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Effect of Breed and Holding Period on Egg Quality Characteristics of Chicken

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Abstract: The external and internal qualities of 80 fresh eggs from each Barred Plymouth Rock (BPR), White Leg horn (WL), Rhode Island Red (RIR) and White Rock (WR) layers were ascertained in one, seven, fourteen and twenty-one days holding periods. Egg weight was highest in WLH (58.38 g), intermediate in BPR (56.3g) and RIR (55.95g) and lowest in WR (59.60g). Egg length was highest in WLH (5.91 cm), intermediate in BPR (5.86 cm) and RIR (5.71 cm) and lowest in WR (5.62 cm). Egg width was highest in WLH (4.21 cm), intermediate in BPR and WR (4.16 cm) and lowest in RIR (4.13 cm). Shape index was highest in WR (74.10), intermediate in RIR (72.32) and WLH (71.34) and lowest in BPR (71.14). Breaking strength was highest in WLH egg (3.38 kg/cm), intermediate in RIR (3.31 kg/cm) and BPR (2.61 kg/cm) and lowest in WR (2.19 kg/cm) egg. Albumen height of WR, WLH, BPR and RIR egg was 4.66, 4.33, 4.19 and 3.60 mm respectively. Haugh unit was highest in WR (58.68), intermediate in WLH (45.81) and BPR (54.20) and lowest in RIR (45.81). Shell thickness was highest in WLH and RIR (0.35 mm), intermediate in WR (0.32 mm) and lowest in BPR (0.31 mm). There were significant difference among the breeds and holding period for all the egg quality traits except egg width. Breed and holding period interactions were significant for egg length, shape index, albumen height and Haugh unit but not for other traits. The egg weight, egg length, egg width, albumen height and Haugh unit of all breeds were higher in fresh egg that means one days egg but breaking strength and shell thickness were higher in seven days holding period eggs than the other period eggs. The egg weight, egg length, egg width, breaking strength performance is superior in White Leghorn over other breeds. Shape index and albumen height is better in White Rock than other breeds.

Key words: Breed, holding period, egg quality, chicken

Introduction

It is generally agreed that all characteristics of egg quality have a genetic basis. Egg quality has been defined by Stadelman (1977) as the characteristics of an egg that affect its acceptability to the consumer's. Egg quality is the more important price contributing factor in table and hatching eggs. Therefore, the economic success of a laying flock solely depends on the total number of quality eggs produced. Weight and proportion of egg represented by albumen, yolk and shell varied significantly between strain of hens (Pandey *et al.*,1986). Inherited differences between strains of White Leghorn in egg weight and shape index have been reported by Arafa *et al.* (1982) and Carter and Jones (1970) respectively. Albumen quality has been reported as a quantitative genetic trait and Eisen and Bohren (1963) found it possible to list desirable characteristics of a numerical expression of albumen quality. Thickness of the shell is significantly influenced by strain (Pandey *et al.*, 1986). Higher egg size may also be factor influencing the shell quality traits. The proportion of albumen had a high heritability and is controlled by additive multiple factors (Scheinberg *et al.*, 1953). There is relatively little information on the effect of breeds and holding periods on the quality of eggs produced in same feeding, housing and managemental practices of Bangladesh. However, sufficient inconsistencies exist in literature on the external and internal qualities of eggs of different breeds. This study was undertaken to evaluate the differences in external and internal quality characters and breaking strength of eggs of Barred Plymouth Rock, White Leghorn, Rhode Island Red and White Rock layers in different holding periods i.e. one, seven, fourteen and twenty one days in summer season of Bangladesh.

Materials and Methods

At the age of between 220 to 260 days, 80 eggs were collected randomly from Barred Plymouth Rock, White Leghorn, Rhode Island Red and White Rock. About 5 number of eggs were taken from each replication for the evaluation of egg quality characteristics and held them for different period (1, 7, 14 and 21 days) in normal environmental temperature at summer season (March, April and May) of Bangladesh. In each period 20 eggs were taken, 5 from each breed. The average temperature and relative humidity were 27.40±1.25 ^{o}C and 80.50±1.90% in summer season. The eggs were numbered according to replication for identifications. At first egg weight was recorded by egg weighing balance. The length and width of egg was determined by egg shape measurer and their shape index were determined according to Reddy *et al.* (1979). The formula was used to calculate the shape index is given below:

$$\text{Egg shape index} = \frac{\text{Width of egg}}{\text{Length of egg}} \times 100$$

Then, the breaking strength (kg/cm) of egg was

Table 1: Egg weight, egg length, egg width, shape index, breaking strength, albumen height, Haugh unit and shell thickness of different breeds of chicken

