Nutrition and Sports Performance KHE 208 (2C)

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Nutrition and sports performance involves a study of nutrients and food needs of people especially as it applies to athletic performance. Basic food groups, importance of adequate diet in health disease and sports. Planning the athletics' diet, content and meals, nutritional demands during exercise and training; factors affect food selection and supplementation would be analysed and discussed.

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MODULE 1

EXPLANATION OF CONCEPTS IN NUTRITION AND SPORTS PERFORMANCE

Introduction:

Good understanding of nutrition education is necessary to effectively train athlete for good performance and good health. Understanding how energy is produced and how the demand for energy during exercise drives energy utilization is critical to recommending appropriate dietary choices to replace that energy and refuel for the next exercise bout. However, for all individuals, whether physically active or inactive, a "prudent diet" is recommended for general health and prevention of diseases. In this module therefore, you will study the meaning of common terms that will help to understand the concepts of this course.

UNIT 1: Concept of Nutrition

Introduction: This unit explains the basic concepts in Nutrition. It defines the meaning and components of nutrition, and, the various nutrients in food.

Intended Learning Outcome

After studying this unit, you should be able to:

1. Define nutrition in your own words

2. Explain adequate / optimum diet

3. State food nutrients

4. List three sources of food nutrient

Nutrition

This is the science of food values. It is relatively a new science, which evolved from chemistry and physiology. The effect of food in our body is explained in nutrition. In other words, nutrition is defined as food at work in the body. In a broader sense nutrition is defined as "the science of food, the nutrients and other substances; their action, interaction, and balance in relationship to health and diseases, the process by which the organism ingests, digests, absorbs, transport and utilizes nutrients and dispose off their end products. In addition nutrition must be concerned with the social, economic, cultural and psychological implication of food and eating."

Therefore, nutrition is the sum total of the processes involved when you take in food, the way you utilized the food substances, which include ingestion, digestion, absorption, transport and utilization of nutrients found in food. You will observe that the above definition stresses the biochemical or physiological functions of the food we eat. However, it can still be interpreted in a broader sense to include a variety of psychological, sociological and economic factors influencing nutrition.

Nutrients

Nutrients are defined as the constituents of food, which perform important functions in our body. Therefore a nutrient is a specific substance found in food that performs one or more physiological or biochemical functions in the body.

The primary purpose of the food we eat is to provide us with a variety of nutrients. If these nutrients are not present in our food in sufficient amount, the result is ill health. Important nutrients include:

Carbohydrate

Proteins

Lipids

Vitamins

Minerals and

water.

That means there are six major classes of essential nutrients found in foods. Food also contains many other substances, which are non–nutrients e.g. coloring and flavoring substances in food.

When all essential nutrients are present in correct amount and proportion as required by our body it is called optimum nutrition or adequate nutrition. Optimum nutrition is required to maintain good health.

Healthy Diet

The term has been used interchangeably by some authors as balance diet or nutritional diet. In this module, it is used as healthy diet.

Below are the guidelines for a healthy diet:

1. Balance the food you eat.
2. Consume only moderate food portions.
3. Eat a nutritionally adequate diet consisting of a wide variety of nutrient-rich foods. Choose a diet moderate in total fat, but low in saturated and trans fat and cholesterol.

4. Choose a diet with plenty of fruits and vegetables, whole grain products, and legumes, which are rich in complex carbohydrates, photochemicals, and fiber.
5. Choose beverages and foods that moderate your intake of sugars.
6. Choose and prepare foods with less salt and sodium.
7. If you drink alcoholic beverages, do so in moderation. Pregnant women should not drink any alcohol.
8. Maintain protein intake at a moderate, yet adequate level, obtaining much of your
9. daily protein from plant sources, complemented with smaller amounts of fish, skinless poultry, and lean meat.
10. Choose a diet adequate in calcium and iron. Individuals susceptible to tooth decay should obtain adequate fluoride.
11. Practice food safety, including proper food storage, preservation, and preparation.
12. Avoid excess intake of questionable food additives and dietary supplements.
13. Enjoy your food. Eat what you like, but balance it within your overall healthful diet.

Sports Nutrition

Sports nutrition is an area of study involving the application of nutrition principles to enhance sports performance. The science of nutrition is applied here on athlete's eating strategies to promote good health and adaption to training, to recover quickly after each exercise training session, and to perform optimally during competition. Therefore, sports nutrition is the practical science of hydrating (adequate water intake) and fueling (adequate food intake) before, during, and after exercise. Executed properly, sports nutrition can help promote optimal training and performance, but when done incorrectly or ignored, it can derail training and hamper performance.

One of the key factors determining success in sport is the ability to maximize your genetic potential with appropriate physical and mental training to prepare both mind and body for intense competition. Brief History of Sports Nutrition shows that Greek Olympians in 300BC used specific mushrooms to enhance performance. In 1800's Dutch swimmers used caffeine before races, Belgian swimmers were also discovered to dipped sugar cubes in ether for use before performance. This idea gained widespread into the late 1980's when some colleges, university and professional teams began hiring and consulting with physicians to prescribe food that can enhance their performance. Well-known athletes started crediting nutrition with their success. This led to various Laboratory-Based Sports Nutrition research works that started in 1960's at Ball State University under the direction of David Costill. Studies on the effects of nutrition on performance, muscle biopsies, and gastric emptying studies were conducted in the Laboratory.

It is a fact that athletes at all levels of competition, whether an elite international competitor, a college (NUGA) player, a high school (NSSF) sprinter or a youth league (U17) soccer player can best improve their performance by intense training appropriate for their age, physical and mental development and sport. However, sports and exercise scientists have investigated a number of means to improve athletic performance beyond that attribute to training, and one of the most extensively investigated areas has been the effect of nutrition.

Food

Edible material that provides you with nutrients is termed as food. Food is fuel for your body. Food refers to anything, which nourishes your body. This includes solids (pounded yam, apu, sweet potatoes) semi-solids (white rice, mashed potatoes, porridge), and liquids (pap, akamo, eko) which can be consumed and help to sustain body and keep it healthy. Food is more than something to satisfy your appetite. Food is a substance which after you ingest, digest and absorbed is capable of being utilized by your body for its various functions. Food has been a basic part of human existence. Life cannot be sustained without food. After air and water, food is the utmost important need for survival. There is no other habit, practice or factor that influences the health of an individual, as much as the kind and amount of food consumed.

Food is broadly classified as:

Cereals

Pulses

Vegetable

Fruits

Proten (milk, meat, eggs)

Fats and

Sugars (carbohydrate).

Food is also said to be plant and animal products that may be taken into the body to yield nutrients.

Conclusion

In this unit you learnt that, nutrition is the science of food values while, nutrients are the constituents of food which are used for the maintenance of life and the growth and repair of tissues. Through the food you eat, you get the nutrients needed to run your body's physiological processes. In module 2 we shall discuss the six basic food groups which includes Carbohydrates, Proteins, Lipids (fats),Vitamins, Minerals and Water. Likewise, in module 5 we shall answer the question of what is food in details.

Self-Assessment Exercises

1. The effect of food in our body is studied through

(a) Nutrient (b) Nutrition (c) Diet (d) Digestion

2. Which of the following is not part of the process of nutrition? (a) ingestion, (b) digestion, (c) respiration (d) transportation.

3. The processes involved in the intake and utilization of food substances by living organisms is concerned with the (a) social implication of nutrition (b) economic implication of nutrition (c) physiological implication of nutrition (d) psychological implication of nutrition.

4. What is the primary purpose of nutrition? (a) to provide us with energy (b) to provide us with strength (c) to provide us with nutrition (d) to provide us with nutrient.

5. The functions of nutrients in the body is (a) mechanical (b) economical (c) biochemical (d) psychological

6. Which of the following is not part of the advantages of application of sports nutrition (a) promote good health (b) hinders adaption to training (c) quickly recover after each exercise training session (d) promotes optimal performance.

7. What is food ? (a) mechanical substances in the body (b) edible material that provides nutrients (c) biochemical materials of nutrition (d) psychological substances to give strength.

8. List the six major classes of essential nutrients found in foods.

9. Outline ten guidelines for a healthy diet.

10. Take a trip to your local market and identify the different types of food in your environment.

Feedback

1. B
2. C
3. C
4. D
5. C
6. B
7. B

For questions 8 and 9 see the text. Use the whatsApp page to compare your list on question 10 with your classmates in another state.

UNIT 2: Food Needs of Different People

Introduction: This unit provides information on the food needs of different people with special focus on the athletes. In your community you will have people of different gender and age. We all eat different types of food. However, the components and quantity needed by each person may not necessarily be the same.

Intended Learning Outcomes

After studying this unit, you should be able to;

1. Explain the food need of children.
2. List different age groups and their nutritional needs.
3. List the main food groups that you as an athlete should be concerned with.

Content

For every one, a well-balanced diet provides sufficient nutrients and energy to meet the metabolic needs for optimal functioning of the body. However, different people will need different food in respect to their age and activity. The food need of your two months old child will not be the same with that of an elder who is 70 years. Likewise, when you or your wife is pregnant the food requirement will change or must be improved both in quantity and quality.

