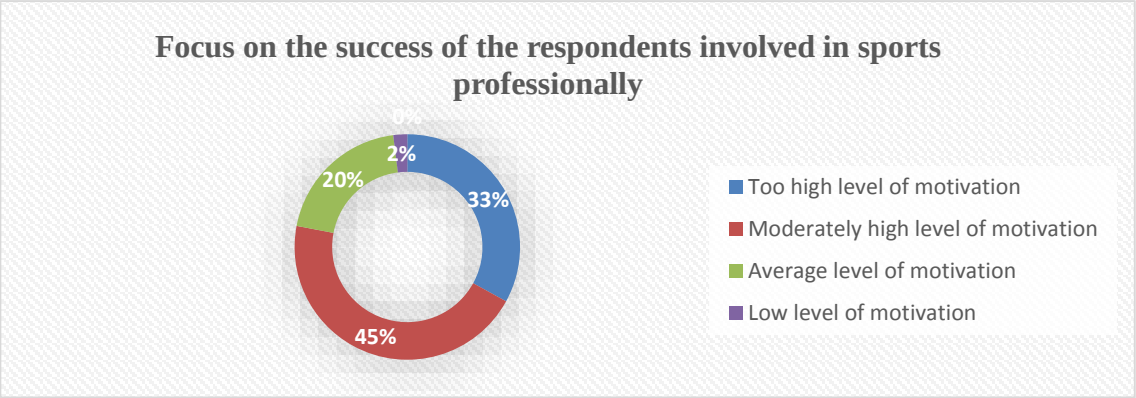

Fig.1. *Focus on the success of the respondents involved in sports professionally*

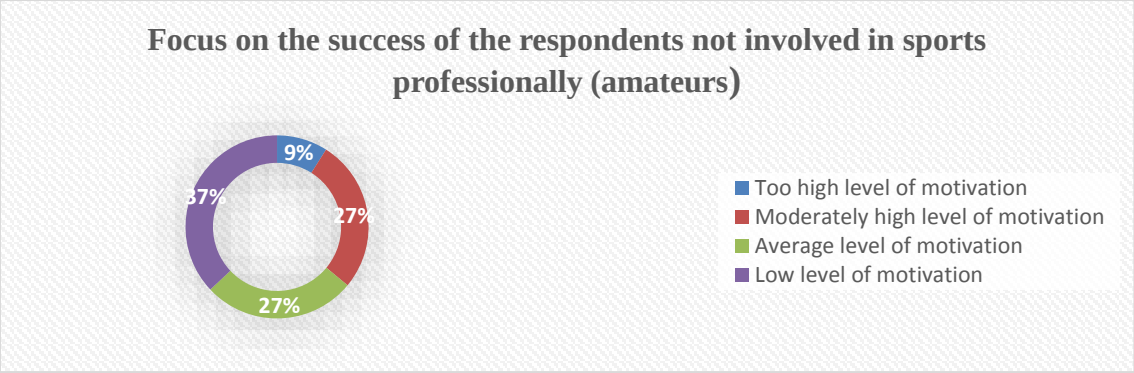

Fig.2. *Focus on the success of the respondents not involved in sports professionally*

The diagram from **Figure 1** shows that people involved in sports professionally are more likely to have a moderately high level of motivation, there is 45% of such students. Only 2 % of the respondents engaging in sports professionally have a low level of motivation, while 33% have a too high level of motivation, and 20% have an average level of motivation. Such results can be explained by the fact that people with a high level of success achievement motivation are characterized by such features as confidence in the successful outcome of the case, a determination in uncertain situations, a tendency to reasonable risks, willingness to take responsibility, great perseverance in striving for the goal [9]. Such qualities are just inherent to sportsmen.

As a result of diagnostics of students, according to the questionnaire of K. Thomas there has been revealed the types of behavior in a conflict situation of the respondents who are engaged in sports professionally **(Fig.3)** and not involved in sports **(Fig.4)**.

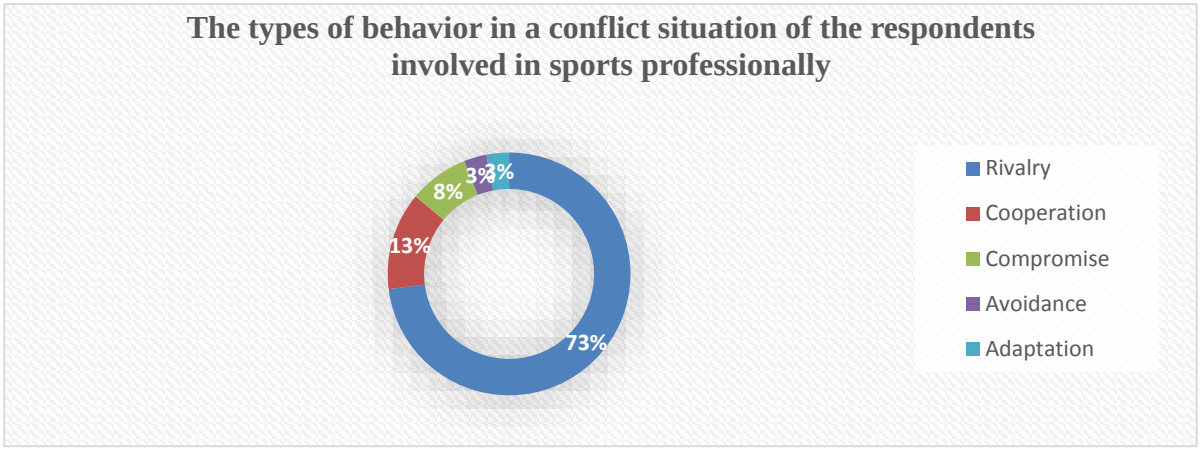

Fig. 3. *The types of behavior in a conflict situation of the respondents involved in sports professionally*

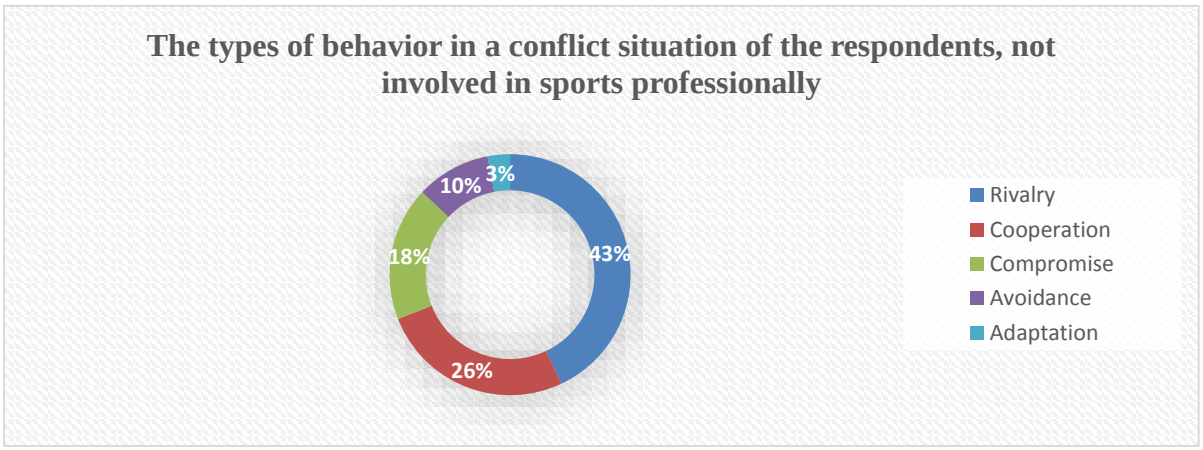

Fig. 4. *The types of behavior in a conflict situation of the respondents not involved in sports professionally*

From a diagram, we see (**Fig.3**) that the respondents involved in sports professionally, the predominant model of behavior in a conflict situation is a rivalry. This confirms the theory of an American psychologist B. J. Kretti [14] that people who are active in sports have motives: the desire to fight, overcome obstacles, change circumstances and achieve success; the desire for perfection.

Statistical Procedures

To establish the link between the level of motivation for success and the type of behavior in a conflict situation, we used the Pearson correlation coefficient.

To calculate the Pearson correlation coefficient, it is necessary to find the value for the criterion x^2, which is calculated by the formula:

$$x^2 = \sum_{N=90}^{\infty} \left(\frac{(fi - fi')^2}{fi'}\right)_N$$

To find fi, we have to count the number of students with a certain set of qualities.

The results are given in **Table №1**.

Table 1. *Finding values for* fi

	rivalry	cooperation	compromise	avoidance	adaptation	TOTAL
Too High	17	1	0	1	0	19
Moderately High	15	7	2	2	6	32
Average	4	4	4	4	6	22
Low	1	2	0	5	9	17
TOTAL	37	14	6	12	21	90

The next step was to find x^2. The results of the calculations are given in **Table 2**.

Table 2. *Finding the value for* x^2

Fi	Fi'	X^2	Criterion
17	7,81	10,8096886	1.1.
1	2,96	1,29390142	1.2.
0	1,27	1,26666667	1.3.
1	2,53	0,92807018	1.4.
0	4,43	4,43333333	1.5.
15	13,16	0,2585961	2.1.
7	4,98	0,82152778	2.2.
2	2,13	0,00833333	2.3.
2	4,27	1,20416667	2.4.
6	7,47	0,28809524	2.5.
4	9,04	2,81348621	3.1.
4	3,42	0,0975469	3.2.
4	1,47	4,37575758	3.3.
4	2,93	0,38787879	3.4.
6	5,13	0,14632035	3.5.
1	6,99	5,13197315	4.1.
2	2,64	0,15704949	4.2.
0	1,13	1,13333333	4.3.
5	2,27	3,29607843	4.4.
9	3,97	6,38683473	4.5.
90	90,00	45,2386383	TOTAL

All the data for the coefficient of contingency of Pearson was found, for the calculation it is used the following formula:

$$p = \sqrt{\frac{x^2}{N+x^2}} = \sqrt{\frac{45,239}{90\times45,239}} = 0,58.$$

To establish the statistical significance of the results - compare the results with the x table, taking into account the error of 5%:

x table = 0.2

Since the resulting Pearson correlation coefficient is greater than the tabular index, we can talk about a close statistically significant direct relationship between the level of motivation for success and the type of behavior in a conflict situation.

Discussion and Conclusion

The main purpose behind conducting this survey was to examine the effect of motivational orientation on the choice of the type of behavior of students involved in sports and not involved in sports (amateurs) in a conflict situation.

The experimental study indicated that the quantity of students with moderately high and too high motivation to achieve success is more among those who are engaged in sports professionally. This is thanks to the fact that people with a high level of motivation to achieve success are characterized by such features as confidence in the successful outcome of the case, determination in uncertain situations, taking reasonable risks, willingness to take responsibility, great perseverance in striving for the goal. Such qualities are just inherent to sportsmen.

Also, sportsmen are characterized by the type of behavior in a conflict situation as a rivalry. Among the respondents having the type of behavior as an adaptation in a conflict situation, there are more of those who are not engaged in sports professionally.

After a correlation analysis between the results of the questionnaire K. Thomas and the questionnaire T. Ehlers, it was found that the level of motivation for success has a statistically significant interconnectedness with the type of behavior in a conflict situation. The correlation coefficient is 0.58, which indicates a strong and direct relationship between the indicators.

References

1. Book: Antsupov A. Y. The meaning, subject and tasks of conflictology/ Moscow: UNITY, 2012. – 591p.
2. Book: Ilyin, E. P. Psychophysiology of physical education. /Moscow: Prosveshcheniye, 2005. - 412 p.
3. Book: Kozlov V. V. Conflict: participate or create.../Moscow: Eksmo, 2009. 169 p.
4. Book: Cretti, B.J. Psychology in modern sport. /Moscow: FiS, 2001. - 224 p.
5. Book: Leontiev A. N. Potrebnost, motives and emotions. /Saint Petersburg: UNITY, 2009. - 40 p.
6. Book: McClelland, D. Human Motivation. / Saint Petersburg: Piter, 2007. - 672 p.
7. Book: Piloyan R. A. Motivation of sports activity. /Moscow: FIS, 2005. 104 p.
8. Book: Safonov V. K. Aggression in sport. / Saint Petersburg: SPBGU, 2003. - 159 p.
9. Book: Thomas K. Psychology and ethics of business communication. /Moscow: YUNITI-DANA, 2011. - 415 p.
10. Book: Heckhausen H. Motivation and Action. /Moscow: Sense, 2013. - 860 p.
11. Article: Shcherbakova O. I. The Problem of psychological readiness of the person to counteract aggressive behavior. Technologies of creating the education systems with the desired features: IV international.science.-practical. Conf. November 21-22, 2013, Moscow: RITS MGTU. M. A. Sholokhov, 2013.
12. Article: Shcherbakova O. I., Yakovleva N. A., Golubeva O. I. Conflict as an initial form of aggressive behavior of young people. Vestnik of St. Petersburg University of the Russian Interior Ministry. 2016. № 2 (70). 12:210-213.
13. Article: Shcherbakova O. I. Tatarintseva, A. M., Black A. K., Shirshov A.V. Psychological health of a person and its software in an educational environment. Theory and practice of physical culture. 2017. No. 9. 13:59-61.
14. https://cyberleninka.ru/article/v/rol-samootsenki-i-motivatsii-v-razvitii-konfliktnoy-lichnosti.
15. Article: Lopatkova I. V., Serykh A. B., Miroshkin D. V., Shcherbakova O. I., Kochetkov I. G., Deberdeeva N. A., Diatlova E. V. The interrelation of post-trauma stress disorders with reactive and personal anxiety. // Electronic Journal of General Medicine. Turkey, 2018; 15(6) p.85.
16. Article: Shcherbakova O.I., Chernykh A.K., Balakhanova D.K., Midova V.O. Stress control practices for mental balance improvement in academic sports. Teoriya i Praktika Fizicheskoy Kultury, Issue 9, 1 September 2018, 16:22-23.
17. SHCHERBAKOVA O.I., RAKAUSKIYENE O.G., VELIKOROSSOV V.V., BALAKHANOVA D.K., KOKOREV I.A., KHACHATURYAN M.V. Investigation of the Motivational Direction and Conduct Type of Conduct in Conflict at Beginners of Athletes and People not in Sports // 2nd International Conference on Pedagogy, Communication and Sociology (ICPCS 2020). 2020. pp. 349-355.- DOI 10.12783/dtssehs/icpcs2020/33893

18. Genkin E., Filin S., Velikorossov V., Kydyrova Z. and Anufriyev K. The fourth industrial revolution: personnel, business and state // E3S Web Conf. The 1st International Conference on Business Technology for a Sustainable Environmental System (BTSES-2020), Almaty, Kazakhstan, March 19-20, Volume 159, 2020 , no. 0412. https://doi.org/10.1051/e3sconf/202015904012
19. Maksimov M.I., Akulinin F.V., Velikorossov V.V., Mayorova I.A., Zaharov A.K., Zhanguttina G.O. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING METHODS FOR SOLVING SNP TASKS // Journal of Advanced Research in Dynamical and Control Systems, Vol. 12, Issue-06, 2020, pp. 1312-1315. DOI: 10.5373/JARDCS/V12I2/S20201323
20. Karyakin A. M., Velikorossov V.V., Rakauskienė O.G., Genkin E.V. Teamwork: Theory and Practice.- Iпdepeпdently published, 2020
21. Rakauskienė, O.G., Velikorossov, V.V. and Balakhanova, D.K., CULTURAL AND ECONOMIC INTERACTION: TRENDS IN EMPLOYMENT AND BUSINESS OF CULTURAL ORGANIZATIONS IN THE EU // WHITHER OUR ECONOMIES– 2019, 2019. Pp.148-161
22. Book: Klimov E.A. Psychology of a professional. - M., Voronezh, 1996. - 397 p.
23. Book: Fromm E. Escape from freedom. - M: Education, 2011 . - 269p.
24. Book: Adler G. NLP: modern psychotechnology. St. Petersburg, 2001 -310 p.
25. Book: Anufriev A.F. Psychological diagnosis. - "Os-89", 2006. - 192 p.
26. Book: Horst H.Sievert. Personlichkeittests erkennen und bestehen. –MVG-Verlag im verlag modern industrie AG/Munchen, Landsberg am Lech, 1994. -198 p.

Secondary Diseases of Infectious and Non-Infectious Origin in Patients Diagnosed with Covid-19

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Abstract

The article considers the features of the occurrence and course of secondary diseases of infectious and non-infectious genesis in patients with a diagnosis of COVID-19, and also examines individual clinical cases described in the literature. The author concludes that the results showed that major respiratory diseases, in particular COPD (chronical obstructive pulmonary disease) and smoking, are associated with severe COVID-19 outcomes. These results contribute to a better understanding of risk factors for patients with severe COVID-19, which are important to support the development of preventive interventions and can help improve the assessment and management of risk factors for patients in clinical practice. Future studies should evaluate the association of severe COVID-19 outcomes with the prevalence of other major respiratory diseases other than COPD, as well as explore the potential impact of their immune responses and pharmacological treatment. In addition, the association of severe COVID-19 with all smoking levels and causal mechanisms should be the subject of future research.

Cardiovascular diseases play an important role in the severity of disease and mortality in patients with COVID-19. Hypertension, acute heart injury, and coronary heart disease in a patient with COVID-19 require careful monitoring and treatment in the case of acute conditions. Other cardiovascular disorders, including arrhythmia and heart failure, must also be considered, as they can be fatal. Therefore, in these patients, careful consideration and treatment of cardiovascular diseases is necessary. The results of this study can help policy makers, doctors and healthcare professionals in the front line to make evidence-based decisions and reduce the mortality and morbidity of this 21st century pandemic.

Understanding the proportion of COVID-19 patients with acute respiratory bacterial co-infection and pathogens is critical for the treatment of COVID-19 patients and helps ensure responsible use of antibiotics and minimize the negative effects of overuse. In addition, this knowledge may have a significant impact on clarifying recommendations for empirical antibiotic therapy for patients with COVID-19.

Keywords: COVID-19, secondary diseases, infectious and non-infectious genesis, disease outcomes.

Introduction

The pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), as of September 27, 2020, affected more than 32 million patients worldwide [1]. The clinical manifestations of this condition (coronavirus disease 2019, COVID-19) range from asymptomatic infection to severe viral pneumonia requiring treatment in the intensive care unit (ICU) [2].

Bacterial infections are an important problem in this regard. Bacterial co-pathogens are usually detected in viral infections of the respiratory tract, such as influenza, and are an important cause of morbidity and mortality, which requires timely diagnosis and antibacterial therapy [3]. Although bacterial co-infection varies greatly in patients with severe influenza, it is reported to reach 20-30% [4] and is associated with greater disease severity, greater use of health resources, and an increased risk of infection. death [5]. The prevalence, frequency, and characteristics of bacterial infection in patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are poorly understood and are considered an important knowledge gap [6].

The impact of the pandemic goes beyond patients with COVID-19. This affected patients with non-COVID-related diseases such as cancer (Rosenbaum, 2020), developmental and epileptic encephalopathies (Aledo-Serrano et al., 2020) and ST-segment elevation myocardial infarction (Tam et al., 2020). A recent systematic review reported that individual cases of Guillain-Barre syndrome (GBS) occurred secondary to COVID-19 infection. GBS is defined as a rare, but potentially fatal, immune-mediated disease of the peripheral nerves and nerve roots that is usually caused by infections. Thus, the incidence of GBS may increase during outbreaks of infectious diseases.

Despite current knowledge, there is no definitive cure for COVID-19, and many people die every day around the world. A deep and comprehensive view of the interaction between the virus and the immune system helps us develop an effective therapeutic strategy. However, it is quite important to prevent the development of secondary diseases of infectious and non-infectious origin in patients who have had COVID-19, as this can have sharply negative consequences for the health of the nation.

The aim of the work is to consider the features of the occurrence and course of secondary diseases of infectious and non-infectious Genesis in patients with a diagnosis of COVID-19.

Materials and Methods

The study was based on materials from the clinical practice of specialists of various medical specialties, and various articles were also used within the designated research topic.

Results

Current research shows that the prevalence of major respiratory diseases was an important predictor of severe COVID-19 outcomes. In particular, significant respiratory diseases are reported in patients with severe COVID-19 compared to non-severe (OR 2.46, 95% CI: 1.76-3.44) [7]

Respiratory diseases were reported using a General variable that could potentially group different conditions or relate specifically to COPD. There was no information on other respiratory diseases, except for one study that reported the prevalence of COPD, asthma, and secondary pulmonary tuberculosis [8]. Consequently, questions arise about the causes leading to a lack of information about the prevalence of respiratory diseases other than COPD and the severity of COVID-19 in the literature.

The authors determined that COPD is often misclassified due to insufficient use of confirmatory spirometry and because a medical professional performs a diagnostic assessment [9]. However, it is also possible that other respiratory diseases were underdiagnosed or not properly documented in databases, which is unlikely since this information was not available in most studies, including the report of the Centers for Disease Control and Prevention (CDC) in the United States [10].

Another possibility may be that the prevalence of other respiratory diseases may not be associated with severe COVID-19 outcomes due to their specific immune response and / or pharmacological treatment [11]. For example, asthma treatment usually involves the use of bronchodilators and inhaled corticosteroids, which have been shown to inhibit coronavirus replication and cytokine production in *in vitro* models [12]. In General, the relationship of COVID-19 severity to specific respiratory diseases other than COPD (e.g., asthma, pulmonary tuberculosis, pulmonary fibrosis, etc.) and their causal mechanisms require further investigation.

Severe COVID-19 outcomes have been largely associated with smoking now and in the past. It is suggested that smoking may play a role in modulating angiotensin-converting enzyme 2 (ACE2) [13], which is reported to be a host receptor for the virus responsible for COVID-19 [14]. A dose-dependent increase in ACE2 expression depending on smoke exposure was found in rodent and human lungs [15].

A recent publication suggested that the predisposition of smokers to severe SARS-CoV-2 infections may be at least partially explained by the response of ACE2 expression to inflammatory signaling, which may be enhanced by viral infections [16]. In addition, increased ACE2 expression was observed in COPD, a respiratory disease closely associated with smoking in previous time and severe COVID-19 outcomes [17]. However, more research will be needed to determine the linkage of smoking, COPD, and ACE2 levels with the clinical course of COVID-19.

The high risk of the disease in question often leads to the death of patients. According to research, the dead infected with SARS-CoV-2 were mostly men over 70 years of age, diabetics, and hypertensive patients.

In addition, comorbidities have been reported in infected individuals, including kidney disease, heart failure, and chronic obstructive pulmonary disease (COPD) [18]. Patients over 70 years of age compared to people under 50 years of age showed that the risk of severe COVID-19 is 5-10 times higher[19] .

Men with diabetes, hypertension, COPD, or cardiovascular disease experienced a twofold increase in severe disease or mortality. High body mass index (BMI) and obesity are also attributed to severe / fatal disease [20].

The severity of COVID-19 was also associated with the distribution of adipose tissue in the abdominal cavity, which indicates the potential pathogenic involvement of visceral obesity in the acute form of the disease [21]. However, the data do not support an increased risk of serious illness or death due to tobacco smoking [22].

Innate immune cells, along with physical barriers, are an early innate immune response to viral lung infections. Innate immune cells include macrophages, DCs, neutrophils, and parenchymal cells such as fibroblasts and epithelial cells. Some innate immune cell receptors, called pattern recognition receptors, are responsible for detecting antigens associated with the virus. Toll-like receptors (TLR) that recognize pathogen-associated molecular patterns (PAMP), RIG-I-like receptors that recognize nucleic acids, lectin-like C-type receptors (CLR), and NOD-like receptors (NLR) are pattern recognition receptors (PRR).) is responsible for identifying viral antigens [23] .

A sufficiently intense innate response is required to ease the burden of the battle for adaptive immunity. The more effective cleaning measures in the early stages of the disease, the less harmful inflammatory consequences. Stimulation of innate immune cells leads to the secretion of inflammatory mediators, such as IL-6 and type I / III interferons (IFN), which together with the complement system play a role against viral progression in the early stages [24] .

However, viruses develop mechanisms to evade innate immunity. For example, viruses can intelligently evade the complement system by removing antibody-antigen complexes from the cell surface, reducing Fc receptor expression, or mimicking complement regulatory components [25].

The interaction of the virus with innate immunity has a decisive effect on the adaptive immune response against the virus and thus on virus elimination and clinical outcome. Accordingly, due to the complex interactions between the virus and innate immunity, the immune system can sometimes delay recovery, progress the disease, or even cause death.

As a lever of innate immunity, the complement system begins to act in the acute phase of the disease. Various strategies developed in viruses to bypass the complement system have shown that complement proteins play an important role in antiviral protection [26].

The supplement plays a double-edged sword role in innate immunity against pathogens. On the one hand, anaphylatoxins such as C3a and C5a can activate immune cells and thereby induce the release of various pro-inflammatory cytokines. Activated complement fragments, such as the membrane attack complex (MAC), C3b and C5b, induce the synthesis of arachidonic acid metabolites, including prostaglandins and leukotrienes, promoting inflammatory processes and directing innate immunity against the virus.

On the other hand, complement-mediated activation of innate immunity must be regulated, because uncontrolled complement activation exacerbates inflammation, promotes disseminated intravascular coagulation (DIC), and ultimately leads to multiple organ failure and death [27].

Secondary diseases are particularly dangerous in COVID-19. For example, a case was reported of a patient who developed extensive symptomatic hemorrhagic pericardial effusion that caused cardiac tamponade. There were no initial signs of cardiac damage or myocardial damage, as indicated by the absence of cTnI elevation or wall movement abnormalities on the TTE. In fact, her symptoms were relatively mild before developing pericardial effusion.

Viral infections are a common cause of pericarditis and usually have a benign course [28]. Hemorrhagic effusion in the pericardium is less often associated with viral infections, but Coxsackie virus has been reported [28]. It is assumed that viruses cause pericardial inflammation through direct cytotoxic effects or through immuno-mediated mechanisms [29].

The literature has reported that COVID-19 causes an excessive systemic inflammatory response in some patients; however, the details of this response are not fully understood [30]. It is likely that COVID-19,

like other viral infections, causes an inflammatory response leading to pericarditis and subsequent effusion; however, the exact mechanism is unclear. Hemorrhagic effusions have also been reported in other inflammatory conditions, such as Dressler syndrome, which is believed to be the result of deposition of immune complexes and the subsequent inflammatory cascade after myocardial infarction [31].

The results of the publication study showed that cardiovascular consequences, including acute heart injury, arrhythmia, coronary heart disease, hypertension, and cardiovascular disease, were significantly associated with the admission of a COVID-19 patient to the intensive care unit. Comparison of the combined OR score for cardiovascular diseases showed that the probability of hospitalization in the ICU was significantly higher for acute heart injury and arrhythmia than for hypertension, but there was no significant difference between other cardiovascular consequences [32].

Studies have shown that mortality in patients with acute heart injury was significantly higher than in patients with coronary heart disease, arrhythmia, and hypertension. Comparison of the estimated frequency of various cardiovascular complications, including acute heart injury, arrhythmia, cardiomyopathy, coronary heart disease, palpitation, hypertension,

Previously, cardiovascular complications have been reported for previous respiratory infections of similar etiology, and their condition affects the severity of the disease [33]; so even hospitalization for pneumonia is associated with a long-term and short-term risk of cardiovascular disease [34].

Viral infections cause an imbalance between cardiac supply and demand and increase systemic inflammation. Therefore, patients with pre-existing CVD have a higher risk of acute heart conditions, thrombosis, infection, and the development of severe conditions during infection [35].

The thrombotic complications of COVID-19 infection are well known. Although there have been several reports of myocardial damage secondary to SARS-CoV-2 infection, this is the first report of coronary artery occlusion confirmed by catheter angiography and cardiac imaging. In one study, during the COVID-19 pandemic, the number of hospital admissions for acute coronary syndromes decreased by about 40%, which probably reflects the preference of patients to stay at home when symptoms appear, given the risk of transmission of the virus in medical institutions. Other studies have confirmed this decrease in the number of hospital admissions to ACS, raising concerns that a large number of patients with the consequences of untreated acute coronary syndrome, such as heart failure, may come out of the pandemic.

The link between COVID-19 infection and cardiovascular disease is well known. Studies have shown that patients infected with SARS-CoV-2 with pre-existing cardiovascular disease have an increased risk of severe illness and death. One study demonstrated an 8% risk of acute heart injury in patients with COVID-19 and a 13-fold higher risk in critically ill patients.

Notably, almost all of these studies used biomarkers and / or ECGs to diagnose acute myocardial injury. Radiology can play a key role in differentiating these formations, which is confirmed by the results of MRI of the patient's heart. Given the different treatment strategies for myocarditis compared to coronary thrombosis, the results of catheter angiography and cardiac imaging may serve as a critical moment in the treatment of patients with heart symptoms in the context of COVID-19 infection.

A PKA infarction in one of the patients described in the study led to a cascade of events, starting with wall movement abnormalities that were visualized on both a bedside echocardiogram and an MRI of the heart that predisposed to the formation of a left ventricular clot. The absence of this clot in a subsequent echo study after an ischemic infarction suggests that it may have embolized into the brain's vascular network. Given the state of hypercoagulation caused by COVID-19 and immobilization in the critical care unit (CCU), an alternative possibility is that the brain infarction is a separate blood clot. Indeed, many critically ill COVID-19 patients end up dying from multiple organ failure, which is thought to be partially related to multiple thrombotic complications[36].

The long-term complications of COVID-19 are becoming increasingly apparent. Persistent interstitial abnormalities and scarring of the lung parenchyma leading to pulmonary fibrosis have become an important and worrisome complication that occurs in many patients.

Reports of long-term neurological consequences also raise questions about the extent of brain involvement in acute infection and whether symptoms can be expected to disappear completely.

In addition to direct infection with the virus, thrombosis that occurs against the background of acute COVID-19 can also have long-term consequences. Prior to this episode, our patient had no cardiovascular

disease. Although his ejection fraction (EF) improved from about 15% to 35% by the end of his hospitalization, the heart attack resulted in long-term suboptimal heart function. Similarly, a large infarction of right brain - in middle cerebral artery (MCA) in this patient led to long-term disability. Neurological damage from COVID-19 is not uncommon and may be the result of the virus itself or a brain infarction [15].

Numerous long-term complications of long-term intensive care have been described, probably directly applicable to critically ill patients with COVID-19, given the long duration of stay in the intensive care unit.

Given the risk of thrombotic complications in patients with COVID-19, clinical guidelines have been issued recommending the use of anticoagulants in hospitalized patients with COVID-19 with continued treatment for high-risk patients.

From a clinical point of view, the level of suspicion of thrombosis in patients with SARS-CoV-2 infection should be increased and appropriate imaging should be prescribed to confirm that therapeutic anticoagulation can be initiated to prevent long-term complications of thrombosis.

Practice shows that in conditions of high transmission of COVID-19 among the population, one should be afraid that the infection is the cause of non-specific symptoms or symptoms that can be attributed to a different etiology. The initial treatment of individual patients, for example, in the emergency department could be associated with asthma, but it is possible that such manifestations have an early infection of COVID-19. Prolonged infection without follow-up can lead to acute coronary syndrome, which eventually leads to heart failure, ventricular thrombosis, and brain infarction. In addition, the patient may have infected hundreds of people with COVID-19 between visits to the emergency Department. Clinicians should be vigilant when recognizing COVID-19 infection, as well as its complications.

COVID-19 also leads to complications in children. All along the path of the Covid-19 pandemic; the number of affected children does not exceed 2% according to a number of publications [37]. throughout the pandemic, the authors reported the appearance of multi-organ inflammatory syndrome (MIS-C: Multisystem inflammatory syndrome in children), which is similar to Kawasaki disease.

The causal relationship with Covid-19 is well established, suggesting an intense immune response that occurs late due to a primary viral infection that went unnoticed. The main symptoms observed are high fever, vasoplegic shock, neurological disorders, and almost permanent digestive disorders. but so far, none of the authors have reported a case of intestinal ischemia in children.

A case was reported where an Algerian girl underwent emergency surgery for pseudo-appendicular syndrome associated with Multisystem disorder (MIS-C) in a child with weakened immune system [38].

The number of children affected by Covid 19 is about 2% of the General population (2% in the UK, 1.7% in the US, 1% in the Netherlands [39].

Symptoms are most often benign (45.5%), the average form is about 41.5%, severe - 4.4%. Critical form 0.9%, deaths are rare (3 cases), according to a series published by Xiaojian Cui 2596 children [40].

Digestive disorders associated with the direct involvement of the virus are rare: diarrhea 6.6%, vomiting 5.8% [41].

Throughout this pandemic, W. G. Jones (USA) first reported Multisystem inflammatory syndrome (MIS-C) on April 7, 2020: a six - month-old baby with Kawasaki disease associated with a positive Covid-19 test [42]. Since then, other cases related to covid-19 and suggesting a post-viral immune response have been reported.

May 6, 2020 .: Riphagen (UK) reported a series of 8 cases of MIS-C.