Parameter	H.P. (days)	Breed				Mean	F value level of significance		
		BPR	WLH	RIR	WR		Breed	H.P.	Breed x H.P.
Egg weight (g)	1	64.00	63.00	57.20	57.00	60.30	3.57*	8.33**	1.32^{NS}
	7	52.20	58.60	54.40	53.40	54.65			
	14	56.80	55.20	58.00	53.20	55.80			
	21	52.40	56.60	54.20	50.80	53.50			
	Mean	56.35	58.35	55.95	53.60				
Egg length (cm)	1	6.12	6.18	5.86	5.66	5.96	6.81**	7.00**	4.02**
	7	5.56	6.12	5.44	5.64	5.69			
	14	6.02	5.64	5.88	5.60	5.76			
	21	5.72	5.68	5.66	5.58	5.66			
	Mean	5.86	5.91	5.71	5.62				
Egg width (cm)	1	4.28	4.24	4.14	4.16	4.21	1.24^{NS}	2.18^{NS}	0.87^{NS}
	7	4.10	4.22	4.12	4.10	4.14			
	14	4.10	4.10	4.12	4.16	4.12			
	21	4.14	4.26	4.14	4.22	4.19			
	Mean	4.16	4.21	4.13	4.16				
Shape index	1	69.99	68.61	69.93	73.50	70.51	3.81*	5.62**	2.64*
	7	73.80	69.03	75.94	72.74	72.88			
	14	68.13	72.70	70.06	74.36	71.31			
	21	72.61	75.02	73.34	75.81	74.20			
	Mean	71.14	71.34	72.32	74.10				
Breaking strength (kg/cm)	1	2.20	3.26	3.34	2.14	2.74	14.53**	8.59**	2.01^{NS}
	7	2.94	3.66	4.12	3.38	3.53			
	14	2.86	2.88	3.00	1.62	2.59			
	21	2.44	3.72	2.76	1.60	2.63			
	Mean	2.61	3.38	3.31	2.19				
Albumen height (mm)	1	8.92	9.16	7.62	9.88	8.90	6.48**	357.94**	2.71**
	7	4.20	3.54	3.72	4.58	4.01			
	14	1.98	3.10	1.41	1.84	2.08			
	21	1.66	1.51	1.64	2.32	1.78			
	Mean	4.19	4.33	3.60	4.66				
Haugh unit	1	93.11	94.83	88.20	99.21	93.84	6.23**	193.46**	3.88**
	7	64.34	53.44	57.79	65.90	60.37			
	14	31.60	50.10	13.07	29.81	31.14			
	21	27.78	22.88	24.19	39.81	28.66			
	Mean	54.20	55.31	45.81	58.68				
Shell thickness (mm)	1	0.31	0.35	0.33	0.32	0.33	3.86*	3.09*	0.28^{NS}
	7	0.33	0.37	0.37	0.34	0.36			
	14	0.30	0.36	0.34	0.31	0.33			
	21	0.28	0.31	0.34	0.30	0.31			
	Mean	0.31	0.35	0.35	0.32				

*P<0.05; **P<0.001; NS = Non-significant; H.P.= Holding period, BPR = Barred Plymouth Rock, WLH = White Leghorn, RIR = Rhode Island Red, WR = White Rock

measured by eggshell intensity tester. The eggs were broken out and than the maximum albumen height were measured from at least 3 places each egg with tripoid micrometer (Froning and Fank, 1958). Individual Haugh unit (Haugh, 1937) score was calculated using the egg weight and albumen height (Doyon *et al*., 1986). The Haugh unit values were calculated for individual egg using the following formula:

$HU = 100 \log (H - 1.7w^{0.37} + 7.6)$

Where

HU = Haugh unit

H = Observed height of the albumen in mm

W = Weight of egg (g)

Eggshell thickness was measured according to Chowdhury (1987).

The analysis of variance was done for all recorded parameters to find out the differences between breeds and holding periods.

Results and Discussion

The effects of breed, holding period and their interactions on external and internal quality traits of egg are presented in Table 1. Egg weight was highest in WLH (58.38 g), intermediate in BPR (56.3g) and RIR (55.95g) and lowest in WR (59.60g). There were significant difference among the breeds (P<0.05) and

holding period (P<0.01) but the interaction effects between breeds and holding periods on egg weight was statistically non-significant. The genetic differences between strains for egg weight was reported by Carter and Jones (1970); Potts *et al*. (1974); Arafa *et al*. (1982). The highest egg weight of White Leghorn layers is supported by Amer (1965); Salahuddin and Howlider (1991). Egg length was highest in WLH (5.91 cm), intermediate in BPR (5.86 cm) and RIR (5.71 cm) and lowest in WR (5.62 cm). The breed, holding period and the interaction effect on egg length was statistically significant (P<0.01). Egg width was highest in WLH (4.21 cm), intermediate in BPR and WR (4.16 cm) and lowest in RIR (4.13 cm). The effect of breed, holding period and the interaction between breed and holding period on egg width was statistically non-significant. There was no available literature to be found on egg length and width.

Shape index was highest in WR (74.10), intermediate in RIR (72.32) and WLH (71.34) and lowest in BPR (71.14). There was significant difference among breeds (P<0.05), holding period (P<0.01) on shape index. Interaction effects were statistically significant (P<0.05). The decreased shape index with increasing egg weight was supported by Reddy *et al*. (1979). The genetic difference between strains for shape index was reported by Potts *et al*. (1974); Arafa *et al*. (1982). Breaking strength was highest in WLH egg (3.38 kg/cm), intermediate in RIR (3.31 kg/cm) and BPR (2.61 kg/cm) and lowest in WR (2.19 kg/cm) egg. Breed and holding period effect on breaking strength of egg was statistically significant (P<0.01) but interaction effect was statistically non-significant.

Albumen height of WR, WLH, BPR and RIR egg was 4.66, 4.33, 4.19 and 3.60 mm respectively. There were significant differences (P<0.01) of breed, holding period and breed x holding period on albumen height of egg. There was no available literature to be found on breaking strength and albumen height of egg. Haugh unit was highest in WR (58.68), intermediate in WLH (45.81) and BPR (54.20) and lowest in RIR (45.81). Breed, holding period and breed x holding period had a significant effect (P<0.01) on haugh unit. Shell thickness was highest in WLH and RIR (0.35 mm), intermediate in WR (0.32 mm) and lowest in BPR (0.31 mm). Breed and holding period had a significant (P<0.05) effect on shell thickness but the interaction effect between breed and holding period was not statistically significant on shell thickness of egg. The differences observed in shell thickness due to breeds are in agreement with Pandey *et al*. (1986).

The results indicate that the egg weight, egg length, egg width, breaking strength performance is superior in White Leghorn over other breeds. Shape index and albumen height is better in White Rock than other breeds.

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