Below are more specific areas that you still need to take note:

1. For children, good nutrition ensures their optimal growth (Fig. 1.1). The converse is true, that is malnutrition, if becomes pronounced, it sometimes leads to stunted growth or obesity.
2. For expectant mothers good nutrition is essential to ensure regular supply of nutrients to the foetus to grow up to his or her genetic potential. Adequate diet will also enable the mother to have expected energy to carry the pregnancy, prevent diseases and ensures resistance to many debilitating conditions that can affect the baby in the womb. Good nutrition is also expected for lactating or nursing mothers.
3. Youth you need adequate nutrition to supply energy for your day-to-day activities. A life long habit of sound nutrition will help you to reduce the possibilities of heart disorders, high blood pressure, diabetes, obesity, protein-calorie deficiency disorders like kwashiorkor, marasmus, ulcer, constipation, dental caries and oedema.
4. Old age requires adequate intake of foo maintain diet but with some modifications.

Fig. 1.1: Baby Pregnant woman Lactating mother Elderly

Nutrition As It Applies To Athletic Performance

As mentioned in the last lecture, good nutrition is a very important aspect of health, quality of life and longevity needed by everyone including the athletes.

The ability to perform well in an athletic event is dependent primarily upon two factors: genetic endowment and state of training. First and foremost is genetic endowment. The individual athlete must possess the characteristics that are necessary for success in his or her chosen sport. For example, a world-class male marathoner must have a high aerobic capacity and a low body fat percentage in order to run over 42km in 2hrs. However, unless he has undergone a strenuous training programme and maximized his genetic potential, his performance will be suboptimal. The state of training is the most important factor differentiating athletes of comparable genetic endowment. The better-trained athlete has the advantage. No matter at what level the athlete is competing, be it a

world championship or at secondary school athletics competition, genetic endowment and state of training are the two most critical factors determining success. Nevertheless, the nutritional status of the athlete may also play a significant impact upon athletic performance.

The 3 main food groups that you as an athlete should be concerned with are:

1. High Quality Protein – As an athlete you will need protein to build and repair your muscle tissue. Protein is the most important nutrient for those trying to increase their lean mass for power events. As a young adult I want to advice that you should stick to high quality, easily absorbed sources such as lean red meat, poultry, fish, eggs, skim milk, cheese, peanuts/natural peanut and butter.
2. High Fiber, Low Glycemic Carbohydrates – This second group known as carbohydrates aid in the absorption of protein, provide your muscles and brain with energy throughout the day and also help to maintain an optimal hormonal environment within the body. My advice on this also is to stick to slow-release, low-glycemic sources that will provide you with a steady stream of sugars throughout the day such as oatmeal, yams, certain fruits, brown rice and whole wheat products.
3. Healthy, Unsaturated Fats – Not all fats will make you fat. However, note that saturated fat will make you store extra fat which is regarded as dead weight for athlete's body. There is a group of fat referred to as Essential fatty acids which are highly beneficial to the muscle growth process by increasing testosterone levels, improves the metabolism and volumnizing the muscle cells. I will therefore recommend some good sources of EFA which include fatty fish, nuts, seeds, avocados and liquids like flaxseed and olive oil.

Conclusion

Athletes require the three main food groups as the major content of their diet, and should be spread out over the course of about 5-7 small meals daily. It may seem like a lot of work at first, but over time you will get used to it.

Summary

Despite that food is needed by all human beings, the components and quantity needed by each person may not necessarily be the same. Stages of development requires different kind of food. Children, expectant mothers, lactating mothers, aged people and

especially the athletes require different kind of food. When highly trained athletes meet for competitions despite all talented and well motivated, the margin between victory and defeat is usually small. Therefore when everything else is equal, nutrition can make the difference between winning and losing. You should still note that despite the therapeutic roles of exercise that you as an athlete have the opportunity, what you eat still plays an important role in the development or progression of a variety of chronic diseases, such as coronary heart diseases, diabetes, high blood pressure, osteoporoses, obesity and cancer. Therefore athletes have double advantages to promote their health through exercise and good food. We shall discuss more on this in module four.

Self-Assessment Exercise

1. Good nutrition to ensures optimal growth is mainly needed by the (a) aged (b) father (c) child (d) mother.

2. As youth you need adequate nutrition mainly to (a) supply energy for your day-to-day activities (b) prevent stunted growth (c) provide stamina (d) provide endurance.

3. Which of the following is not part of the need for good nutrition for expectant mothers ?

(a) to ensure optimal growth of the mother (b) for regular supply of nutrients to the foetus (c) to provide energy to carry the pregnancy (d) prevent diseases that can affect the baby in the womb.

4. Adequate nutrition will help you to improve the possibilities of (a) heart disorders (b) high blood pressure (c) energy (d) diabetes.

5. Pick the best source of protein for the elderly (a) natural peanut (b) red meat (c) poultry (d) fish.

6. Some good source of essential fatty acids include (a) sugar (b) avocados (c) oatmeal (d) brown rice .

7. As an athlete, why do you need high quality protein ?

8. List five functions of high fiber in athlete diet.

9. State the benefit of essential fat in athlete's diet

10. State the double advantages that athletes have to promote their health

Feedback

1.C
2.A
3.A
4.C
5.A
6.B
7. High Quality Protein is needed to build builds and repairs muscle tissue.
8. Fibers and carbohydrates aid (a)in the absorption of protein (b)provide your muscles with energy (c)provide your brain with energy (d) help to maintain an optimal hormonal environment within the body (e) aid digestion.
9. Essential fat in athlete's diet beneficial to the muscle growth process by increasing testosterone levels, improving the metabolism and volumizing the muscle cells.
10. Athletes have double advantages to promote their health through exercise and good food.

References/Further Reading

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MODULE 2

BASIC FOOD GROUPS

Introduction

In this module you will study the basic food groups. Food classification is based on their nutrients. Therefore, our discussion will follow the classification cited in module 1. The six classes of nutrients are:

1. Carbohydrates
2. Proteins
3. Lipids (fats)
4. Vitamins
5. Minerals
6. Water

Each type of nutrient has a specific purpose and meets a specific need in your body.

Unit 1: Carbohydrates

Introduction

The primary function of carbohydrate is to serve as a source of energy. This nutrient is principally synthesised by plants from water and carbon dioxide using the sun's energy. Quantitatively, carbohydrates are the most important dietary energy source for humans, accounting for around 40-80% of total energy intake across different global population groups (Gibney et al., 2009). National and international dietary guidelines typically recommend high consumption of vegetables, fruit, wholegrains, and other fibre-providing carbohydrate-rich foods, and low consumption of free sugars.

Intended Learning Outcomes

After studying this unit, you should be able to;

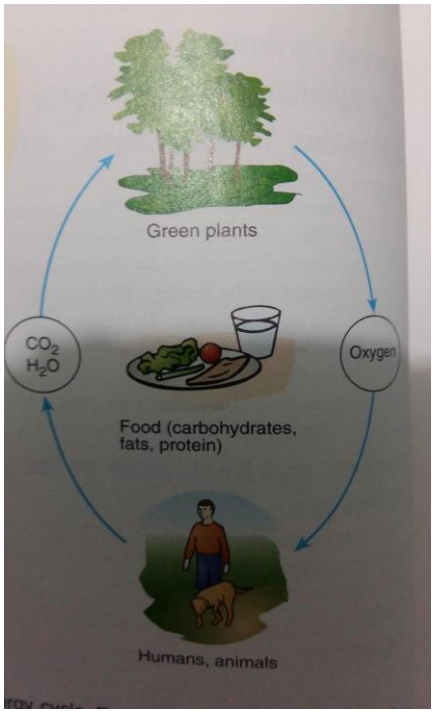
4. Explain the meaning of carbohydrate
5. List and explain three importance of carbohydrate
6. List and explain the three types of carbohydrate
7. Explain the process of digestion of carbohydrate
8. Describe the process of absorption of carbohydrate

Carbohydrates ($C_6H_{12}O_6$)

Carbohydrates are the primary source of energy for our body. Carbohydrates power every system in our body, including our brain, heart, muscles and internal organs. They are simple sugars or substances, which can be reduced to simple sugars. They are composed of carbon, hydrogen, and oxygen, the last two being in the proportion to form water (H_20) hence termed as "Carbohydrate". Which means hydrated-carbon (carbon and water)

Carbohydrates are formed through the process of photosynthesis which involved complex reaction.

$6CO_2 + 6H_2O - C_6H_2O_6 + 6O_2$

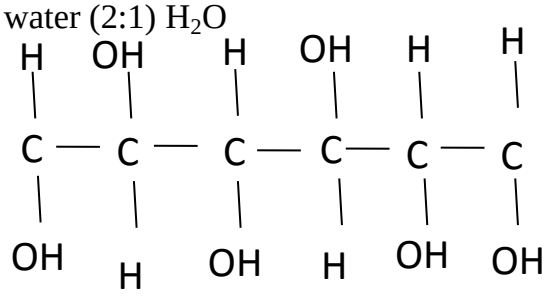


The process of photosynthesis [adapted from Williams, M.H. 2005]

During this process chlorophyll of the plant uses the sun energy to synthesis carbohydrate from the carbon dioxide in the air and water from the soil. Thus it is through the medium of the plant that animals and man are able to get food. All Carbohydrate contains

- Carbon
- Hydrogen and
- Oxygen

In a simple Carbohydrate unit there are 6 carbon atoms arranged in a chain (C-C-C-C-C-C) with the atoms of hydrogen (H) and oxygen (O) attached to the carbon in the same ratio as found in water (2:1) H_2O



Molecular Structure of Carbohydrate

Carbohydrates are widely distributed in nature in the form of sugar, starch, cellulose and other substances. Carbohydrates are classified as **monosaccharides, disaccharides and polysaccharides.** The term "*Saccharide*" (saccharine) meaning sugar or sweetness is related to the characteristics taste of many of the simple carbohydrates. Monosaccharides are simple sugars, which serve as the building blocks of complex sugars and

polysaccharides. Carbohydrates were first named according to the sources from which they were obtained e.g. fruit sugar (e.g grape sugar, cane sugar), malt sugar, milk sugar, etc. Then they were named from a prefix related to the sources followed by the suffix "ose". eg. Fructose (fruit sugar), maltose (malt sugar) and Lactose (milk sugar) (Fig 2.1).