May 13, 2020 Verdoni (Italy) published a series of 10 cases (PCR +: 20%, serological IgG +: 80%). may 14, 2020 Tubiana (France): 17 cases (PCR +: 41% and serological IgG +: 88%)

And on may 17, 2020, the new York state Department of health issues a warning identifying more than 100 cases of MIS-C related to Covid 19 [43].

Clinical data were most often expressed with fever for more than 4 days with persistent vasoplegic shock. 55% of the patients required vasoactive drugs, digestive symptoms come to the fore (83%); we also noticed heart damage on echocardiography (69%), neurological signs: headaches, irritability, confusion and irritation of the meningeal vessels (61%), skin lesions increased to 69%, chest imaging was seen within 44%

Recently, 5 cases of pneumomediastinum were reported after intubation in COVID-19. The development of pneumomediastinum from the moment of tracheal intubation ranged from 4 hours to 14 days. Four patients also had subcutaneous emphysema. Our patient (Wali et al.) also developed

subcutaneous emphysema, pneumopericardium, and pneumomediastinum. An increased risk of alveolar damage, tracheobronchial damage, and higher ventilation pressure were suggested as possible mechanisms for the development of pneumomediastinum. Three of the five patients reported to have survived. In contrast to the case of Wali et al., one patient developed spontaneous pneumomediastinum and pneumopericardium without any direct trauma such as intubation. A possible explanation for spontaneous pneumomediastinum can be explained by the Macklin effect.

This phenomenon is defined as the tracking of alveolar air from ruptured alveoli along the peribronchial vasculature towards the mediastinum and pericardium. [Wang et al.] One patient was reported who simultaneously developed pulmonary pathologies with spontaneous pneumothorax, pneumomediastinum, and subcutaneous emphysema.

The current body of evidence in regions with a high COVID-19 burden worldwide suggests that superinfections are common, especially in severe cases. In a study conducted in Wuhan, out of 41 patients, secondary infections were reported in 31% of patients in the intensive care unit and in 10% of patients overall. In another study conducted in Wuhan, of 68 patients who died, 11/68 (16%) were found to have secondary infections, although further details were not provided [44]. In this study, we found that out of 151 patients with secondary infections, 56 (37%) were intensive care patients, and among these patients there was a hospital mortality rate of 33%.

Like our results, most pathogens reported in patients with COVID-19 are hospital-acquired multidrug-resistant (MDR) microorganisms. In our center, MDR was detected in 60% of isolates, and the genes of antimicrobial resistance (AMR) were also found in bacteria, co-infectious patients with COVID-19. Published ICMR data indicate a high prevalence of AMR in Indian hospitals in the pre-COVID period. High antimicrobial pressure in intensive care units to treat COVID-19 patients with empirical antimicrobial drugs will further exacerbate the problem of AMR. This is especially true for COVID-19 centers that do not have adequate microbiological support for cultivation, or the culture of cultivation does not exist (due to fear of taking samples or lack of policies / resources).

In contrast to normal circumstances, in patients with COVID-19, various invasive methods that are otherwise used to diagnose secondary infections are limited as part of infection control measures. Thus, doctors often resort to empirical broad-spectrum antimicrobial therapy. Taking into account, that empirical prophylactic antibiotics may instead select MDR pathogens, if clinicians lower their threshold for culture data and prefer targeted antibiotic therapy over empirical prevention, this will allow for later reduction of escalation or re-targeting of treatment. This will also lead to fewer secondary infections and favorable outcomes in patients with COVID-19.

Limited evidence suggests that nosocomial infections are associated with increased COVID-19 severity, prolonged ICU stay, and a higher risk of death [45]. For example, in one study, nosocomial mortality was observed in 50/151 (33%) patients with COVID-19 with secondary infections. It was found that it is statistically significant that in 24% of the total number of hospital deaths, the cause was secondary infection.

Secondary blood diseases left the majority of secondary infections: 58 out of 731 patients (7.9%) had at least one case. A high incidence of such diseases due to coagulase-negative staphylococci and a significant proportion of patients with multiple isolates have been documented [46]. This finding may reflect the high burden of catheter-associated infections. However, there were no data on the presence of intravascular catheters.

Several factors may have contributed to a higher incidence of secondary infectious blood diseases due to coagulase-negative staphylococci.

First, being at the epicenter of the COVID-19 pandemic in our country and given the unprecedented strain on our health system, critically ill patients with multiple devices were treated outside the intensive care unit, which may have led to an increase in diagnoses related to blood diseases.

Second, the conditions of the pandemic may have reduced compliance with strict aseptic procedures, especially in critically ill patients outside the intensive care unit or in crowded or makeshift intensive care units. Moreover, adequate use of personal protective equipment can be problematic and could potentially lead to a reduction in compliance with aseptic methods when handling intravascular devices.

Reviews were also conducted on concomitant bacterial infections in patients hospitalized with COVID-19; 24 studies were included. Co-infection was reported in 3.5% (95% CI: 0.4–6.7%) of patients, and secondary infection was reported in 14.3% (95% CI: 9.6–18.9%) of patients with COVID-19. Overall, the reported bacterial infection was 6.9% (95% CI 4.3–9.5%), but varied slightly depending on the patient population: from 5.9% in hospitalized patients to 8.1% in critically ill patients. Despite the overall low level of bacterial infections, more than 70% of patients received antibiotics, most of which were broad-spectrum agents such as fluoroquinolones and third-generation cephalosporins.

A total of 30 studies were conducted evaluating co-infections among patients infected with COVID-19. Similarly, the authors reported that 7% of patients had bacterial co-infection with a high degree of heterogeneity (I 2 = 92.2%) and a higher prevalence in intensive care units compared to mixed inpatient facilities [47].

Discussion

The results showed that major respiratory diseases, particularly COPD and Smoking, increase the likelihood of severe COVID-19 outcomes. This is an important finding, given the high prevalence of COPD and Smoking worldwide, as well as the rapid spread of SARS-CoV-2. Research results can support the development of preventive interventions, including training of patients and healthcare professionals, and contribute to improving the assessment and management of patient risk factors in clinical practice, leading to mitigation of severe outcomes in patients with COVID-19 infection [48].

From a public health perspective, these results may have implications for policy development and potential funding for respiratory diseases such as COPD. Moreover, Smoking cessation programs and efforts should be expanded, given the link between severe COVID-19 outcomes and Smoking. Future studies should evaluate the Association of severe COVID-19 outcomes with the prevalence of respiratory diseases other than COPD, and examine the potential impact of their immune responses and pharmacological treatment. In addition, the Association of severe COVID-19 outcomes with all levels of Smoking status and causal mechanisms should be studied.

There are also many factors to consider. First, there is limited information about respiratory diseases and Smoking presented in the identified studies, which does not allow us to draw further conclusions about the specific role of each risk factor in the development of severe COVID-19 outcomes. Evidence suggests that there is a close relationship between COPD, Smoking, and ACE2 modulation, which may increase the risk of severe COVID-19 outcomes, but more research is needed to clarify this relationship. Second, the studies mentioned in this review were mostly conducted in China (95%). It is possible that factors such as the prevalence of respiratory diseases and their treatment, among other things, may be context-specific. Therefore, the results of this study should be treated with caution and re-evaluated as new literature from other countries becomes available [49, 50,51,52].

It should also be said that patients with rare diseases experienced special difficulties when being admitted to hospitals. Access to health care has become more difficult due to the perceived risk of COVID infection by patients and their caregivers, and the allocation of health resources to reduce the number of non-emergency services. The impact of COVID-19 on infected patients and the high rate of infection worldwide has caused many to worry about infection, especially those who are more vulnerable with existing comorbidities [50,53,54,55].

Conclusions

The results showed that major respiratory diseases, particularly COPD and Smoking, are associated with severe COVID-19 outcomes. These results contribute to a better understanding of risk factors for patients with severe COVID-19, which are important to support the development of preventive interventions and can help improve the assessment and management of risk factors for patients in clinical practice. Future studies should evaluate the Association of severe COVID-19 outcomes with the prevalence of other major respiratory diseases other than COPD, as well as explore the potential impact of their immune responses and pharmacological treatment. In addition, the Association of severe COVID-19 with all Smoking levels and causal mechanisms should be the subject of future research.

Cardiovascular diseases play an important role in the severity of disease and mortality in patients with COVID-19. Hypertension, acute heart injury, and coronary heart disease in a patient with COVID-19 require careful monitoring and treatment in the case of acute conditions. Other cardiovascular disorders, including arrhythmia and heart failure, must also be considered, as they can be fatal. Therefore, in these patients, careful consideration and treatment of cardiovascular diseases is necessary. The results of this study can help policy makers, doctors and healthcare professionals in the front line to make evidence-based decisions and reduce the mortality and morbidity of this 21st century pandemic.

Understanding the proportion of COVID-19 patients with acute respiratory bacterial co-infection and pathogens is critical for the treatment of COVID-19 patients and helps ensure responsible use of antibiotics and minimize the negative effects of overuse. In addition, this knowledge may have a significant impact on clarifying recommendations for empirical antibiotic therapy for patients with COVID-19.

References

1. N. Chen, M. Zhou, X. Dong, *et al.*Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study Lancet, 395 (10223) (2020), pp. 507-513
2. F.A. Klok, M.J.H.A. Kruip, N.J.M. van der Meer, *et al.*Incidence of thrombotic complications in critically ill ICU patients with COVID-19 Thromb Res, 191 (2020), pp. 145-147
3. J. Helms, C. Tacquard, F. Severac, *et al.*High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study Intensive Care Med, 46 (6) (2020), pp. 1089-1098
4. M. Dolhnikoff, A.N. Duarte-Neto, R.A. de Almeida Monteiro, *et al.*Pathological evidence of pulmonary thrombotic phenomena in severe COVID-19 J Thromb Haemost, 18 (6) (2020), pp. 1517-1519
5. S.T. Reddy, T. Garg, C. Shah, *et al.*Cerebrovascular disease in patients with COVID-19: a review of the literature and case series Case Rep Neurol, 12 (2) (2020), pp. 199-209
6. A. Porfidia, E. Valeriani, R. Pola, E. Porreca, A.W.S. Rutjes, M. Di NisioVenous thromboembolism in patients with COVID-19: systematic review and meta-analysis Thromb Res, 196 (2020), pp. 67-74
7. H. Su, M. Yang, C. Wan, *et al.*Renal histopathological analysis of 26 postmortem findings of patients with COVID-19 in China Kidney Int, 98 (1) (2020), pp. 219-227
8. Y.-Y. Zheng, Y.-T. Ma, J.-Y. Zhang, X. XieCOVID-19 and the cardiovascular system Nat Rev Cardiol, 17 (5) (2020), pp. 259-260
9. C. Magro, J.J. Mulvey, D. Berlin, *et al.*Complement associated microvascular injury and thrombosis in the pathogenesis of severe COVID-19 infection: a report of five cases Transl Res, 220 (2020), pp. 1-13
10. S. Bangalore, A. Sharma, A. Slotwiner, *et al.*ST-segment elevation in patients with Covid-19 - a case series N Engl J Med, 382 (25) (2020), pp. 2478-2480
11. M.M. Mafham, E. Spata, R. Goldacre, *et al.*COVID-19 pandemic and admission rates for and management of acute coronary syndromes in England Lancet, 396 (10248) (2020), pp. 381-389
12. N. Braiteh, W.U. Rehman, M. Alom, *et al.*Decrease in acute coronary syndrome presentations during the COVID-19 pandemic in upstate New York Am Heart J, 226 (2020), pp. 147-151
13. A. Kapoor, R. YadavWill the hidden specter of acute coronary syndrome (ACS) and ST-segment elevation myocardial infarction (STEMI) emerge from the avalanche of COVID-19? Indian Heart J, 72 (3) (2020), pp. 192-193
14. E. Driggin, M.V. Madhavan, B. Bikdeli, *et al.*Cardiovascular considerations for patients, health care workers, and health systems during the COVID-19 pandemic J Am Coll Cardiol, 75 (18) (2020), pp. 2352-2371
15. B. Li, J. Yang, F. Zhao, *et al.*Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China Clin Res Cardiol, 109 (5) (2020), pp. 531-538
16. E.A. Troyer, J.N. Kohn, S. HongAre we facing a crashing wave of neuropsychiatric sequelae of COVID-19? Neuropsychiatric symptoms and potential immunologic mechanisms Brain Behav Immun, 87 (2020), pp. 34-39
17. Z. Li, T. Liu, N. Yang, *et al.*Neurological manifestations of patients with COVID-19: potential routes of SARS-CoV-2 neuroinvasion from the periphery to the brain Front Med (2020), pp. 1-9
18. S.V. Desai, T.J. Law, D.M. NeedhamLong-term complications of critical care Crit Care Med, 39 (2) (2011), pp. 371-379

19. H.K. Siddiqi, M.R. MehraCOVID-19 illness in native and immunosuppressed states: a clinical-therapeutic staging proposal J Heart Lung Transplant, 39 (2020), pp. 405-407
20. A. Zangrillo, L. Beretta, A.M. Scandroglio, G. Monti, E. Fominskiy, S. Colombo, *et al.*Characteristics, treatment, outcomes and cause of death of invasively ventilated patients with COVID-19 ARDS in Milan, Italy Crit Care Resusc, 22 (2020), pp. 200-211
21. M. Pagnesi, L. Baldetti, A. Beneduce, F. Calvo, M. Gramegna, V. Pazzanese, *et al.*Pulmonary hypertension and right ventricular involvement in hospitalised patients with COVID-19 Heart, 106 (2020), pp. 1324-1331
22. S.I. Blot, F.S. Taccone, A.-M. Van den Abeele, P. Bulpa, W. Meersseman, N. Brusselaers, *et al.*A clinical algorithm to diagnose invasive pulmonary aspergillosis in critically ill patients Am J Respir Crit Care Med, 186 (2012), pp. 56-64
23. J.P. Fine, R.J. Gray A proportional hazards model for the subdistribution of a competing risk J Am Statist Assoc, 94 (1999), pp. 496-509
24. H.T. Kim Cumulative incidence in competing risks data and competing risks regression analysis Clin Cancer Res, 13 (2007), pp. 559-565
25. F. Zhou, T. Yu, R. Du, G. Fan, Y. Liu, Z. Liu, *et al.*Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study Lancet, 395 (2020), pp. 1054-1062
26. Y. He, W. Li, Z. Wang, H. Chen, L. Tian, D. LiuNosocomial infection among patients with COVID-19: a retrospective data analysis of 918 cases from a single center in Wuhan, China Infect Control Hosp Epidemiol [Internet] (2020), pp. 1-2
27. P. Goyal, J.J. Choi, L.C. Pinheiro, E.J. Schenck, R. Chen, A. Jabri, *et al.*Clinical characteristics of covid-19 in New York city N Engl J Med [Internet], 382 (24) (2020), pp. 2372-2374
28. N. Chen, M. Zhou, X. Dong, J. Qu, F. Gong, Y. Han, *et al.*Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study Lancet [Internet], 395 (10223) (2020), pp. 507-513
29. C. Huang, Y. Wang, X. Li, L. Ren, J. Zhao, Y. Hu, *et al.*Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China Lancet [Internet], 395 (10223) (2020), pp. 497-506
30. H. Li, K. Chen, M. Liu, H. Xu, Q. XuThe profile of peripheral blood lymphocyte subsets and serum cytokines in children with 2019 novel coronavirus pneumonia J Infect [Internet], 81 (1) (2020), pp. 115-120
31. X. Dong, Y. Cao, X. Lu, J. Zhang, H. Du, Y. Yan, *et al.*Eleven faces of coronavirus disease 2019 Allergy [Internet], 75 (7) (2020), pp. 1699-1709
32. N. Chen, M. Zhou, X. Dong, J. Qu, F. Gong, Y. Han, *et al.*Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study Lancet, 395 (2020), pp. 507-513
33. Y. Liu, Y. Yang, C. Zhang, F. Huang, F. Wang, J. Yuan, *et al.*Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury Sci China Life Sci, 63 (2020), pp. 364-374
34. F. Zhou, T. Yu, R. Du, G. Fan, Y. Liu, Z. Liu, *et al.*Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study Lancet, 395 (2020), pp. 1054-1062
35. C.R. MacIntyre, A.A. Chughtai, M. Barnes, I. Ridda, H. Seale, R. Toms, *et al.*The role of pneumonia and secondary bacterial infection in fatal and serious outcomes of pandemic influenza A(H1N1)pdm09 BMC Infect Dis, 18 (2018), p. 637
36. Z.A. Memish, S. Perlman, M.D. Van Kerkhove, A. Zumla Middle East respiratory syndrome Lancet, 395 (2020), pp. 1063-1077
37. C. Huang, Y. Wang, X. Li, *et al.*Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China Lancet, 395 (10223) (2020), pp. 497-506
38. J. Yanga, Y. Zhenga, X. Goua Prevalence of comorbidities and its effects in coronavirus disease 2019 patients: a systematic review and meta-analysis Int. J. Infect. Dis., 94 (2020), pp. 91-95
39. W. Tai, L. He, X. Zhang, J. Pu, D. Voronin, S. Jiang, Y. Zhou, L. DuCharacterization of the receptor-binding domain (RBD) of 2019 novel coronavirus: implication for development of RBD protein as a viral attachment inhibitor and vaccine Cell. Mol. Immunol., 17 (6) (2020), pp. 613-620

40. N. Keicho, S. Itoyama, K. Kashiwase, N.C. Phi, H.T. Long, L.D. Ha, V.V. Ban, B.K. Hoa, N.T. Hang, M. Hij ikata, S. Sakurada, M. Satake, K. Tokunaga, T. Sasazuki, T. QuyAssociation of human leukocyte antigen class II alleles with severe acute respiratory syndrome in the Vietnamese population Hum. Immunol., 70 (7) (2009), pp. 527-531
41. G. Li, Y. Fan, Y. Lai, T. Han, Z. Li, P. Zhou, P. Pan, W. Wang, D. Hu, X. Liu, Q. Zhang, J. WuCoronavirus infections and immune responses J. Med. Virol., 92 (4) (2020), pp. 424-432
42. M.G. Katze, Y. He, M. Gale Jr. Viruses and interferon: a fight for supremacy Nat. Rev. Immunol., 2 (9) (2002), pp. 675-687
43. J. Bernet, J. Mullick, A.K. Singh, A. SahuViral mimicry of the complement system J. Biosci., 28 (3) (2003), pp. 249-264
44. E. Bettelli, Y. Carrier, W. Gao, T. Korn, T.B. Strom, M. Oukka, H.L. Weiner, V.K. KuchrooReciprocal developmental pathways for the generation of pathogenic effector TH17 and regulatory T cells Nature, 441 (7090) (2006), pp. 235-238
45. C.A. Hunter, S.A. JonesIL-6 as a keystone cytokine in health and disease Nat. Immunol., 16 (5) (2015), pp. 448-457
46. P.J. Hotez, M.E. Bottazzi, D.B. CorryThe potential role of Th17 immune responses in coronavirus immunopathology and vaccine-induced immune enhancement Microbes Infect., 22 (4–5) (2020), pp. 165-167
47. M. Frieman, M. Heise, R. Baric SARS coronavirus and innate immunity Virus Res., 133 (1) (2008), pp. 101-112
48. K.J. Huang, I.J. Su, M. Theron, Y.C. Wu, S.K. Lai, C.C. Liu, H.Y. LeiAn interferon-gamma-related cytokine storm in SARS patients
49. R.C. Becker COVID-19 update: covid-19-associated coagulopathy J. Thromb. Thrombolysis, 50 (2020), pp. 54-67
50. F. Klok, M. Kruip, N. van der Meer, *et al.*Incidence of thrombotic complications in critically ill ICU patients with COVID19 Thromb. Res., 191 (2020), pp. 145-147
51. Achmad H, Adam AM, Azizah A, Sukmana BI, Huldani, Khera SN, Ramadhany YF. A Review of Bandotan Leaf Extract (Ageratum conyzoides L.) in Inhibition Test to the Growth of Bacteria (Porphyromonas gingivalis) Case of Periodontitis Disease. Systematic Reviews in Pharmacy. 2020; 11(4): 390-395. doi: 10.31838/srp.2020.4.58
52. Achmad H, Adam AM, Azizah A, Sukmana BI, Huldani, Khera SN, Ramadhany YF. A Review of Bandotan Leaf Extract (Ageratum conyzoides L.) in Inhibition Test to the Growth of Bacteria (Porphyromonas gingivalis) Case of Periodontitis Disease. Systematic Reviews in Pharmacy. 2020; 11(4): 390-395. doi: 10.31838/srp.2020.4.58
53. Achmad H, Tanumihardja M, Ramadhany YF. Teledentistry as a Solution in Dentistry During The Covid-19 Pandemic Period: A Systematic Review. Journal of Pharmaceutical Research. July-December, 2020. Supplementary Issue 2.272-278.
54. Achmad H, Djais AI, Syahrir S, Inayah Y, Elnangwati W, Fitri A, Ramadhany YF. Impact of COVID-19 in Pediatric Dentistry: A Literature Review. International Journal of Pharmaceutical Research. January-June, 2020. Supplementary Issue 1. p. 830-940.
55. Achmad H, Rasmidar Samad, Hendrastuti Handayani, Sri Ramadhany, Mardiana Adam, Mardiana And Andam Dewi Suci. 2018 . Analysis of Disease Risk Factors of Early Childhood Caries (Ecc) On Pre-School Children Psychosocial Project Review. Asian Journal. of Microbiol. Biotech. Env Sc. © Global Science Publications pp. 18-25, Vol. 20, Oct Suppl Issue. ISSN-0972-3005.

Development of Professional Interest of Adolescents in the Implementation of Online Learning in Institutions of Additional Education

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Abstract

The problem of developing the professional interest of the oncoming generation is associated with the acquisition of qualities that are significant from both social and public points of view and contribute to professional self-determination, and to readiness to design the character of behavior, mastery of high art and digital technologies, the formation of relevant competencies that contribute to the development of a competitive, creative and dynamically minded specialist. This problem can be effectively solved in institutions of additional education, taking into account the individual inclinations and age characteristics of an individual, satisfying diverse educational needs, encompassing a variety of interests and ways to achieve personal and professional goals. In addition, today the system of additional education implements additional pre-vocational general education programs aimed at the implementation of continuous art education of middle and higher levels. It is important to note that to date pre-vocational educational programs are being developed by teachers of additional education independently at the expense of a large amount of time and effort, on the one hand, and the insufficient formation of a bank of innovative programs and practices at the regional and federal levels, on the other. This circumstance entailed certain difficulties, namely: there is an urgent need for organization and development of scientific research and pilot projects ensuring the innovative nature of training and updating forms and approaches to the educational process that meet the needs and requirements of the state and many professional areas of activity. In this regard, one of the forms that are in demand and new for institutions of continuing education is online learning. However, we found that this form is little studied and unsystematically used in additional education, which requires organization of a special study. During the study, we applied the following methods:

1) Theoretical: analysis and systematization of philosophical, psychological, and pedagogical literature;

2) practical: generalization of empirical material, pedagogical experiment, and interpretation of the data.

As a result, we studied the concept of "professional interest", revealed the essence of the process of developing professional interest in adolescents, and proved during the experiment that the use of online learning forms contributes to a more effective development of professional interest of adolescents.

Keywords: art education, professional interest, development of professional interest, online learning for adolescents.

Introduction

Modern socio-economic transformations which improve the trends of computerization and technologization in many areas of professional activity have entailed the reform of additional education for children. The essence of the changes is characterized by the transition from traditional educational programs, methodological principles, and forms of teaching developed in the 20th century to innovative

ones that meet the expectations and needs of students and their parents, and the current state of society as a whole. The system of additional education for children should provide the outstripping character of personality development, orientation and motivation of adolescents to innovative activities in the field of high technologies, and, as a result, professional self-determination.

Among the new forms of training, which are the innovative basis for the development of the education system as a whole, online learning forms are distinguished, which, firstly, are associated with the use of telecommunication and information technologies, and secondly, have significant educational and didactic potential (Means et al., 2009).

The works by A.A. Andreev, Ya.A. Vagramenko, A.D. Ivannikov, V.I. Ovsyannikov, E.S. Polat, V.I. Soldatkin, V.P. Tikhomirov, and other scholars and researchers consider online learning as one of the new forms of education covering network structures, organizational forms and virtual means of interaction of subjects in their integrity of the training. The didactic potential of online learning is manifested in the fundamental basis of "open education".

The aforementioned characteristics of online learning forms correspond to the structure and style of additional education and can be "smoothly" introduced into this system at a certain time and quantity ratio.

Based on the material studied by leading researchers in the field of online learning, we define the online learning method in institutions of additional education as a system of specially designed tools aimed at expanding and deepening the core competencies obtained, based on the use of computer and telecommunication facilities, and oriented towards the domination of students' independent work as part of the variable part of the curriculum.

It's no secret that independence acts as the dominant component of professional development. In this regard, we put forward the assumption (which also requiring proof, of course) that online learning forms effectively affect the development of professional interest of adolescents.

Such researchers as E.I. Bayramova, A.D. Sazonov, R.G. Salakhutdinov, and G.G. Solodov were involved in the development of professional interest. They consider this concept as a conscious need of a person to orient in the social space, and as the ability to make optimal decisions in a certain professional field (Andreev, 2005; Bayramova, 2001; Sazonov, 2000; Salakhutdinov, 2005).

Based on the study of different approaches to the determination of the "professional interest" concept, we consider it as a state of the active need of a adolescent's personality for the wide knowledge of the chosen professional sphere, field or activity, including the functions of psychological, pedagogical, economic, and social aspects.

The process of developing professional interest is associated with the activation of other characteristics of the personality of a adolescent, such as:

- The conscious need of adolescents to develop their own beliefs and views;
- Expansion of the intellectual sphere and mental horizons;
- Awareness by a adolescent of their personal, mental, and activity capabilities and abilities to achieve their goals.

Method

Stimulation of adolescents in the development of their professional interest should be the foundation of the educational process. The process should be filled with pre-professional educational tasks, the solution of which is possible in the context of disclosing the values and characteristics of their future profession.

It should be noted that motivated and ready to pre-vocational training adolescents come in institutions of additional education: children's art schools and schools of design (in which the Painting, Decorative and Applied Arts or Design programs are implemented). Therefore, admission of applicants is based on the principle of differentiation, aimed at identifying adolescents with their potential to receive education at a pre-professional level, and their professional inclinations. The educational process for adolescents should be based on a deliberate combination of academic, educational and creative tasks that contain elements of the professional activity of an artist, a decorator, a designer, and also online learning aimed at implementing quasi-professional projects.

Based on our personal experience, we are confident that the following algorithm of the teacher's actions for the introduction of online learning is effective:

- Determination of individual routes for promoting students on executing online tasks, monitoring of their technical capabilities and means, as well as interests;
- Preparation of explanatory and illustrative material that reveals the features of students using remote techniques and technologies;
- Express conversations with parents of students about issues of motivation and performance;
- The development of special creative tasks that meet the needs of the student.

Thus, the following requirements must be observed to develop the professional interest of adolescents in the process of online learning:

1) To identify professional inclinations and the potential of adolescents to receive an art education at a pre-professional level within the framework of the selection committee;

2) When selecting the content of special tasks within the framework of online learning, take into account the age characteristics of adolescents and their interests through the introduction of projects containing significant problems at social and public level that allow them to implement elements of the professions of a designer, decorator;

3) Building online learning paths with each adolescent that allows them to show their creative abilities.

Results and Discussion

During the pedagogical experiment, two experimental sites were selected: Children's Design School No. 3 and Children's Art School named after M.A. Balakirev in the city of Kazan. A control group (CG) and an experimental group (EG) of adolescent students of 103 people each were identified there; they were diagnosed in the CG and EG with the existing level of development of adolescents' professional interest before including the PRO-sketching online course in their educational process.

A set of methods was used to diagnose the level of development of adolescents' professional interest:

- A method of expert evaluation of educational and creative tasks;
- A method of analysis of art, and also art and design training and creative work of adolescents.

Diagnosis concerning the level of development of adolescents' professional interest was carried out according to two criteria:

1) Cognitive criterion (tests "Geometric figures", "Compasses", "Squares" were carried out), which allowed us to study the level of development of spatial representation, perception, artistic and constructive thinking.

2) An activity-meaningful criterion revealed in the parameters of the use of performing, instrumental, artistic and expressive graphic skills. Two special diagnostic situational design tasks were solved out; and their results were evaluated by experts.

As a result of the ascertaining stage of the experiment, professional interest below the average level was found in most adolescents of the experimental (53%) and control groups (47%). The data are presented in Table 1.

Table 1: *The level of development of professional interest of adolescents participating in the experiment at an ascertaining stage*

Groups	High (excellent) level	Above the average (optimal) level	Middle (sufficient) level	Below average (elementary) level	Low (critical) level
	%	%	%	%	%
EG 103 persons 100%	0	6	11	53	29
CG 103 persons 100%	0	6	17	47	29

The revealed level will not allow the adolescents to succeed in pre-professional art education in the future. Therefore, a formative stage was further organized in the experimental group of adolescents, aimed at involving them in the online course "PRO-sketching" as part of the variable part of the curriculum.

The main goal of the formative stage was to increase the initial level of development of adolescents' professional interest. To achieve this goal, we have developed and implemented a special course "PRO-sketching", which provides for the use of online forms for the development of professional interest components.

To develop the professional interest of adolescents, it is necessary to ensure the awareness of the need to develop their own views and beliefs; expand mental horizons; form a conscious and adequate attitude to their abilities and talents to achieve their goals. The online course is aimed at deepening the knowledge of the specifics of the designer and decorator profession, and the training material does not duplicate classroom-based topics. It reveals the essence of sketching as one of the modern areas of fast and effective drawing, which is used by designers, decorators and architects in order to visualize their design ideas accessible to customers.

The course contains explanatory and illustrative material in the form of presentations, useful links to sketches and the work process performed by professional designers, and tasks of a reproductive and creative nature built on a "simple-to-complex" basis. During the course, students get acquainted with the basic sketching styles, the necessary materials and tools, and intensively perform about 60 sketches per month. Their tasks cover different genres: floristry, food sketching, still life, animalistic genre, industrial sketching, furniture, interior and architectural sketching. This approach contributes to a more effective development of interest and training of important performing, instrumental, artistic and expressive graphic skills.

At the end of the online course, we re-diagnosed the level of development of professional interest in adolescents in the CG and EG groups. During the diagnosis, the previous methods were used. Unlike adolescents from the control group, the level of adolescents studying in the experimental group increased: the data are presented in Table 2.

Table 2: *The level of development of professional interest in adolescents participating in the experiment at the control stage*

Groups	High (excellent) level	Above the average (optimal) level	Middle (sufficient) level	Below average (elementary) level	Low (critical) level
	%	%	%	%	%
EG 103 persons	10	65	15	8	0
CG 103 persons	0	31	31	29	8

Summary

Diagnosis indicates an increase in the level of development of professional interest in adolescents of the experimental group in connection with the targeted formation of the whole complex of professional interest components (65% of the above average level). EG participants are more active in showing responsible attitude to the work being done, and also demonstrating independence, interest in the professions of a designer or a decorator; there is a conscious need for students to proactively develop their own beliefs and views, to adequately assess their abilities to achieve their goals. Participants in the experiment consciously perform sketches in a remote format, and then carry out work on sketch ideas in classroom activities.

The level of readiness of adolescents in the EG group to reflect their ideas through graphic programs on a computer and the degree of independence in the selection and use of art materials in practical work is increased. Experts analysed the creative work of adolescents from the EG group and noted a higher level of development of artistic and graphic skills, which is expressed in the variability of the search for original ideas by means of graphics; the depth, expressiveness and originality of the composition and artistic images.

Conclusions

The experimental work during the study, including the ascertaining, formative and control stages, allows us to conclude that there are significant positive dynamics in the development of all the parameters and indicators that are relevant to the research problem that occurred in adolescents of the experimental group. Namely, the progressive transformation of quantitative and qualitative indicators of the cognitive sphere: the level of development of visual perception, spatial representation, and artistic thinking; and also the sphere of activity: the degree of stability and depth of artistic and graphic skills, the experience of applying a set of skills in activities and the creation of artistic design work. These results confirm the effectiveness of the use of online learning forms that were implemented with the introduction of a special course "PRO-sketching".

The result of the work was a high level of formation of professional interest of adolescents; maturity of a process on stable formation of responsibility; independence, decision-making ability, initiative behaviour; systematic development of artistic and graphic knowledge and skills.

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References

Andreev, A.A. (2005). The Internet in the Continuing Education System. *Text. Online and virtual learning, 12*, P.5-7.

Bayramova, E.I. (2001). *The formation of the professional orientation of the personality as a socio-pedagogical problem* [Text]. Actual problems of pedagogical science: a collection of scientific papers. - Kazan: KSPU, 20-21.

Kadyjrova, L. H., & Musina, K. I. (2019). TO THE QUESTION OF STUDY OF THE FEATURES OF THE OBJECT" STONE MILL" SETTLEMENT IN THE PROCESS OF TRAINING BACHELORS-DESIGNERS IN KFU. *Revista TURISMO: Estudos e Práticas*, *2*, 1-10.

