

LESSON 1: NUTRITION, HISTORY OF NUTRITION AND SCOPE OF NUTRITION

The course offered is General Nutrition. What do you perceive by the word nutrition? Let's start our study of nutrition by defining it.

Definition

Nutrition is defined as the "science of food, the nutrients and other substances therein, their action, interaction and balance in relation to health and disease, and the processes by which the organism ingests, absorbs, transports, utilizes and excretes food substances".

Nutrition - (physiology) the organic process of nourishing or being nourished, the processes by which an organism assimilates food and uses it for growth and maintenance.

Physiology - the branch of the biological sciences dealing with the functioning of organisms

Biological process, organic process - a process occurring in living organisms

Nutrition - the scientific study of food and drink (especially in humans) Human being, homo, human, man - any living or extinct member of the family hominidae Science, scientific discipline - a particular branch of scientific knowledge; "the science of genetics

Nutrients

Nutrients are substances that are essential to life, which must be supplied by food. There are six nutrients, which are required by the human body.

They are

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals
- Water

Metabolism

Metabolism is the sum of all the chemical and physical changes that take place within the body and enable its continued growth and functioning. Metabolism involves the breakdown of complex organic constituents of the body with the liberation of energy, which is required for other processes and the building up of complex substances, which form the material of the tissues and organs. The process of building the body's molecular structures from nutrients is called anabolism and breaking them down for energy is called catabolism.

The chemical and physical processes continuously going on in the body involving creation and breakdown of molecules; a process utilizing the raw materials of nutrients, oxygen, and vitamins, along with enzymes, to produce energy for bodily functions is called metabolism.

Metabolism is the biochemical processes that sustain a living cell or organism.

Have you an idea when nutrition made its start. Study of nutrition dates back to 400-500 B.C. We will study it chronologically.

History of the Study of Nutrition

Nutrition has been understood and discussed throughout history. Often, through folk stories or ceremonies, the young people in a tribe are instructed into what is correct and best to eat. Today we are able to study and learn a great deal about the food we eat.

The word nutrition itself means "the process of nourishing or being nourished, especially the process by which a living organism assimilates food and uses it for growth and replacement of tissues."

Air, soil, and water pollution in addition to non-organic modern farming techniques, have depleted soil of vital minerals.

The widespread use of food additives, chemicals, sugar and unhealthy fats in our diets appears to contribute to many of the serious diseases of our day such as diabetes, cancer and heart disease.

Let's look at the history of nutrition:

1. Prehistory

ZAn evolutionary perspective.

Are *Homo sapiens* 'naturally' vegetarians or meat eaters or omnivores?

Consensus suggests that *Homo sapiens* evolved as hunter-gatherers. The structure of the gut too confirms the ability to deal with an omnivorous diet and our nearest relatives, chimpanzees, were omnivorous and occasionally would hunt and kill small 'game'.

Agriculture was invented about 10,000 years ago probably in more than one location worldwide. In Pre-farming therefore there would be no (or very little): wheat (bread / pasta), rice, milk, cheese butter etc in the human diet.

Some foods are very recent additions (in UK): potato sugar, tea, coffee, tomato, cauliflower citrus fruits, all manufactured foods (bottled, canned, frozen...) and additives.

Certainly early diets must have been primarily plant based with meat a rare luxury.

Food in Pre-history

Food was sacred – hence eating was a sacred act. Food is magical – cooking was a magico-religious activity, every gesture, act and dish perhaps, endowed with ritual significance. Purity was considered paramount. Eating (and hunter-gatherer lifestyle) developed community. Eating was allowed only after doing

penance (work) – only work gave right to eat. Work, especially in the physical sense. Food was recognised to give strength and to safeguard health and salvation. Eating should help prevent and eliminate evil.

Balance of opposites made a healthy diet (person):

- Wet – dry
- Hot – cold

500 – 450 B.C.—Anaxagoras, reasoned that food became the human body and hence must contain ‘generative components’ termed by him ‘homeomers’.

400 B.C. —Hippocrates, the “Father of Medicine”, said to his students, “let thy food be thy medicine and thy medicine be thy food”. He also said, “a wise man should consider that health is the greatest of human blessings.”

400 B.C. — Foods were often used as cosmetics or as medicines in the treatment of wounds. In some of the early far-eastern biblical writings, there were references to food and health. One story describes the treatment of eye disease, now known to be due to a vitamin a deficiency, by squeezing the juice of liver onto the eye. Vitamin a is stored in large amounts in the liver.



The first recorded nutritional experiment is recorded in the book of daniel in the bible. Daniel was among the finest young men captured by the king of babylon when the babylonians over ran israel, and was to serve in the king’s court. He was to be fed from the king’s table of fine foods and wine. Daniel objected and preferred his own choices, which included vegetables (pulses) and water. The chief steward was afraid for his head, but agreed to a trial. Daniel and his friends received his own diet for 10 days and then were compared to the king’s men. As they appeared fitter and healthier, they were allowed to continue with their own foods, not defiling themselves with those of the king.