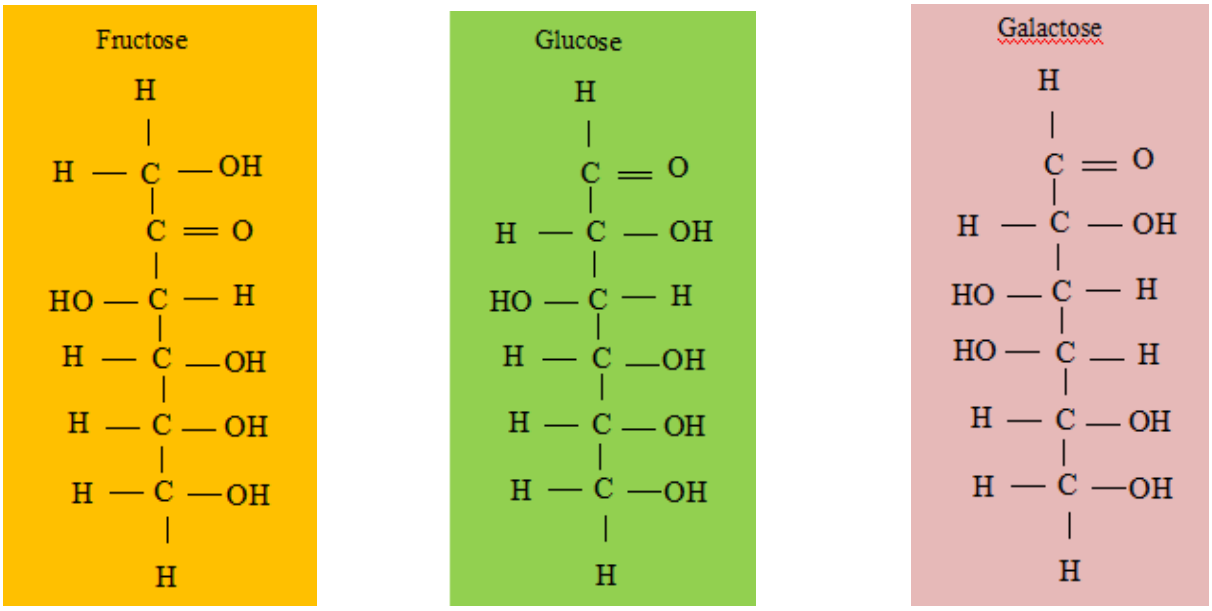


Fig 2.1: *Molecular Structure of Fructose, Glucose and Galactose* ***[adapted from Williams, M.H. 2005]***

Foods rich in carbohydrate include bread, rice, cereals, corn, Vegetables (especially the leafy ones), fruits, spaghetti, yam, noodles etc (Fig 2:2).

Plantain Yam Maize

Fig 2.2: Sources of Carbohydrate

Digestion of Carbohydrate

From the Mouth to the Stomach

Carbohydrates are most commonly consumed as polysaccharides (e.g. starch, fibre or cellulose) or disaccharides (e.g. lactose, sucrose, galactose). When you eat carbohydrate it will brake down into simpler monosaccharide forms which your body can utilise. The digestion process of polysaccharides such as starch begins in the mouth. Thus the mechanical and chemical digestion of carbohydrates begins in the mouth. The mechanical is done by using the teeth to cut and chew. This process also known as **mastication**, crumbles the carbohydrate foods into smaller and smaller pieces.While the chemical digestion starts with the action of the salivary glands in the oral cavity which secretes saliva that coats the food particles. The saliva contains the enzyme, salivary amylase. This enzyme breaks the bonds between the monomeric sugar units of disaccharides, oligosaccharides, and starches.

The salivary amylase breaks down amylose and amylopectin into smaller chains of glucose, called dextrins and maltose. The increased concentration of maltose in the mouth that results from the mechanical and chemical breakdown of starches in whole grains is what enhances their sweetness. Only about five percent of starch are broken down in the mouth (this is a good thing as more glucose in the mouth would lead to more tooth decay). When carbohydrate gets to the stomach no further chemical breakdown occurs because the amylase enzyme does not function in the acidic conditions of the stomach.

But mechanical breakdown is ongoing—the strong peristaltic contractions of the stomach mix the carbohydrates into the more uniform mixture of chyme.

Fig2.3: Organs of Digestive System

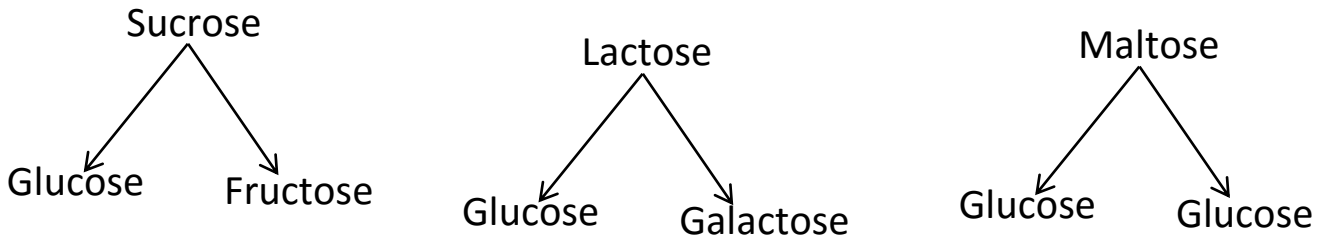
National Institute of Merck Manual Home Health Handbook. Overview of the Digestive System. (2018).

From the Stomach to the Small Intestine

The chyme is gradually expelled into the upper part of the small intestine. Upon entry of the chyme into the small intestine, the pancreas releases pancreatic juice through a duct. This pancreatic juice contains the enzyme, pancreatic amylase, which starts again the breakdown of dextrins into shorter and shorter carbohydrate chains. Additionally, enzymes are secreted by the intestinal cells that line the villi. These enzymes, known collectively as disaccharides, are sucrase, maltase, and lactase. Sucrase breaks sucrose into glucose and fructose molecules. Maltase breaks the bond between the two glucose units of maltose, and lactase breaks the bond between galactose and glucose. Once

carbohydrates are chemically broken down into single sugar units they are then transported into the inside of intestinal cells.

When there is inadequate lactase, lactose is not sufficiently broken down resulting in a condition called lactose intolerance. The undigested lactose moves to the large intestine where bacteria are able to digest it. The bacterial digestion of lactose produces gases leading to symptoms of diarrhea, bloating, and abdominal cramps.



Absorption: Going to the Blood Stream

The cells in the small intestine have membranes that contain many transport proteins in order to get the monosaccharides and other nutrients into the blood where they can be distributed to the rest of the body. The first organ to receive glucose, fructose, and galactose is the liver. The liver takes them up and converts galactose to glucose, breaks fructose into even smaller carbon-containing units, and either stores glucose as glycogen or exports it back to the blood. How much glucose the liver exports to the blood is under hormonal control and you will soon discover that even the glucose itself regulates its concentrations in the blood.

Importance of Carbohydrates

(1) **Energy Yielding**: Carbohydrates are the cheapest source of energy. One gram of carbohydrate gives four (4) calories. Glucose is the main source of energy. So all types of carbohydrates are converted to glucose in body and then used for immediate tissue energy need. A small amount is stored as glycogen in the liver and muscles, and some is stored as fat in the adipose tissues.

(2) **Protein Sparing Action**: The body uses carbohydrates preferentially as a source of energy when it is adequately supplied in the diet, thus sparing protein for tissue building.

(3) **Provide taste to the food**: As most of the carbohydrates are sweet in nature, they improve the palatability of the diets.

(4) **Complete oxidation of fats**: A certain amount of carbohydrates is necessary in the diet so the oxidation of fats can proceed normally. If carbohydrates are severally restricted fats are metabolized resulting in ketosis.

(5) **Lactose:** Being less soluble than other sugars remain in the intestine long enough to encourage the growth of desirable bacteria, which help in synthesis of B-Complex vitamins. It also helps in better absorption and utilization of calcium.

(6) **Provide bulk to the diets:** Cellulose and pectin's gives no nutrients to the body, but these fibres are very useful in providing bulk to the diets and also facilitates the elimination of intestinal wastes. Lack of adequate dietary fibre in diets containing refined foods, leads to constipation.