Kadyjrova, L. H., Akhmetshina, E. G., Kadyjrov, T. R., & Peremislov, I. A. (2018). Principles of realization of the Polycultural Educational Model of the Republic of Tatarstan in the Fine Arts. *Dilemas Contemporáneos: Educación, Política y Valores*, *6*(1), 8-17.

Kadyjrova, L., & Akhmetshina, E. (2018). Pedagogical potential of national self-explicit art in the system of development of artistic culture of the person. *Uluslararasi Türk sanati, tarihï ve folkloru kongresi¨, Sanat Etkinlikleri¨*, 10, 226-228.

Kayumova, R., Dyganova, E., Batyrshina, G., & Baghdasaryan, A. (2019). Formation of visual culture in teenagers by teaching them photographic art. *SCOPUS-2019-9-1-SID85075206747*.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. *US Department of Education*.

Salakhutdinov, R.G. (2005). *Traditional folk culture: pedagogical and leisure technologies* [Text]. - Kazan: Gran-Dan,- 376 p.

Sazonov, A.D. (2000). *Vocational guidance for students of secondary schools in Russia* [Text]: Monograph.- Kurgan: KSU,.- 192 p.

Solodova, G.G. (2011). The formation of professional self-determination of students as a pedagogical problem [Text]. *Bulletin of the Kemerovo State University, 3*, 99-103.

Formation of Speech Communication in Preschool Children with Autism Spectrum Disorders

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Abstract

The relevance of the article is due to increased interest among scientists and practitioners in the formation of speech function and communication in preschool children with autism spectrum disorder (ASD). The purpose of the article becomes more significant in connection with the inclusion of children with ASD in preschool education and the insufficient justification of the technology of this process. The authors proposed a program for the formation of speech function and communication of children with ASD using PECS as an image exchange system. The study was carried out on the basis of theoretical analysis methods, including comparative and system analysis, as well as empirical methods (testing, questioning) and methods of ascertaining and formative experiment. The authors attempted to develop thematic lesson planning in a preschool educational institution (PEI) using PECS cards. The results of such work showed that children with ASD have learned to successfully use not only alternative communication, but also speech communication. The article is intended for scientists and practitioners dealing with the problems of RAS based on alternative communication tools like PECS.

Keywords: autism spectrum disorder, communication, communicative disorders, communicative abilities, preschool age.

Introduction

Today, the problem of the social adaptation of children with autism and autism spectrum disorders (ASD) remains largely unexplored and poorly studied at different ages. On the one hand, this is due to difficulties and complexity in the psychological assessment of the emotional state of the child with autism, especially in the pre-school period, On the other hand, this is due to the insufficiency of objective psychological criteria and pedagogical conditions for correcting and developing the adaptive capacity of this category of children for socialization.

At the present stage of the development of society, as emphasized by S.V. Alekhina (Alekhina et al., 2014) and M.M. Semago (Semago et al., 2017), the full potential of this factor is ensured by the ideology and technologies of inclusive education. However, the modern Russian education system, with all its declarations of the need for inclusion on the basis of the law of the Russian Federation, is not yet fully prepared to provide educational services to the full children with ASD (Alekhina et al., 2014).

Today, pre-school educational institutions in both the Russian Federation and the Republic of Tatarstan are ready to create, and can provide, adequate conditions for the development of children with autism, However, there is a need for a system of adapted activities for children with ASD, taking into account their communication and adaptation.

Methods

The main methods of this research are theoretical (systematic analysis, generalization) and empirical (observation, included observation, monographic observation, questionnaire, testing, study of activity products). The organization of sessions on the development of speech communication took place on the basis of thematic planning on 15 October 2018 – 20 May 2019 Kazan RT kindergarten (Maklakova et al., 2019; Khairutdinov et al., 2019). The PEI has created an adaptive socio–pedagogical environment for working with children with ASD.

Results and Discussion

It is well known that the basis of a child's communication with the ASD is related to the processes of adaptation of the child to the conditions of society and, in particular, to the micro–group of the educational institution in general, and to the PEI in particular (Vinogradova, 2015; Gorina et al., 2019; Erofeeva, 2019; Konrateva & Fakhrutdinova, 2017; Lisina, 1986; Khowaja & Salim, 2019). Thus in K.N. Vinogradova revealed correlations between the development of speech and communication in a child in autism spectrum disorders (Vinogradova, 2015).

The manifestation of ASD in children is characterized, first of all, by a persistent lack of access to the media, to digital technologies and, above all, by stereotypical behaviours, nervousness, self–care and, much less frequently, by various intellectual violations (Khowaja & Salim, 2019; Metcalfe et al., 2019; Talbott et al., 2020).

A systematic analysis of the scientific literature on the problems of developing speech communication in children with ASD has enabled us to find that the determinants of mental manifestations in children with ASD are being sought. The active search for such determinants takes place in the study of three important areas of behaviour of the child with the ASD: social relations; verbal and non–verbal communication; forms of interests and needs embodied in obnoxious, cyclical or standard and stereotypical forms of behaviour (Khowaja & Salim, 2019; Metcalfe et al., 2019; Talbott et al., 2020; Wing, 1996; Melis et al., 2019). A number of scientists such as O.C. Nikolskaya (Nikolskaya, 1995), M. Talbott and others are inclined to consider that one of the main violations which hampers the process of socialization and individualization of children with ASD is the low level of becoming and development of communication and speech functions (Khowaja & Salim, 2019; Metcalfe et al., 2019; Talbott et al., 2020; Wing, 1996; Melis et al., 2019). We agree with O.S. Yerofeyeva that children with autism spectrum disorders show weakness or loss of contact with the outside world, as well as social interaction and the beginning of restriction of interests and, of course, there is repetitive and stereotypical behaviour, and above all there are various speech violations (Erofeeva, 2019).

Thus, the development of speech in children with ASD is considered to be one of the dominant tasks in the formation of speech communication, which, above all, will contribute to the socialization of the child, its adaptation and upbringing (Konrateva & Fakhrutdinova, 2017). In this context, the structure and composition of communication, the motives and needs for communication, the stages of communication development, and the ability of direct speech substitution for other forms of communication are being studied for children with ASD (Konrateva & Fakhrutdinova, 2017). Scientists are also concerned about diagnosing ASD children. For example, N.A. Platohina believes that children are diagnosed by systematic observation of their behaviour and identification of a characteristic triad of disorders (lack of social interaction, communication, stereotypical behaviour), and unfortunately, there is no institute of early detection and early intervention for such children in Russia (Platokhina & Abashina, 2018).

Of course, one of the main problems of children with ASD is the disruption of communication with other people, because such children cannot express their wishes and needs (Maklakova et al., 2019; Khairutdinov et al., 2019; Erofeeva, 2019; Lisina, 1986; Mukhametzyanova et al., 2020). It is therefore very important to teach them how to interact with others in order to socialize and adapt to society, and in addressing this problem scientist develop and implement alternative programmes for the development and formation of speech functions and communications (Semago, et al., 2017; Khowaja & Salim, 2019; Nikolskaya, 1995; Platokhina & Abashina, 2018). This article presents new views on the main directions of work with children with PECS products, which are reflected in a number of our works (Maklakova et al., 2019; Khairutdinov et al., 2019). In the context of this article we continue to describe the results of the longitudinal study of the formation of the speech communication and speech functions of preschoolers with

ASD using the alternative PECS technology with the reasoning of its modifications, as in our previous works (Mukhametzyanova et al., 2020).

The first area of work is the so–called sequential and algorithmic education of children with ASD, which included, first of all, the teaching of primary skills in the expression of requests or demands using verbal and non–verbal means of communication. The second line of work or emotional learning involved teaching children with ASD socio–emotional skills, which included learning how to express their feelings and emotions through words, gestures, facial expressions and pantomimics. The third area of work or communication training focused on the development of communication skills, which involved the development of oral communication skills, which consisted in the development of the ability to initiate and complete dialogue and the development of the ability to use dialogue speech.

The organization of classes on the development of speech communication provided for the creation and use of thematic planning from 15 October 2018 to 20 May 2019, but with some additions takes place at the current day–care center of № 332 which is of an inclusive type in Kazan, Republic of Tatarstan (Maklakova et al., 2019; Khairutdinov et al., 2019). At the stage of the formative experiment, individual work was carried out with 6 children with ASD and classes for the formation of communication were used, which were carried out individually with each child for 10–20 minutes

The training was organized on the basis of one week of study. The training was conducted twice a week. In the second stage, classes on the same topic were held for 2 weeks, because this stage is quite difficult for children with ASD, because the process of creating the « I-concept» and understanding their desires was carried out.

Thus, classes were held on the development of the concept of the essence of communication, such as « Favorite toy », « Feel your body » and «Pleasant words», the purpose of which was to form the ability to display the initiative of communication, increase the vocabulary and name objects. It also contributed to the reaction to greeting and farewell. It is also worth mentioning, formation of the ability to name different characters from cartoons, increase of vocabulary, ability to answer a question.

Experimental work with the identified group of children with ASD was started from the preparatory stage or the pilot stage of the diagnostic phase of the experiment, which consisted of integrated and monographic monitoring of the child's behaviour in an informal setting to identify elements that enhance the child's vocal function.

The first phase of the experiment consisted of seven sessions on various topics. In more detail these lessons were reflected in our final qualifying work and in a number of our works. This article will focus on the most interesting activities and results of our integrated and monographic monitoring of children with ASD. In the first class while working with the topic: «Favorite toy» children with ASD did not immediately understand what they needed to do, but with the help of the assistant teacher they were able to execute this algorithm of actions. The lesson ended with this category of children precisely on the correct execution of the action algorithm. It should be noted, however, that some children have learned the connection from the first class and have become our helpers for other children, so–called less capable of speaking.

For most children, the second lesson «Feel your body», did not cause any particular difficulties, because the majority managed to show the main parts of their body, but the two children did not want to look in the mirror, started to cry, did not answer the questions, so we gave them several classes (8-9).

That stage of the experiment was finished with «Pleasant words», when we used a bag with toys. We noticed that several children were afraid of the appearance of the toy, but then they became interested and started repeating the words themselves (Maklakova et al., 2019; Khairutdinov et al., 2019).

Based on the results of the first stage, we found that children with ASD learned to bear the time interval, went quietly and even with pleasure to the classes, were more relaxed in case of failure and tried to correct error (Maklakova et al., 2019; Khairutdinov et al., 2019).

Classes, we realized that many tasks were difficult for them, as several children were in constant need of more training due to their misconduct (children crying, screaming, biting, throwing cards). In the early classes, the children sought to obtain a desired item from the action algorithm they had already learned, and were hysterical or simply left when they were forced to perform the necessary actions. Two children easily repeated and drafted proposals, and for others, that action algorithm caused difficulties. Our greatest

achievement was the introduction of the phrase by one child (Maklakova et al., 2019; Khairutdinov et al., 2019).

Summary

Researchers of the ASD phenomenon in preschool children believe that the main violation is the lack of communication skills. For children with autism and ASD, all problems are related primarily to the development of speech, speech functional and speech communication. The results of inclusion of children with ASD allowed us to agree with our colleagues that such children are not only important, but also vital, for a specially organized process of algorithmic communication skills transfer, without which the child cannot be socialized. We tried to develop the program «Development of speech communication in preschool–age children with autism spectrum disorders by means of PECS» and tested it in a number of our works. The content of the classes is based on the works of A.V. Hausov, T.V. Volosovets, E.N. Kutepova (Khairutdinov et al., 2019). The developed program includes thematic planning; in which we have included PECS cards in the learning system to form speech communication in children with ASD.We are impressed by the research of E.N. Gorina, E.S Grinina and T.F. Rudzinskaya, who use in practice modern approaches to study families with children with ASD and their adaptation and correction (Gorina et al., 2019). We fully agree with these authors that the main medium for bringing up a child with ASD is their achievement of the social, educational and other rights guaranteed by the state to persons with disabilities, including children with ASD. It is necessary to find various resources, which contribute to the social integration of such children (Gorina et al., 2019). There are currently various ways of correcting autism and ASD, focusing on various aspects of the development and formation of the speech and communication functions of children such as behavioral, emotional, communicative, etc. (Gorina et al., 2019). Theoretical analysis of studies on problems of ASD and experience of practical activities, has allowed us to identify among all technologies of correction of ASD a program of alternative communication, such as «PECS» system, which has proven its effectiveness in working with children of ASD, has gained great fame and popularity as an alternative means of communication for people with ASD as an image exchange system and has gained popularity in Russian practice (Gorina et al., 2019).

Conclusions

So, after the groundbreaking work of developing speech communication using PECS cards, it can be emphasized that children with autism learned to use not only alternative communication, but also speech. Most of the children had a greater vocabulary, and a proposal had been made, and the children had learned to express their requests, express their emotions, use polite words and answer questions.

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References

Alekhina, S.V. et al., (2014). Methodological approaches to the psychological and pedagogical support of the inclusive process in education. Siberian Pedagogical Journal, 5, 97–104.

Erofeeva, O.S. (2019). Features of the correctional development work of a speech therapist with children with autism spectrum disorders. Auditorium, 2(22).

Gorina, E.N., Grinina, E.S., & Rudzinskaya, T.F. (2019). Modern approaches to the study of families raising a child with an autism spectrum disorder. World of Science. Pedagogy and psychology, 5.

Khairutdinov, R.R., Safin, R.S., Korchagin, E.A., Mukhametzyanova, F.G., Fakhrutdinova, A.V., & Nikishina, S.R. (2019). The Content of Educational Programs in Technical Universities: Quality Standards of Applying the Modern Professional University. International Journal of Instruction, 12(1), 357-370.

Khowaja, K., & Salim, S. S. (2019). Serious game for children with autism to learn vocabulary: An experimental evaluation. International Journal of Human–Computer Interaction, 35(1), 1-26.

Konrateva, I.G., & Fakhrutdinova, A.V. (2017). Issues of continuous and flexible education / In the collection: Foreign languages in the modern world. Proceedings of the X International Scientific and Practical Conference. Edited by D.R. Sabirova, A.V. Fakhrutdinova, 140–147.

Lisina, M.I. (1986). Problems of communication ontogenesis: monograph.– Moscow: Pedagogy, 1986. – 136 p.

Maklakova, N.V., Khovanskaya, E.S., & Favictorovna, A.V. (2019). Critical thinking as a fundamental ability of a personality. Journal of Sociology and Social Anthropology, 10(4), 142-147.

Melis, Y., Bilge, S., & Barış, K. (2019). Social competence in children with autism. International Journal of Developmental Disabilities, 1, 10–19.

Metcalfe, D., McKenzie, K., McCarty, K., & Pollet, T. V. (2019). Emotion recognition from body movement and gesture in children with Autism Spectrum Disorder is improved by situational cues. Research in Developmental Disabilities, 86, 1-10.

Mukhametzyanova, F.G., Mysagutova, A.F., & Valiullina, G.V. (2020). Designing the speech communication of preschoolers with autism spectrum disorders. Kazan pedagogical magazine, 2(139), 247-254.

Nikolskaya, O.S. (1995). Problems of teaching autistic children. Defectology, 2, 8–18.

Platokhina, N.A., & Abashina, N.N. (2018). Improving the professional competence of teachers of a preschool educational organization for working with children with a diagnosis of "Early childhood autism". Concept, 1, 3–13.

Semago, N. Ya. et al. (2017). Psychological and pedagogical support of a child with ASD. Autism and developmental disorders,15(1), 4–14.

Talbott, M. R., Young, G. S., Munson, J., Estes, A., Vismara, L. A., & Rogers, S. J. (2020). The developmental sequence and relations between gesture and spoken language in toddlers with Autism Spectrum Disorder. Child development, 91(3), 743-753.

Vinogradova, K.N. (2015). Speech and communication with autism spectrum disorders. Autism and developmental disorders, 2(47), 17 – 28.

Wing, L. (1996). The autistic spectrum.— London: Constable,. — 578 p.

From The History of the Kazan Tatar Teaching School (1876–1917)

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Abstract

The article is devoted to the history of the establishment and development of the Kazan Tatar teacher's school. The relevance of this study stems from the fact that during the period under study, the Imperial Government, influenced by worldwide trends of development, sought to adapt the components of its policy towards non-Russian peoples to the realities of the times. The article uses a wide range of archival sources, many of which are being introduced for the first time. The authors of the article present the historical background of the period under consideration, showing the reasons and prerequisites that led to the opening of the Kazan Tatar teacher's school. Great attention was paid to the objectives of the educational institution, organizational and administrative aspects of its establishment and functioning were examined, and the role of certain state structures in these processes was shown. The article provides information on the class and geography of students and describes the organization of the educational process. Considerable attention is paid to studying the work of the school's administrative staff and teaching staff. Based on the analysis of the material examined, the authors conclude on the place and role of the Kazan Tatar Teachers' School in the policy of tsarism towards Tatar Muslims and its significance in the life of the Tatar society.

Keywords: Russian Empire, Ministry of Public Education, Kazan Education District, the Kazan Tatar Teachers' School, Muslim Tatars, Tatars communication.

introduction

In the history of any multi-ethnic State, the policy concerning the national education of its peoples occupies a special place. The state of national affairs in the country as a whole depends to a large extent on its balance and thoughtfulness - it can become both a source of social unrest and discontent and a factor of stable and sustainable development of the society.

The above was in no small measure relevant to the Russian Empire of the second half of the XIX - the beginning of the XX centuries, when under the influence of socio-economic and political changes autocracy sought to find new ways and forms of influence on the development of formation of non-Russian peoples. In this connection, the history of the creation and evolution of one of the structures set up to solve this problem - the Kazan Tatar Teachers' School - is of considerable scientific interest: which was to serve as a guide to the government's course on the schooling of the Muslim Tatars.

Different formats and contexts, its history is reflected in works devoted to the general study of the school policy of tsarism towards Tatars-Muslims or its individual aspects. Domestic historiography of the studied problem can be divided into pre-revolutionary, Soviet and modern periods. In turn, the works of pre-revolutionary authors can be divided into two groups: the first - conservative conservation - is represented primarily by the works of missionaries, a number of officials of the educational department (Ильминский, 1910; Машанов, 1910; Коблов, 1906); The second group consists of the writings of liberal-democratic authors and attempts to analyse objectively and critically individual aspects of school policy

(Малиновский, 1916; Голубев, 1916; Фәхретдин, 1909). The Soviet historiography of the problem was characterized by a negative interpretation of the tsarist policy in the school affairs of non-Russian peoples, while at the same time aiming at the progressive influence of Russian culture on them (Горохов, 1941; Эфиров, 1939; Ханбиков, 1967; Хакимов, 1972; Беркутов, 1968; Рустямова, 1958; Махмутова, 1982; Днепров, 1985).

After the collapse of the Soviet Union, a wave of interest in national history led to the publication by historians of certain aspects of the school policy of the State towards the Muslim Tatars (Загидуллин, 1992; Рахимов, 1997; Махмутова, 1998; Фархшатов, 2000). The work of this period is characterized by new scientific approaches, access to previously closed archival documents.

The formation and evolution of foreign historiography of the problem was influenced by the own scientific traditions, sociocultural and political-ideological conditions of the state entities where the works were written (Usmanova, 2018; Gafarov, 2019; Lieven, 1991; Belentsov et al., 2017; Kappeler, 2018; Crews, 2006; Russian Empire: Space, People, Power, 1700-1930, 2007). This explains the distinctiveness of foreign researchers in the approaches and emphasis of the problem.

In the school policy of tsarism period 1860s - 1870s. is characterized by the formation by the Government of a new system of education of Muslim peoples, which has been formalized in the «Rules on Measures for the Education of Foreign Residents of Russia» 26 March 1870. According to the new educational concept, the Tatar teacher-training schools played a key role in the training of teachers for primary Russian-Muslim schools.

The administration of the Kazan Educational District (KED) played a significant role in developing the projects of the Tatar teachers' schools. P.D. Shestakov, a trustee of the KED, took the initiative in 1869 to organize a teacher training institute for Russian-speaking teachersIn 1872, the inspector of Tatar, Bashkir and Kyrgyz schools, V.V. Radlov, was a teacher's institute in Kazan. Kazan Tatar teacher's school (KTTSH).

Methods

The methodological basis of the study was the civilizational approach, which allowed the authors to consider the subject of the study in a comprehensive format, taking into account the political, economic and sociocultural aspects, their interaction and their interdependence.

In preparing the article, the authors were guided by the principle of history, which made it necessary to consider the events and phenomena studied in the light of the historical reality; the principle of a social approach, which made it possible to evaluate the events from the standpoint of the interests of various sectors of society.

Results and Discussion

KTTSH was established on January 1, 1876 on «The Status of Tatar Teachers' Schools in Ufa and Simferopol» of March 27, 1872. It was a 4-grade secondary school with a one-year term in each class and enjoyed rights progymnasium.

KTTSH was met with distrust by most Tatars, which affected the number of students. KTTSH started its activities with 9 pupils. The number of students gradually increased. In 1888 the number reached 25 (Belentsov et al., 2019), in 1901. - 66 (Национальный архив Республики Татарстан), 1913. - 78 (Национальный архив Республики Татарстан).

Most of the inmates of KTTSH were State-funded. Students were also financed by the provinces of the KED (Kazan, Vyatsk, Simbirskaya, Samarskaya) and, since 1901, by the provinces that were not part of the Kuo (Ufa, Orenburg, Perm, Nizhny Novgorod and Ural Cossack troops). KTTSH also trained people from Siberia and Central Asia.

In the first years, the school's pupils were from the urban strata (1878) and the clergy (1884), and in the later years the majority belonged to the peasants.

The KTTSH collective consisted of Orthodox and Muslim. V. V. Radlov played a key role in the management of the school. Its functions have since been transferred to the KTTSH Inspector.

The curriculum at KTTSH included 84 lessons per week in all 4 grades and included Russian language, mathematics, religious studies, science, geography and history, pedagogy, didactics, writing and

drawing. The authorities took account of the students' religious affiliation: Friday, etc., was declared a holiday.

At the organization of the KTTSH, the authorities assumed that the graduates of the school, having become teachers of Russian-Tatar educational institutions, had to replace the mull in spiritual field, which in turn could form among the Tatar clergy a category, sympathetic to the aspirations of the Government in disseminating Russian education to the Tatar-Muslims of the province (Казанская татарская учительская школа 1876-1917 гг, 2005), but these intentions have not been realized.

In 1892, the Ministry of Public Education (MPE) proposed the abolition of the school. The favourable response of the trustee of the Committee, N.G. Potapov, made it possible to defend the KTTSH. In 1900, the director of the Kazan Foreign Teachers' Seminary, N.A. Bobrovnikov, proposed to establish a joint education of Tatars with Russians. The withdrawal of KTTSH inspector S.I. Ahmerov in defence of the mono-ethnic composition of the students avoided the planned changes (Национальный архив Республики Татарстан).

During the period of social and political democratization during the First Russian Revolution, the KTTSH pedagogical council proposed the transformation of the school into a Tatar pedagogical institute. The project was aimed at strengthening the national component in education: the teaching of Tatar, Arabic languages and literature, Islamic history, etc. The project was not implemented.

However, the gradual progressive development of the educational system has made it possible to expand the KTTSH curriculum. Since 1905, the school has organized the teaching of hygiene. Since 1911 - physics. This has had an impact on the number of weekly lessons, which reached 91 by 1913-1914 (Коблов, 1906).

In total, 389 persons have graduated from KTTSH (1876-1917) during its existence (Михайлова, 1979). As a result of the examinations, 128 men and 8 women were awarded the title of teacher of primary Russian-Tatar educational institutions as well as the rank of teacher of external KTTSH (Халиков, 1972). The teaching activities of KTTSH graduates have extended beyond the KED.

An important activity of KTTSH was the organization of pedagogical courses to improve the qualifications of teachers of Russian-Tatar educational establishments. It is known that between 1880 and 1882, 10 teachers per year were invited (Национальный архив Республики Татарстан), 1883. - 12 (Казанская татарская учительская школа 1876), in 1900. - 18 (Казанская татарская учительская школа 1876), in 1901. - 17 (Национальный архив Республики Татарстан).

Summary

To sum up, it should be noted that the initiative in the organization of KTTSH belonged to the inspector of Tatar, Bashkir and Kyrgyz schools of KED, V.V. Radlov, who actively participated in the organization and management of the school. Gradually, KTTSH gained the confidence of the Muslim population and became an important component of national education. Attempts to close down (1892) and reorganize (1900) KTTSH were eliminated by the efforts of the school administration with the active support of the management of the KED, but the educational department did not agree to transform KTTSH into a Tatar teacher's institute (1905) by allowing only increased hours in general education. A number of changes in the KTTSH were in line with the changes in the pedagogical and secondary education institutions, as well as the influence of the internal political situation.

Conclusions

Thus, from the point of view of the Government, KTTSH was one of the instruments for unifying the educational system in respect of Tatars-Muslims; in the course of its operation, KTTSH became a kind of teaching and methodological center of the initial Russian-Muslims Tatar schools; the activities of KTTSH have to a certain extent had positive consequences for the Tatar society, facilitating the spread of secular education in it.

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References

Belentsov, S.I, Fahrutdinova, A.V, & Okulich-Kazarin, V. (2017) Education of civic consciousness in George Kershenshteyner's creativity. *European Journal of Contemporary Education, 6*(1), 5-13.

Belentsov, S.I, Fahrutdinova, A.V, & Grevtseva, G.Y, (2019). Free education: Fundamentals of humanistic pedagogics (on the example of activity of the German public figures of the second half of XIX - the beginning of the XX centuries of F. Gansberg, L. Gurlitt, G. Sharrelman)//European Journal of Contemporary Education, 8(1), 201-207.

Crews, R.D. (2006). *For Prophet and Tsar: Islam and Empire in Russia and Central Asia.* First Harvard University Press paperback edition 463 p.

Gafarov, A.A. (2019). Educational Policy of the Russian Empire in the Turki-stan Region (the Second Half of the XIX - the Beginning of The XX Century). *International Journal of Innovative Technology and Exploring Engineering (IJITEE), 9*(1), 5180-5183.

Kappeler, A. (2018). *The Russian empire : a multiethnic history.* Harlow, England; New York: Pearson Education, 455 p.

Lieven, D. (1991). *Russia's Rulers Under the Old Regime.* Yale University Press, 407 p.

Russian Empire: Space, People, Power, 1700-1930. (2007). Associate Professor of History Jane Burbank, Mark Von Hagen, A. V. Remnev. Indiana University Press. 538 p.

Usmanova, D. (2018). The Search for Identity in the Era of Nationalism: Discussions about the "Muslim" and "Turkic-Tatar" Nation among Russian Volga-Ural Tatars in the early 20th Century. *Istoriya-elektronnyi Nauchno-obrazovatelnyi Zhurnal. Tom: 9. Vypusk, 8*(72).

Беркутов, В.М. (1968). О преподавании математики в татарских школах на территории Казанского учебного округа. *Ученые записки Казанского государственного педагогического института. Вып, 60,* 105–125.

Голубев, И. (1916). *Закон 1 июня и инородческая школа.* Инородческая школа: Сб. ст. Пг., 76–95.

Горохов, В.М. (1941). *Реакционная политика царизма в отношении татар Поволжья*. Казань: Татгосиздат, 260 с.

Днепров, Э.Д. (1985). *Школьная политика: содержание понятия и аспекты изучения / Э.Д. Днепров*. Школа России накануне и в период революции 1905 – 1907 гг.: Сб. науч. трудов. М.,25–55.

Загидуллин, И.К. (1992). *Татарская школа и русификаторская политика царизма во второй половине XIX в.* Народное просвещение у татар в дооктябрьский период: Сб. ст. Казань,. С. 60–84.

Ильминский, Н.И. (1910). *Система народного и в частности инородческого образования в Казанском крае*. Казань: Тип. И.С. Петрова, 1910. 15 с.

Казанская татарская учительская школа 1876 – 1917 гг (2005): Сб. док. и матер. – Казань,

Казанская татарская учительская школа 1876-1917 гг. (2005): Сборник документов и материалов / Отв. сост. Л.В. Горохова; сост. Н.С. Горицкая, Н.А. Шарангина; под общ. ред. Д.И. Ибрагимова; отв. ред. Д.Р. Шарафутдинов. Казань: Гасыр,. 256 с.

Коблов, Д.Я. (1906). Татарские мусульманские школы (медресе). *Церковно-общественная жизнь, 9,* 323–325.

Малиновский, Н.П. (1916). *Законодательство об инородческой школе.* Инородческая школа: Сб. ст. Пг., 119–158.

Махмутова, А.Х. (1982). *Становление светского образования у татар (Борьба вокруг школьного вопроса* (1861 – 1917) / А.Х. Махмутова. Казань: Изд-во Казан. ун-та, 96 с.

Махмутова, А.Х. (1998). П.А. Столыпин: направить «серьезные усилия к пресечению национально-татарского натиска». *Эхо веков, ¾,* 68–87.

Машанов, М.А. (1910). *Современное состояние татар-мухаммедан и их отношение к другим инородцам.* Казань: Тип. И.С. Петрова, 132 с.

Михайлова, С.М. (1979). Казанский университет и просвещение народов Поволжья и Приуралья (XIX в.) Казань: Изд-во Казан. ун-та. 224 с.

Национальный архив Республики Татарстан. Фонд. 142. Опись 1. Дело 32.

Национальный архив Республики Татарстан. Фонд. 92. Опись 1. Дело 391.

Национальный архив Республики Татарстан. Фонд. 92. Опись 1. Дело 15097.

Национальный архив Республики Татарстан. Фонд. 92. Опись 2. Дело 736.

Национальный архив Республики Татарстан. Фонд. 92. Опись 2. Дело 451.
Национальный архив Республики Татарстан. Фонд. 92. Опись 2. Дело 19812.
Рахимов, С.Т. (1997). Социально-правовой статус татарских учебных заведений последней четверти XVIII – начала XX в. Панорама–Форум. Ислам в татарском мире: история и современность: матер. Междунар. *симпозиума (г. Казань, 29 апреля – 1 мая 1996 г.). Казань, 12*, 71–82.
Рустямова, А.Б. (1958). К вопросу о женском образовании среди казанских татар. *Ученые записки Казанского государственного педагогического института. Вып, 13*, 403–422.
Фархшатов, М.Н. (2000). *Самодержавие и традиционные школы башкир и татар в начале XX века* (1900-1917 гг.). Уфа: Гилем, 144 с.
Фәхретдин, Р. (1909). *Исламнар хакында хөкүмәт тәдъбирләре. 1-нче җ.* Оренбург: «Кәримов, Хөсәенов шәрикәсе» матбагасы, 66 б.
Хакимов, Х.Х. (1972). *Роль Казанской татарской учительской школы в развитии и распространении прогрессивной педагогической мысли среди татар.* Ученые записки Казанского государственного педагогического института. Казань, Вып. 105. С. 3–8.
Халиков, Х.Х. (1972). Роль Казанской татарской учительской школы в развитии и распространении прогрессивной педагогической мысли среди татар. *Из истории педагогики Татарии: Сб,* ст. Казань,
Ханбиков, Я.И. (1967). Из истории педагогической мысли татарского народа. /А.Я. Ханбиков. Казань, 232 с.
Эфиров, А.Ф. (1939). *Царская русификаторская школа у народов Поволжья.* М., 184 с.

Pedagogical Conditions for the Development of Technical Specialty Students

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Abstract

In the system of higher technical education, there is a problem of a mismatch between the rapidly changing conditions of professional activity of specialists and the conservatism of the system. The resolution for this contradiction may be the development of forms and technologies of vocational training. At the same time, training forms implemented by universities in close collaboration with researchers, business and industry are becoming increasingly important. The purpose of the study is to identify the pedagogical conditions for the successful development of technical specialty students in the current conditions of scientific and technological progress. Empirical and mathematical methods were used, as well as a dialectical analysis of developmental psychology and acmeology which are both nature-compatible and contradictory in their scientific knowledge. As a result, three components of the educational environment within a framework of contextual education are identified, which consider the development of the competencies of future engineers. The material and technical base of the educational process includes traditional resources of universities and the industrial base of enterprises, and an experimental production site. The activity and technological component involves the organization of the educational process on the basis of personality-oriented learning. Of particular importance is the psychological and pedagogical component as a condition for the formation and development of a professionally competent harmonious personality of a future specialist. The authors propose a non-traditional approach to considering the development process as overcoming dyssynchrony (unevenness) in the mental development of technical specialty students in the process of training. Development can be seen as overcoming barriers arising due to dyssynchrony. The results of the study showed a mismatch in the cognitive, emotional and personal spheres. The theoretical and practical significance of the study lies in assessing the effectiveness of the application of pedagogical conditions to overcome student development dyssynchrony. The criterion is minimization of the dyssynchrony factor and the minimum value of the intensity and duration of dyssynchrony of development.

Keywords: educational environment, pedagogical conditions, technical specialty students, development, dyssynchrony of mental development.