1500’s – Scientist and artist Leonardo da Vinci compared the process of metabolism in the body to the burning of a candle.



Antoine Lavoisier

1770 — Antoine Lavoisier, the “Father of Nutrition and Chemistry” discovered the actual process by which food is metabolized. He also demonstrated where animal heat comes from. In his equation, he describes the combination of food

and oxygen in the body, and the resulting giving off of heat and water.

1747 – Dr. James Lind, a physician in the British navy, performed the first scientific experiment in nutrition. At that time, sailors were sent on long voyages for years and they developed scurvy (a painful, deadly, bleeding disorder). Only nonperishable foods such as dried meat and breads were taken on the voyages, as fresh foods wouldn’t last. In his experiment, Lind gave some of the sailors sea water, others vinegar, and the rest limes. Those given the limes were saved from scurvy. As vitamin c wasn’t discovered until the 1930’s, Lind didn’t know it was the vital nutrient. As a note, British sailors became known as “limeys”.



1740-1770—William stark experimented with diet (on himself and died) – gradually restricted his diet more and more to find what was a minimum range food could exist on – bread & water (31days – after 16 days gums began to bleed).

Early 1800’s – It was discovered that foods are composed primarily of four elements: carbon, nitrogen, hydrogen and oxygen, and methods were developed for determining the amounts of these elements.

1816—Magendie, noted that dogs fed only carbohydrate (CHO) and fat lost body protein and died in a few weeks but dogs fed protein as well survived – showing protein in the diet was essential.

1840 — Justus Liebig of Germany, a pioneer in early plant growth studies, was the first to point out the chemical makeup of carbohydrates, fats and proteins. Carbohydrates were made of sugars, fats were fatty acids, and proteins were made up of amino acids.

Early 1880s— Takai observed that Japanese sailors, but not British, developed Beri Beri – adding milk and meat to Japanese diets prevented Beri Beri, but not due to protein. Beri Beri, a disease caused by a deficiency of something in the diet.

1912—Gowland Hopkins, identified ‘accessory food factors’, i.e. more to healthy diet than energy, protein and minerals. Organic materials which the body could not synthesise were essential to health.

1897 – Christiaan Eijkman, a Dutchman working with natives in java, observed that some of the natives developed a disease called beriberi, which caused heart problems and paralysis. He observed that when chickens were fed the native diet of white rice, they developed the symptoms of beriberi. When he fed the chickens unprocessed brown rice (with the outer bran intact), they did not develop the disease. Eijkman then fed brown rice to his patients and they were cured. He discovered that food could cure disease. Nutritionists later learned that the outer rice bran contains vitamin B1, also known as thiamine.

1813-1878—Claude Bernard, body fat could be synthesised from carbohydrate and protein, blood glucose could be stored as glycogen.

Carl Von Voit (1831-1908) - first applied physics to nutrition – measured energy expenditure different species.

Rubner (1854-1932) in Germany developed chemical analysis of food & digestion / absorption nutrients.

Atwater – Benedict (1903) invented a respiration chamber to perform direct & indirect calorimetry. Performed incredibly accurate balance studies still use results today: ‘metabolisable energy’.

Benedict (1909) showed doing examinations did not burn off appreciable amounts extra energy.

Wilcock & Hopkins (1906) showed a supplement of the amino acid tryptophan was necessary for survival mice fed on a diet low in tryptophan.

1912– E.V. McCollum, while working for the US Department of agriculture at the University of Wisconsin, developed an approach that opened the way to the widespread discovery of nutrients. Using this procedure, he discovered the first fat soluble vitamin, Vitamin A (1913) and water soluble B (1915). He found that rats fed butter were healthier than those fed lard, as butter contains more vitamin A.

1912 – Dr. Casimir Funk was the first to coin the term “vitamins” as vital factors in the diet. He wrote about these unidentified substances present in food, which could prevent the diseases of scurvy, beriberi and pellagra (a disease caused by a deficiency of niacin, vitamin B-3). The term vitamin is derived from the words vital and amine, because vitamins are required for life and they were originally thought to be amines — compounds derived from ammonia.

Osborne & Mendel (1913) observed that fed purified diets to rats and showed growth failed, but by substituting milk fat for lard growth occurred.

McCullum & Davis: fat soluble A (1913) and water soluble B (1915) – i.e. growth was supported by a fat extract and by a water extract of adequate diets.

Mellanby (1919) rickets deficiency of a vitamin D

1930’s – William Rose discovered the essential amino acids, the building blocks of protein.