Conclusion

Carbohydrate is an important source of dietary energy. Carbohydrates are a relatively diverse group of compounds, classified according to molecular size and individual monomer units present, both of which can determine the site and rate of digestion and blood glucose response. The rate of starch digestion mainly depends on the structure of the starch granules (ratio of amylose and amylopectin polysaccharides, protein and lipid content) and processing techniques (e.g. milling, refining and cooking).

Summary

Carbohydrates is the major source of energy. Healthy sources of carbohydrates include: Whole grain cereals, breads, and pasta; fruits; vegetables; and beans.
Healthier blood cholesterol levels; and lower risk of heart disease, diabetes, and cancer are other health benefits that you can derived from the intake carbohydrate diet. However, the performance benefit shows that Carbohydrates are your major muscle fuel source for high-intensity exercise**.**

Self-Assessment Exercises

1. Carbohydrate provides the energy need of the body, including our brain, heart, muscles and internal organs (a) true (b) false

2. Carbohydrate is mainly composed of (a) carbon, zinc, and oxygen (b) carbon, hydrogen, and oxygen (c) water, hydrogen, and oxygen (d) carbon, hydrogen, and nitrogen.

3. Which of the following is not a classification of carbohydrates (a)monosacharides, (b) disaccharides (c) dualsaccharides (d) polysaccharides

4. Monosaccharides are (a) simple sugars (b) complex sugar (c)compound sugar (d) double sugar

5. Lactose is (a) fruit sugar (b) cream sugar (c) soft sugar (d) milk sugar
6. All types of carbohydrates are converted to glucose in body and then used for immediate tissue energy need (A) true (b) false

7. The digestion process of polysaccharides begins in the (a) mouth (b) intestine (c) pharynx (d)larynx

8. The strong peristaltic contractions of the stomach mixes the carbohydrates into the more uniform mixture called (a) sugar (b)glucose (c) chyme (d) none of the above

9. The first organ to receive glucose, fructose, and galactose is the (a) kidney (b)liver (c)heart (d) blood

10. ---------- breaks sucrose into glucose and fructose molecules (a) sucrase (b) maltase (c) lactase (d) frutase

Feedback

1. A
2. B
3. C
4. A
5. D
6. A
7. A

8. **C**
9. **B**
10. **A**

References/Further Reading

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Unit 2: Protein

Introduction

In the last unit we discussed carbohydrate, in this unit we shall pick another important nutrient which is protein. Protein can be from plants or animals. Proteins are essential nutrients for the human body. Protein is an important component of every cell in the body. Hair and nails are mostly made of protein. Your body uses protein to build and repair tissues. You also use protein to make enzymes, hormones, and other body chemicals. Protein is an important building block of bones, muscles, cartilage, skin, and blood. They are one of the building blocks of body tissue and can also serve as a fuel source. Therefore, intake of protein is very important to your body.

Intended Learning Outcomes

After studying this unit, you should be able to;

1. Define protein
2. List and explain four importance of protein
3. Explain the digestion of protein in the stomach and intestine
4. Describe the process of absorption of protein

Proteins

Proteins are complex organic compounds containing carbon, hydrogen, oxygen, nitrogen, and usually sulphur. Some proteins also contain phosphorus, iron, iodine, copper and other inorganic elements. Proteins are made up of *amino acids*. Chemically, protein is composed of amino acids, which are organic compounds made of carbon, hydrogen, nitrogen, oxygen or sulfur. Amino acids are the building blocks of proteins, and proteins are the building blocks of muscle mass. Protein is like the brick and mortar of your body.

Protein is a macronutrient that is essential to building muscle mass. It is the building blocks that provide the structure for the tissues of your body. They are also used to transport essential elements in your blood stream.

Amino acid

The basic component of all protein molecules is a rather small compound called an **amino acid.** Amino was formed from the word amin which means nitrogenous compounds (N). Each of the amino acids contains the two key structural features suggested by the name – an amino group ($-NH_2$) and an organic acid radical (-COOH). Actually only some 20 different amino acids are found in foods, but the variety of compounds that can be constructed by altering the proportions and the sequences of the different amino acids is many. Protein molecules have well over a hundred amino acids linked together in a variety of sequences to make a single protein molecule.

Sources of Proteins

Protein is commonly found in animal products, though is also present in plant (such as nuts, beans, peanut, peas and legumes). Foods rich in animal protein include fish, meat, egg, milk and cheese. Therefore, protein sources can be in two forms:

Complete proteins are proteins from animal sources like milk, eggs, meat, especially lean meat, fish and chicken. Animal proteins are complete protein. They are also known as first class proteins since they supply all the essential amino acids (that cannot be synthesized by the body) in sufficient amount and proportions to support life and promote growth.

Fig 2.4: Examples of foods rich in complete Protein.

Partially complete proteins are plant proteins found in legumes (beans, chickpeas, lentils, soyabeans, carob and peas); nuts (like cashew nuts, groundnut); and cereals (wheat, oats, corn, guinea corn, rice, millet). Plant proteins are often referred to as second class proteins and their building blocks are non essential amino acid.

Fig.2.5: Examples of foods rich in Partially Complete Protein. (Groundnuts, Avocados and Beans)

Protein is made from over twenty basic building blocks called amino acids. Because your body do not store amino acids, it make them in two different ways: either from food, or by modifying other amino acids that are already in the body to form a new one. Those that must come from food that we eat is known as the essential amino acids, they are nine in number, namely:

- Histidine
- Isoleucine
- Leucine
- Lysine
- Methionine

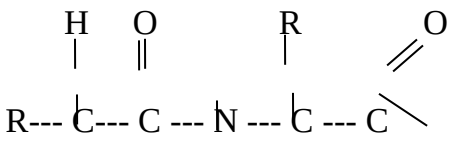
- Phenylalanine
- Threonine
- Tryptophan, and
- Valine

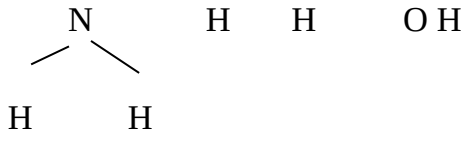
Other eleven amino acids that can be manufacture within the body and consequently termed “nonessential”, include:

- Alanine
- Arginine
- Asparagine
- Aspartic acid
- Cysteine
- Glutamiv acid
- Glutamine
- Glycine
- Proline Serine
- Tyrosine

Proteins are highly complex substance that is present in all living organisms. Proteins are of great nutritional value and are directly involved in the chemical processes essential for life. Proteins are species-specific; that is, the proteins of one species differ from those of another species (protein from egg differs from beans). They are also organ-specific; for instance, within a single organism, muscle proteins differ from those of the brain and liver.

A protein molecule is very large compared with molecules of sugar or salt and consists of many amino acids joined together to form long chains, such as beads are arranged on a string.





Structure of Amino Acid

Assignment: Draw and compare the molecular and structural formula of amino acid and that of glucose.

Protein Digestion

From the Mouth to the Stomach

The organs of digestion as we discussed under carbohydrate are still relevant for protein digestion. In your mouth it is only mechanical digestion (cutting, tearing and chewing) that protein foods like meat, beans or fish can pass through. In the stomach we have two major enzymes (pepsin and renin). Pepsin, is an important peptic enzyme of the stomach, and most active at a pH of 2.0 to 3.0 to initiates the process of protein digestion. The gastric glands of the stomach secrete a large quantity of hydrochloric acid. This hydrochloric acid is secreted by the parietal (oxyntic) cells in the glands. This acidic environment and the pH averages around 2.0 to 3.0, are highly favourable for pepsin activity. Pepsin is to digest the protein collagen (in meat). Collagen is a major constituent of the intercellular connective tissues; therefore, for the digestive enzymes to penetrate meats and digest the other meat proteins, it is first necessary that the collagen fibers be digested. Pepsin only initiates the process of protein digestion, usually providing only 10 to 20 percent of the total protein digestion to convert the protein to proteases, peptones and a few polypeptides. This splitting of proteins occurs as a result of hydrolysis at the peptide linkages between amino acids which are digested to the final stage to form single amino acids and little small peptides. More than 95 percent of the final protein digestive products that are absorbed are individual amino acids, with only 5 percent absorption of di- and tripeptides and very rare absorption of other small peptide molecules. Even these very few absorbed molecules of whole peptides and/or protein can sometimes cause serious allergic or immunologic disturbances.

Digestion in the intestine

Most protein digestion occurs in the small intestine, in the duodenum and jejunum, by proteolytic enzymes from pancreatic secretion. In the small intestine, protein digestion undergo multi stages, done by major proteolytic pancreatic enzymes (trypsin, chymotrypsin, carboxypolypeptidase and proelastase). Stage one is the partial breakdown of the protein foods by trypsin and chymotrypsin split protein molecules into small polypeptides. Stage two is done by the carboxy-polypeptidase which cleaves individual amino acids from the carboxyl ends of the polypeptides. Proelastase, in stage three then digests elastin fibers that partially hold meats together. Despite all these initial stages of digestion only small percentages of the protein are digested all the way to their constituent amino acids by the pancreatic juices. Therefore, most still remain as dipeptides and tripeptides. The last digestive stage of the proteins takes place in the intestinal lumen. This is done by the enterocytes that line the villi of the small intestine, mainly in the duodenum and jejunum. These cells have a brush border that consists of hundreds of microvilli projecting from the surface of each cell. Two types of peptidase enzymes that are important at that site are, aminopolypeptidase and dipeptidase. The aminopolypeptidase enzyme proceed to split the remaining larger polypeptides into tripeptides and dipeptides. While, dipeptidase enzyme completed the process of breaking a few tripeptides and dipeptides into amino acids. The amino acids with the dipeptides and tripeptides are easily transported through the microvillus membrane to the interior of the enterocytes.