Introduction

Changes in the global economy present new requirements for the professional competencies of specialists. High rates of scientific and technological progress, the introduction of digital technologies provide for an increase in the role of the training of engineering personnel, suggest changes in the position of an employee from a direct executor to a remote manager.

Regular development of a society depends on the level of education of people (Slavina et al.). The goal of higher engineering education is to train a competent engineer. Modern society places new demands on professional education, the purpose of which, along with the high competence, is the formation of specialists' qualities such as general and professional culture, a high level of intellectual development, psychological readiness for active professional and social activities (Ganieva et al., 2013). State-of-the-art developments and machine data processing (Slavina et al., 2016) introduced in industry require from workers not only theoretical knowledge and practical skills, but also the development of their intellectual creativity. Of particular relevance in modern conditions is the quality of education of specialists, bachelors and especially masters.

Challenges of time determine the set of professional competencies that a student should master. The current stage of development of the higher education system in the world is characterized by the introduction of new educational standards, the implementation of which requires changes in the conditions of the educational process. This entails the development of engineering pedagogy, where special importance is given to developments in the field of digitalization in education (Valeeva & Ziyatdinova, 2018).

Scientists of various countries discuss at international conferences the mechanisms of the influence of the fourth industrial revolution on engineering education, development trends, tasks, problems and solutions (Osipov et al., 2020). In terms of the Society 4:0 development strategy, it became clear that socio-economic and cultural life are associated with the strategy and priorities of the social development based on the use of digital technologies (Liliya et al., 2019). The conclusions that are being drawn are reduced to the idea of the need for reforms in higher engineering education, taking into account the calls of the time.

There is a problem in the system of higher technical education concerning a mismatch between the rapidly changing conditions of professional activity of specialists and the conservative system of higher education. One of the directions for resolving this contradiction is "the development and search for new forms and technologies of training in order to bridge the gap between the changing requirements of professional activities of engineers and learning (goals) outcomes. Moreover, training forms implemented by universities in close cooperation with researchers, business and industry are becoming increasingly important" (Polyakova, 2019).

Another direction in solving problems should be the study of the psychological characteristics of the development demonstrated by modern students. Particularly important is the formation of the personality of an engineer who is able to independently make managerial decisions.

The development of technical specialty students is determined by their educational environment. At the present stage of development of the Russian higher education system, new methods and technologies, and also educational content standards that reflect the most significant scientific achievements are being developed. However, the problem is that the possibilities of students' mental development are not adequately taken into account. In such conditions, the personal and professional development of students becomes difficult. What causes these difficulties?

In this regard, it is necessary to determine the pedagogical conditions for successful education in a higher educational institution. It is proposed to consider the development of students within the framework of the phenomenon of mental development dyssynchrony, which will allow an educational trajectory to build more flexibly. The unevenness of mental development often causes difficulties in the learning process, and in professional development, and can lead to social maladaptation. Therefore, it is necessary to consider the pedagogical conditions of the educational environment, to identify the dyssynchrony features of the mental development of technical specialty students and ways to overcome it.

Methods

The study was conducted using the following methods: a dialectical analysis of the nature-friendly and contradictory features in scientific knowledge of developmental psychology, empirical methods, testing, and mathematical methods.

Results and Discussion

The interpretation of the "pedagogical conditions" concept is not unambiguous. Pedagogical conditions were studied in three components: organizational and pedagogical conditions (V.A. Belikov, E.I. Kozyreva, S.N. Pavlov, A.V. Sverchkov, D.L. Kulikov, G.P. Zhilin, N. V. Ippolitov), didactic conditions (M.V. Rutkovskaya, E.V. Klyuchenko, V.S. Tenetilova), psychological and pedagogical conditions (N.V. Zhuravskaya, A.V. Krugliy, A.O. Malykhin, A .V. Lysenko, N.V. Ippolitova, N. Sterkhova, E.V. Andrienko). R.N. Mamedova identifies the external and internal sides of the concept (Mamedova, 2017). Let us dwell more specifically on the psychological and pedagogical conditions.

The variety of approaches to the definition of the educational environment concept gives rise to the consideration of its structure from various positions (V.V. Rubtsov, V.I. Slobodchikov, V.A. Yasvin, S.D. Deryabo, K.G. Krechetnikov, O.F. Latypov)

We consider three aspects of the educational environment of a university within the frame of contextual education, where the pedagogical conditions are most significant. A.A. Verbitsky notes that "there is a need for a transition to a practice-oriented type of lifelong education based on the fundamental content of sciences and on the inexhaustible possibilities of a person as a subject of general and professional development, including through the use of the enormous potential of digital teaching aids" (Verbitsky, 2019).

The first component is the material and technical base of the educational process. The material and technical base is of particular importance in the system of training of technical specialty students. In addition to practical training and experimental laboratories, students of Nizhnekamsk Institute of Chemistry and Technology have the opportunity to practice directly at industrial enterprises in the city of Nizhnekamsk and the Republic of Tatarstan.

The activity-technological component involves the organization of interaction between teachers and students based on a personality-oriented approach (Ashrapova et al., 2019). Research in psychology (V.V. Davydov, V.A. Petrovsky, B.D. Elkonin, I.S. Yakimanskaya) and pedagogy (N.G. Alekseev, E.V. Bondarevskaya, G.I. Zhelezovskaya, B.B. Kosov, V.V. Serikov, V.A. Slastenin) are focused on children and developments for higher education are not enough. A personality-oriented approach involves taking into account individual abilities, interests, motives, previous experience, the desire for self-development, awareness of the prospects for professional realization of students even in their learning process. The use of digital technology expands the teacher's ability to differentially build the educational process of each student.

Using an electronic educational system as an additional resource can be useful. But the distance learning system, which is gaining momentum recently, robs the learning process of live contact. Such a communicative process is impersonal and requires additional scientific research. In turn, students have the opportunity to choose the forms of organization and the degree of independence in the study of disciplines. Personally oriented approach allows realizing the unity of education and upbringing processes.

The success of training depends on the organization of the learning process. Let's consider the organizational conditions for the process of formation of set competencies.

The educational environment must be modelled in a certain way. The main purpose of the organization of the educational process is to transfer the student from a school child's position to a student's position, and then to a specialist's position. During the period of study at the university, the leading activity changes from academic to professional. The form of internships of students in their workplaces successfully solves this problem. In such conditions, the formation of the personality of a professional is laid back still during studentship.

Since 2018, the Nizhnekamsk Institute of Chemistry and Technology being the branch of Kazan National Innovation University has resumed its participation in the implementation of the program by the Ministry of Education and Science of the Russian Federation "Federal Experimental Site" in conjunction with the city-forming enterprise PJSC "Nizhnekamskneftekhim". Graduate students undergo internships at workplaces in their specialty during academic year. It is valuable that after defending graduation qualifications, bachelors and masters will have a priority opportunity to continue working at PJSC Nizhnekamskneftekhim. Ten years of experience have shown the effectiveness when this form of the education is integrated with the production into a cluster. An innovative program allows university students to qualitatively form professional competencies. Real opportunities are opening up for the fastest professional and creative growth for graduates of undergraduate and graduate programs.

In modern conditions, in accordance with the requirements of the Federal State Educational Standard of Professional Training of Students, the organization of the educational process can be represented by contextual learning ideas justified by A.A. Verbitsky. The author offers three models of vocational training: semiotic, imitative and social. Each model is characterized by a specific form of educational activity and organizational forms of training. The implementation of these pedagogical conditions requires special training of teachers. The planning of educational and cognitive activities of students involves focusing on the individual personality characteristics of students.

Learning foreign languages allows students to study and undergo a training / study course in foreign universities (Shageeva et al., 2017).

Let's consider the third component: the psychological and pedagogical conditions for the formation and development of a harmonious personality of a future specialist. In our study, we relied on the concept of dyssynchrony of mental development (J.-S. Terrasier, P. Mersha, I.F. Sibgatullina), using the definition of "dyssynchrony" proposed by I.F.Sibgatullina: "Dyssynchrony is a mismatched state of systems of interconnected phenomena manifested in the imbalance of personality, cognitive, emotional, volitional and physical human features (Sibgatullina & Israfilova, 2013)."

In the pedagogical process, the dyssynchrony of mental development is considered as a set of levels of advancing or normal development and mental development barriers that affect the success of students' learning activities. The reasons for the dyssynchrony of the mental development of students are the mismatch of the process of their natural maturation and the results of the educational process. The organization of the educational environment can enhance or weaken the dyssynchrony (G.K. Muratova).

During the period of study at the university, future engineers develop personality traits that characterize a positive attitude to socially accepted standards, and the personal introversion raised, which helps to intensify mental activity and increase its effectiveness. It should be noted that the future engineers are characterized by narrowness and depth of cognitive interests. The questionnaire revealed that students of engineering and technical specialties prefer to engage in sports, research and cultural activities.

The system of pedagogical and psychological conditions plays an essential role in overcoming the dyssynchrony of students' development in the process of vocational training.

The study was conducted on the basis of the Nizhnekamsk Institute of Chemistry and Technology being the branch of KNITU, the sample was 400 people. To measure the dyssynchrony of mental development, we used a coefficient showing the statistical spread of test indicators $0 \leq K_d \leq 1$. The closer to 1 the dyssynchrony coefficient, the greater the statistical spread of the indicators and the stronger (in intensity and duration) the manifestation of dyssynchrony. As a result, manifestations of dyssynchrony were revealed by 15 parameters out of 38. Let us consider the most significant ones.

The manifestations of dyssynchrony have been revealed in personality structure for professionally important qualities of the specialists of the "Man-Technique" system with K_d = 0.5-0.9 (technical literacy, a tendency to monotonous work, a sense of self-preservation, attention, physical development, speed of decision making, responsibility, extraversion, neuroticism)

Manifestations of dyssynchrony in "mathematical abilities" were revealed in the cognitive sphere with K_d=0.53.

Dyssynchrony in the field of mental states (anxiety, frustration, aggression) is manifested in the affective sphere with K_d = 0.52-0.4.

An important aspect of personal development is the response mechanisms to difficult life situations, where K_d = 0.42-0.77. Young men often use the mechanisms of "denial", "compensation", "projection", "intellectualization" as protective mechanisms of behaviour; girls prefer "regression", "compensation", "projection", "intellectualization", and "rationalization".

The study of mental development dyssynchrony of technical specialty students allows us to highlight the psychological conditions for overcoming them in the process of training. An effectiveness indicator for the use of pedagogical conditions can be minimization of the dyssynchrony factor, a decrease in the manifestations of intensity and duration (Israfilova, 2014).

A teacher as the subject of the pedagogical process, organizing the educational activities of students, is more able to influence the overcoming of dyssynchrony in the mental development of students in the cognitive sphere, and also in motivational, affective, communicative, and personal. The organization of the educational process in a university is also focused on the development of personal characteristics of students, their creative and communicative abilities.

Higher education has a huge impact on the development of the human psyche, and the formation of his personality. If favourable conditions are created during training at a university, then students develop at all levels of their psyche.

Summary

The pedagogical conditions for the development of technical specialty students should be studied in accordance with the new requirements of the time. An important place is given to the professional training

of the corresponding teaching staff, the material and technical support of the educational process and the psychological and pedagogical aspect in the educational space of the educational institution.

The study of dyssynchrony in the mental development of students examines the totality of the advancing or normal development and also mental development barriers that affect the success of the educational activities of students who determine the psychological factors of overcoming the dyssynchrony of mental development.

Conclusions

High rates and qualitative changes in scientific and technological progress, and the introduction of digital technologies require the formation of new competencies of engineers. The system of higher professional education has special requirements for training creative professionals who will be able to independently manage the production process, including in remote mode.

The educational environment of an educational institution should develop in the direction of more flexible satisfaction of the production needs, and be proactive. Particular attention should be paid to the psychological and pedagogical aspect based on the use of research, in particular, studying the conditions for overcoming the dyssynchrony of the mental development of technical specialty students.

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References

Ashrapova, A., Litvinenko, E., & Shakirova, D. (2019). Language identity and its context policies. *Utopía y praxis latinoamericana: revista internacional de filosofía iberoamericana y teoría social*, (5), 44-50.

Ganieva, G. R., Garaeva, R. S., & Vasiljeva, A. A. (2013, September). A role of foreign languages in training modern engineers. In *2013 International Conference on Interactive Collaborative Learning (ICL)* (pp. 393-395). IEEE.

Israfilova, G.Yu. (2014). Psychological and pedagogical support of gifted technical specialty students. "*Bulletin of Kazan Technological University.*" - *Kazan,15*(17), 424–430

Liliya, S., Jamila, M., Alloghani, M., & Gulnara, G. (2019, October). Challenges for Language Education within the Industry 4.0: Case of California. In *2019 12th International Conference on Developments in eSystems Engineering (DeSE)* (pp. 225-230). IEEE.

Mamedova, R.M. (2017). Pedagogical conditions as a reflection of the educational environment. Education and science in modern realities: materials of the International scientific and practical conference (Cheboksary, June 4, 2017). In 2 volumes, 1 / Editorial Board: O.N. Shirokov [et al.]. Cheboksary: Central nervous system "Interactive plus", 186-188.

Osipov, P.N., Kraisman, N.V., Suntsova, M.S., & Fakhretdinova G.N. (2020). The influence of the fourth industrial revolution on engineering education (review of international conferences). *Sustainable Development Management, 1*(26), 90-103.

Petrov, A. (1916). General theory of relativity. *Annalen der Physik*, *49*(7), 769–822.

Polyakova, T.Yu. (2019). Modern trends in the development of engineering educators. *Higher Education in Russia, 28*(12), 132-140.

Shageeva, F. T., Erova, D. R., Gorordetskaya, I. M., Kraysman, N. V., & Prikhodko, L. V. (2017, September). Training the achievement-oriented engineers for the global business environment. In *International Conference on Interactive Collaborative Learning* (pp. 343-348). Springer, Cham.

Sibgatullina, I.F., & Israfilova, G.Yu. (2013). Dyssynchrony of the mental development of technical specialty students. Materialy IX Miądzynarodowej naukowi-praktycznej konferencji „Wyksztalcenie i nauka bez granic -" *Volume 34.Psychologia i socjologia. Politologija.: Przemyśl. Naukaistudia, 80*, 15-17.

Slavina, L., Mustafina, L., Ganieva, G., Petrov, E., & Aydaeva, G. The Regional Language in Education: The Case of the Republic of Tatarstan, Russian Federation. *Advances in Education Sciences Volume 13*, 116-122.

Slavina, L., Mustafina, L., Ganieva, G., Petrov, E., & Aydaeva, G. (2016). The Regional Language in Education: The Case of the Republic of Tatarstan, Russian Federation. *Advances in Education Sciences Volume 13*, 116-122.

Valeeva, E., & Ziyatdinova. Yu.N. (2018). The European Higher Education Area: Development Trends. *Management of Sustainable Development, 6*, 78-83.

Verbitsky, A. A. (2019). Digital Learning: Problems, Risks and Prospects [Electronic resource]. *Electronic scientific journalism" Homo Cyberus*, (1), 6.

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Russian Students' Ideas about Scientific Tourism Concept

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Abstract

The article analyzes the current state of the organization of scientific tourism for students in the Russian Federation as an actual form of academic and scientific communication. One of the types of tourism that still remains insufficiently studied and developed is "scientific tourism", particularly relevant is the study of ideas about this concept and exploring the relationship of students to this type of tourist activity in the Russian Federation. The authors propose to compare different approaches to the scientific study of the phenomenon of tourism to University students. The study is based on the methods of comparative, systemic analysis and empirical data obtained through the use of the author's questionnaire technique. The authors found that visits to various University scientific-educational centers and visits to cultural and historical objects (in the context of scientific tourism for students) helps to increase the interest of young people in scientific pursuits and self-actualization in science, which leads to the active development of research activities. In this article the analysis of ideas about the concept of "scientific tourism" students studying at the Kazan Federal University (Russia). To define the idea of scientific tourism students had used the questionnaire and compared the idea of this concept and the attitude of the two groups of students. The first group is actively involved in research activities students. The second group is not involved in science students. A study conducted by the authors showed that the scientific tourism and tourist guiding students in scientific space combines knowledge of scientific advances and expanding horizons about the relationship of historical and cultural heritage with scientific research. The results of the authors presented in the article will be useful in the organization of scientific tourism in the student's environment as a means of communication.

Keywords: scientific tourism, world tourism, tourism activities, scientific activities, student, student environment, teaching, communication.

Introduction

The world today in the new socio-economic and socio-cultural environment makes new demands among students for scientific tourism as new forms of communication between students of different universities, not only in Russia but also at the international level of student mobility.

For modern Russia and the former Soviet republics, the strategic goal of region development is the increased level of competitiveness in the field of education and standard of living of teachers and students.

Entering of Russian universities into the world educational space requires a change in attitude to the problems of scientific tourism, both among teachers and students as subjects of communication and effective communication. The solution to this problem requires changing attitudes towards issues of scientific tourism as new forms of student mobility and communication.

Student scientific tourism in our understanding is a complex of activities of higher education institutions how new forms of work with students on the design of open scientific and educational space. Modern students today, the students choose the program of student mobility and exchange, which can be

implemented in particular, and the process of scientific tourism. Not less important form of familiarizing students to scientific tourism is the travel of students in the universities of different countries to participate in scientific conferences, forums, symposiums, congresses and educational events.

Analysis of scientific literature on the study of problems of scientific tourism allowed us to identify the contradiction between the increasing demand of the student youth in it and lack of theoretical justification of its possibilities, conditions and risks. Of interest is the treatment of the problems of scientific tourism as a sociocultural phenomenon, aimed at increasing its role in the formation of value orientations and the search for new forms of communication among students.

This article presents the concept of "scientific tourism" as a type of tourism, which is based on the involvement of the scientific community and students to science. In some studies the scientific tourism is considered as a type or component of nature tourism (Laarman & Perdue, 1989). In other works the scientific tourism is considered as part of (or form) of cultural tourism with special values, travel in the context of scientific tourism provides the opportunity to evaluate the research results, a scientific perspective, the communication with different students and researchers at new locations (Cynarski & Ďuriček, 2014). Also "scientific tourism" is presented as an educational type of youth tourism, with the aim of obtaining new knowledge and skills (Ilyina & Mieczkowski, 1992).

In General, under the scientific tourism is defined as "the type of tourism whose purpose is the participation in certain research programs, without extracting the tourist material benefits" (Holodilina, 2011). Scientific tourism is seen as equal to research activity. This kind of tourism involves a journey aimed at making a specific research contribution of tourists in a specific area of science. Scientific or educational tourism involves travel for the purpose of conducting research, training or professional development (Ivanova, 2012). The basis of scientific tourism is the transfer of scientific knowledge, concentrated in the relationship between visitors (tourists) and local (indigenous) inhabitants (Slocum et al., 2015).

Tourist support of student's youth in conducting scientific and practical activities consistent with the objectives of scientific tourism are presented Holodilina (2012), for students is relevant participation in scientific tourism in the context of practical and academic studies and the history of scientific research and historical-cultural heritage (Holodilina, 2012).

Based on these ideas and concepts about the scientific tourism, reveals an important current objective in the training of future researchers. Scientific tourism contributes to the expansion of scientific Outlook of students attending scientific meetings. The importance of highlighting a separate category"Scientific tourism" represents the fact that supporting of tourism through the science, involves the participation in scientific communities. Scientific tourism as a special type of tourism acts not only as a recreational activity, but as a direction related to obtaining knowledge and scientific result.

Thus, it revealed the need for the provision of ideas about scientific tourism students expressed the need for more efficient use of travel support scientific workshops, which is important for the formation of students' scientific and educational environment and new forms of cooperation. The prospect of scientific tourism developing on the basis of Kazan Federal University, therefore, corresponds to the main task: supporting the future researchers, opening the human potential in science and commercialization the products of scientific activity in the Russian Federation.

Methods

This study is a pilot or primary and, in fact, comes down to getting new, fresh data on scientific tourism and its real manifestation in the lives of those students who focused on science.

The main research question was: What is the scientific tourism as a concept for students in university? An additional objective of the study was to determine the relationship for this type of tourism among students.

Data source: the study involved 74 students of Kazan Federal University, studying at the last courses of undergraduate in various fields. The whole sample was divided into two groups. Group 1 consisted of students (36 individuals) actively participating in research activities and engaged in scientific activities. Group 2 were students (38 persons) not engaged in scientific activities.

In this study we applied the method of comparative survey. The questionnaire used in the survey of students included 10 questions, some of which were of the open type and the part was made dichotomous choice between the answers "Yes" or "No".

The survey questions are:

1. Are you involved in research activities in the framework of learning process?
2. Do you participate in any scientific, scientific-technical and scientific-practical events?
3. Are your studies presented in any scientific collections, journals and abstracts of conferences?
4. Have you encountered the concept of "scientific tourism"?
5. What, in your opinion, does the concept of "scientific tourism" mean?
6. What is the purpose of scientific tours?
7. Where would you go as a scientific tourist traveling around the world (name 2 countries and 2 scientific events)?
8. Where would you go as a scientific tourist on the territory of the Russian Federation (name 2 specific places and 2 scientific events)?
9. What would you advise to visit as part of scientific tourism in the Republic of Tatarstan?
10. What are the main areas of interest for scientific tourism, in your opinion, presented at Kazan Federal University?

Results and Discussion

Students' answers to the first three questions of the questionnaire make up a block of indicators of student involvement in research activities. The results showed that out of 74 people, 36 students consider themselves involved in the development of science at Kazan Federal University (Figure 1). Of the total study sample, 38 people are not interested in science and do not participate in any scientific activities.

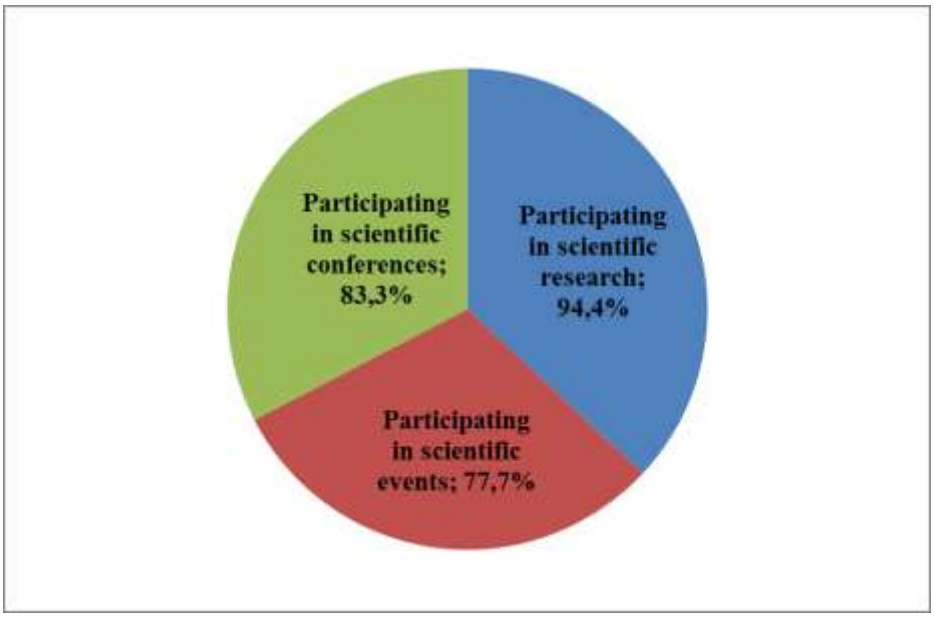

Figure 1: *The percentage of involved in research activities students in group № 1.*

The answers of all students to questions 4, 5, and 6 were distributed and grouped by topics regarding the representation of the concept of "scientific tourism". These answers represent a generalized view of students of the two surveyed groups about scientific tourism (table 1). According to the results obtained, those students who are engaged in scientific and research activities are more aware of the concept of "scientific tourism" than those students who are not interested in science. Thus, students believe that scientific tourism is travel combined with participation in scientific events and research, as well as visits to

scientific and educational centers and universities. Making scientific tours, students of the first group assume that their primary goal is the accumulation of scientific knowledge. These results are consistent with the main motives of students regarding their participation in research activities in conjunction with tourist trips, for students it is important to benefit the future profession and deepen knowledge (Chernysheva, 2017).

Students of the second group are more motivated to relax, and scientific tourism, first of all, is associated with the possibility of entertainment during their participation in scientific events.

Table 1. *Results of representation of "scientific tourism" concept among students*

Results of group № 1			**Results of group № 2**		
Students were faced with the concept of "scientific tourism"	Students were not faced with the concept of "scientific tourism"		Students were faced with the concept of "scientific tourism"	Students were not faced with the concept of "scientific tourism"	
69,4 %	**30,6%**		**39,5%**	**60,5%**	
The meaning of scientific tourism concept					
Traveling and participating in scientific events	Visiting to scientific centers and Universities	Traveling and participating in scientific research	Resting and participating in scientific events	Traveling and participating in scientific events	Visiting to scientific centers and Universities
44,4%	**30,6%**	**25%**	**55,2%**	**26,3%**	**18,5%**
The aim of scientific tourism					
Accumulation of scientific knowledge	Participating in scientific research	Communication with scientific environment	Entertainment	Participating in scientific research	Communication with scientific environment
47,2%	**41,6%**	**11,2%**	**57,9%**	**36,8%**	**5,3%**

The answers of all students to 7,8,9 and 10 questions were distributed and grouped in the areas of scientific tourism of interest to them in the world, the Russian Federation, the Republic of Tatarstan (table 2). The items in the table are ranked according to the content of students' answers, from the most common to the least presented in the answers. The most popular answer was the United States, as one of the largest centers of research activity. Today, the largest universities and research and educational centers in the United States and European countries provide the opportunity to implement scientific tourism (Tovmasyan & Tovmasyan, 2018).

However, students of the first group, in contrast to students who are not engaged in science, are more aware of other large and significant scientific platforms, both in the world and in Russia. The interest of students of the first group is focused on participation in conferences, research programs and training programs.

The second group of students stereotypically marked conferences as the main scientific event. Also, in the representations of the second group of students, the scientific platform of Kazan Federal University and the field of science, which would be interesting to scientific tourists from other countries, are less represented. Students from group No. 2 would be more willing to travel to Latin America and Italy for the purpose of recreation and entertainment.

Table 2. *Results of representation of international and Russian "scientific tourism" directions among students*

Results of group № 1		**Results of group № 2**	
International "scientific tourism"			
Places	*Events*	*Places*	*Events*
1. The United States of America (USA), 2. The United Kingdom of Great Britain and Northern Ireland (UK), 3. Germany, 4. Australia	1. Conferences, 2. Master classes, 3. Research programs, 4. Congresses, 5. Training program	1. The United States of America (USA) 2. Latin American Countries 3. Italy	1. Conferences, 2. Training programs
Russian "scientific tourism"			
Places	*Events*	*Places*	*Events*
1. Moscow 2. Saint-Petersburg 3. Kazan 4. Tomsk 5. The Russian Far East 6. Kaliningrad	1. Conferences, 2. Research programs, 3. Training programs 4. Guided tour and excursions	1. Moscow 2. Saint-Petersburg	1. Conferences, 2. Master classes
"Scientific tourism" in Republic of Tatarstan			
Places	*Events*	Areas of *"scientific tourism" in Kazan Federal University*	*Places*	*Events*	Areas of *"scientific tourism" in Kazan Federal University*
1. Kazan Federal University 2. Innopolis 3. Elabuga Institute of KFU	1. Research program, 2. Training program 3. Guided tour and excursions	1. Maths 2. Biology and medicine 3. History and Culture 4. Pedagogy and psychology	1. Kazan Federal University	1. Conferences	1. Biology 2. History 3. Psychology

Based on the content and the nature of "scientific tourism", summarizing the results obtained in this pilot study and to A. Benson (2005), we can distinguish educational, scientific and research tasks of this type of tourism:

Educational challenges inclusion of scientific and tourism activity in the continuous process of training of graduate students through their visits to universities and colleges around the world.

Scientific tasks associated with the expansion of knowledge on world trends in science.

Research tasks associated with the searching for new scientific goals, directions, presenting their research results, as well as the possibility of cooperation and exchanging of experience.

Summary

Summarizing the existing research on the direction of scientific tourism and the results of a survey of students regarding the concepts of "scientific tourism", you can make the following conclusions:

1. Scientific tourism and tourist guiding students in scientific space combines knowledge of scientific advances and expanding horizons about the relationship of historical and cultural heritage with scientific research.

2. Students engaged in scientific activities, we believe that scientific tourism is travel in conjunction with participation in scientific events and research, as well as visits to scientific and educational centers and universities.

3. Active participation in science and participation in scientific events are of interest to the scientific and tourist activities. Students are motivated to achieve the accumulation of scientific knowledge through scientific tourism.

Conclusions

In general, scientific tourism can be considered as a special type of tourism, the most important feature of which is the tourist's direct attitude to science in the process of a tourist trip. Thus, scientific tourism can be represented as a tourist type of activity carried out in combination with scientific research or scientific task. The variety of locations and objects, that have scientific value or significance in organizing and guiding scientific research, establishes a scientific heritage. These locations and objects determine the involvement in scientific activities and attractiveness for tourists.

Consequently, scientific activity implies the need to exchanging the overseas and Russian researchers' experience. The development of scientific tourism highlights the relevance for young people to be interested in the various educational programs and scientific directions. Students are still not sufficiently aware of opportunities of scientific tourism. This research has revealed the importance of creating and organizing research tours for University students.

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References

Benson, A. (2005). Research Tourism-Professional travel for useful discoveries. *In M. Novelli (Ed.), Niche Tourism Oxford: Elsevier*, 133-144.

Cynarski, W.J., & Ďuriček, M. (2014). Scientific tourism. Self-realisation, dialogue-cultural and sacral dimensions. *Ido Movement for Culture. Journal of Martial Arts Anthropology*, *14*(4), 39-45.

Holodilina, Yu.Ye. (2011). Theoretical aspects of development scientific tourism in region. *Vestnik of the Orenburg State University, 13*, 500-505.

Holodilina, Yu.Ye. (2012). Resource capacity of the region as basis of development of scientific tourism. *Vestnik of the Orenburg State University*, *8*, 169-173.

Ilyina, L., & Mieczkowski, Z. (1992). Developing scientific tourism in Russia. *Tourism Management, 12,* 327-331.

Ivanova, R.N. (2012). Content and objects of the scientific tourism in Yakutia. *Vestnik of North-Eastern Federal University, 9*(2), 73-77.

Laarman, J.G., Perdue, R.R. (1989). Science tourism in Costa Rica. *Annals of Tourism Research*, *16*(2), 205-215.

Slocum, S., Kline, C., & Holden, A. (ed.). (2015). Scientific Tourism: Researchers as Travellers. *Routledge*.

Tovmasyan, G., & Tovmasyan, R. (2018). Scientific Tourism Development Bases in Armenia. *SocioEconomic Challenges (SEC)*, *1*(V.2), 85-90.

Chernysheva, T.L. (2017). Scientific tourism of universities students' associations as the way of activation of the country scientific potential. *Business. Education. Law. Bulletin of Volgograd Business Institute*, *1*(38), 268–275.

Teaching Russian as a Foreign Language in the Turkmen Audience in the Distance Learning Condition

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Abstract

The authors consider the experience of using distance learning in teaching Russian as a foreign language for a Turkmen audience, its advantages and disadvantages in order to effectively implement the potential of modern educational technologies and their further improvement. Particular attention in the work is given to both the problems that the students faced in the transition to a new training format for them, as well as to the ways of solving them, inherent in the Turkmen group. The article describes the features of the approach to learning the language, due to the ethnocultural and mental features of this mono-ethnic audience. This article is relevant due to the need to constantly search for effective technologies for teaching Russian as a foreign language, to improve teaching methods, as well as to solve modern challenges related to COVID-19 and faced not only by the educational systems in Russia, but also in other countries affected by the pandemic. Based on observations and analysis of the experience of distance learning in Russian as a foreign language in Turkmen groups, the authors come to the conclusion that it is possible to introduce distance learning as part of full-time education and offer the most effective, in their opinion, forms of using distance technologies in the educational process.

Keywords: Russian as a foreign language, distance learning technology, distance learning, Turkmen students.

Introduction

A lot of Turkmen students study at the Russian universities. The diploma obtained in Russia is attractive due to a number of reasons: Russian education is considered to be of high quality and affordable, and a tendency to increase the role of bilingualism and the return of the Russian language to the cultural, business and educational environment of Turkmen society allows the graduates of Russian universities counting on successful employment in their homeland. The students from Turkmenistan also choose Kazan (Volga) Federal University because of the historically developed multicultural environment and multilingualism in the capital of Tatarstan (Sultan et al., 2019).

A prerequisite for the successful training of future specialists is the mastery of the Russian language at the level sufficient to form professional competencies and acquire the necessary knowledge and skills. But it is no secret that it is Turkmen students who often experience difficulties in language training, especially in the groups of non-philologists. This is due to reasons of both linguistic and extralinguistic nature. If the former are explained by linguistic differences, the latter is due to the ethnocultural and mental features of the Turkmen audience.