Hungarian Szebt-Gyorgyi (1935) isolated vitamin C.

Du Bois (1936) calculates BMR in health and disease. Comprehensive measurements of energy cost different activities and ‘basal metabolic rate’ (as early as 1865 Playfair had estimated energy requirements eg: soldier – light work – 3029 Kcals). Noted links between intake and work performance (and school performance).

1940’s – The water soluble B and C vitamins were identified.

1940’s — Russell Marker perfected a method of synthesizing the female hormone progesterone from a component of wild yams called diosgenin.

1950’s - the present — the roles of essential nutrients as part of bodily processes have been brought to light. For example, more became known about the role of vitamins and minerals as

components of enzymes and hormones that work within the body.

1968— Linus Pauling, a Nobel Prize winner in chemistry, created the term orthomolecular nutrition. Orthomolecular is, literally, “pertaining to the right molecule”. Pauling proposed that by giving the body the right molecules in the right concentration (optimum nutrition), nutrients could be used by people to achieve better health and prolong life. Studies in the 1970’s and 1980’s conducted by Pauling and colleagues suggested that very large doses of vitamin C given intravenously could be helpful in increasing the survival time and improving the quality of life of terminal cancer patients.

1994 – 2000- have you ever wondered why vitamin bottle labels and nutritional web sites include a phrase saying that their products and information are not intended to diagnose, cure or prevent any disease? These also usually state that their health claims have not been evaluated by the Food & Drug Administration (FDA). Here’s why: the dietary and supplement health and education act was approved by congress in October of 1994 and updated in January 2000. It sets forth what can and cannot be said about nutritional supplements without prior FDA review.

While this law limits what vitamin manufacturers can claim about preventing or curing diseases, its passage has been a major milestone in the natural health field. It acknowledges the millions of people who believe dietary supplements can improve their diets and bestow good health. It opens the way for people to obtain the information they need to make the best nutritional choices for themselves.

Scope of Human Nutrition

The scope of human nutrition extends far beyond the classical study of the physiological and biochemical processes involved in nourishment; i.e., how substances in food are converted into energy and body tissues. Human nutrition has come to involve all the effects on humans of any component found in food; these include most chronic degenerative diseases (dental decay, coronary heart disease, some cancers, etc), which are now major targets of research activity. The scope of nutrition extends to the effects of food on human function e.g. mental function, athletic performance, resistance to infection, and fetal health and development.

There is a growing interaction between nutritional science and genetics because of the diversity of human chemical make-up and because food components of which most people are unaware can have marked effects on some individuals. Last, nutrition also considers why people choose to eat the foods they do, even after they have been advised that doing so may be unhealthy. The study of food habits and people’s attitudes, beliefs, likes and dislikes overlaps with the social sciences of psychology, anthropology, sociology and economics. Dietetics is the application of nutrition in the health services.

Career opportunities include

- Dietetics
- Work in the food industry
- Food provision

- Education and public relations

Other possibilities include a career in clinical nutrition, community nutrition, public health or other health related disciplines and clinical studies. A research career is also possible.

The science of human nutrition has experienced a dramatic revolution over the past twenty-five years. Major advances in molecular and cell biology and the initiation of population-based, epidemiologic studies have increased the potential for nutrition programs to prevent disease and improve the quality of life for more people worldwide. The importance of applied nutrition is greater than ever before, and its research scope broader.

Once concerned primarily with eliminating nutritional deficiencies, nutrition programs are now focusing on the critical relationship between diet and the development of chronic diseases like cancer, heart disease, obesity, and diabetes. At the same time, problems of malnutrition, and vitamin and mineral deficiencies in developing countries are still of great concern.

The aim is to develop new ways to apply nutrition knowledge to improve the health of specific populations. Current areas of emphasis include maternal-infant nutrition, micronutrient deficiencies, protein-energy metabolism, and obesity prevention intervention programs.

The objective of this course is to prepare students to function as nutrition professionals, to meet changing needs of society and industry, and to generate scholarly work in the areas of Foods and Nutrition. Graduates are placed in a variety of dietetics positions as well as research positions with universities, medical schools, federal laboratories, and industry. The primary emphasis of the program is the scientific basis for diversity in the human needs for foods and nutrients, the metabolic responses to dietary change, and the interactions among genetics, nutrients and food consumption patterns on human health and well being.

References

- Swaminathan, M., 2002, Essentials of Food and Nutrition. Vol. I The Bangalore Printing and Publishing Co. Ltd.
- www.mc.vanderbilt.edu
- www.afs.ttu.edu

Study Questions

1. Define the following
 - Nutrition
 - Metabolism
 - Nutrients
2. Write the chronological history of vitamins.
3. How would you think this course would help you to shape your career?
4. Explore the new fields of nutrition applications.

Notes