Absorption of Peptides

For proper absorption of peptides it must firstly diffuse across the mucus layer before absorption across the epithelia is possible. The aqueous boundary or unstirred water layer can act as a limiting factor for highly lipophilic peptides (these are peptides that have affinity for fat). Once a protein crosses the monolayer of intestinal epithelial cells, it can enter either the capillaries of the portal venous system or the lymphatic lacteal. The lipophilic peptides are more likely to be absorbed by the lymphatic system. The lymphatic circulation bypasses the liver and thus the attractive approach to delivery of peptides and proteins. Absorption into the lymphatic lacteals provides very slow systemic delivery over several hours as the lymph moves at a slow rate. Although, absorption into the portal venous system results in rapid delivery within minutes to systemic circulation after an initial hepatic pass.

Importance of Protein

As discussed during the introduction of this unit, proteins are very essential for life processes, as there is hardly any important body physiological function in which proteins do not participate. The important functions of proteins are:

(1) ***Body building: This*** is the most important function of protein. Proteins are the major structural components of body tissues. Infact every living cell in your body contains protein. The first need for proteins therefore is to supply the materials for your growth and development and the continuous replacement of the worn-out cells.

(2) ***Body Regulatory:*** Many proteins have highly specialized functions in the regulation of body processes. A lot of chemical reactions in the body are carried out by enzymes, which are protein in nature. Proteins are also a constituent of hemoglobin, which is necessary to carry oxygen from lungs to tissues and bring back CO_2. Governing the body reaction are hormones, which are also proteins. Plasma protein has a fundamental role in the maintenance of water balance. Blood proteins also help in maintaining acid base balance of the body.

(3) ***Body protection:*** There is a protein called gamma globulin, which has a capacity to fight against invading organism. The body's resistance to disease is maintained in part by antibodies, which are protein in nature.

(4) ***Energy Yielding:*** The energy needs of the body take priority over other needs, and if the diet does not furnish sufficient energy from carbohydrates and fats. The proteins of the diet as well as tissue protein will be used up for giving energy. One gram of protein gives 4 calories.

(5) ***Maintenance of body temperature:*** During the metabolism of proteins extra heat is liberated, which is used for maintaining the body temperature.

Conclusion

Proteins are highly complex substance that is present in all living organisms. Proteins and many peptides compound digested in alimentary system. Proteins are of great nutritional

value and are directly involved in the chemical processes essential for life. Therefore, adequate proteins must be taken through your diet for proper body functions.

Summary

Proteins Healthy sources:
Fish, poultry, lean meats, low-fat and nonfat dairy foods, seeds, nuts, beans, and eggs.

Nutritional benefits:
Provides amino acids, the building blocks for making proteins.

Health benefits:
Proteins make up muscle and play roles in digestion, metabolism, and immune function.

Performance benefits:
Protein helps in the building and repair of muscle tissue, and works with carbohydrate to boost the rate of recovery after exercise.

Self-Assessment Exercises

1. Proteins are complex organic compounds containing (a) carbon (b) hydrogen (c) oxygen (d) oxides

2. Proteins are made up of amino acids (a) true (b) false

3. Digestion of protein starts from the (a)stomach (b)mouth (c)oesophagus (d) none of the above

4. Which of the following is not an amino acids (a) histidine (b) isoleucine, (c) leucine (d) chime

5. Plasma protein and blood protein have similar function (a) true (b) false

6. Which of the following is not an importance of protein (a) Body regulatory(b) Body protection (c) Energy yielding (d) blood formation

7. Protein digestion does not occur in the (a)duodenum (b)jejunum,(c) pharynx (d) none of the above

8. Proteolytic enzymes are found in (a)salivary secretion (b) pancreatic secretion (c) Langerhans (d) stomach secretion

9. Once a lipophilic protein crosses the monolayer of intestinal epithelial cells, it can enter which of the following (a) capillaries of the portal venous system (b) blood (c)lymphatic lacteal (d) liver

10. The final splitting of proteins to amino acid is done by which enzyme (a) proelastase (b) dipeptidase (c) chymotrypsin (d) trypsin

11. List 20 important functions of proteins in human body.

Feedback

1. D
2. A
3. A
4. D
5. A
6. D
7. C
8. C
9. C
10. **B**
11. Check your answer by making outlines of importance of proteins as discussed under the content of the lesson.

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Unit 3: Lipids

Introduction

Lipids are also organic compound of carbon, hydrogen and oxygen, just like that of carbohydrate as discussed in unit 1. However, these differ from carbohydrates in that they have much smaller proportion of oxygen and much greater proportions of carbon and hydrogen. Major types of lipids include fats and oils, waxes phospholipids and stroids. Fat and oil will be of more interest to this unit because they are important components of our diets and serve a number of functions. Fat is the storehouse of energy. When you have excess nutrients in your body, some of it is stored as fat. The primary purpose of fat is energy production. Most oils are liquid while fat is solid in room temperature.

Intended Learning Outcomes (ILOs)

After studying this unit, you should be able to;

1. Define lipids
2. List four importance of fats
3. Explain the digestion of fats
4. Differentiate between fats and oil
5. Describe the process of absorption of fats

Fats

Fats and oils are the most abundant lipids in nature. Fats provide energy for living organisms, insulate body organs, and transport fat-soluble vitamins through the blood. Contrary to what you might expect, pure fats and oils are colorless, odorless, and tasteless. The characteristic colors, odors, and flavors that we associate with some of them are imparted by foreign substances that are lipid soluble and have been absorbed by these lipids. For example, the yellow color of butter is due to the presence of the pigment carotene; the taste of butter comes from two compounds; diacetyl and 3-hydroxy-2-butanone; produced by bacteria in the ripening cream from which the butter is made.

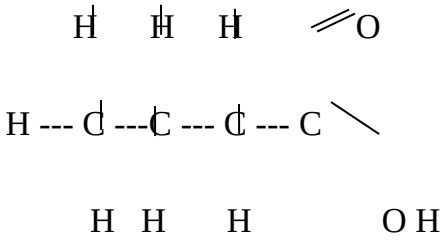
Composition of Fat

As discussed at the introduction of this unit most organic materials like carbohydrate (unit 1) and proteins (unit 2) the same way oils and fats (unit 3) are made up of three elements: Carbon, Oxygen and Hydrogen. However, these elements in fats and oils combine together to form chains known as fatty acids. Three of these chains when joined together will form a molecule known as a **triglyceride**. The fats and oil used in food preparation are under simple lipids. Salad oil, margarine, butter, fats in meat, legumes & cereals are examples of simple lipids. Simple fats are fatty acid and ester of glycerol. Fatty acid and glycerol are the end products of fat and oil digestion.

Fatty Acids

Fatty acids are the end product of fat. They are classified as saturated and unsaturated depending on the source and the number of hydrogen available. It is saturated fatty acid when all the carbon atoms have at least 2 hydrogen the source is usually from fat in beef, chicken or other animals. Fatty acids are organic acids consisting of a carbon chain and an organic acid radical --- C(=O)OH

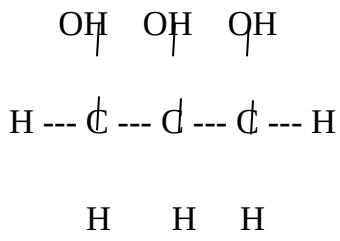
A very simple example of the structure of a fatty acid is that of butyric acid ($C_4H_8O_2$) and palmitic acid (C_{16} H_{32} O_2)



Structure of Butric Acid

Glycerol

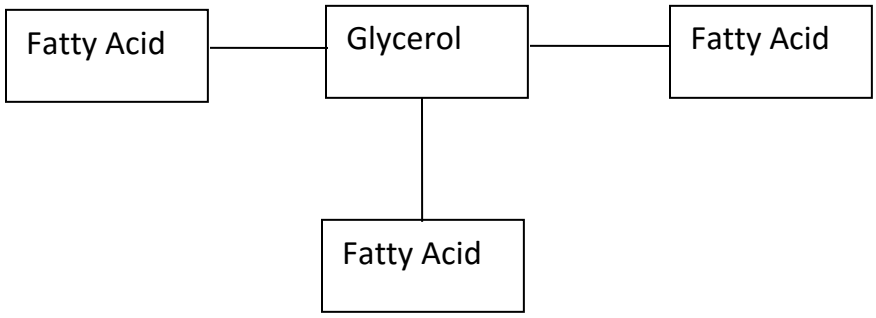
The three hydroxyl groups are key features in the structure of glycerol, for these are the portions of the molecule that can combine with fatty acids to make a variety of simple fats.



Structure of Glycerol

Triglyceride

The triglycerides also known as the true fats or the neutral fats, are the principal form in which fats are eaten and stored in the human body. Triglycerides are composed of two different compounds - fatty acids and glycerol when an acid [fatty acids] and an alcohol [glycerol] combine, an ester is formed. This process is known as esterification [three fatty acids are attached to each glycerol molecule].