In our opinion, these difficulties were most clearly manifested during transition to distance learning, which became a forced non-alternative technology in the second semester of the 2019/2020 academic year.

The article is aimed at considering the advantages and disadvantages of distance learning of the Russian language for the Turkmen student audience in order to effectively implement the potential of using these technologies. This article is relevant due to the need for a constant search for effective technologies for teaching Russian as a foreign language, improving teaching methods, as well as solving modern challenges to education related to COVID-19 pandemic.

Methods

The study includes empirical methods of observation, study of experience, survey, as well as the analysis method.

Results and Discussion

Article 16 of the Federal Law "On Education in the Russian Federation" (No. 273-ФЗ as amended dated 24.04.2020) defines distance educational technologies as "implemented mainly with the use of information and telecommunication networks with indirect (at a distance) interaction between students and teachers (Federal Law of December 29, 2012)".

In his work, E.S. Polat (with co-authors) also emphasizes that distance learning is an educational process organized on specific topics and subjects, involving an active information exchange between the students and the teacher, as well as between the students themselves, which uses modern means of new information technologies (audio-visual funds, personal computers, telecommunications) to the maximum extent (Polat, 1998).

In our study, we consider distance learning as a component of full-time education, based on the fact that some conditions should be created for the functioning of electronic information and educational environment for the implementation of educational programs using exclusively e-learning, distance educational technologies in the organizations, which ensures that the students learn the educational programs in full regardless of their location.

We analyzed the experience of conducting remote classes in Russian as a foreign language in the Turkmen groups of freshmen non-philologists of one of the KFU institutes. Classes were held on the Microsoft Teams platform.

Literally, the very first distance learning revealed a number of technical problems - from the inability to use the platform to the lack of necessary high-tech devices (phones, tablets, computers) or their malfunctions. Some of these problems were overcome during training, and some of them remained unresolved for objective reasons. Given that the classes were conducted under the conditions of a self-isolation mode introduced in Tatarstan, the students did not have the opportunity to involve anyone in solving the problems, everyone coped with the situation as much as possible. The tasks of mastering Microsoft Teams had to be solved during training.

It is worth noting that Turkmen students with different levels of Russian language enter the first university course. As a rule, graduates of Russian schools and city schools, where Russian is taught from the first grade, quickly adapt to the linguistic and cultural environment. Graduates of provincial schools have more difficulties, they are most often unable to maintain communication, as well as have a low level of basic knowledge.

It should also be noted that there are cases when the students are grouped according to nationality. Thus, in our case, two groups turned out to be purely Turkmen. Compared with the students studying in mixed groups, the students of "Turkmen" groups has much more slow progress in mastering the Russian language. In addition, the leading position of students, speaking a lot and quickly, but often incorrectly, remains in such groups. Even while studying in Turkmenistan, they formed speech errors and a desire for fluent reading and verbal communication, which is perceived by the students themselves as a sign of good language proficiency level.

The transition to learning in a remote environment, involving elements of individual work with the teacher, the inability to hide behind the "chorus of voices", an increase in the share of independent work in the self-isolation conditions has become a serious stress for many of the Turkmen students. And some of them found the easiest way out of this stress - skipping classes using a variety of reasons: "idle" phones, "bad" Internet, "interruptions" in the work of the Microsoft Teams platform itself. For the sake of justice, we should note that there were technical failures, but still their number is was so significant and the nature was not so critical.

The very first classes with the students who had no problems with the connection and equipment began to resemble the children's game "Find a treasure" in many respects: they looked for the task tabs and training materials files, learned to mute the microphone and not to speak in chorus, as well as attach the completed tasks. As the platform gradually developed, class attendance began to recover.

And then small Turkmen "life hacks" began to be applied.

Teachers working with the Turkmen student audience know that there is a high level of collectivism and mutual assistance in such groups. To help a classmate, albeit incorrectly, is the noble and natural impulse of every Turkmen student. If someone is the first to complete his/her homework with errors, you can be sure that these errors are multiplied to most of the group. With distance learning, the students went further. There were repeated attempts to submit the same work on behalf of different students.

During the oral survey, the easiest way to get away from the answer was to refer to the poor communication quality. Moreover, some students have discovered the opportunity to join the meeting and have never respond to a teacher's question. Maybe the problem could be solved by the mandatory use of webcams, but in the context of an emergency transition to online training, the technical equipment of the process was taken by default as it was at that time: with poorly functioning microphones, old phones, etc.

The insufficient quality of the audio stream during the lessons made it difficult to complete a number of tasks: reading dialogs by roles, phonetic exercises. Inevitable temporary losses due to connecting/disconnecting listeners, repetitions of vaguely heard phrases reduced the attractiveness of discussions. As a result, the volume of independent work of students has increased.

At the same time, a number of positive aspects emerged that, in our opinion, should be taken into account at further integration of distance learning technologies into full-time studies.

Firstly, it should be noted greater psychological comfort in comparison with the classroom studies for students with poor language training. It is necessary to clarify that many Turkmen students are modest and shy, they do not ask questions in the classroom, do not say that they do not understand something, afraid to look worse than others or be criticized. In a large audience, where there are always excellent and good students vying to give an answer, such students prefer to stay unnoticed, they are very difficult to talk about. In a situation where everyone is "alone" with a teacher, these students feel more relaxed and are not afraid to make mistakes, their participation in classes is becoming more active. Other teachers share this observation. So, in an interview with "Kommersant" newspaper, Aleksandr Fokin, assistant professor of the Russian History Department at the Tyumen State University, noted: "The main plus is that the gadget screen removes the psychological block for many students. They are more likely to participate in the discussion. Those who sat in the audience and preferred to remain silent yesterday, are active now" (https://www.kommersant.ru).

In addition, the students who were previously embarrassed to turn to the teacher with their questions, have the opportunity to do this in an individual chat on a learning platform now. In Turkmen groups, the student activity increased several times.

In our opinion, the classes on expressive reading of verses turned out to be interesting due to the removal of psychological clamp. While it is difficult for Turkmen students to avoid the influence of the phonetic system of their native language in oral speech, and the presence of a large audience often negates attempts to achieve the correct intonation, everyone tried to listen carefully and repeat, and then read Pushkin's, Blok's poems independently, paying attention precisely to the sound of poetic speech, to the intonation in the virtual classroom. Thus, we can say that distance technologies are successfully combined with the use of conscious learning methods (Miftakhova et al., 2019).

Secondly, conducting online classes using computer gives the teacher the opportunity to use, if necessary, additional personal information sources - audio, video and text files, - quickly use the Internet resources (for example, quickly pick up an illustration, if it is necessary to explain the unfamiliar word).

Thirdly, the group gets access to a common interactive whiteboard. The students also have the opportunity to upload their visual and audio materials selected according to the teacher's instructions, as well as write answers in the chat during the lesson. All these things make the lesson more interesting and visual.

However, the specific nature of language learning lies in the fact that distance technologies cannot completely replace the teacher's live communication with students. With great information content, distance learning does not, however, give students the opportunity to achieve the required level of communicative competence.

Indeed, it is possible to repeatedly listen to the audio file with the task of phonetics, but there is no way to listen to live colloquial speech, enter into a full dialogue or polylogue. This is especially true for

Turkmen students studying in monogroups, because their circle of native speakers of the Russian language has narrowed to teachers. This means a step back in studying the Russian language for the students with poor communication skills.

It is possible to use numerous information resources, but this requires students to have a high degree of self-organization, as well as the ability to analyze and synthesize the information received. For the majority of Turkmen students, these skills are not their strengths, as the teachers working with such audiences - L.S. Vasyukovich (International University "MITSO", Belarus) (Vasukovich, 2018), N.G. Glebova (Nizhny Novgorod State Agricultural Academy) (Glebova, 2016) et al. - have noted more than once.

In a survey of Turkmen first-year students of the KFU, 90% said that they prefer live classes to remote ones. Of course, it should be taken into account that such training only seems undemanding to the conditions in which the student is. In fact, everything is important: the quality of the Internet connection, and the quality of the device itself, through which the student goes online, as well as the opportunity to retire in a quiet place, since even 3-4 students studying remotely simultaneously create serious obstacles to each other. And almost all Turkmen students live in the dormitories.

It should be noted that access to high-tech equipment is different for the students living at home and students living in a dormitory. And the level of knowledge of modern technologies is also different. Thus, at the beginning of studies at the university in Turkmen groups, only ten out of fifty students had their e-mail. In our opinion, it is worth thinking about a preliminary seminar or training that gives such students basic ideas about the use of distance technologies in their study, introducing them to the educational platform, and the possibilities of interactive learning (Varlamova et al., 2016).

However, many Russian students are now skeptical of distance learning. Thus, one of the students of the Ural Federal University noted in an interview given to "Kommersant" that the teachers also have constant problems with the Microsoft Teams platform, which leads to an increase in homework in order to somehow compensate for class breakdowns. “In the end”, the girl complains, “you have to deal with it by yourself, but there is almost no free literature in our field” (Rebysheva & Vasilchenko, 2015).

This idea is continued by Dmitry Nechiporuk, senior researcher at the Network Research Center "Man, Nature, Technology" of the Tyumen State University: “After the audience was closed, it turned out that it is not possible to quickly and massively switch to this format. Without the methodological assistance of universities, a lot of student will not master Zoom or Skype” (https://www.kommersant.ru).

Moreover, the idea of a complete transition to the distance learning format, specified in March this year, has been criticized more than once from the highest power stands in our country.

Summary

But, in our opinion, it’s still worthwhile to use some opportunities of distance technologies as auxiliary in full-time education. Thus, it is advisable to introduce it into the educational process for individual work with students, for example, advising. At the same time, the personal time of students and teachers should not be infringed.

It seems convenient to us to carry out current control in the form of testing on the Microsoft Teams platform. The time spent by the teacher on its preparation is compensated by saving time on the test, and the students have the opportunity to immediately see their results.

The remote format for presenting presentations, reports and other written works, providing educational text and audio materials is also convenient and already familiar to most students and teachers (Bochina et al., 2014). With a certain user training, it will be in demand among Turkmen students.

Conclusions

Foreign language teaching is a multidimensional pedagogical process that requires the university and teachers to constantly improve, choose the most effective technologies and effective teaching methods. Our demand and attractiveness for students depends on how successfully we implement this. In 2019, the President of Turkmenistan, Gurbanguly Berdymukhamedov signed a decree “On Approval of the Recognition Procedure of the Certificates of Higher and Secondary Special Education Issued in Foreign Countries in Turkmenistan” (A new procedure for studying abroad and obtaining a diploma in Turkmenportal, 2020), which limits the number of foreign universities whose diplomas will be recognized in

Turkmenistan. The list will be based on the ratings published by AcademicRanking of World Universities, QS World University Rankings and The Times Higher Education World University Rankings. The document also emphasizes that the study in the foreign universities should be full-time. Kazan (Volga) Federal University is currently in this list.

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References

A new procedure for studying abroad and obtaining a diploma in Turkmenportal. (2020). 23 April, 2019, available at: www.turkmenportal.com/tm/blog/18641/, accessed: 27 May 2020.

Bochina, T., Ageeva, J., Vlasicheva, (2014). Multimedia presentation as a strategy of teaching speaking. *INTED2014, Proceedings 8th International Technology, Education and Development Conference March 10th-12th,* 7661-7669.

Difficulties at a distance. (2020). *Kommersant*, 28 March, 2020, avialable at: https://www.kommersant.ru/doc/4307297/

Federal Law of December 29, (2012). N 273-ФЗ (as amended on 04.24.2020) "On education in the Russian Federation", available at: www.pravo.gov.ru

Glebova, N.G. (2016). Modern methods of Russian language teaching of the Turkmenian group of preliminary Department of NNSAA", *Philological science*, *8-1,* 128-132.

Miftakhova, A.N, Sadykova, I.A, & Iliasova, S.V. (2019). Teaching expressive reading as one of the methods of conscious learning. *[La ense?anza de la lectura expresiva como uno de los m?todos de aprendizaje consciente], 35*(22), 978-993.

Polat, E.S. (1998). *Distance Learning: Study Guide.* 192 p.

Rebysheva, L.V., & Vasilchenko, E.V. (2015). Problems of distance education at the present stage", *Modern problems of science and education*, *2*(2).

Sultan, D.S., Bochina, T.G., Agmanova, A.Ye., & Zhuravleva Ye.A. (2019). Tatar Language: tendencies of conservation and development in polyetnic society [Case Study of Russia and Kazakhstan]. 8(7), 81–92,.

Varlamova, M.Yu., Bochina, T.G., & Miftakhova, A.N. (2016). Interactivity in teaching a foreign language. *Journal of Language and Literature*, 7(3), 190-194.

Vasukovich, L.S. (2018). Teaching Russian as a foreign language (RFL) in mononational Turkmen audience. *Higher school: problems and prospects: materials of the 13th International scientific conference*, *pt, 1*, 198-201.

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Effect of Kinetic Control Retraining on Chronic Low Back Pain with Radiculopathy. A Randomizied Controlled Trial Study

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Abstract

Background & Aim: Low back pain (LBP) is a global well documented health problem. It is the primary reason for seeing doctors and jobs sick leaves. The aim of the study was to identify the effect of Kinetic control retraining on the chronic LBP with radiculopathy. Study design: Single blinded randomized controlled trial. Methods:Forty patients from both sexes diagnosed of having chronic LBP with radiculopathy (age from 25-50 years) participated in the study. The patients were randomly allocated into two equal groups: Group (A) (study group) received a selected physical therapy program plus kinetic control retraining for 8 weeks (n=20). Group (B) (control group) received the selected physical therapy program only for 8 weeks (n=20). All the patients were evaluatedpre and post treatment, using PainDETECT questionnaire (PD-Q) for neuropathic pain,Visual Analogue Scale (VAS) for pain intensity, Oswestry Disability Index (ODI) for disability, and inclinometer for trunk range of motion (ROM). Results: Comparing both groups post treatment showed that there were statistically significant improvements in neuropathic pain, pain intensity,disability and trunk flexion ROM (P = 0.0001) in favour of group (A). However, there were non-significant differences regarding trunk extension and lateral bending ROMs between both groups post treatment (P > 0.05).Conclusion: Kinetic control retraining plus selected physical therapy program yieldgreaterimprovement in neuropathic pain, pain intensity, disability and trunk flexion ROM in patients having chronic LBP with radiculopathy.

Keywords: Low back pain, Radiculopathy, Kinetic control, Pain DETECT questionnaire.

Introduction

Low back pain (LBP) is a well-known medical conditionall over the world. It is the primary reason for activity restrictions, seeing doctors and jobs sick leaves throughout the world, resulting in a great economic burden on the individuals, families and health insurance systems **[1,2,3].** Specific LBPconstitutes only 15% of the totalcases of back pain. About 50% of the specific LBP are caused by prolapsed inter-vertebral disc, where pressure on the nerve roots by the protruded disc causes inflammation, pain and radiculopathy (pain along the nerve course because of a problem at or near to the nerve root) **[4].**

The health care systems seek to diminish LBP prevalence by many ways including surgeries like osteotomies, internal fixations and discectomy, as well as physiotherapy rehabilitation like McKenzie approach **[5]**, therapeutic modalities **[6,7,8,9]** and the Motor Control approach **[10,11,12]**.

The kinetic control involves performance of movement with optimal interaction between neuromuscular control (sensory feedback, central nervous system processing and motor coordination) and physiological stresses **[10].** The action should be performed with appropriate intensity and timing. The movement system requires coordination between different body systems including neural, myofascial, articular and connective tissue systems in addition to central nervous system, psychosocial and physiological factors. Any problem in one or more of those systems results in pain, dysfunction and compromised life activities **[11].** Reduction of functional lumbar mobility and returning to daily living activities occur as a result of chronic LBP. Kinetic control training in combination with lumbar stabilization exercises was found to improve the functional lumbar mobility and the return to perform the daily living activities in patients with chronic LBP **[13] .**

There is also little literature with no clear results about the effect of kinetic control retraining on the LBP and radiculopathy **[12,14**].

Materials and Methods

Study Design

The study was designed as a single blinded randomized control trial.It was approved from the ethical committee of the Faculty of The Physical Therapy, Cairo University (no. P.T.REC/012/002259).

Participants

Forty patients suffering from chronic LBP with radiculopathy, from both sexes, participated in the study.The inclusion criteria werelumbar disc prolapse (mild to moderate posterior and postrolateral disc bulge at the levels of L4-L5/L5-S1) proven clinically by the neurological examination and MRI, age of 25-50 years, and body mass index (BMI) of less than 30 Kg/m^2.The participants were excluded if they had other causes of radiculopathy (e.g. piriformis syndrome), pain duration of less than three months, spinal tumors, lumbar instability caused by structural problem (e.g. ligament tear or spondylolythesis), history of any spinal surgery, auto-immune disorders, infection, renal problems, gynecological problems causing LBP in females (e.g. retroverted uterus or uterine congestion), psychological problems interfering with the patient understanding of the orders, or patients who did not have direction preference.Each patient signed a consent form before beginning of the treatment.

Randomization and Blindness

The patients were randomly assigned into two equal groups (A and B) using sealed envelopes. Blindness was in the form of another qualified physiotherapist who did the assessment before and after the intervention.

Interventions

Group (A) include 20 patients whoreceived a selected physical therapy program (including TENS, moist hot pack, lumbar stabilization exercises, neural glide and manipulation) plus kinetic control retraining for 8 weeks, while group (B) include 20 patients who received the selected physical therapy program only for 8 weeks.

Selected Physical Therapy Program

All patients in both groups (A and B) receiveda selected physical therapy program, in the form oftranscutaneous electrical nerve stimulation (TENS), moist heat, lumbar stabilization exercises, neural glide and lumbar manipulation, for 1 hour per session, three sessions per week, for eight weeks.For TENS application,four electrodes were applied in a cross over manner to focus the electric current on the lumbar region. The used parameters were burst mode with burst duration of 20 seconds and duration of 3 seconds between each burst, intensity of 20-50 mA (according to the patient's tolerance), and total duration of 20 minutes. For moist heat application,the therapist placed hot pack on the lumbar region of the patient for 20 minutes. For lumbar stabilization exercises,curl up (head and shoulders lifting), bridging exercise with leg elevation, and quadruped with arm and leg lift were performed with maintaining the lumbar spine neutral. Neural glide was performed for the affected nerve(s). If the sciatic nerve was affected, the therapist applied hip flexion with simultaneous dorsiflexion and planter flexion of the patient's foot. The sciatic neural glide was performed from 15^o to 90^o of hip flexion, 20-30 repetitions for 1-2 sets. If the femoral nerve was affected,

the therapist stood behind the patient, with stabilizing the pelvis by one hand and grasping the patient's leg by the other hand. Then, hip extension was applied while maintaining the knee flexed. Finally, the patient was instructedto relax and take a deep breath. The therapist then performed lumbar manipulation, in the form ofsudden low amplitude high velocity thrust counter rotation of the lower trunk on the upper trunk. **[15].**

Kinetic Control Retraining

Each patient in group (A) received kinetic control retraining 3 sessions per week, for 8 weeks. For each movement direction, specific control tests were conducted. The direction and site of the uncontrolled movement were evaluated using special tests in accordance with the pain history of the patient. The tests were chosen according to the patient's symptoms; screening of all patients was done through at least three tests in each direction according to the patient's symptoms. The aim of each test and the way of its performance were explained to each patient.

The tests of each direction of movement control included flexion movement control tests, extension movement control tests and rotation/side bending control tests. The flexion movement control tests were performed if the patient's symptoms were aggravated in the lumbar spine in addition to radiculopathy by performing flexion movements (e.g. sitting, leaning forward and grasping an object from the ground). These tests included standing trunk lean, ischial weight bearing (standing to sitting), sitting forward lean, standing bow (Forward lean), and sitting double knee extension. The extension movement control tests were performed if the patient's symptoms were aggravated in the lumbar spine in addition to radiculopathy by performing extension movements and postures. These tests included standing thoracic extension (sway), sitting thoracic extension (tilt), prone double knee bent, prone hip extension, and hip extension with knee extended from standing. Rotation/ side bending control tests were performed if the symptoms were aggravated by rotation or side bending or symptoms that appeared unilaterally while flexion or extension. Rotation control tests were divided into two groups including open chain tests and closed chain tests.

The retraining strategy was based on patient education, retrainingthe coordination of movements and musclesynergy retraining. For patient education, each patient was educated about his/her uncontrolled movements and the cause of the symptoms related to movement deficiency and the importance to stick on the training and perform the home exercises. For retraining the coordination of movements after assessing the site and direction of the uncontrolled movement, the coordination training was the test position but in training module. First, the movement was performedindividually then incorporated with other movements. Feedback could be added by own hands of the patient, a mirror or a wall. Then, the test positions were progressed to more challenging positions. For flexion control retraining, the patient was positioned in kneeling position with feet outside the bed. Then, he/she was asked to perform knees flexion over 90º with no flexion of the lumbar spine. For extension control retraining, the patient was positioned in standing with supporting the back on the wall and flexing both knees. Then, he/she was asked to perform knees extension with no extension of the lumbar spine through keeping the pelvis on the wall. For rotation/side bending control retraining, was positioned in standing with supporting the back on the wall. Then, he/she was asked to perform pelvic sliding to the right and to the left with no pelvic lifting from the wall and with no hip hiking up. In each direction of uncontrolled movement, specific muscle synergy retraining was done. For flexion uncontrolled movement, retraining was done for spinalis, multifidus, illiacus and abdominal obliques while release was done mainly for the hamstrings and rectus abdominis. For extension uncontrolled movement, retraining was done for abdominal obliques and deep gluteus maximus while release was done mainly for quadrates lumborum and superficial back extensors. For rotation/side bending uncontrolled movement, retraining was done for abdominal obliques, gluteus medius and gluteus minimus muscles while release was done mainly for quadrates lumborum, lattissmusdorsi, tensor fascia lata and piriformis muscles.The main aim is to train the muscles in a low threshold level. Each exercise was done for two consecutive minutes, 3 sessions per week (day after day), for 8 weeks. The performed exercises in the session were repeated as a home program, twice daily **[10].**

Outcome Measures

Neuropathic pain

It was assessed, using the Arabic version of Pain DETECT (PD-Q), for all patients in both groups (A and B) before and after 8 weeks of treatment. The PD-Q is highly valid and reliable questionnaire for identifying the neuropathic pain component in chronic pain patients **[16].** The questions were explained to each patient to answer them by him/her-self, within 10-15 minutes.

Pain intensity

It was assessed, using the Visual Analogue Scale (VAS), for all patients in both groups (A and B) before and after 8 weeks of treatment. The patient was asked to give a numerical value on the scale reflecting his/her pain intensity at that moment only (not the previous pain). The duration required for marking the scale ranged from 30 seconds to 2 minutes.

Disability

It was assessed, using the Arabic version of Oswestry Disability Index (ODI), for all patients in both groups (A and B) before and after 8 weeks of treatment. It comprised 10 sections; each section scored from 0 to 5 points, with the lowest score represented better health status. The questions were explained to each patient to answer them by him/her-self, within 5-10 minutes. The scores were summated, multiplied by 2 to provide a percentage of disability resulting from the chronic LBP **[17].**

Trunk range of motion (ROM)

It was assessed, using the inclinometer, for all patients in both groups (A and B) before and after 8 weeks of treatment. The inclinometer was sterilized first, using liquid alcohol, before putting it directly on the patient's back. The investigator put the inclinometer on the lumbar region (L3-L4 level). The patient was asked to move forward (for flexion ROM assessment), backward (for extension ROM assessment) and to bend to the right and to the left (for right and left bending ROM). Instructions were given for all patients to move their back only, with no substitutions from the chest or the hips.

Statistical Analysis

T-test was conducted for comparison of subject characteristics between both groups. Chi- squared test was used for comparison of sex. The normality of data was checked using Shapiro–Wilk test. Levene's test was used to check the homogeneity between groups. Mixed MANOVA was performed to compare within and between groups effects on PD-Q, VAS, ODI and trunk ROM. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Results

1. General characteristics of the patients:

Table (1) showed the subject characteristics of the study and control groups. There was no significant difference between both groups in the mean age, BMI and sex($p > 0.05$).

Table 1. *Comparison of subject characteristics between the study and control groups:*

	Mean±SD		F- value	P-value
	Study group	Control group		
Age (years)	41.7 ± 9.01	40.3 ± 8.31	0.26	0.76
BMI (kg/m²)	28.03 ± 1.7	28.16 ± 1.74	0.06	0.94
Sex				
Males/females	12/8	12/8	($\chi^2 = 0.13$)	0.71

SD, Standard deviation; χ^2, Chi squared value; p value, Probability value

2-Effect of different treatment protocols on PD-Q, VAS & ODI by mixed MANOVA:

Table (2) showed thatthere was no significant difference between both groups pre-treatment ($p > 0.05$), while there was a significant change in**PD-Q, VAS & ODI**of study group compared with that of control group post treatment ($p = 0.0001$).

Table 2. *Comparison of Effect of different treatment protocols on PD-Q, VAS & ODI between the study and control groups*

	Study group	Control group		
	Mean±SD	Mean±SD	MD	p value
PD-Q				
Pre treatment	37.15 ± 6.65	35.5 ± 9.16	1.65	0.80
Post treatment	10.6 ± 3.18	23.05 ± 6.91	-12.45	0.0001**
MD	26.55	12.45		
% of change	71.46	35.07		
	p = 0.0001	***p = 0.0001***		
VAS				
Pre treatment	7.7 ± 1.03	7.8 ± 1	-0.1	0.98
Post treatment	1.35 ± 0.48	3.4 ± 1.6	-2.05	0.0001**
MD	6.35	4.4		
% of change	82.46	56.41		
	p = 0.0001	***p = 0.0001***		
ODI				
Pre treatment	72.36 ± 14.22	71.82 ± 16.44	0.54	0.90
Post treatment	10.16 ± 2.64	48.59 ± 8.79	-38.43	0.0001**
MD	62.2	23.23		
% of change	85.95	32.34		
	p = 0.0001	***p = 0.0001***		

$\overline{X}$: Mean	**SD: Standard Deviation**	**MD: Mean difference**
p value: Probability value	**S: Significant**	**NS:Nonsignificant**

3-Effect of different treatment protocols on trunk ROM by mixed MANOVA:

Table (3) showed that there was no significant difference between both groups pre-treatment ($p > 0.05$), while there was a significant increase in trunk flexion ROM of study group compared with that of control group post treatment ($p = 0.001$). There was no significant difference in others trunk ROM between both groups post treatment ($p > 0.05$).

Table 3. *Comparison of Effect of different treatment protocols on trunk ROM between the study and control groups*

	Study group	Control group		
	Mean±SD	Mean±SD	MD	p value
Trunk flexion ROM				
Pre treatment	61.75 ± 4.06	59.8 ± 6.79	1.95	0.70
Post treatment	75.6 ± 5.1	66.8 ± 10.27	8.8	0.001*
MD	-13.85	-7		
% of change	22.42	11.7		
	p = 0.0001	***p = 0.0001***		
Trunk extension ROM				

Pre treatment	6.9 ± 3.46	8.1 ± 3.19	-1.2	0.71
Post treatment	15.15 ± 2.15	14.45 ± 3.28	0.7	0.90
MD	-8.25	-6.35		
% of change	119.56	78.39		
	p = 0.0001**	***p = 0.0001*****		
Trunk right bending ROM				
Pre treatment	12.6 ± 4.05	14.15 ± 3.29	-1.55	0.49
Post treatment	15.65 ± 2.03	16.05 ± 2.08	-0.4	0.90
MD	-3.05	-1.9		
% of change	24.2	13.42		
	p = 0.0001**	***p = 0.0001*****		
Trunk left bending ROM				
Pre treatment	13 ± 4.22	14 ± 3.09	-1	0.93
Post treatment	16.4 ± 2.16	16.45 ± 2.03	-0.05	0.99
MD	-3.4	-2.45		
% of change	26.15	17.5		
	p = 0.0001**	***p = 0.0001*****		

$\overline{X}$: Mean	**SD: Standard Deviation**	**MD: Mean difference**
p value: Probability value	**S: Significant**	**NS: Non significant**

Discussion

In the current study, both groups showed significant improvements in neuropathic pain,,pain intensity, disability and trunk flexion ROM.The results of the current study agreed with **[18]** who found by using surface EMG that lumbar stabilization exercises help in gaining endurance more than gaining strength in the lumbar multifidus, abdominal obliques and transverses abdominis. The gained endurance after the exercises provides spinal stability during movement and therefore, it is important in improving LBP.

[19] examined the response of pain, stability index and disability to lumbar stabilization exercises in chronic LBP patients, and found significant differences in all variablesfollowing the training. The significant increase of stability in the lumbar stabilization exercise group may be related to more optimalback muscles activity. **[20]** suggested that concurrent exercising ofthe spinal multifidus and the abdominal obliques(e.g. bridging with leg elevation,orquadriped with arm and leg movement while maintaining neutral spine) result in pain intensity reduction and functional stability improvement in the lumbopelvic region of chronic LBP patients.

The current study agreed with **[21]** who reported the effectiveness of neural glide in minimizing pain and increasing ROM of the hip in chronic LBP patients with sciatica. Additionally, **[22]** revealed that neural glide has a positive effect on improving functional ROM, decreasing pain and reducing disability inacute and chronic LBP patients with radiculopathy.

The current study agreed with the findings of a systematic review and meta-analysis by **[23]** that found a moderate to high quality evidence about the efficacy and safety of manipulation in reducing pain and improving function for chronic LBP patients.

In the current study, the kinetic control retraining group showed significant improvements more than the other group in disability, pain intensity, radiculopathy and trunk flexion ROM.The results of our study agreed with **[24]** who conducted a clinical practice guidelines for LBP management. The researchers stated that patient education and involvement in the treatment had high evidence in improving LBP. Also, the

combination of cognitive training and exercise therapy showed high evidence in enhancingfunctional ability and lowering pain intensity in chronic LBP patients.

In addition,the results of the current study were consistent with **[25]** who revealed that patients with LBP have altered movement strategies in the form of uncontrolled movements which cause symptoms. Kinetic control retraining helped in the modification of the strategies and exercises that changed the movement synergies had helped to reduce symptoms, disability and LBP recurrence. Patient education on how to self-manage his/her condition had beneficial effects not only on the short-term outcomes but alsoon the long-termoutcomes of the patient. Moreover, **[18]** demonstrated that low threshold activation of the core muscles (particularly abdominal obliques, transverses abdominis and lumbar multifidus) is desirablefor providingsegmental stability to the lumbar spine during the daily living activities. The researchers recommended targeting the low threshold muscle recruitment in the retraining for optimal postural stability and control.

The findings of the current study disagreed with a review by**[26]** that reported a very minimal evidence about the effectiveness of kinetic control exercises in chronic LBP. This conflict is because the researchers collected the data from very low quality studies. Also, the researchers did not specify a specific age range and did not specify if the chronic LBP combined with radiculopathy or not.

Limitations of the Study

There were no direct measures for the effect of using TENS and moist heat on the patient's outcome.

Six patients demonstrated that it takes a long time to explain the procedure first before the assessment and treatment in the Kinetic control group

Conclusion

The addition of kinetic Control retraining to selected physical therapy program for 8 weeks has a favourable effect on improving neuropathic pain, pain intensity, disability and trunk flexion ROM in patients having chronic LBP with radiculopathy.