Structure of a Triglyceride

A triglyceride is called a fat if it is solid at 25°C (room temperature); it is called an oil if it is a liquid at that temperature. These differences in melting points reflect differences in the degree of saturation and number of carbon atoms in the constituent fatty acids. Triglycerides obtained from animal sources are usually solids, while those of plant origin are generally oils. Therefore, we commonly speak of animal fats and vegetable oils.

Lipids Classification

Lipids are broadly classified into two groups; simple lipids and compound lipids. Simple lipids include fatty acids and waxes. All other lipids are included under compound lipids e.g. carotenieds and phosphoglycerides. Also fats can be classified as saturated and unsaturated. Animal fats (meat, butter, lard) are usually saturated fats and contribute to heart disease and cancer. Vegetable oils (olive oil, corn oil) are generally unsaturated fats and are less harmful. However, coconut-oil has been found to be saturated, hence the reason why it is not commonly used in food preparation. Some fats have been found to be helpful in preventing some cancers and heart diseases. These fats called omega-3 fatty acids are found in some fish, especially cold-water fish. Sources of fats include vegetable-oil, butter, pork, poultry, chocolate, margarine, cheese and fish

Sources of Fats and Oils

Fat is an important component of our diets. Fats in the diets can be of two kinds, the visible and invisible fat. The visible fats are those which are derived from animal fats like butter, ghee (cookeen oil) and those derived from vegetables sources like mustard oil, groundnut oil, sunflower oil etc. Apart from the added /visible fat, some amount of invisible fat is present in some foods like cereals, pulses, oilseeds, milks, eggs, cheese and meats. The invisible fat is believed to contribute significantly to the total fat and essential fatty acid content of the diet depending upon the foodstuffs present in the diet.

Digestion and Absorption of Lipids

Lipids are large molecules and generally are not water-soluble. Like carbohydrates and protein, lipids must be broken into small components for absorption. Therefore, for fats to also perform the various functions in the human body it must pass through the same process of digestion.

The first step in the digestion of fat (especially compound fat e.g.triacylglycerols and phospholipids) begins in the mouth as lipids encounter saliva. Next, the physical action of chewing coupled with the heat environment in the bucca cavity started the mechanical action of the digestion.

In the stomach, the enzyme lingual lipase, along with a small amount of phospholipid act as an emulsifier. Emulsification is the process of opining the fat to initiate the process of digestion. These actions cause the fats to become more accessible to the digestive enzymes. As a result, the fats become tiny droplets and separate from the watery components. gastric lipase starts to break down triacylglycerols into diglycerides and fatty acids. Within two to four hours after eating a meal, roughly 30 percent of the triacylglycerols are converted to diglycerides and fatty acids. The stomach's churning and contractions help to disperse the fat molecules, while the diglycerides derived in this process act as further emulsifiers. However, even amid all of this activity, very little fat digestion occurs in the stomach.

As stomach contents enter the small intestine, the digestive system sets out to combine the separated fats with its own watery fluids. The solution to this hurdle is bile. Bile contains bile salts, lecithin, and substances derived from cholesterol so it acts as an emulsifier. It attracts and holds on to fat while it is simultaneously attracted to and held on to by water. Emulsification increases the surface area of lipids over a thousand-fold, making them more accessible to the digestive enzymes. Once the stomach contents have been emulsified, fat-breaking enzymes work on the triacylglycerols and diglycerides to sever fatty acids from their glycerol foundations. As pancreatic lipase enters the small intestine, it breaks down the fats into free fatty acids and monoglycerides.

Has discussed before, lipids are insoluble in water hence they require special handling in the digestive tract to move within a water-based environment, also they require similar handling to travel in the bloodstream. Inside the intestinal cells, the monoglycerides and fatty acids reassemble themselves into triacylglycerols. Triacylglycerols, cholesterol, and phospholipids form lipoproteins when joined with a protein carrier. Lipoproteins have an inner core that is primarily made up of triacylglycerols and cholesterol esters (a cholesterol ester is a cholesterol linked to a fatty acid). The outer envelope is made of phospholipids interspersed with proteins and cholesterol. Together they form a chylomicron, which is a large lipoprotein that now enters the lymphatic system and will soon be released into the bloodstream via the jugular vein in the neck. Chylomicrons transport fats perfectly through the body's water-based environment to specific destinations such as the liver and other body tissues.

Cholesterols are poorly absorbed when compared to phospholipids and triacylglycerols. Cholesterol absorption is aided by an increase in dietary fat components

and is hindered by high fiber content. This is the reason that a high intake of fiber is recommended to decrease blood cholesterol. Foods high in fiber such as fresh fruits, vegetables, and oats can bind bile salts and cholesterol, preventing their absorption and carrying them out of the colon.

Importance of Lipids

(1) ***Energy fielding*:** Fats are concentrated source of energy. One gram of fat gives 9 calories. Compared to carbohydrate (4 calories) fats do not only gives more amounts of energy but at a faster rate.

(2) ***Storehouse of energy for the body's needs:*** In fact not only amount of fats as such are stored in adipose tissue, but any amount of glucose, amino acids, not promptly utilized are also synthesized (amino-acid) and (glucose) stored in the body, thereby energy is continuously available from the stores in adipose tissues.

(3) ***Insulation and padding:*** The subcutaneous layer of fat is an effective insulator and reduces losses of body heat in cold weather, thus regulating the body temperature. The vital organs such as the kidneys are protected against physical injury by a padding of fat around the organs.

(4) ***Fats help in absorption and transportation*** of fat-soluble vitamins (A,D,E and K) in the body.

(5) ***Provides essential fatty acids:*** Fat is also the source of certain fatty acids which are essential for metabolism and for maintaining a normal skin.

(6) ***Fats acts as a lubricant*** for various body organs especially the organs of the gastrointestinal tract.

(7) ***Fat also increases the palatability*** of the diet by adding flavour to many cooked preparations.

Conclusion

Fats and oils are the most abundant lipids in nature. They provide energy for living organisms, insulate body organs, and transport fat-soluble vitamins through the blood. Fats in the diets can be of two kinds, the visible and invisible fat. The visible fats are those which are seen padding various organs in animal fats and those derived from vegetables sources like mustard oil, groundnut oil, sunflower oil etc. While invisible fats are hidden in foods like meat-pie, cheese, cake and ice-cream.

Summary

Fats and Oils Healthy Sources:
Vegetable oils such as sun-flower oil and olive oil, nuts, seeds, and fish.

Nutritional benefits:
Major source of energy; transport vitamins A, D, E, K; for omega-3 fatty acids; and production of essential fats.

Health benefits:
It helps in production of healthier blood cholesterol levels and lower risk of heart diseases.

Performance benefits:
Fats are the major muscle fuel sources for low-intensity exercise.

Precautions
Limit certain fats
Limit your intake of saturated fats and cholesterol by choosing lean meats and low-fat or nonfat dairy foods and egg whites.
Keep trans fats intake as low as possible by reading labels and limiting your intake of fried fast foods and commercially prepared baked goods.

Self-Assessment Exercises

1. The primary purpose of fat is (a) body building (b) temperature regulation (c) energy production (d) body protection

2. Identify a Simple lipid (a)waxes (b)chyme (c) Proteolytic (d) cholesterol

3. The characteristic of pure fats and oils include (a) colorless (b)odorless (c) tasteless (d) not water-soluble

4. A triglyceride is called a fat if it is a solid at what temperature (a) 23°C (b) 24°C (c.) 25°C (d) 26°C

5. Triglycerides obtained from animal sources are (a) liquid (b) solid (c) semi solid (d) semi liquid

6. Fats is not an organic compound of (a) carbon (b) hydrogen (c) oxygen (d) sulphur

7. Which of the following is a function of fats (a) Insulation (b) absorption (c) transportation (d) digestion

8. Which of the following enzyme participate to initiate the digestion process of fats (a) lingual lipase (b) gastric lipase (c) pancreatic lipase (D) ptylin

9. In the stomach, which enzyme starts to break down triacylglycerols into diglycerides and fatty acids (a) lingual lipase (b) gastric lipase (c) peptic lipase (d) pancreatic lipase

10. In the small intestine, the breaks down of fats into free fatty acids and monoglycerides is done by which enzyme (a) lingual lipase (b) gastric lipase (c) peptic lipase (d) pancreatic lipase

Feed back

1. C
2. A
3. D
4. C
5. B
6. D
7. D
8. A
9. B
10. D

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Unit 4: Vitamins and Minerals

Introduction

In the last lecture, we discussed a major nutrient – Lipids-. You learn about the fats and oils as nutrients in our diets. In this unit, we shall discuss vitamins and minerals which are considered essential nutrients because they perform hundreds of roles in the body. They help in healthy development of bones, heal wounds, and boost your immune system.

Intended Learning Outcomes

After studying this unit, you should be able to;

1. Explain what are vitamins and minerals.
2. List and explain at least four importance of vitamins and minerals.
3. List three each of macro and trace minerals
4. Differentiate between vitamins and minerals

5. Explain two diseases that can result from vitamin deficiencies

Vitamins

The term ‘vitamine’ derives from the word ‘vital amine’ which means essential nitrogenous compounds. Vitamins are complex chemical substances, required by the body in very small amounts. They do not yield energy, but act as catalyst in various body process. Since vitamins cannot be manufactured in the body (at least in sufficient amounts) they have to be supplied through your diet. As mentioned in the introduction of this unit, vitamins are multi-functional. They may serve as structural components in the body, act as co-enzymes in multiple metabolic pathways, and/or act as antioxidants.

Classification of Vitamins

Vitamins fall into two categories: fat soluble and water soluble. The fat-soluble vitamins are A, D, E, and K and dissolve in fat and can be stored in your body. The water-soluble vitamins are C and the B-complex vitamins (such as vitamins B6, B12, niacin, riboflavin, and folate) and they need to dissolve in water before the body can absorb them. Because of this, your body cannot store these vitamins. Any vitamin C or B that your body does not use as it passes through the system is lost (mostly in your urine). Therefore, there is a need for fresh supply of these vitamins every day. Sources of vitamin include (from plants) fruits, green leafy vegetables, peanut, (from animals) milk, egg, fish, and liver. Lack of these vitamins in the body is called **avitaminosis.** This deficiency leads to various diseases which are discussed bellow.

Fat- Soluble Vitamins

These are usually associated with fats in nature. Just as discussed above the **fat-soluble** vitamins are A, D, E, and K and dissolve in fat and can be stored in your body.

Vitamin A (Retinol):

This was the first vitamin to be identified. Thus it is designated by the first letter of the alphabet “A”. It is necessary for healthy eyes and skin. If you did not take enough of it in your diet it leads to night blindness or even total blindness. The deficiency is then called

night blindness. Good sources of vit. A include fatty foods like liver, fish liver oils, butter, margarine, egg yolk, whole milk. It is also available in plants or vegetables containing carotene like green leafy and yellow vegetables like spinach, cassava leaves, carrots, tomatoes, mangoes, pawpaw, melons, pumpkin and yellow corn.

***Vitamin D (Cholecalciferol*):**

This vitamin is also known as the sunshine vitamin. It is essential for absorption of calcium and phosphorus.The deficiency disease due to lack of this vitamin is **rickets**, a bone disorder. There is usually no deficiency in the tropics where sunshine is plentiful all round the year. In the presence of sunlight, certain sterols in the skin are activated by exposure to ultraviolet light to form vitamin D. However, confined people may exhibit symptoms of adult rickets (osteomalacia). The Oriental women who remain indoors or go out only occasionally with veiled faces and totally covered bodies have been reported to be susceptible to the deficiency disease. The vitamin is also found in eggs, milk, butter and livers to a certain extent.

***Vitamin E (Tocopherol)*:**

The chemical name for this vitamin is tocopherol. It is an antioxidant. Thus it helps to protect vitamin A and unsaturated fatty acid, from oxidation in the body. It has also been called the reproductive vitamin because it affects the reproduction in some animals. The effect it has on human reproduction is still controversial though it is sometimes a part of the treatment used in male sterility.

It is essential for the structure and function of living cells. It promotes wound healing. Its functions have however been exaggerated. Presently it is a component in most beauty products claimed to have rejuvenating properties. Thus there are vitamin E creams, lotions and oils and soap. There are also Vitamin E tablets, capsules, that some women (and men perhaps) take regularly. Vitamin E has been used as ergogenic aids in attempts to improve sports performance.

Good sources include oils of cotton seed, other seeds, wheat germ, (the seed embryos) rice germ, groundnuts, corn and soya beans. Other sources are dark green leafy vegetables like lettuce, eggs, nuts, legumes and whole grain cereals.

Vitamin K (phylloquinone): This vitamin is produced in the intestines and is also widely distributed in foods like all green leafy vegetables, egg yolk, soya bean oil, liver, lettuce, spinash, cabbage. Consequently, deficiency is not common. It is essential for normal clotting. It has been called the coagulation vitamin.

Fat-soluble vitamins are more stable to heat than B vitamins, they are absorbed from the intestinal track with the fats in which they are dissolved in. They are not excreted in the urine, but excess is stored in the body, mainly in the liver.

Water-Soluble Vitamins

Vitamin B Complex: These are vitamins B_1, B_2. Niacin, Vitamin B_6, B_{12} etc. This is because there is a group of B vitamins. The B vitamins are necessary for normal growth and development. They are very important in carbohydrate metabolism.

Thiamin (Vit. B_1): Sometimes called the anti beriberi vitamin is especially involved in the metabolism of carbohydrates (Beriberi is a disorder of the nerves which may result in paralysis of the legs and heart failure). The best sources of vitamin B_1 are germs of cereals, brewers yeast, whole-grain cereals, fresh leafy green vegetables, nuts and legumes, and organ meats like liver, heart and kidneys.

Vitamin B_2 (Riboflavin) helps to promote growth and helps to maintain the eyes . The best sources of this vitamins are milk, liver, brewer, yeast, eggs, green leafy vegetables, whole grain cereal (especially outer coat of grain) lean meat, legumes and nuts.

Niacin (Nicotinicacid): is a pellagra-(symptoms include diarrhoea, dermatitis and dementia and sometimes madness) preventive factor. The best sources of niacin include groundnut, yeast, liver, meats, fish, legumes, whole grain, and some nut.

Vitamin B_6: This vitamin is essential for good health, it plays some important role in the metabolism of carbohydrate, polyunsaturated fatty acid and protein. Some deficiency symptoms include weakness, loss of appetite, soreness of lips and tongues, dermatitis,

nervousness, anaemia etc. Best sources of the vitamin include wheat germ, bran, whole grain cereal, liver, soya beans, bananas, avocados, peanuts, and meat.

Vitamins B_{12} (Cyano Cobalamin): This Vitamin contains cobalt. It is associated with folacin. It is an co enzymes, helps in the formation of red blood cells and helps prevents pernicious anaemia. It is found in animal foods, thus moderates use of milk and eggs in the diet will provide the necessary vitamin $B_{12.}$

Folacin or Folic acid: is essential for growth and reproduction. It is also associated with haemoglobin formation. Best sources include deep green leafy vegetables like pumpkins and cassava leaves, yeast and liver. Folacin is also found in whole wheat cereal, dried legumes and nuts

Vitamin C (ascorbic acid): vitamin C is also found in citrus fruits. It is an important factor in the body's reaction to stress, also it is believed to help in acquiring resistance against certain infections. It is necessary for healthy bones and teeth and strong capillary walls. It has been shown that ascorbic acid lowers the blood cholesterol content of patients with atherosclerosis. Deficiency brings about scurvy-characterized by swollen and bleeding gums, hemorrhages under the skin and great weakness. Wound healing is retarded and defective during deficiency of vitamin C.

Best sources include citrus fruits (oranges, lemon, limes, grapefruits, tangerines); mangoes, guava, melons, tomatoes, black currants, cherry, strawberries, cabbage etc. Vitamin C is susceptible to destruction during cooking. However, if the sources are boiled for short periods of time, using little water and the water consumed, the loss will not be significant. Greater retention of the vitamin may also be achieved if you exclude as much air as possible when cooking- like in pressure cooking, tightly covered vessel Pre-boiling the cooking water for about one minutes (to remove dissolved oxygen from the water before putting the vegetable to be boiled.

Minerals

Minerals are inorganic elements that are essential to body functions such as maintenance of acid-base balance, normal hemoglobin levels and osmotic pressure.

Minerals are components of vitamins, hormones, enzymes and many stable complexes in bone and tissues. They are compounds, obtained from your diet, that combine in several ways to form the structures of your body. Minerals may also be defined as those elements which remain largely as ash when plant and animal tissues are burnt. The human body contains more than 19 minerals, all of which must be derived from foods. A total of 4% of the body weight is made up of minerals. Some of the important minerals found in our body include calcium, phosphorus, iron, iodine, sodium, potassium, zinc and chloride. All these minerals are derived from the food we eat.

Classification of Minerals

Minerals can be classified according to the quantity required in the body.

1. Those required in large amount by the body include calcium, phosphorus, sodium, potassium, chloride and magnesium. Calcium and phosphorus account for three-fourth of the minerals present in the body, and five other elements account for most of the rest.
2. Those required in minute amounts include chromium, copper, iodine, iron, selenium, and zinc.

Whereas vitamins are organic substances (made by plants or animals), minerals are inorganic elements that come from the soil and water and are absorbed by plants or eaten by animals. Good sources of minerals include lean meat, whole grain, cereals, organ meat, egg yolk and green leafy vegetables.

Table 2.1: Showing the classification of minerals as required

	Required in large amount	**Required in smaller amount**
1	Calcium	Iodine
2	Phosphorus	Copper
3	Magnesium	Zinc
4	Chloride	Iron
5	Potassium	-

Calcium: The most abundant of the minerals is calcium followed by phosphorus, these are mostly found in the bones and teeth. In addition, to the formation of bones and teeth. Calcium is needed for muscle, nerves, blood clotting etc. Calcium ion regulates contractility of muscles and delays fatigue. The best source of calcium is milk. Millet and dry fish (the bone) and some rocks also contain calcium. Deficiency may lead to osteoporosis. It is claimed to be an important factor in the prevention of atherosclerosis.