Declaration of interests: None

Reference

1. Jay Indravadan Patel, Kumar Prem and Ravish V N. 2016. "Effect Of Mckenzie Method With Tens On Lum- Bar Radiculopat- A Randomized Controlled Trial " 3 (1): 94–99.
2. Hoy, Damian, Lyn March, Peter Brooks, Fiona Blyth, Anthony Woolf, Christopher Bain, Gail Williams, et al. 2014. "The Global Burden of Low Back Pain: Estimates from the Global Burden of Disease 2010 Study." Annals of the Rheumatic Diseases 73 (6): 968–74.
3. Tamburin, Stefano, Stefano Paolucci, Nicola Smania, and Giorgio Sandrini. 2017. "The Burden of Chronic Pain and the Role of Neurorehabilitation: Consensus Matters Where Evidence Is Lacking." Journal of Pain Research 10: 101–3.
4. Cho, S. Charles, Mark A. Ferrante, Kerry H. Levin, Robert L. Harmon, Yuen T. So, and J. Vavricek. 2010. "Utility of Electrodiagnostic Testing in Evaluating Patients with Lumbosacral Radiculopathy: An Evidence-Based Review." Muscle and Nerve vol.42 (2): 276–82.
5. Liang, Chen, Jianmin Sun, Xingang Cui, Zhensong Jiang, Wen Zhang, and Tao Li. 2016. "Spinal Sagittal Imbalance in Patients with Lumbar Disc Herniation: Its Spinopelvic Characteristics, Strength Changes of the Spinal Musculature and Natural History after Lumbar Discectomy." BMC Musculoskeletal Disorders 17 (1): 1–8.
6. Furlan, Andrea D., Judy Clarke, Rosmin Esmail, Sandra Sinclair, Emma Irvin, and Claire Bombardier. 2001. "A Critical Review of Reviews on the Treatment of Chronic Low Back Pain." Spine 26 (7): E155–62.
7. Simon, Corey B., Joseph L. Riley, Roger B. Fillingim, Mark D. Bishop, and Steven Z. George. 2015. "Age Group Comparisons of TENS Response Among Individuals With Chronic Axial Low Back Pain." The Journal of Pain 16 (12): 1268–79.
8. Poon, Tsz Hin, and Catherine Carus. 2016. "The Effectiveness of McKenzie Exercise Therapy on the Management of Chronic Low Back Pain." International Journal of Therapy and Rehabilitation 23 (9): 432–43.
9. Ebadi, Safoora, Noureddin Nakhostin Ansari, Tannaz Ahadi, Ehsan Fallah, and Bijan Forogh. 2017. "No

Immediate Analgesic Effect of Diadynamic Current in Patients with Nonspecific Low Back Pain in Comparison to TENS." Journal of Bodywork and Movement Therapies, November.
10. Comerford, Marc. and Mottram, Sarah , Kinetic Control management of uncontrolled movements 2012 . First Edit. Human Kinetics.
11. Shumway-Cook, Anne, and H. Marjorie Woollacott. 2012. Motor Control: Translating Research Into Clinical Practice. Fourth Edition, Wolters Kluwer, Lippincott Williams & Wilkins
12. Saragiotto, Bruno T, Ã Christopher G Maher, and Ã Tie. 2016a. "Motor Control Exercise for Non-Specific Low Back Pain." Spine Journal vol.41 (16): 1284–95
13. Miranda, Iã Ferreira, Catiane Souza, Alexandre Tavares Schneider, Leandro Campos Chagas, and Jefferson Fagundes Loss. 2018. "Comparison of Low Back Mobility and Stability Exercises from Pilates in Non-Specific Low Back Pain: A Study Protocol of a Randomized Controlled Trial." Complementary Therapies in Clinical Practice 31: 360–68.
14. Maher, Chris, Martin Underwood, and Rachelle Buchbinder. 2017. "Non-Specific Low Back Pain." The Lancet 389 (10070): 736–47.
15. Koes, Bart W., Maurits van Tulder, Chung-Wei Christine Lin, Luciana G. Macedo, James McAuley, and Chris Maher. 2010. "An Updated Overview of Clinical Guidelines for the Management of Non-Specific Low Back Pain in Primary Care." European Spine Journal 19 (12): 2075–94.
16. Abu-shaheen, Amani, Shehu Yousef, Muhammad Riaz, Abdullah Nofal, Isamme Alfayyad, Sarfaraz Khan, and Humariya Heena. 2018. "Testing the Validity and Reliability of the Arabic Version of the PainDETECT Questionnaire in the Assessment of Neuropathic Pain" 970: 1–13.
17. Algarni, A S, S Ghorbel, J G Jones, and M Guermazi. 2014. "Validation of an Arabic Version of the Oswestry Index in Saudi Arabia." Annals of Physical and Rehabilitation Medicine 57 (9–10): 653–63.
18. Barr, Karen P., Leah G. Concannon, and Mark A. Harrast. 2016. Chapter 33 (Chronic Low Back Pain). Braddom's Physical Medicine and Rehabilitation. Fifth Edition. Elsevier Inc.
19. Shamsi, Mohammad Bagher, Javad Sarrafzadeh, Aliashraf Jamshidi, Navid Arjmand, and Farshid Ghezelbash. 2017. "Comparison of Spinal Stability Following Motor Control and General Exercises in Nonspecific Chronic Low Back Pain Patients." Clinical Biomechanics 48 (November 2016): 42–48.
20. McGill, Stuart. 2015. Low Back Disorders : Evidence-Based Prevention and Rehabilitation.Third Edition. Elsevier Inc.Pages: 55-86/ 230-310
21. Anikwe, BA Tella, Al Aiyegbusi, and SC Chukwu. 2015. "Influence of Nerve Flossing Technique on Acute Sciatica and Hip Range of Motion." International Journal of Sports Physical Therapy vol.4 (2).
22. Butler David Sheridan and James Matheson. 2000. "The Sensitive Nervous System". First edition. Pages 8-26/ 55-86/ 91-140/ 260-399
23. Coulter, Ian D., Cindy Crawford, Eric L. Hurwitz, Howard Vernon, Raheleh Khorsan, Marika Suttorp Booth, and Patricia M. Herman. 2018. "Manipulation and Mobilization for Treating Chronic Low Back Pain: A Systematic Review and Meta-Analysis." The Spine Journal vol.18 (5): 866–79.
24. Stochkendahl, Mette Jensen, Per Kjaer, Jan Hartvigsen, Alice Kongsted, Jens Aaboe, Margrethe Andersen, Mikkel Andersen, et al. 2018. "National Clinical Guidelines for Non-Surgical Treatment of Patients with Recent Onset Low Back Pain or Lumbar Radiculopathy." European Spine Journal 27 (1): 60–75.
25. Sahrmann, Shirley. 2015. Diagnosis and Treatment of Movement Impairment Syndromes. Second Edition, Elsevier Inc.
26. Saragiotto, BT, CG Maher, TP Yamato, LOP Costa, LC Menezes Costa, RWJG Ostelo, and LG Macedo. 2016b. "Motor Control Exercise for Chronic Non-Specific Low-Back Pain (Review)." Cochrane Database Syst Rev, no. 1: CD012004.

Education for Sustainable Development: Self-Regulating Learning Strategies in an Online Environment

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Abstract

Online learning and the use of modern ICTs in the educational process solve the problems of forming students ' General cultural and professional competencies in accordance with the law "on education in the Russian Federation" and the Federal state educational system of higher education. In the context of the information society, online learning, like traditional learning, requires changes in the competencies of a modern teacher and the organization of the educational process.

Keywords: education, development, learning strategy, online environment, self-regulation, science, thinking, society.

Introduction

Sustainable development cannot be achieved solely through technology, political regulation, or financial mechanisms. Humanity needs to change its way of thinking and behavior. This, in turn, requires providing quality education and training for sustainable development at all levels and regardless of social conditions. Education for sustainable development (ESD) is designed to help us find constructive and creative solutions to present and future global challenges and increase the sustainability and viability of society [1].

The development of the education system for sustainable development is directly linked to the implementation of the main policy documents adopted by the world community at the UN world summit on environment and development in Rio de Janeiro in 1992. It was then that the world's leaders and governments agreed that "education is the decisive factor for change", change for the better, change for a sustainable and prosperous future. The September 2002 summit in Johannesburg (South Africa) also suggested that education for sustainable development should be considered as one of the main priorities of the world community. Developing this thesis, the world community put forward a proposal for the development of education for sustainable development as a global civilizational project. Appreciating and supporting this initiative, the United Nations announced the UN Decade on education for sustainable development (2005-2014).

Many countries and regions of the world have already made a significant contribution to creating education for sustainable development. In 2005, the United Nations Economic Commission for Europe (UNECE) "strategy for education for sustainable development" (ESD), developed at the initiative of the Russian Federation and Sweden, was adopted in Vilnius by the UNECE member countries, which unite 55 States of Europe, Central Asia and Northern Eurasia, and the Vilnius framework for its implementation was adopted. The United Nations economic Commission for Europe strategy for sustainable development is the first regional action programme on ESD, marking the beginning of practical actions within the framework of the UN Decade on education for sustainable development. The essence of the strategy is to move from the simple transfer of knowledge and skills necessary for existence in modern society to the readiness to act and live in rapidly changing conditions, to participate in social development planning, to learn to anticipate the consequences of actions taken, including possible consequences in the field of sustainability of natural ecosystems and social structures. As noted in the Strategy: "Education is one of the prerequisites for achieving sustainable development and an essential tool for effective governance and the development of democracy" [2].

The main goals and priorities of the concept of sustainable education reflect the Agenda for the 21st century [3].

Thus, in order to form a system of sustainable education, it is necessary to:

- providing education in the field of protection and preservation of the environment for all people, regardless of age or status, etc.;
- integration of concepts of development and environmental protection in all educational programs;
- ensuring the involvement of young people and the public in General in resolving issues related to environmental protection [4].

If these target orientations are considered specifically for the Russian state, they can be reduced to the following:

- equal access to opportunities to receive quality education in the economic, environmental and social spheres for everyone, regardless of status, income, living conditions and other factors, circumstances;
- to create a legal and material basis for forming a full-fledged system of education for sustainable development;
- provide formal and non-formal training, conduct educational activities for the development of ESD;
- take into account national cultures and traditions, as well as their role in education.

We can list the following key areas for achieving the goal of sustainable development in the education system of the Russian state:

- develop and publish educational and methodological materials for teachers, students and researchers at all existing educational levels;
- encourage the use of ICT technologies and electronic tools to improve the visibility and effectiveness of training, productive information exchange;
- ensure uniformity of the content of educational and methodological materials that are used in both formal and informal education;
- develop effective strategies to disseminate the necessary information [6].

The formation of ESD in the Russian state is focused on:

- classical and engineering environmental education, geographical, biological, geological and economic education;
- taking into account current educational standards, which reflect a number of imperatives of sustainable development;
− the first elements that will be included in the future system of institutional support for ESD, the presence of positive experience of training and research centers for sustainable development in Russian higher education institutions;
- distance education and certification of such education;
− professional development of teaching staff in the field of sustainable development − - availability of educational materials on ESD;
- consistency of educational programs at both national and international levels.

Sustainable development plays a huge role in the modernization and progressive development of the Russian education system, as the introduction of ESD has a beneficial effect on the educational process and contributes to its improvement. In particular, pre-school, primary, secondary, higher and postgraduate education is being improved in the direction of sustainable development, public awareness is being raised, and higher-quality professional training and professional development are being provided [4,5].

Today, a self-regulating strategy of learning in an online environment with the help of modern information and communication technologies has also come to our aid.

Information and communication technologies are widely used in education. Technical means of ICT have formed new directions in training, such as e-learning, mobile learning, online learning, and distance learning. One of these areas - distance learning, appeared on the basis of distance learning and today has become popular in General education. Due to the convenience and flexibility, this eliminates many problems of students: health problems, problems of remote residence from schools, etc.

When studying remotely, you can choose a convenient time for classes according to your own schedule and your own pace of learning (for example, in a Virtual Academy). To ensure effective interaction of students in distance learning, a full set of tools is used, including interactive computer programs, the

Internet, email, Skype, Facebook, video phone, etc. But this set of technological tools is not fully used for getting a quality education. The use of technology helps only effective interaction between students and freely choose the time and place to study. The reason for dissatisfaction with the quality of education is the fact that these computer programs consist of teaching materials of traditional learning, learning by transferring private, unsystematic, illogical knowledge. To improve the quality of distance learning, it is necessary to develop a new strategy for distance education [7].

First, technological knowledge tools used in distance learning are based on artificial intelligence. Artificial intelligence was created based on zagaevsky theory of natural intelligence of piaget. If knowledge tools are created in accordance with artificial intelligence, then the knowledge that should be studied with these tools should be logically created in accordance with the development of natural intelligence.

Secondly, these two tools of knowledge - artificial and natural, have developing mechanisms and tools for influencing knowledge. If each student uses these developmental mechanisms and tools of action on knowledge in the learning process, personal knowledge will be transformed and embedded in a new form. This form will develop in the thinking of each student and in the generation process.

During this process, it is not possible to use the traditional method of transferring knowledge. The cognitive way of learning should be applied where the process of knowledge creation takes place. Thus, the learning strategy should be constructive both in the cognitive and social direction [10].

The third criterion for evaluating knowledge is expanded here as an action that includes thinking and social interaction. Therefore, not only knowledge, but also intellectual (cognitive) and social skills and abilities will be evaluated [7].

Along with the knowledge assessment, the level of analytical and synthesized knowledge methods, the level of assessment and generation of new knowledge, and the level of social interaction will be assessed.

When implementing the distance learning strategy in an online environment, the following will be achieved:

1. multimedia textbooks of the new generation will be modeled based on logical integrity and fuzzy logic;

2. new operational tasks will be developed on knowledge and methods of using project approaches in the educational process;

3. new criteria for evaluating the development of knowledge, intellectual and social skills Will be obtained;

4. the boundaries of high-quality use of ICT with pedagogical technologies Will be expanded;

5. Applying this knowledge model to other areas of education;

With the implementation of the educational strategy, a successful step will be taken in teaching without a teacher, in self-learning and lifelong learning [7].

Currently, the implementation of online learning is possible not only in an Autonomous LMS, but also in a closed group in the social network "Vkontakte", using Google Drive, which has almost all the necessary tools for working in a virtual environment – posting information and documents, discussions, communication tools, Bulletin Board. A special place among online learning tools is occupied by the social network "Vkontakte". Results of the survey of students (table. 1) showed that the majority of students used social networks in the educational process and believe that the most suitable for teamwork network "Vkontakte".

If we consider online education not as the transfer of traditional forms in a virtual environment, but as a new educational paradigm, the strategy of e-learning organization and the regulations on the organization and management of educational process of the University should reflect the use of modern methods, active and interactive teaching methods, new ICT (social media, cloud services, moocs, mobile technologies) and ways of assessing work of the teacher, implementing current pedagogical and information technologies. So far, business structures that prepare content and train company employees online have been more successful in developing modern pedagogical technologies (pedagogical design) than universities [8-10].

Online learning and the use of modern ICTs in the educational process solve the problems of forming students ' General cultural and professional competencies in accordance with the law "on education in the Russian Federation" and the Federal state educational system of higher education. In the context of the information society, online learning, like traditional learning, requires changes in the competencies of a

modern teacher and the organization of the educational process. The modern teacher is required not only to master new technologies, but also to change the teaching methodology. A University implementing e-learning needs to study and develop issues of pedagogical design, pedagogy in e-learning at the institutional and organizational and technological levels [9].

References

1. UNESCO. Education for sustainable development-an Electronic resource. URL access mode https://ru.unesco.org/themes/obrazovanie-v-interesah-ustoychivogo-razvitiya-0 (accessed: 27.05.2020).
2. UNESCO. National strategy of education for sustainable development in the Russian Federation. Electronic resource. URL access mode https://www.unece.org/fileadmin/DAM/env/esd/Implementation/NAP/RussianFederationNS.r (date accessed: 27.05.2020).
3. Agenda 21: the United Nations Conference on environment and development in Rio de Janeiro. New York: UN, 1992 [the official website of the United Nations]. URL: http://www.un.org/ru/documents/decl_conv/conventions/agenda21.shtml (accessed: 29.05.2019).
4. Tokarev, A. A. the Role of sustainable development in the education system in Russia. - Text: direct // Research of young scientists: proceedings of the II international conference. scientific Conf. (Kazan, July 2019). - Kazan: Young scientist, 2019. - P. 53-55. - URL: https://moluch.ru/conf/stud/archive/340/15183/ (accessed: 27.05.2020).
5. Murtazina L. G., Gaisin I. T. Model of development of continuous environmental education of students: analysis of foreign experience // Bulletin of the Samara state technical University. Series: Psychological and pedagogical Sciences. 2015. no. 1. Pp. 165-170.
6. Nemtsev I. A. Introduction of ideas and principles of sustainable development in Russian education // Bulletin of Tomsk state University. Philosophy. Sociology. Political science. 2014. no. 4. P. 1-11.
7. Southwestern state University. Distance education strategy. Electronic resource. URL access mode https://swsu.ru/sbornik-statey/strategy-of-distance-education.php (accessed: 27.05.2020).
8. Cyberleninka. Online education in higher education institutions: methods, content, technologies. Electronic resource. URL access mode: https://cyberleninka.ru/article/n/onlayn-obuchenie-v-vysshem-uchebnom-zavedenii-metodiki-kontent-tehnologii (accessed: 27.05.2020).
9. STRATEGY FOR THE DEVELOPMENT OF ONLINE LEARNING AT THE HSE. Electronic resource. URL access mode: https://elearning.hse.ru/data/2018/09/17/1153572780/Стратегия%20онлайн%20обучения%20НИУ%20ВШЭ.pdf (accessed: 27.05.2020).10. Starostina S.E., Kazachek N.A., Tokareva J.S. The Development of the Education Quality Assurance System in the Context of Socio-Economic Growth of the Cross-Border Region. International Electronic Journal of Mathematics Education. 2016. 11(9). pp. 3289-3300.

Analysis of the Development of Entrepreneurship and Entrepreneurial Activity in the Russian Federation

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Abstract

In this article the analysis of the development and activities of entrepreneurship and business environment in Russia and their significance in the life of the economy, with the implementation of the study the theoretical and practical foundations for its activities in the economy. The novelty of the article shows the actual development and operation of entrepreneurship in Russia in comparison with other proposed information.

Keywords: entrepreneurship, environment, activities, business, innovation, economics

Introduction

After a long break, in the 90s, the concept of entrepreneurship returned to the country. Since this period there has been a permanent development of entrepreneurship and entrepreneurial activity. There have been many positive and negative aspects of the developments in this area, over all the years of reforms. At all stages of development, many legislative and normative documents regulating entrepreneurial activity have been issued.

Some legislative documents improve the business environment, while others only worsen it. For example, in 2019, 166 federal laws have been adopted; they impact on the regulation of entrepreneurial activity, and 44% of them worsened entrepreneurship management. This situation leads to the negative consequences, and one of the sides is that many small and medium-sized businesses, being an integral part of the big business, complement it, and by this way, this allows big businesses to free themselves from their uncharacteristic functions and thereby this developpes the country's economy. Entrepreneurship and entrepreneurial activity allow developing more dynamically the economy and forming the middle class which is acting as a guarantor of socio-economic and political stability in the country.

Therefore, the subject of this study will be the analysis of the current problem, the analysis, study, and development of the various proposals and recommendations in the field of development and activities in the Russian Federation.

The purpose of the study

The purpose of this study is implementation of the analysis of the development and activity of entrepreneurship in Russia in comparison with the criteria and status the foreign countries.

A large number of works and various studies have been devoted to entrepreneurship and entrepreneurial activity. So, the problems of entrepreneurship development in the country's economy are considered in the article of the authors L. A. Akhmetov, A. M. Chernopyatov [1], and the socio-economic

orientation and development of domestic business and its impact on the life and welfare of society are considered in the work of L. V. Makushchenko, V. V. Popova, N. V. Antonova [2].

Considerable attention is paid to this problem in various works of foreign researchers in the field of entrepreneurship and the development of their activities. This problem can be found in the works that we will present below. So, L. Mises devoted a lot of works, including a Treatise on Economics, for understanding the nature of entrepreneurship, [3]. It can be seen in the work of F. Hayek, where the role of private property in the development and activity of entrepreneurship is considered [4]. Moreover, these two economists considered entrepreneurship as a factor of economics, along with natural resources. M. Mescon, M. Albert, F. Khedouri explored the theoretical foundations in the field of production management and its impact on the development and activity of entrepreneurship in their works [5]. J. Schumpeter in his works considered entrepreneurship as an innovative movement, contributing to the development of production and society on the whole [6].

Results

A lot of attention is paid to the development and activities of the entrepreneurship in the Russian Federation. Many various regulations, laws, and other provisions are issued for protecting, developing and operating the businesses throughout all the permanent reforms' processes. The basic laws in this direction are the Civil Code of the Russian Federation and Federal Act № 208-FA of July 24, 2007 «On the development of small and medium-sized businesses in the Russian Federation» [7].

However, the development of entrepreneurship and the entrepreneurial environment lags behind those which are adopted in many legal and regulatory documents. The process of development is in a slow state and has its ups and downs. We can list the most significant failures:

- In 2011, there was introduction of the high insurance rates up to 34%, followed by a reduction to 30%;
- In 2013, there was introduction of the increased insurance rates for the individual entrepreneurs;
- In 2018 and subsequent periods – there was introduction of the additional charges and increases of rates on many previously existing for all organizational and legal forms, and the strengthening of business practices;

This situation affected the number of the enterprises and, first of all, the individual entrepreneurs (table 1).

Table 1. *The number of enterprises and individual entrepreneurs in Russia [8, p. 45]*

Criterion	2013	2014	2015	2016	2017
medium-	15372	15326	15492	16308	no data
small-	234537	235579	242661	172916	275 460
micro-	1828589	1868201	no data	2597646	2 497 879
IE	2 499 000	2 413 800	no data	2 523 600	2 561 100

As a result of such actions, the outflow of the entrepreneurs from the legislative field to the shadow market began. And this market is growing noticeably and, according to various estimates, is within 30-40% of the country's GDP. This withdrawal affects the reduction of small businesses only for individual entrepreneurs by 7.3% in relation to 2012 to 2014, and for small businesses the difference was more than 26% in relation to 2016.

However, we do not agree with the thesis proposed by A. Kudrin in 2018. He put forward that at the present in Russia only 2 percent of the population is interested in opening their own business, while according to our calculations, the economy in the dynamic development shows the statistics around 6-8 percent of people [9, p. 123]. It is confusing how the author assessed the situation. How this information was got and by whom? According to the statistics of the Russian Federal State Statistics Service, we can calculate

the required result to answer the question that a figure of 6-8% has already been met. Despite the government's opaque and volatile policy towards entrepreneurship, it is still developing and improving its activities.

First, we will calculate the number of people involved in the entrepreneurship based on the number of employed people in Russia in 2016, as these figures were indicated in 2017:

VP=((16 308+172916+2597646+2523600) : 76 636 000))x100%, where the number 76 636 000 is according to the Russian Federal State Statistics Service.

VP=(5 310 470 : 76 636 000)x100%=6,92%.

Now we will calculate the total population of the country in 2016:

VP==((IB + ME + SE + ME) : TP)) x100%

VP=((16 308+172916+2597646+2523600) : 146 545 000))x100%

VP=3,62%

In these calculations, we take into account the fact that we take in each company one founder, although there may be up to 50 founders in each company.

Now we will perform the calculation only with the participation of the individual entrepreneurs without taking into account the enterprises:

VP=(2523600 : 76 636 000) x 100%=3,29%

We add to the total population:

VP=(2523600 : 146 545 000) x 100%=1,72%

Taking into account that a large number of economically active people, who do not want to register, work in the shadow field of the country's economy because of the volatile policy of the government as we have already said, we will perform the calculation with their participation. According to [9, 10], the economically active (able-bodied) population in Russia included 84.1199 million people. We find the difference between the registered employed and the able-bodied population (BSE).

BSE= EAP - EAN, where

EAP - Economically Active Population

BSE=84 199 000 - 76 636 000 =7 563 000 people

According to our calculations, more than 7 million potential entrepreneurs, who do not want to register, work in the shadow field. Taking into account these entrepreneurs, the number of people involved in entrepreneurship will increase to:

VP=((IB + BSE) : EAN)) x 100%

VP=((2523600 + 7 563 000) : 76 636 000)) x100%=13,16%

Taking into account the individual and potential entrepreneurs, and the total population:

VP=((2523600 + 7 563 000) : 146 545 000)) x100%=6,88%

After performing the calculations, we prove that the use of the different types of techniques leads to a distortion of the information field and, accordingly, to the multiplication effect of the presented data. In these calculations, we did not proceed from the fact that according to the government, more than 20 million people work in the shadow field, which will accordingly increase the figures in the calculations. So, according to the Russian Federal State Statistics Service, the volume of «off the books» and «under the table» salary for 2018 amounted to 13 trillion rubles.

Despite various difficulties, Russia was able to increase exports and reduce imports in recent years, and this could not have happened without the development and activity of the entrepreneurship.

Discussion

Even though for many years since the 90s of the last century, a lot of legal and regulatory documents and various programs for the development and support of small and medium-sized businesses were adopted at the state level, we still cannot solve the target. As a result, we always try to catch up with the EU countries and the United States, and still, we succumb to them in terms of quantitative and qualitative

indicators. « In the market economy, the small businesses of many developed countries are the leading sector determining the quality, structure and economic growth rate of GNP... GDP rate accounts for 60 to 70% of small businesses. The main part is about 99.3-99.7% of the total number of enterprises are small and medium-sized firms in several countries, such as the UK, USA, France, Japan, Germany. Almost half of the volume of the produced products account for such firms. Many small and medium-sized enterprises create about 75-80% of new jobs, in contrast to the large enterprises, where there is a decline in employment» [11, p.127]. We state only the statistics, but we should know and take into account one feature that the criteria to classify the small businesses in different countries are different and, accordingly, the figures give a distorted picture.

We add that in the EU countries and the United States the small business is understood as small and medium-sized businesses. Many different sources of the European Observatory for SMEs use the different criteria for small and medium-sized businesses [OECD SME Outlook, Paris, 2000]. Therefore, we can obstruct these data and at the same time bring to a common denominator the criteria for attributing to the small and medium-sized businesses. For instance, in the United States, small businesses can include businesses with more than 1500 employees, and in Russia, the highest criterion is determined by up to 100 people.

According to the Russian Federal State Statistics Service, the contribution of the small businesses to the country's GDP is about 20%, but this gives an inaccurate figure. Moreover, it is necessary to take into account the medium-sized businesses and the large business of up to 251 to 500 people. Accordingly, applying the western criteria in Russia, the figure of 70-80% will be almost reached.

Another feature of the distribution of business development is its irregularity, more than half of the businesses are on 8 subjects of the Russian Federation. More than one-third of all the small businesses from these subjects account for Moscow and Saint Petersburg.

In this context, it is necessary to increase the number of small businesses for the small remote localities (cities, villages) and single-industry towns of the country that have lost their city-forming enterprises. To solve this problem, it is necessary to influence the state in many various ways. These are the easing of strict administration by the regulatory authorities, which will improve the socio-economic component. This approach will give the possibility to revive the activities of small cities in the country.

Conclusions

Thus, the business entities should be under the real guardianship and protection of the government formed through many various ways and mechanisms. The forms must be multifaceted, real, and having the following aspects:

- a legislative and regulatory field with preferences;
- the simplified and transparent tax policy for a long period;
- the reduction of administrative influence;
- the expanding of the scope of application of the leasing company;
- the concessional lending;
- the application of the policy of cheap and long money, etc.

Only due to the sustained and broad support of the government, many various organizational and legal forms and forms of ownership of the enterprises can be optimally combined. However, on the one hand, it is necessary to take into account that at the present stage, the main players in the international market are the multinational companies, with which the entrepreneurs cannot compete due to many various features. It is impossible to solve this problem without the help of the government. On the other hand, the high rate of entrepreneurs in the country will lead to the addition of small-scale production, which is not able to perform wide functions, especially in the Russian Federation. No entrepreneur can solve the issue even of an average project, and even more so within the framework of national projects. Such tasks can only be performed by large companies with the participation of the government. This shows that it is impossible to solve global problems without governmental entrepreneurship.

Referens

1. Akhmetov L. A., Chernopiatov A. M. Problems of development of entrepreneurship in the economy// scientific notes of the Russian Academy of entrepreneurship: "the Role and place of civilized business in the Russian economy". Vol. 45. Scientific-practical edition. M.: RAP - 2015. AP "Science and education". Pp. 7-19.
2. Chernopyatov A.M., Makushchenko L.V., Popova V.V., Antonova N.V. Balabanov V.C., Balabanova A.V., Dudin M.N. Entrepreneurship development and business activity in the Russian Federation //Journal of Entrepreneurship Education.-2018.T.21 №4.- P.220.
3. Mises L. Human action: a Treatise on economic theory / 2-e ISPR. ed. — Chelyabinsk: Socium, 2005. — 878 p.
4. F. A. Hayek. Fatal conceit. The errors of socialism. -M.: Publishing house "news"with the participation Izd-VA "Catallaxy", 1992. -304 S.
5. Meskon M., albert M., Hedouri F. Fundamentals of management. – M.: Business, 1992. – S. 704.
6. Schumpeter, J. A. The theory of economic development. Moscow: Progress. 1982. –S. 231.
7. Federal law of 24 July 2007 № 208-FZ "About development of small and medium entrepreneurship in the Russian Federation" (hereinafter – the Law № 88-FZ).
8.Science, education and practice: professional public accreditation, tutoring, information technology, information security: collective monograph.- Moscow: RUSYNS, 2017.-160C.
9.Russia in figures. 2017: Times.stat.sat./Rosstat - M.,2017 - 511 p.
10.Chernopyatov A. M. the Role of government in business regulation in the Russian Federation: monograph/A. M. Chernopyatov. - M.: Publishing House "Paleotype", 2014. -100C.
11. Chernopyatov A. M. A role of the state is in development and adjusting of institucional'noy environment of Russian enterprise. Raleign, North Carolina, USA: Lulu Press, 2016. 259p.

Higher Education Under the Epidemic

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Abstract

On March 4, UNESCO published a report on the sharp transition to distance forms as a result of quarantine measures. In 22 countries around the world, it was decided to partially or completely close schools and universities and switch to distance education for the period of active spread of the virus. As a result, about 290 million children study from home. According to UNESCO Director General Audrey Azoulé: "The scale and speed of the interruption in the educational process today is unprecedented and could violate the basic rights of many children to receive education."
Keywords: education, epidemic, coronavirus, students, pupils, distance education, remotely.

Introduction

The transition to distance education will not be a problem for universities, but it will require solving certain problems. In the context of the coronavirus pandemic, in order to keep up with the educational program, all students in institutions will have access to distance learning lessons and electronic textbooks. But are universities ready for mass education in an "exotic form?"

Distance learning is a more complex process. He assumes that the student at home is registered on a special portal, views video tutorials, participates in a video conference when analyzing the taught material, after which he receives his homework online and does it at home. There is even a form of control when the completed task is photographed and the file is sent to the teacher for verification, which ultimately puts an assessment.

To say that distance learning in Russia has now become a kind of know-how is wrong - it has been used for a long time and widely in the country both in higher education and in general educational institutions.

The experience of universities confirms this. It turned out that at the end of February Russia imposed a ban on the entry of Chinese citizens, several students from China still managed to enter Russia. According to Vice-Rector of the Baltic State Technical University "Voenmekh" Marat Goguadze. "Three of these students were isolated in a separate room, they were provided with medical supervision, and after they were hospitalized, the diagnosis was not confirmed in the end. But even after discharge they lived separately and study remotely."

"Today there is a database of video lessons, they are very popular," said Mikhail Puchkov, Vice-Rector for Innovation and Information Technologies of the Herzen State Pedagogical University, "If you are motivated to study, you will find a huge amount of information and get the necessary knowledge base. Now Russian services have opened access - Russian teachers can get an account and conduct lessons online [1].

Of course, distance learning is difficult to carry out when teaching physical education, disciplines that imply the need to perform laboratory work on special equipment, medicine, and creative professions.

Obviously, everyone turned out to be differently prepared for the transition to online learning. Say, schools in Singapore, Moscow or New York have been using digital systems for managing the educational process and communicating with children and parents for several years. In the transition to the remote format, teachers and students use not only scanned pages of ordinary textbooks, but also interactive task books, entire digital environments for self-education [5].

There is no doubt that digital technology will not replace the teacher and live communication, but now the situation is such that in the coming weeks there is no alternative to distance learning. There are many difficulties - technical and organizational - but universities, teachers, parents and students are interested in overcoming them.

In many countries, special resources for the education system are included in government aid packages for the national economy.

The transition to remote access was facilitated by allowing free access to online platforms. For example, services such as:

SkyEng - a service that helps to learn languages, has provided a free opportunity for everyone.

Coursera is an online platform that helps students study through online courses and watch video lectures by teachers from leading countries of the world. It is only necessary for the university to register on the portal.

Some resources were available before. For example, there were always online courses on "Open Education" in the public domain. Here are collected video lectures and assignments from teachers of leading universities of the country. However, now the service offers students to undergo free certification and get a certificate of courses. Such a document is appreciated during employment and adds points upon further admission to the university, for example, to a magistracy or graduate school.

Khan Academy provides free access for students. It also contains the most useful and popular lectures in all areas.

Add platforms that offer training materials only for certain specialties.

For example, Netology is a platform that allows you to study marketing and management. Now free access to useful information is open until the end of quarantine.

The Pruffme online platform is useful for teachers in that they can conduct a webinar for students for free, as well as upload their own tests and assignments, and then test them.

Channel "Russia-Culture" also prepared for students an excellent service "Academy" for entertaining self-education. Here are collected different lectures on the type of television programs. Most often discussed are cultural phenomena.

“Lectorium”, which offers 5,000 video lectures in various directions, will be useful for students. For schoolchildren and their parents, for students and teachers - everyone will be able to choose an interesting video course.

Many teachers have already managed to express the transition to distance learning in universities because of the coronavirus. The ease and speed of transferring education to remote access is noted. Students do not have any difficulties with the use of Internet resources and completing assignments.

In Russia, to discuss the main problems of distance education, on March 17, 2020, the Higher School of Education Institute of Higher Education organized a round table discussion “Higher Education in an Epidemic: Digital Opportunities”, in which international experts discussed the global challenges associated with the transition to online education caused by the massive closure of universities due to the COVID-19 coronavirus pandemic, as well as the readiness of educational systems in Russia and other countries of the world for such emergency measures.

Taking into account that the accelerated transition to online forms is just beginning in Russia and the USA, experts from Russian and American universities also shared their thoughts and made some general recommendations:

- Teachers need at least a week to prepare for the transition to online teaching.
- The use of basic technical tools already familiar to teachers has a positive effect on the transformation process.
- At the moment, the priority task of education is to ensure safety, not quality [2].

Russia started organizing online training later than many other countries, and this allows us to analyze the experience that has already been accumulated, said HSE Online Training Director Evgenia Kulik. In Russia there are about 1 thousand quality courses that can be used by universities, and now we are testing technological systems: we need to understand whether they are capable of delivering content to hundreds of thousands of students.

“This is also a test of our human relationship to each other. “Many people have found themselves in a stressful situation due to a significant change in various processes, and this is superimposed on the stressful situation in society arising from the epidemic.”

In her opinion, the algorithm for transitioning higher education to online is understandable, and the main task is to make all changes carefully in relation to people, focusing on their education and support [3-4].

Our world is changing rapidly. And this applies not only to the coronavirus pandemic, but also to dozens of other processes.

An important point for the successful completion of the school year is the possibility of distance learning in quarantine.

Good students who think about the future will get a chance to raise the level of knowledge about those with learning difficulties. Coronavirus can give impetus to the development of distance learning, the wider use of control methods without human intervention, today it is real.

Referens

1. The coronavirus epidemic is changing education standards in Russia. [Electronic resource] Link to the site: https://tehnowar.ru/142116-Epidemiya-koronavirusa-menyaet-standarty-obrazovaniya-v-Rossii.html(accessed: 02.05.2020).
2. International seminar " Higher education in the context of the epidemic: opportunities of digital technologies». [Electronic resource] Link to the site: https://iite.unesco.org/ru/news/mezhdunarodnyj-seminar-vysshee-obrazovanie-v-usloviyah-epidemii/ (accessed: 02.05.2020).
3. "No one expected that online education would receive such a powerful boost to development». [Electronic resource] Link to the site: https://www.hse.ru/news/350393139.html (accessed: 02.05.2020).
4. Assistance in organizing the translation and publication of the article in the journal Scopus was provided. By the international scientific publishing, house "Scientist View".[Electronic resource] Link to the site: https://scientist-view.ru/ (accessed: 02.05.2020).
5. Distance learning in universities due to coronavirus. [Electronic resource] Link to the site: https://killer-antiplagiat.ru/blog/Distancionnoe-obuchenie-v-vuzah-iz-za-koronavirusa (accessed: 02.05.2020).

Hamstring and Quadriceps Strength Ratio of Crossfit Athletes Compared to Basketball Players and Sedentary Males

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Abstract

CrossFit is a strenuous training program with growing popularity in recent years. It is important to determine the potential internal risk factors in the musculoskeletal system of the CrossFit athletes to minimize the already high injury risks of training. The objective of this study was to examine the imbalance in the strength of the knee extensor and flexor muscles of CrossFit athletes in relation to basketball players and sedentary males as control groups. A total of 51 voluntary individuals between 18 and 30 years old, consisting of 18 male basketball players, 15 male CrossFit athletes, and 18 sedentary male individuals participated in this study. The maximum concentric (60°/sec, 120°/sec, and 240°/sec) and eccentric (60°/sec, 120°/sec) knee extension and flexion torque parameters were measured by using isokinetic dynamometer, respectively. The functional H:Q ratio was calculated as the ratio of eccentric hamstring to the concentric quadriceps peak torques at each angular velocity. Concentric flexion and extension peak torque values were found to be significantly higher in basketball players and CrossFit athletes compared to sedentary males ($p<0.05$), except for flexion torques at 180°/s ($p>0.05$). Functional peak torque and average H:Q peak torque ratios of CrossFit athletes were significantly lower than the sedentary group at 120^0/s ($p<0.05$). The knee extension and flexion strength of CrossFit athletes and basketball players found to be higher than sedentary males as expected because of their training background. Functional H:Q difference between CrossFit athletes and sedentary males showed CrossFit athletes' quadriceps muscles were stronger concentrically than their eccentric strength of hamstring muscles. These results indicate that strength training programs aimed at increasing hamstring strength, especially eccentrically may be beneficial for CrossFit athletes to minimize their injury risks.

Key words: CrossFit, Basketball, Isokinetic, H:Q ratio, peak torque, strength.

Introduction

CrossFit is a high-intensity training program that incorporates various exercise modalities such as powerlifting (squat, deadlift, press/push press, bench press), plyometrics, gymnastics, calisthenics, running, rowing, Olympic-style weight lifting (snatch, clean, and jerk) and high-intensity interval training. It aims to develop a broad range of physical qualities; muscular endurance, strength, power, coordination, speed, agility, balance, flexibility and cardiovascular capacity (1). CrossFit has grown in popularity in recent years (2). The ever-changing training variations, distinct exercise repertoire, challenging nature of CrossFit, along with the results and sense of community that it provides, are the main driving forces for its popularity. The requirements of CrossFit training programs elevated some concerns on the possible dangers of the CrossFit training for the average person (3). The workouts of CrossFit last around 30 minutes. It incorporates different types of exercises, mostly performed explosively with short or no rest periods between them in a circuit fashion (4). In terms of physical development, this type of training has major benefits on musculoskeletal and cardiovascular gains systems (5, 6) However, not without its risks. Fast-paced nature of CrossFit training may lead to high levels of fatigue during training, especially for inexperienced practitioners. The accumulation of fatigue can potentially result in improper technique and may lead to injuries while the individuals trying to lift the prescribed weights before the limited workout time ends (7, 8). Mechanically improper technique, especially when the individual is fatigued, is one of the leading causes of injuries (9).

The prevalence of injuries sustained in CrossFit practitioners has been documented before. Overall injury rate has been determined to be 19.4% among 386 CrossFit practitioners (10). Other studies have reported injury rates between 2.3-3.1 for every 1000 hours of CrossFit training (11, 12), the most frequently injured body parts being the shoulders, low back, and knees (12). In a more recent study that analyzed the

injuries related to CrossFit between 2003-2016 in a sports medicine clinic, knee joint was found to be most injured part by 27%, followed by spine (24.3%) and shoulder (16.5%) (3).

Knee injuries sustained during training may be the result of various internal or external factors (13). While the external factors such as the amount of weights lifted, exercise tempo, and shoe selection could be adjusted for the individual with educated choices; internal factors that are bound to musculoskeletal and cardiovascular characteristics of the individual cannot be adjusted on demand, unless necessary adaptations occur after a proper training regimen (9). The relationship between musculoskeletal characteristics of the CrossFit practitioners and the underlying mechanisms of knee injuries should be examined to design proper training regimens to minimize the knee injuries. One of the major musculoskeletal characteristics that may lead to knee injuries is the imbalance in strength of the knee extensor and flexor muscles (14, 15). Hamstring:Quadriceps (H:Q) strength ratio is most commonly assessed by isokinetic dynamometers (15) H:Q isokinetic peak torque (PT) ratio that is over the safety range reported to be a major contributor to musculoskeletal injuries in the lower extremities in athletes (17). Furthermore, it has been shown that training to correct muscle strength imbalances may decrease the occurrence of injuries (18)

H:Q ratio is conventionally calculated as the ratio of the concentric peak torque of the two muscle groups (19) Conventional H:Q ratio lacks the characteristics of functional movement as agonist and antagonist muscles never contract concentrically at the same time during daily or athletic movement (20).The functional H:Q ratio was presented later to eliminate this problem by calculating the ratio of hamstring eccentric peak torque to quadriceps concentric peak torque (21,22). This contraction mode better reflects the reciprocal inhibition during human movement such leg swing during running or kicking.

To our knowledge there is no study that has evaluated functional H:Q ratios in CrossFit athletes. In only one study, the conventional H:Q isometric strength ratios were tested in CrossFit practitioners without any control group (15). In this study, we aimed to evaluate functional H:Q isokinetic strength ratios of male CrossFit practitioners along with sedentary males as the first control groups. In addition, basketball players were tested and evaluated as the second control group. The basketball players were chosen because of the high lower extremity injury rate of the sports.

Material and Methods

Participants

Eighteen basketball players, 15 CrossFit athletes, and 18 sedentary males' ages between 18-30 years were included in the study. Demographic properties of the athletes and sedentary males are below (Table 1). Prior to this study, Local Ethical Approval (Marmara University Institute of Health Sciences) was obtained and approval forms were signed by the participants after they were informed about the study. Participants were informed that they should not perform any resistance or similar heavy exercise two days prior to the test date. Inclusion criteria of the participants in the study were (i) no history of any major lower-body musculoskeletal injury, (ii) having at least two years of practice in the field of their respective sports.

Table 1. *Groups' demographic values*

	Basketball Players (N=18)	**CrossFit Athletes (N=15)**	**Sedentary Males (N=18)**
	Mean±Sd	Mean±Sd	Mean±Sd
Age (years)	19.88±2.13	24.88±4.22	21.11±2.42
Weight (kg)	84.62±10.21	77.68±12.38	69.75±9.74
Height (cm)	189.33±7.21	175.44±7.56	176.83±7.27
BMI (kg/m²)	23.58±2.46	25.26±4.00	22.46±4.22
Training Year (years)	7.88±2.82	373±1.79	X

Measurements and Procedures

The isokinetic testing of the participant players and athletes was completed in one testing session at the end of the season. The tests were carried out in the morning. At first, the body weight and height of the

participants were measured. The body weight and body mass impedance (BMI) were computed using the Tanita SC-330 body composition analyzer on barefoot. Afterwards, all participants have performed the isokinetic measurements with their daily sports shoes and sports clothes. Knee flexor and extensor isokinetic concentric strength were measured using the Biodex System 4 Pro isokinetic dynamometer (Biodex Corporation, Shirley, NY). Measurements were applied only over the dominant extremities of the participants. Before the isokinetic test, 10 minutes of warm-up exercise was conducted as follows: 5 minutes walking at 5 km/h speed on the treadmill following 5 minutes of dynamic stretching for the lower extremity.

After the warm-up, participants were seated upright on the Biodex with their hip joints flexed to approximately 90^{o} using the lateral femoral condyle as an anatomical reference for the axis of rotation. A pelvic strap and two shoulder straps were used to secure the subjects and reduce mechanical assistance from other body parts. The lever arm length was individually determined, and the ankle resistance pad was positioned proximal to the medial malleolus. Gravity correction was applied before the test. The range of motion of the knee joint was set from 0^{o} to 100^{o}: during knee extension, the lower leg moved from 100^{o} to 0^{o}, and during knee flexion, it moved from 0^{o} to 100^{o}. After completion of all adjustments, the testing process was explained as the participants watched a sample knee isokinetic strength test video. Concentric knee flexor and extensor muscle strength was measured at 3 different angular velocities; 60°/sec (5 repetitions), 120°/sec (6 repetitions), and 240°/sec (8 repetitions). After 15 minutes rest, eccentric knee strength was applied at 2 speeds (60°/sn, 120°/sn). Three minutes (180 sec) rest was given between different angular velocities. Two familiarization trials were made before starting the measurement at each angular velocity. During the test, the participants were verbally encouraged by the same instructor to help them generate their greatest maximum voluntary contraction torque. Participants were instructed to 'push as hard as possible'. The highest value of the repetitions was selected as the peak torque (Nm) and the average peak torque (Avg PT) at each angular velocity was calculated. In addition, the peak torque and average peak torque values were reported as body weight-normalized PT (Nm/kg). In this study, eccentric knee flexion and extension PT values were only used to determine functional H:Q ratios. The functional H:Q ratio was calculated as the ratio of eccentric hamstring to the concentric quadriceps peak torques at each angular velocity.

Statistical Analysis

For statistical analysis, SPSS Windows package program was used. All the data collected were reported as mean ± SD. Statistical evaluation between groups was calculated by one-way ANOVA test method and the significance level for the whole procedure was set as $p \leq 0.05$. In the post-hoc analysis, the Games-Howell test was used because the number of participant groups was not equal and homogeneous variance in parameters could not be determined.

Results

As shown below in Table 2, the normalized concentric knee extension PT values of basketball players and CrossFit athletes at all angular velocities were significantly different than the sedentary group ($p<0.05$). The isokinetic knee extension strength of basketball players and CrossFit athletes was higher than the sedentary subjects ($p<0.05$). The normalized concentric knee flexion PT values of the basketball players and CrossFit athletes at angular velocities of 60^{o}/sec and 120^{o}/sec were significantly higher than the sedentary group ($p<0.05$); but, there was no significant difference between the three groups at an angular velocity of 180^{o}/sec ($p>0.05$). There were no significant differences in normalized peak torques of basketball players and CrossFit athletes at the three different angular velocities ($p>0.05$).

Table 2. *Normalized concentric peak torques (Nm/kg) by different angular velocities in knee extensor and flexor muscles of elite male basketball players, CrossFit athletes and sedentary group*

PT/BW	Angular Velocity	Basketball Players (N=18)	CrossFit Athletes (N=15)	Sedentary Males (N=18)		
		Mean±Sd	Mean±Sd	Mean±Sd	p	Post-Hoc (p)
Concentric Extension (Nm/kg)	60°/s	320.62±26.36	322.68±28.35	269.49±32.54	.000**	b-c: .975 b-s: .000 ** c-s: .000 **
	120°/s	263.31±19.84	259.38±25.98	224.13±22.67	.000**	b-c: .881 b-s: .000 ** c-s: .001**
	180°/s	223.00±22.88	219.15±25.01	190.14±20.01	.000**	b-c: .892 b-s: .000 ** c-s: .003 *
Concentric Flexion (Nm/kg)	60°/s	141.31±21.59	143.50±21.82	120.60±21.24	.005*	b-c: .956 b-s: .017 * c-s: .013 *
	120°/s	121.16±21.40	121.96±16.92	103.38±19.65	.011*	b-c: .992 b-s: .036 * c-s: .017 *
	180°/s	113.54±22.75	109.28±14.63	100.50±21.18	.153	b-c: .794 b-s: .192 c-s: .353

**p<0,05, **p<0,001, PT/BW: Peak Torque/Body Weight*

Table 3 shows that functional H:Q peak torque ratios of CrossFit athletes were significantly different than the sedentary group at 120^0/s ($p<0.05$).

Table 3. *Functional H:Q peak torque ratios (%) of elite male basketball players, CrossFit athletes and sedentary group for dominant limb*

	Angular Velocity	Basketball Players (N=18)	CrossFit Athletes (N=15)	Sedentary Males (N=18)		
		Mean±Sd	Mean±Sd	Mean±Sd	p	Post-Hoc (p)
Functional H:Q Ratio (%)	60°/s	86.64±8.29	82.90±11.59	91.19±12.75	.106	-
	120°/s	103.82±13.67	94.07±11.73	108.16±15.82	.019*	b-c: .086 b-s: .656 c-s: .017*

**p<0,05, **p<0,001, Functional H:Q ratio: Eccentric Hamstring PT/ Concentric Quadriceps PT*

As shown in Table 4, the normalized concentric knee extension Avg PT values of basketball players and CrossFit athletes at all angular velocities were significantly higher than the sedentary group ($p<0.05$). The isokinetic knee extension strength of basketball players and CrossFit athletes is higher than the sedentary subjects. The normalized concentric knee flexion Avg PT values of basketball players and CrossFit athletes at all angular velocities were significantly higher than sedentary group ($p<0.05$). Although there is a

significant difference between the groups, there is no significant difference in pairwise comparisons at the angular velocity of 180°/sec. However, basketball players' normalized concentric knee flexion Avg PT tends to be higher than sedentary subjects (p= 0.064) at the angular velocity of 180°/sec. There were no significant differences in normalized peak torques of basketball players and CrossFit athletes at all angular velocities (p>0.05).

Table 4. *Normalized Avg peak torques (Nm/kg) by different angular velocities in knee extensor and flexor muscles of elite male basketball players, CrossFit athletes and sedentary group*

Avg PT/BW	**Angular Velocity**	**Basketball Players (N=18)**	**CrossFit Athletes (N=15)**	**Sedentary Males (N=18)**		
		Mean±Sd	Mean±Sd	Mean±Sd	p	Post-Hoc (p)
Concentric Extension (Nm/kg)	60°/s	299.71±22.76	299.64±24.27	251.11±33.21	.000**	b-c: 1.000 b-s: .000 ** c-s: .000 **
	120°/s	245.86±19.99	241.45±24.56	203.75±22.35	.000**	b-c: .843 b-s: .000 ** c-s: .000**
	180°/s	203.78±22.10	202.83±21.25	170.18±18.30	.000**	b-c: .991 b-s: .000 ** c-s: .000 **
Concentric Flexion (Nm/kg)	60°/s	132.89±19.98	131.63±20.19	108.97±21.38	.001**	b-c: .982 b-s: .004 * c-s: .011 *
	120°/s	111.99±21.01	111.70±15.28	93.12±22.14	.010*	b-c: .999 b-s: .034 * c-s: .021 *
	180°/s	104.62±20.76	99.03±13.87	88.66±20.15	.044*	b-c: .631 b-s: .064 c-s: .206

**p<0,05, **p<0,001, Avg PT/BW: Average Peak Torque/Body Weight*

Table 5 shows that functional Avg H:Q peak torque ratios of CrossFit athletes were significantly different than the sedentary group at 120°/s (p<0.05).

Table 5. *Functional H:Q Avg PT ratios (%) of elite male basketball players, CrossFit athletes and sedentary group for dominant limb*

	Angular Velocity	**Basketball Players (N=18)**	**CrossFit Athletes (N=15)**	**Sedentary Males (N=18)**		
		Mean±Sd	Mean±Sd	Mean±Sd	p	Post-Hoc (p)
Functional Avg H:Q ratio (%)	60°/s	86.00±9.67	82.26±11.30	89.46±13.48	.217	-
	120°/s	101.10±13.92	92.27±15.93	106.66±14.98	.029*	b-c: .231 b-s: .489 c-s: .033*

**p<0,05, **p<0,001, Functional Avg H:Q ratio: Eccentric Hamstring Avg PT / Concentric Quadriceps Avg PT*

Discussion and Conclusions

The objective of this study was to investigate the knee joint isokinetic strength and functional H:Q ratios of CrossFit athletes, compared to basketball players and sedentary males. There was significant difference in both of these metrics between CrossFit athletes and sedentary males. Concentric flexion and extension peak torque values were found to be significantly higher in basketball players and CrossFit athletes compared to sedentary males, except for flexion torques at 180°/s. Higher-strength capacity was expected in these athletic groups because of their training experience. No significant difference was found in concentric PT values between the CrossFit athletes and basketball players. Strength exercises in the training routines common to the CrossFit and basketball groups, such as squat and lunge, may explain the similarity in peak torque values between the two groups.

The concentric knee extension PT and flexion PT values of basketball players at 60°/sec were found to be 246.5 Nm and 124.6 Nm respectively in a previous study (23). In another study, concentric knee extension PT and flexion PT values of elite basketball players at 60°/sec were found to be 297.5 Nm and 172.0 Nm respectively (24). On the other hand, Alemdaroğlu (2012) found the concentric extension PT values to be 203.27 Nm for the right leg, 207.72 Nm for the left leg; and the concentric flexion PT values to be 163.81 Nm for the right leg and 159.18 Nm for the left leg studying in professional basketball players at 60°/sec (25). All of the concentric flexion PT values to be higher than the results of our study. The high conventional H:Q ratios and therefore relatively higher hamstring strengths of the elite players participated in those studies may be the reason for the difference between those studies and ours (23, 26).

The functional H:Q ratios of CrossFit athletes were found to be lower than basketball players and sedentary males. Statistically significant difference was only found compared between CrossFit athletes and sedentary males at 120°/s. Higher functional H:Q ratio of CrossFit athletes showed that concentric strength of their quadriceps muscles in relation to eccentric strength of their hamstring were relatively higher than the other groups. Previous studies on the functional H:Q ratios in athletes were done in football players. The functional H:Q ratio of football players (~0.80) was found to be similar to CrossFit athletes and likewise, lower than the control group (27, 28, 29). It was discussed that this could be the result of relatively higher quadriceps concentric strength than the hamstrings eccentric strength of the football players compared to controls. Same could be said for the CrossFit athletes. The vast majority of lower extremity pushing exercises that require quadriceps concentric strength in CrossFit may lead to higher quadriceps concentric strength than hamstrings eccentric strength. Basketball also requires concentric quadriceps strength but differently, basketball players do not necessarily participate in high-intensity strength training like CrossFit athletes.

Limitations of the study may be listed as the differences in the leg length and moment arms of the isokinetic device due to the differences in the average heights of basketball players and other groups. In this study, the leg length of the participants was not measured. However, as in our study, normalizing peak torque values to weight, normalized the differences in height and leg length as well (30). Other limitations were that the basketball players and CrossFit athletes neither followed a standard training program, nor the training programs of the athletes could be controlled prior to their participation in the test. Differences in group training routines may affect the work outcome, as the training programs and contents followed by the athletes will result in differences in their strength profiles (31).

In conclusion, the functional H:Q ratio that was determined in this study could be an important indicator of knee injury risk in CrossFit athletes as a major strength imbalance of the musculoskeletal system. Lower functional H:Q ratios found in CrossFit athletes may be an important factor that could increase the injury risk. Specific training programs that aim to correct the strength imbalance between knee extensors and flexors by strengthening the hamstring muscles relatively to quadriceps may benefit CrossFit athletes to minimize the risk of injury. For future studies, it is recommended to evaluate the effects of hamstring training programs on correcting functional H:Q ratios of CrossFit athletes.

References

1- Glassman, G. Understanding crossfit. CrossFit Journal 2007; 56(4):1.
2- Brenner JS. Sports specialization and intensive training in young athletes. Pediatr. 2016;138.
3- Stracciolini A, Quinn B, Zwicker RL, Howell DR, Sugimoto D. Part I: Crossfit-Related Injury Characteristics Presenting to Sports Medicine Clinic. Clin J Sport Med 2020; 30(2): 102-107.
4- Butcher SJ, Neyedly TJ, Horvey KJ, et al. Do physiological measures predict selected CrossFit (R) benchmark performance? Open Access J Sports Med 2015; 6:241–247.
5- Eather N, Morgan PJ, Lubans DR. Improving health-related fitness in adolescents: the CrossFit teens randomised controlled trial. J Sports Sci. 2016; 34:209–223.
6- Smith MM, Sommer AJ, Starkoff BE, et al. Crossfit-based high-intensity power training improves maximal aerobic fitness and body composition. J Strength Cond Res 2013; 27:3159–3172.
7- Elkin JL, Kammerman JS, Kunselman AR, Gallo RA. Likelihood of injury and medical care between CrossFit and traditional weightlifting participants. Orthop J Sports Med 2019; 7(5).
8- Maté-Muñoz JL, Lougedo JH, Barba M, García-Fernández P, Garnacho-Castaño MV, Domínguez R. Muscular fatigue in response to different modalities of CrossFit sessions. PloS one 2017; 2(7): e0181855.
9- Lauersen JB, Andersen TE, Andersen LB. Strength training as superior, dose-dependent and safe prevention of acute and overuse sports injuries: a systematic review, qualitative analysis and meta-analysis. Br J Sports Med 2018; 52(24): 1557-1563.
10- Weisenthal BM, Beck CA, Maloney MD, DeHaven KE, Giordano BD. Injury rate and patterns among CrossFit athletes. Orthop J Sports Med 2014; 2(4).
11- Hak PT, Hodzovic E, Hickey B. The nature and prevalence of injury during CrossFit training. J Strength Cond Res 2013; doi: 10.1519/JSC.0000000000000318
12- Montalvo AM, Shaefer H, Rodriguez B, Li T, Epnere K, Myer GD. Retrospective injury epidemiology and risk factors for injury in CrossFit. J Sci Med Sport 2017; 16(1): 53.
13- Wang V, Mayer F, Bonaventura K, Wippert M. Intrinsic and extrinsic injury risk factors of elite winter sports athlete in training. Br J Sports Med 2017; 51(4): 406-406.
14- Gianzina EA, Kassotaki OA. The benefits and risks of the high-intensity CrossFit training. Sport Sci Health 2019; 15(1): 21-33.
15- Dandres R. Ratio entre cuádriceps e iquiosurales en crossfit, 2017.
16- Huang H, Guo J, Yang J, Jiang Y, Yu Y, Müller S, Ao Y. Isokinetic angle-specific moments and ratios characterizing hamstring and quadriceps strength in anterior cruciate ligament deficient knees. Sci Rep 2017; 7(1): 1-11.
17- Liporaci RF, Saad M, Grossi DB, Riberto M. Clinical features and isokinetic parameters in assessing injury risk in elite football players. Int J Sports Med 2019; 40(14): 903-908.
18- Croisier JL, Ganteaume S, Binet J, Genty M, Ferret JM. Strength imbalances and prevention of hamstring injury in professional soccer players: a prospective study. Am J Sports Med 2008; 36(8): 1469-1475.
19- Steindler A. Kinesiology of the human body under normal and pathological conditions. Spring-field, IL. Charles C Thomas, 1977.
20- Coombs R, Garbutt G. Developments in the use of the hamstring/quadriceps ratio for the assessment of muscle balance. J Sci Med Sport 2002; 1(3): 56.
21- Aagaard P, Simonsen EB, Magnusson SP, Larsson B, Dyhre-Poulsen PA et al. New Concept For Isokinetic Hamstring: Quadriceps Muscle Strength Ratio. Am J Sports Med 1998; 26(2): 231–237.
22- Aagaard P, Simonsen EB, Trolle M, Bangsbo J, Klausen K. Isokinetic hamstring/quadriceps strength ratio: influence from joint angular velocity, gravity correction and contraction mode. Acta Physiol Scand 1995; 154(4): 421-427.
23- Bamaç B, Çolak T, Özbek A, Çolak S, Cinel Y, Yenigün Ö. Isokinetic performance in elite volleyball and basketball players. Kinesiology 2008; 40 (2): 182-188.
24- Bradic A, Bradic J, Pasalic E, Markovic G. Isokinetic leg strength profile of elite male basketball players. J Strength Cond Res 2009; 23(4): 1132-1337.
25- Alemdaroğlu U. The relationship between muscle strength, anaerobic performance, agility, sprint ability and vertical jump performance in professional basketball players. J Hum Kinet 2012;31: 149-158.

26-Cheung RTH, Smith AW, Wong DP. H:Q ratios and bilateral leg strength in college field and court sports players. J Hum Kinet 2012; 33: 63-71.
27-Fousekis K, Tsepis E, Vagenas G. Lower limb strength in professional soccer players: Profile, asymmetry, and training age. J Sci Med Sport 2010; 9: 364–373.
28-Tourny-Chollet C, Leroy D. Conventional vs. dynamic hamstring-quadriceps strength ratios: A comparison between players and sedentary subjects. Isokinet Exerc Sci 2002; 10:183–192.
29-Evangelidis PE, Pain MTG, Folland J. Angle-specific hamstring-to-quadriceps ratio: A comparison of football players and recreationally active males, J Sport Sci 2015; 33 (3): 309-319.
30-Keating JL, Matyas TA. The influence of subject and test design on dynamometric measurements of extremity muscles. Phys Ther 1996;76(8):866-889.
31-Franchi MV, Reeves ND, Narici MV. Skeletal muscle remodeling in response to eccentric vs. concentric loading: Morphological, molecular and metabolic adaptations. Front. Physiol. 2017; 8:447.

Hardware and Software Complex "Varikard" as an Effective Method of Students' Health Monitorin

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Abstract

The problem of modern society is a deteriorating health of higher education institutions students. Monitoring of students' health state is necessary for timely adjustment of physical education classes at the University in order to create a health-preserving learning environment. Sufficient information of the health state can be obtained by means of hardware and software system "Varikard". For electrocardiogram (ECG) monitoring and HRV analysis, a commercially available four-channel "Varikard" complex with "ISCIM 6" is applied, along with a student's health passport with the functional state assessment based on the parameters of IARS and other HRV indicators in electronic and paper format, and the obtained data is subjected to the methods of mathematical processing. The main advantage of the hardware and software complex "Varikard" as a method of collecting and processing information about the students' health is a simplicity of application, good verifiability and availability. Monitoring of students' health by means of this hardware and software complex allows to identify priority and prospective measures to prevent and neutralize the adverse factors effects of environment and educational process on the health of students, allows to apply an individual approach to training in the subject "Physical culture", i.e. use an individual health passport to create student's personal trajectory of physical improvement.

Keywords: physical health monitoring, heart rate variability, student health passport, "Varikard" complex.

1. Introduction

Rapidly evolving technologies, the process of informatization, and the intensification of production impose high standards on the physical and mental health of a person, one's performance, and an ability to reproduce a healthy generation. Therefore one of the main problems of modern civilization is the problem of preserving the student's health [1, 2, 3, 4, 23, 24].

Many researchers point to a fairly steady decline of students' health condition. The increase in the incidence of student's youth causes concern, because this leads to a decrease in the specialists' performance in the future and may negatively affect the efficiency of production in general. Therefore the preservation of the health of students in the educational process is the most important task among other problems of higher education being solved today [5, 6, 7, 8, 9, 10, 23, 24].

The hopes for the effective contribution of young generation in the economic and technological growth of the country require the students themselves to be successful in their educational activities, to be able to resist the influence of powerful flows of information and to acquire health-preserving competencies in the process of studying at the University.

However, the lack of initiative of some young people who are dissatisfied with traditional types of motor activity is the reason why students do not form a demand for systematic physical training.

Therefore, in order to improve the training program and organization of physical culture classes, it is necessary to keep up to date such forms and methods of pedagogical influence that would form students' values-based attitude to its means and shift the traditional vector of interaction between teachers and students for the manifestation of youth initiative in the healthy lifestyle promotion [11, 23, 24].

The most common method of monitoring students' physical health is pedagogical tests. The main advantages of such methods are simplicity of application, good verifiability and availability. But there are also some limitations. For example, it is not always possible to conduct motor tests for people with serious health disorders. Therefore, well-proven hardware tools, including those based on the study of heart rate variability, allow to minimise the above mentioned disadvantages. In the study, the authors studied the effectiveness of the hardware and software complex "Varikard" application in assessment of the current state of health of students. [12, 13, 14, 15].

The use of the hardware and software complex "Varikard" allows to create a monitoring basis for designing the physical culture environment of students at the University, evaluation of the effectiveness of the educational process in physical education, and correction of its training program.

With the help of hardware and software complex "Varikard" it is possible to point out weaknesses in the development of motor and functional qualities of students, monitor the dynamics of their physical development and fitness during the academic year and for the entire period of study at the University. "Varikard" evaluates heart rate variability. "Variability" is a property of biological processes that is associated with the organism's necessity to adapt to changing environmental conditions. In other words, variability is the change of different parameters, including the heart rate, in response to the influence of any factors. Therefore, heart rate variability (HRV) reflects the work of the cardiovascular system and the functioning of the regulation mechanisms of the entire body, allows to assess the overall state of a person, get information about the body's adaptive capabilities, which makes it possible to predict failures in the cardiovascular system [16].

Monitoring of students' health by means of this hardware and software complex allows to identify priority and prospective measures to prevent and neutralize the adverse factors effects of environment and educational process on the health of students, allows to apply an individual approach to training in the subject "Physical culture", i.e. use an individual health passport to create student's personal trajectory of physical improvement.

2. The Objective of the Study

to find out to what extent the hardware and software complex "Varikard" is informative for monitoring the health of students, what is the complexity and labor intensity of collecting and processing information by its means.

3. Materials and Methods

Heart rate variability (HRV) analysis is one of the modern informative methods for rapid assessment of the functional state of various parts of vegetative regulation and the body as a whole [22]. For electrocardiogram (ECG) monitoring and HRV analysis, a commercially available four-channel "Varikard" complex with "ISCIM 6" software is applied (Pic. 1), which allows to perform examination of about 30 people per training session. The ECG is recorded in a sitting position, in one of the standard leads, within 5 minutes. A comprehensive HRV assessment is performed based on the index of activity of the regulatory systems (IARS). When evaluating the IARS parameters, three zones of functional states are conditionally distinguished. For clarity, they are presented in the form of a "traffic light". The hardware and software complex "Varikard" allows to draw a comprehensive conclusion based on the HRV analysis data in the form of a health passport with an assessment of the functional state based on the IARS parameters and other HRV indicators, which can be given out to each interested student printed on paper or on an electronic storage device (Pic. 2).

Picture 1. *Hardware and software complex "Varikard*

The examination of 126 first-year students of CSU was conducted according to the standard method of heart rate variability (HRV) recording and analysis using the hardware and software complex "Varikard" [5] in the pre-sessional period. Out of 126 people, there were 21 boys and 105 girls, respectively, aged 18 – 19 years. Of the 52 HRV indicators calculated by the "ISCIM 6" program, 16 of the most informative ones were used for comparative analysis. The abbreviation of these indicators and its interpretation are shown in table 1.

Picture 2. *A model of the student's health passport*

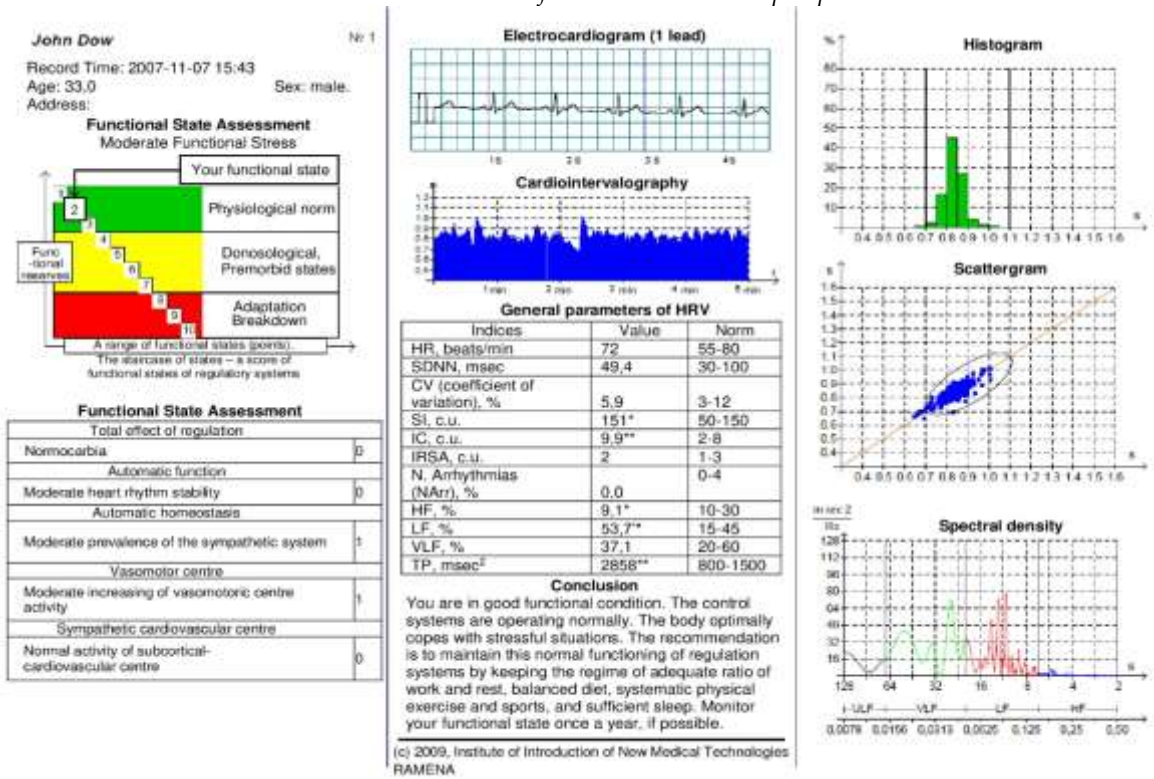


Table 1. *Indicators of the software and hardware complex "Varikard 2.51" selected for the analysis of CSU students heart rate variability*

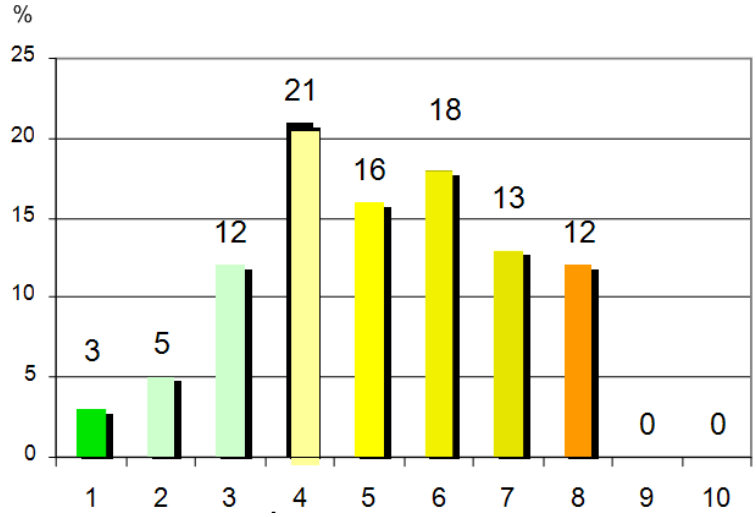
1.	HR	Heart rate (HR), BPM
2.	MeanRR	An average value of R-R intervals, msec
3.	RMSSD	The square root of the sum of the squares of the differences of the last pairs of R-R intervals values
4.	SDNN	The standard deviation of normal-to-normal intervals, msec
5.	CV	Coefficient of variation, %
6.	Mo	Mode, msec
7.	AMoSDNN	The standard deviation of NN intervals mode, %/SDNN
8.	CC1	Autocorrelation function indicator, the first lag
9.	SI	A stress index of regulatory systems, c.u.
10.	TP, msec	Total power, msec²
11.	HF, %	Power in the high-frequency band, msec²
12.	LF, %	Power in the low-frequency band, msec²
13.	VLF, %	Power in very-low-frequency band, msec²
14.	VLFmx,	Maximum power in very-low-frequency band, msec²/Hz
15.	IC	Index of centralization (VLF+LF)/HF
16.	IARS, c.u.	Index of activity of the regulatory systems, c.u.

These indicators and their values are presented in the "health passport" of the "Varikard" system.

4. The results of the study and their review

The data obtained in the course of mathematical processing are presented in the form of graphs (Histogram 1 and 2). The first graph shows the relative distribution of students over the "rungs of the ladder" of Baevsky within the range from 1 to 10, where functional classes 4 and 5 correspond to the donosological state, and 6 and 7 to the premorbid state. Thus, classes 4 to 7 indicate an overstrain of the body's regulatory systems, a disruption in adaptive capacity, and an average state of health. On the contrary, the body state with indicators of classes from 1 to 3 indicate a physiological norm, and from 8 to 10 – a breakdown of adaptation and a poor state of health.

Histogram 1. *The relative number of students with various functional states in the range from 1 to 10 (according to Baevsky)*

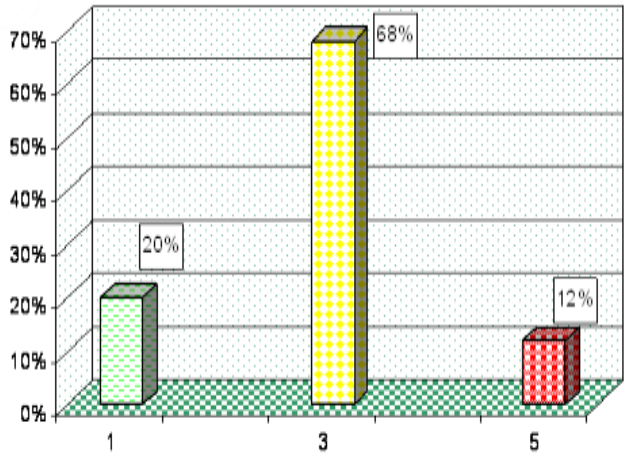


Remarkably, the majority of first-year students of CSU in the pre-session period were in a state of overstrain and adaptation breakdown (in accordance with Histogram 2).

Repeated examination of students in the second and third years allows to track the dynamics of their functional state in the process of studying at the University. The conducted research makes it possible to conduct a comparative analysis of the adaptive capabilities and functional reserves of the body of students of different genders, different faculties and specialties, who came from different districts of the region and other regions of the country, etc.

It is particularly relevant to identify students with heart rhythm disorders of various degrees who are attributed to the "main medical group" (students with no serious health or developmental disorders), in order to ensure adequate exercise load so as to prevent potentially hazardous conditions during practical training in physical culture.

Histogram 2. *Functional state of the body of first-year students (1 – norm, 3 – overstrain, 5 – adaptation breakdown)*



The detected deviations in the state of health, regulation mechanisms of physiological functions require considering them when organizing the educational process and planning recreational activities with students (table 2).

Table 2. *Identified abnormalities indicating adaptation breakdown and poor health*

Students	Heart rate, beats/min.		MxDMn, msec		SI, conventional unit		TP, msec²		HF, msec²		LF, msec²		VLF, msec²		ULF, msec²	
	standing	lying	standing	lying	standing	lying	standing	lying	standing	lying	standing	lying	standing	lying	standing	lying
1	74	97	**125**	**158**	**445**	**392**	**443**	**589**	**152**	98	**57**	**300**	**144**	**138**	**90**	52
2	66	**106**	**157**	**197**	**199**	**225**	**985**	**1282**	485	87	**119**	**487**	**169**	**135**	**212**	**574**
3	73	85	**132**	**231**	**325**	**131**	**676**	**1284**	352	211	**92**	**499**	**87**	**262**	**145**	**311**
4	64	83	**156**	**203**	**187**	**178**	**852**	**962**	514	156	**126**	**545**	**72**	**114**	**140**	**146**
5	71	95	**114**	**186**	**403**	**234**	**488**	**1163**	**220**	**106**	**97**	**791**	**157**	**151**	**14**	**115**
6	78	**115**	**105**	**136**	**509**	**606**	**227**	**1022**	**107**	104	**61**	**623**	**29**	**139**	**28**	**156**
7	79	**116**	**108**	**119**	**649**	**924**	**343**	**819**	**90**	42	**60**	**477**	**89**	**231**	**105**	69
8	76	**106**	**109**	**135**	**491**	**533**	**429**	**809**	**144**	64	**81**	**557**	**141**	**108**	**64**	81
9	81	111	**133**	**157**	**525**	**371**	**399**	**770**	**69**	55	**67**	**408**	**114**	**111**	**150**	**196**
10	76	110	**165**	**161**	**290**	**510**	**873**	**532**	**248**	39	**173**	**308**	**113**	**80**	**339**	106
11	74	**109**	**99**	**152**	**570**	**335**	**333**	**1285**	**117**	**140**	**118**	**776**	**79**	**266**	**18**	**103**
12	78	95	**132**	**172**	**353**	**229**	**377**	**1321**	**150**	**173**	**59**	**667**	**72**	**253**	**96**	**228**

*highlighted values of HRV indicators do not correspond to the norm

5. Conclusion

The hardware and software complex "Varikard" is an effective tool for monitoring the health of students, which allows to develop software and methodological support for training process correction and enhancement of the functional reserves of students' physical health of various medical groups. Systematic collection of objective data about students physical health makes the process of physical education manageable. The individual health passport, created with the hardware and software complex "Varikard",

helps to stimulate health-preserving activities and allows to personalize the process of student's health improvement.

Conflict of interests

The authors declare that there is no conflict of interest.

References

1. Drogomeretsky V.V., Kopeikina E.N., Kondakov V.L., Haweni S.S. et al. Adaptation of Ruffier's test for assessment of heart workability of students with health problems // Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports. – 2017. – V.21. – N5. – P. 227–235. DOI: 10.15561/20755279.2017.0102
2. Petrenko N.V., Petrenko O.P., Romanova V.B., Haweni V.V. et al. Analysis of the functional state of students in the process of healthy training exercises in different phases of the ovarian-menstrual cycle / N.V. Petrenko, O.P. Petrenko, V.B. Romanova, V.V. Haweni et al. // Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports. – 2017. – V.21. – N5. – P. 227–235. DOI: 10.15561/18189172.2017.0605
3. Semenov Yu.N., Baevsky R.M. Apparatno-programmnyj kompleks "Varikard" dlya ocenki funkcional'nogo sostoyaniya organizma po rezul'tatam matematicheskogo analiza ritma serdca. Variabel'nost' serdechnogo ritma. – Izhevsk: Udmurtskij gos. un-t, 1996. – P. 160–162.
4. Tavolacci M.P., Delay J, Grigioni S. et al. Changes and specificities in health behaviors among healthcare students over an 8-year period // Plos One. – 2018. – V.13. – N3. DOI: 10.1371/journal.pone.0194188
5. Zheleznyak Yu.D., Leyfa A.V., Perelman Yu.M. Cohesion of physical activity, health and quality of life of students // Theory and Practice of Physical Culture. – 2015. – N11. – P. 41–43.
6. Zheleznyak Yu.D., Leyfa A.V., Perelman Yu.M. Cohesion of physical activity, health and quality of life of students // Theory and Practice of Physical Culture. – 2015. – N11. – P. 41–43.
7. Rodriguez-Rodriguez F., Cristi-Montero C., Villa-Gonzalez E. et al. Comparison of the physical activity levels during the university life // Revista Medica De Chile. – 2018. –V.146. – N4. – P. 442–450.
8. Izaak S.I., Volodkovich S.L. Current problems preservation of health students in Russia and Belarus // Human Capital. – 2016. – N5 (89). – P. 8–10.
9. Kuzmina O.I. Deviations in physical development and health state of youth of the special medical group studying at the Technical University of Baikal region and the ways for their correction // Uchenye zapiski Universiteta imeni P.F. Lesgafta. – 2016. – N9 (139). – P. 84–91.
10. Melki H., Bouzid M.S., Haweni A. et al. Formative assessment: exploring Tunisian cooperative teachers practices in physical education // Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports. – 2017. – V.21. – N5. – P. 227–235. DOI: 10.15561/20755279.2017.0102
11. Shlyk N.I., Gavrilova E.A. Heart rate variability in express-evaluation of the functional state of athlete // Prikladnaya sportivnaya nauka. – Minsk, 2015. – P. 115–125.
12. Druz V.A., Iermakov S.S., ArteArtemyeva G.P. et al. Individualization factors of students' education at modern stage of its realization // Physical Education of Students. – 2017. – V.21. – N1. – P. 10–16. DOI: 10.15561/20755279.2017.0102
13. Leifa A.V., Zheleznyak Yu.D. Influence of physical activity on students' life quality // Physical Education of Students. – 2017. – V.21. – N5. – P. 244–248. DOI: 10.15561/20755279.2017.0102
14. Koryahin V.M., Blavt O.Z., Haweni V.V. et al. Control of psychophysiological functions of students with ophthalmologic diseases in the process of physical education // Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports. – 2017. – V.21. – N5. – P. 227–235. DOI: 10.15561/18189172.2017.0605
15. Velten J., Bieda A., Scholten S. et al. Lifestyle choices and mental health: a longitudinal survey with German and Chinese students // Bmc Public Health. – 2018. – Vol. 18. DOI: 10.1186/s12889-018-5526-2
16. Germanov G.N., Gotovtsev E.V., Mashonina E.V., Romanova G.N. Monitoring of health and physical readiness of students as the methodology of the analysis and estimation of efficiency of physical education process // Uchenye zapiski universiteta imeni P.F. Lesgafta. – 2012. – N1. – P. 40–45.

17. Perez-Lopez I.J., Garcia E.R., Delgado-Fernandez M. Improvement of healthy lifestyle habits in university students through a gamification approach // Nutricion Hospitalaria. – 2017. – V.34. – N4. – P. 942–951. DOI: 10.20960/nh.669
18. Germanov G.N., Stradze A.E., Sabirova I.A. Physical Education concepts in context of human resource development theory // Theory and Practice of Physical Culture. – 2018. – N2. – P. 47–50.
19. Yahia N., Brown C.A., Snyder E. et al.Prevalence of Metabolic Syndrome and Its Individual Components Among Midwestern University Students // Journal of Community Health. – 2017. – V.42. – N4. – P. 674–687. DOI: 10.1007/s10900-016-0304-5
20. Perepelyukova E.V. Special health group students' functionality and physical fitness monitoring study // Theory and Practice of Physical Culture. – 2018. – N3. – P. 41–43.
21. Druz V.A., Iermakov S.S., Nosko V.O. et al. The problems of students' physical training individualization // Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports. – 2017. – V.21. – N5. – P. 227–235. pp. 51–59. DOI: 10.15561/20755279.2017.0102
22. Yammine, K. The prevalence of physical activity among the young population of UAE: a meta-analysis // Perspectives in Public Health. – 2017. – V.137. – N5. – P. 275–280. DOI: 10.1177/1757913916675388
23. Salkova N.A. Health-preserving behavior of the modern students // Physical Culture. Sport. Tourism. Motor recreation. – 2018. – V.3. – N1. – P. 90–97.
24. Yarushin S.A. Formation of students' competence on preservation and increase of health reserves // Physical Culture. Sport. Tourism. Motor recreation. – 2019. – V.4.– N4. – P. 67–70.

Impact of Exercise on Psychological Health of Housewives in Qom

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Abstract

Background: Prolonged stress or abnormal stress level could result in long term psychological and physical issues. Its potential consequences include psychosocial responses, such as hopelessness, anxiety, irritability, the feeling of inability for coping with the world, behavioral problems, and reluctance to do occupational and social activities. The general feeling in Iranian culture is that the stress level in men is higher than in women. Moreover, not only employed females are stressed, but also housewives are under stress in meeting social and family expectations.

Objective: The present research was conducted aiming at assessing the impact of exercise on the housewives' psychological well-being.

Research design: Experimental research

Sample: Random sampling

Method: 60 Qomi housewives with the age range of 25-45 were assigned into two groups. In Group A (n=30), a 12-week aerobic exercise program was conducted, while no exercise program was performed for Group B (n=30). For measuring the outcomes, the Psychological General Well-Being Index (PGWBI), Pittsburg Sleep Quality Index, and Perceived Stress Scale Index were employed.

Findings: At the end of the 12-week aerobic exercise program, group A significantly improved compared to the pre-aerobic training. A significant improvement was also observed in scores of PGWBI, the perceived stress score was reduced, and the score of Sleep Quality Index was improved.

Conclusion: According to the research findings, exercise beneficially influenced general well-being, quality of sleep, and stress in the Qomi housewives. Thus, it can be employed as a means for the promotion of housewives, and their psychological health.

Key Terms: Psychological and General Well Being Index, Perceived Stress Scale, Aerobic exercise, Pittsburg Sleep Quality Index, Qomi housewives

Introduction

Stress is experienced by all people. Stress is vital for humans at a certain level for meeting crises. However, abnormal or prolonged stress level can result in long term psychological and physical issues (French & Sim, 1997) Stress is described as an internal state caused by social situations, environment, or physical demands on the body that are perceived as uncontrollable, potentially harmful, or beyond our capability to cope with (Keable, 1997).

Stress can lead to various medical and physical issues like cardiovascular disease, gastrointestinal disease, respiratory disorders, immunological disturbances, dermatological disorders, musculoskeletal pain, fatigue, lethargy, impaired task performance, and frequent minor illness. It can also lead to psychosocial issues, such as hopelessness, anxiety, irritability, general sense of inability for coping with the world, drug and alcohol abuse, behavioral disruptions, avoidance of social and occupational activities inside and outside home Blumenthal, 1982).

In general, women have significantly higher rates than men for all disorders, particularly anxiety & depression (Kaplan et al, 1991; Aziz, 2004). Females living in urban areas are the most influenced group concerning depression. It has been found that the rate of prevalence of depression and anxiety is higher in females, and these problems show a steady increasing rate with age from 18-50 years (Aziz, 2004).

The socioeconomic status, education, and age are the potential risk factors causing higher rates of anxiety and depression prevalence in females.

Immediate and emergency response of body to stress is mediated by the Sympathetic Nervous System through fight and flight response. Stressors (physical, social & environmental causes of stress) have the ability to activate the nerve cells of the hypothalamus so more CRF (corticotrophin-releasing hormone) is

transferred to the pituitary gland that causes increased release of cortisol from the adrenal gland. Cortisol and other similar hormones allow body to deal adaptively with stressors for a long period of time. But maintained level of these hormones is harmful (Keable, 1997).

The neurotransmitter serotonin has involvement in the regulation of various major physiological (body-oriented) functions, such as aggression, sleep, eating, mood, and sexual behavior. As suggested by recent studies, low serotonin levels in some people stimulate a decline in norepinephrine levels, leading to depression (Nemade et al, 2007).

Some works have studied the relationships between depression, norepinephrine, and stress. Using norepinephrine, the human body can identify and show reactions to stressful situations. According to researchers, the norepinephrinergic system in individuals vulnerable to stress might not be able to cope with the stress effects in an effective manner. There is also a relationship between neurotransmitter dopamine and depression. Glutamate, another neurotransmitter, has been also recently implicated in psychological disorders. However, further studies are required for determining the nature of this association. An inability to handle stress or anxiety can cause insomnia. You may develop severe sleeping disorders, which leave you exhausted and less productive (Kaplan et al, 1991).

The psychological disorders can have a pharmacological and a non-pharmacological approach. The non-pharmacological approach towards stress and anxiety include mental relaxation techniques, physiological relaxation, cognitive behavioral modification techniques, and physical exercise. The recent evidence indicates that regular exercise improves psychological as well as physical health. Several studies have reported the following benefits of reduced anxiety, feeling of stress, depression, fatigue; improved alertness, concentration, mood, energy level, and resistance to infection; improved appearance (including weight loss and physical fitness), confidence, self-esteem; as well as increasing social contact and enjoyment (keable, 1997).

The general feeling in Iranian culture is that stress level in men is higher than in women that is contradictory to the survey done for Indian culture by Nandi et al. Besides, not only employed females are stressed but also housewives are under stress in meeting social and family expectations (Aziz, 2004).

Materials and Methods

Sixty healthy housewives in Qom between age 25-45 years with a mean age of 36.17 ± 2.85 years for exercise group and 37 ± 3.75 years for the control group participated in this study. With a Perceived stress score ≥ of 12, from a similar socioeconomic background were randomly placed in the control group and exercise group (30 each). Informed consent was received from the subjects. A detailed history and physical examination were done. Individuals who had been physically active during the past 3 months, with any neurological, cardiovascular, or musculoskeletal disorder and those diagnosed to have psychiatric disorders were excluded.

Outcome Measures:

1. Perceived Stress Scale Index (PSSI)-14

PSS-14 contains 14 items that are commonly employed as a psychological means for measurement of the stress perception with high validity and reliability (Leung et al, 2010; Augustine, 2011). Thoughts and feelings and thoughts during the last month are asked on this scale.

2. Psychological General Well-Being Index (PGWBI)

This scale contains 22 items related to the quality of life that provides a self-perceived assessment of self-control, general health, and psychological well-being, with high validity and reliability (Revicki et al, 1996).

3. Pittsburg Sleep Quality Index (PSQI)

It is an efficient tool for measuring the pattern and quality of sleep in adults with high validity and reliability. It distinguishes 'poor' from 'good' sleep through measurement of 7 areas: sleep latency, sleep quality, sleep duration, sleep disturbance, habitual sleep efficiency, day time dysfunction, and use of sleeping medication during the last month (Carole, 2007).

Procedure

Baseline outcome measures were individually measured using the mentioned psychological instruments, for both the aerobic exercise group and the control (non-exercise) group. For minimizing the impacts of positive expectations on aerobic group responses, the present study's purpose was not expressed to the participants until the questionnaires were completed. Then, the research purpose was expressed to the participants for learning the impact of different attitudes and feelings on healthy individuals. The control group was instructed not to indulge in any type of exercise during this period.

Aerobic Exercise Program

The subjects exercised 60 minutes one time per day, 6 times per week, during 12 consecutive weeks at moderate intensity (65%- 80% of maximum heart rate) (Kisner & Colby, 2007; Schmidt, 1998), which included a warm-up, conditioning, and cool down. The conditioning program was gradually increased within the first week from 20-45 minutes, using a combination of Treadmill, Cross Runner and Static Cycle depending upon the comfort of the patient, but it was ensured that the subject exercised in the target heart rate range and at score 13 on Burg's Rating of Perceived exertion scale (Kisner & Colby, 2007; Schmidt, 1998). The subjects' blood pressure and pulse rate were measured before, during and after exercise.

They were instructed to inform when any of the following occurs – giddiness, shortness of breath, chest pain, excessive perspiration, palpitation and/or muscular pain (Kisner & Colby, 2007). Following completion of 12 weeks of aerobic exercise training, the participants were again asked to complete the PSSI, PGWBI, PSQI questionnaires. The subjects in the control group were also asked to fill the same questionnaires again after 12 weeks.

Data Analysis

An unpaired t-test was employed for finding homogeneity of two groups in the parameters and comparing the outcome assessment data between the two groups.

A paired t-test was used for determining id PSSI, PGWBI and PSQI were significantly different after and before the intervention in the aerobic exercise group and the control group, and an Unpaired t-test was employed for comparing the outcome measures between the case and control groups. Each calculated t-value was employed for testing the one-tailed hypothesis for all the parameters. None of the 60 patients participating in the research were lost in follow-up evaluation at the end of the research. All 30 subjects in the aerobic exercise group participated in 90% of the planned aerobic exercise program.

Table 1 *(Perceived Stress Scale Index – PSSI)*

Groups	Mean / SD	Pre	Post	t-calculated	P value	Significant
Aerobic Exercise Group (A)	mean	15	10.733	16.47	<0.0001	Yes
	SD	2.1655	0.907			
Control Group (B)	mean	14.96	14.23	2.665	>0.0001	No
	SD	2.04	2.29			

Table 2 *(Psychological & General Well Being Scale - PGWBI)*

Groups	Mean / SD	Pre	Post	t calculated	P value	significant
Aerobic Exercise Group (A)	Mean	69.3	79.03	14.32	< 0.0001	Yes
	SD	4.92	2.97			
Control Group (B)	Mean	69.26	69.53	0.7871	> 0.0001	No
	SD	5.55	5.81			

Table 3 *(Pittsburg Sleep Quality Index – PSQI)*

Groups	Mean / SD	Pre	Post	t calculated	P value	significant
Aerobic Exercise Group (A)	Mean	4.93	3.31	8.191	< 0.0001	Yes
	SD	1.08	0.46			
Control Group (B)	Mean	4.53	4.36	1.720	> 0.0001	No
	SD	1.10	1.09			

Comparison of outcome measures between the groups

There is a significant reduction in the stress perception in the aerobic group as compared to the control group.

PSIS (post-exercise)					
Parameters	Aerobic	Control	t calculated	P-value	Significant
Mean	10.73	14.23	6.812	< 0.0001	Yes
SD	0.90	2.29			

There statistically significant enhancement in the General and Psychological Well Being of the patient in the aerobic group in comparison with the control group.

PGWBI (post-exercise)					
Parameters	Aerobic	Control	t calculated	P-value	Significant
Mean	79.03	69.53	7.969	< 0.0001	Yes
SD	2.97	5.81			

There is statistically significant reduction in sleep disturbances in the aerobic group in comparison with the control group.

PSQI (post-exercise)					
Parameters	Aerobic	Control	t calculated	P-value	Significant
Mean	3.31	4.37	4.72	< 0.0001	Yes
SD	0.46	1.09			

Discussion

A significant enhancement in the overall psychological well-being in subjects who participated in the aerobic exercise program was attested. The possible neurophysiological mechanism in this psychological benefit may be related to an increase in B-endorphins, which increases as much as five times the resting level, depending on the type of exercise (McArdle et al, 2001).

The aerobic exercise group experienced a reduction in the level of stress measured by PSSI-14 and improvement in the scores of PGWBI scores as compared to the non-exercise group. Also, the difference in the pre- and post-exercise period stress level in the exercise group is significant. De Gues & Stubble in 2007 had similar findings. Similar results were obtained by Cramer et al in 1991.

De Gues & Stubble in 2007 also found that improvement in psychological well-being after aerobic training only in clinically anxious or depressed subjects. This correlates with the present study, as more change in the scores of PSSI and PGWBI was seen in subjects with comparatively higher stress level before exercise.

The PSQI scores showed a significant difference between the two groups that shows a significant improvement in sleep quality before and after the aerobic exercise program. This is probably due to a reduction in the stress level. Passos GS et al. (2011) in their study on "moderate aerobic exercise training impact on chronic primary insomnia" found a significant increase in sleep efficiency, enhancement of sleep onset latency, quality of sleep, and feeling of rest in the morning (Passos et al, 2012).

The data analysis of this study shows that the psychological status of the housewives who participated in the aerobic exercise program for 12 weeks improved significantly related to a group of non-exercising housewives. However, none of the subjects in this study were diagnosed to have any psychological disorder or were on Psychopharmacol-therapy. Rather the data indicate that well-adjusted, healthy housewives can enhance their well-being sense in comparison with otherwise healthy individuals

that do not exercise.

It is possible to explain the differences observed between the two groups and the before and after psychological scores in the aerobic group in various ways. The exercise group may have a greater expectation for enhancement. The purpose of the experimental design was to minimize the expectancy by ensuring that none of the subjects was informed about the research purpose; thus, positive expectation is not transferred to the subjects. Luxton in 2010 examined whether aerobic and perceived fitness are associated with life stress, job stress, and well-being. They found a significant relationship between well-being and life stress, whereas aerobic fitness was not associated with these variables. Moreover, aerobic fitness had a positive relationship with perceived fitness and perceived fitness may partially account for exercise-psychological enhancement relation.

In 1988, MacMohan et al. assessed the effect of aerobic exercise on the physical fitness and self-concept depression level in 98 youths (comparative study). They showed that there was a relationship between involvement in aerobic program and improvement in mood, fitness, and self-concept. Enhancement of psychological variables did not depend on enhanced physical fitness.

Sixteen out of thirty women reported a decrease in premenstrual mood fluctuations after commencing the aerobic training. However, this was not taken as a study parameter. Also, there was subjective reporting of enthusiasm, which lasted the whole day in the exercise group. Maroukalis & Zervas in 1993 studied the impact of aerobic exercise on adult females' mood and their analysis indicated a significant beneficial effect on all dimensions of mood.

Nevertheless, the findings of this study support the potential usefulness of regular physical exercise as a way of promoting psychological health in housewives. However, its long-term benefits need to be further evaluated.

Conclusion

It is concluded from this study that aerobic exercise has a beneficial effect on stress, psychological well-being, and quality of sleep in Qomi housewives.

References

Augustine, Little Flower; Vazir, Shahnaz; Rao, Sylvia; Vishnu, M & Madhavan Nair, M.. Perceived stress, life events and coping among higher secondary students of Hyderabad, India: A pilot study. Indian J Med Res 134, July 2011, 61-68 (reliability of PSS).

Aziz, Mohsen. Role stress among women in the Indian information technology sector". Women in management Review, 2004, vol.19 Issue: 7, 356-363.

Blumenthal, James A.; Williams, R. Sanders & Wallace, Andrew G.. Psychological changes Accompany Aerobic Exercise in Healthy Middle-Aged Adults, Department of Psychiatry and Medicine, Duke Medical Center, North Carolina, 1982.

Carole, Smyth. The Pittsburgh Sleep Quality Index (PSQI). New York University College of Nursing. Issue Number 6.1, Revised 2007 Series.

Cramer, S.R.; Neiman, D.C. & Lee, J.W.. The effects of moderate exercise training on psychological well-being and mood state in women. J Psychosom Res; 1991;35(4-5):437-49.

De Gues, E.J.C. & Stubble, J.H.. Aerobic exercise and Stress reduction. Sep 2007, Vrije University, Amsterdam, The Netherlands.

French, Sally & Sim, Julius. Physiotherapy, a psychological approach. 2nd edition. Butterworth-Heinemann; 1997.

Kaplan, Harold I. & Sadock, Benjamin J.. Synopsis of Psychiatry, 6th edition. Lippincott Williams & Wilkins. 1991.

Keable, Diana. The Management of Anxiety; A Guide for Therapist. 2nd Edition; Churchill Livingstone. 1997.

Kisner, Carolyn & Colby, Lynn Allen. Therapeutic Exercise Foundations and Techniques, 5th edition. F.A. Davis Company. 2007.

Leung, Doris YP; Lam, Tai-Hing & Chan, Sophia SC. Three versions of Perceived Stress Scale: validation in a

sample of Chinese cardiac patients who smoke. BMC Public Health. 2010; 10:513. PMCID: PMC2939644.
Luxton, Brooke. Effects of perceived and Aerobic Fitness on Well-being, job stress and life stress, Nov 2010.
Macmohan, J. R.. Physical and psychological effects of aerobic exercise in delinquent adolescent males; Am J Dis Child; 1998 Dec; 142(12):1361-6; PMID:3195535.
Maroulakis, E. & Zervas, Y.. Effect of aerobic exercise on mood of adult women. Percept Mot Skills, 1993 Jun;76(3 Pt 1):795-801. PMID:8321589.
McArdle, William D.; Katch, Frank I. & Katch, Victor L.. Exercise Physiology- Energy, nutrition, and human performance. 5th edition: Lippincott Williams & Williams. 2001.
Nemade, Rashmi; Staats-Reiss, Natalie & Dombeck, Mark, Updated: Sep 19th (Biology of Depression – Neurotransmitters) 2007.
Passos, G.S. et al, "Effects of moderate aerobic exercise training on chronic primary insomnia", Sleep medicine 12(2012)1018-1027.
Revicki, DA; Leidy, NK & Howland, L.. Evaluating the psychometric characteristics of the Psychological General Well-Being Index with a new response scale. Quality of life research; vol 5, 1996: 419-425.
Schmidt, Pollock. Heart Disease and Rehabilitation. 2nd Edition. CRC Press, 1998.