Phosphorus, is an essential factor in the metabolism of carbohydrates, fats and proteins, is part of the buffer system that maintains the body's acid - base balance, is in the cytoplasm of all cells, and is part of the genes that transmit hereditary characteristics. All these and more are in addition to its functions in the bones and teeth. Good sources of phosphorus include milk, dried beans, peas and other legumes, groundnuts and whole grain cereals, eggs, meats, fish and fowl.

Magnesium is also a component of bones and teeth. It is also important to the heart, nerves and muscles. It is widely distributed in various food like nuts, whole grains, beans, peas, soya beans, and green leafy vegetables. It serves as a catalyst for the conversion of ADP to ATP.

Iron**:** This mineral element is necessary for blood formation, iron is an important component of haemoglobin of blood, hence it plays a very important part in oxygen transport. It is also found in the myoglobin of muscles and is stored in the liver and spleen. Women from pubescence to pre-menopause usually need to choose wisely iron-rich food to avoid iron-deficiency anaemia. Good sources include : egg yolk, whole wheat, beans, dark green leafy vegetables, liver and meat, plantain.

***Salt*:** Table salt is made up of the elements sodium and chlorine. Salt improves the taste of the food. They help to maintain the acid-base balance of the body. They are usually in sufficient supply in most foods, thus from nutritional point of view there is no need to add extra table salt to food. Excess over a long period may be injurious to health.

***Iodine*:** this is needed in very small quantity, lack of it is manifested in goitre - enlargement of the thyroid gland in the neck. It is iodized salts sold in areas lacking iodine.

***Fluorine*:** This found in water and helps to build strong bones, strong teeth, and to prevent dental caries (cavities). It probably helps in preventing osteoporosis (a demineralization of the bones common with age).

To obtain adequate serving of vitamins and minerals, it is sufficient to eat fruit and vegetables once a day rather than at every meal.

Importance

1. Calcium is a mineral that is crucial in the formation and maintenance of bones.
2. Minerals also help regulate body functions.
3. Prevention of some diseases such as goiter
4. Helps in oxygen carrying ability of the blood
5. Helps in proper functioning of the nervous system
6. Minerals help in muscular contraction
7. Helps maintain normal metabolic functions (e.g. energy production, hormone synthesis)
8. Prevents or repairs damage to cells and tissues
9. Promotes optimal growth and development in children and adolescents

10. May decrease the risk of nutrient-related chronic diseases, such asType 2 diabetes mellitus, obesity, rickets, osteoporosis, hypertension, cardiovascular diseases (CVD) and certain cancers

Conclusion

Vitamins are organic molecules that are essential micronutrient that you need in small quantities for the proper functioning of its metabolism. Essential nutrients cannot be synthesized in the organism, either at all or not in sufficient quantities, and therefore must be obtained through the diet. Vitamins and minerals are often called micronutrients because your body needs only tiny amounts of them. Yet failing to get even those small quantities virtually guarantees disease. Your body needs larger amounts of some minerals, such as calcium, to grow and stay healthy. Other minerals like chromium, copper, iodine, iron, selenium, and zinc that are called trace minerals are only needed in very small amounts.

Summary

Vitamins and minerals are essential to the diet. You cannot make them so you have to get them from foods or dietary supplements. Essential micronutrients have many important functions, including: Supporting growth, repairing tissues, carrying oxygen to muscles and other tissues, and supporting the metabolism of energy, carbohydrates, protein, and fat.

All the essential vitamins and minerals are important to athletic performance and good health. Some key examples are:
B vitamins (thiamin, riboflavin, and pyridoxine) – for energy and nutrient metabolism.
Vitamin C – for healthy immune function. Calcium and vitamin D – for strong and healthy bones. Iron – for optimum oxygen delivery to tissues and the prevention of anemia.

Vitamins and minerals do not provide calories; rather, they work with each other and with other essential nutrients (carbohydrates, protein, fats) to start (or “trigger”) many chemical processes for growth, maintenance of well-being, and possibly, prevention of disease.

Self-Assessment Exercises

1. Vitamins and minerals do not provide calories (a)true (b) false

2. Complex chemical substances, required by the body in very small amounts for the proper functioning of its metabolism is (a)vitamin (b) minerals (c)vitamin and mineral (d) all of the above

3. Diseases that can result from vitamin deficiencies does not include (a) Scurvy (b) Blindness (c) Rickets (d) all of the above

4. Fat-soluble vitamins do not include (a) Vit.A (b)Vit. B (c)Vit.D (c)Vit. E

5. Water-soluble vitamins do not include (a) niacin (b) riboflavin (c) folate (d) retnol

6. Inorganic elements that are essential to body functions such as maintenance of acid-base balance, normal hemoglobin levels and osmotic pressure is (a)vitamin (b) minerals (c)vitamin and mineral (d) all of the above

7. Minerals required in larger amounts by the body do not include (a) zinc (b) calcium (c) phosphorus (d)chloride

8. Minerals required in small amounts by the body do not include (a) iodine (b) copper (c) iron (d)potassium

9. Which of the following is not a function of vitamin and mineral (a**)** repairs damage to cells and tissues (b) promotes optimal growth and development in children and adolescents (c) helps in oxygen carrying ability of the blood (d)none of the above

10. Minerals are not components of (a)vitamins (b)hormones (c)fats (d) enzymes

Feedback

1. A
2. A
3. D
4. B
5. D
6. B
7. A
8. D

9. D
10. C

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Unit 5: **Water**

Introduction

In our last lecture we discussed vitamins and minerals, these nutrients are indispensable to normal growth and health and necessary in the prevention of many diseases. In this unit we are going to conclude our discussions on classes of food. We have already discussed five nutrients; carbohydrate, protein, lipids, vitamins and minerals. Therefore, we shall discuss the last nutrient which is water. It is important to understand water consumption patterns. The daily water volume ingested determines the consumption of any minerals that it contains. An individual's daily aqueous fluid ingestion requirement can be said to roughly equate to the obligatory water losses plus sweat/perspiration losses resulting from increased physical exertion and climate. Not drinking enough water can increase the risk of kidney stones and, in women, urinary tract infections. It can also lower your physical and mental performance, and salivary gland function, and lead to dehydration.

Intended Learning Outcomes

After studying this unit, you should be able to;

1. Describe water
2. List and explain five importance of water
3. Explain dehydration
4. List and explain five causes of dehydration
5. Explain the link between water and sports performance

Water

Water is the most important, yet overlooked, nutrient for athletes. Water and food are basic requirements of life. It is a simple compound of two atoms of hydrogen and one of oxygen (H_2O). Water and fluids are essential to keep the body hydrated and at the right temperature. Your body can lose several litres of sweat in an hour of vigorous exercise. Clear urine is a good sign that you have fully rehydrated. The body's need for water is only second to that of oxygen. One can live for weeks without food, but death is likely to follow a deprivation of water for more than a few days. A 10 percent loss of body water is a serious hazard and death usually follows at a 20 per cent loss. Water is a nutrient. It is the most important nutrient. In fact, the body is approximately 50 to 55 percent water and the human body uses water 24 hours a day. A by-product of the energy production in our body is heat. Water regulates our body temperature by dissipating that heat. Water also carries nutrients to the cells in our body. Not drinking enough water can increase the risk of kidney stones and in women, urinary tract infection. It can also lower your physical and mental performance and salivary gland function and lead to dehydration. Dehydration occurs when the water content of the body is too low. This is easily fixed by fluid intake.

Symptoms of Dehydration

1. Thirst
2. Headaches
3. Lethargy
4. Dry nasal passages
5. Dry or cracked lips
6. Dark coloured urine
7. Weakness
8. Tiredness
9. Confusion and hallucination

If dehydration is not corrected by fluid intake, eventually urination stops, the kidneys fail and the body cannot remove toxic waste products. In the extreme cases, dehydration may result in death.

Causes of Dehydration

There are several factors that that can cause dehydration including

1. Not drinking enough water
2. Diarrhea or vomiting
3. Recovering from burns
4. Increased output of urine due to a hormone deficiency, diabetes, kidney disease or medications
5. Increased sweating due to hot weather, humidity, exercise or fever
6. Insufficient signaling mechanism in the elderly

Water and Sports Performance

Fluid needs of athletes during training and competition vary greatly depending on many factors. For upcoming athletes exercising in mild conditions, less fluid may be needed. Well-trained athletes competing at high intensities in warm condition may need more fluid. As athlete, start your workouts/ training fully hydrated so that:

- You'll be able to train harder and achieve better workouts.
- You'll be able to compete at a higher level for longer duration. Also you need to make up for any fluid deficits from prior workouts. Make a habit of consuming about 400–600 ml of water or a sport drink 2–3 hours before training or competing.
- Keep hydrating as needed during warm-ups. Monitor your hydration status before training by checking the color of your urine: Light-yellow color is consistent with adequate hydration. If urine is the color of apple juice, more fluids are needed.

Importance of Water

1. Aids digestion and prevent constipation
2. Moisten mucous membranes such as those of the lungs and month

3. Water is a solvent for the products of digestion.
4. Moisturize the skin to maintain its texture and appearance
5. It is a carrier of nutrients as well as of waste.
6. Regulate body temperature through sweating
7. Lubricate and cushion joints
8. Carry nutrients and oxygen to cells
9. Water is essential as a body lubricant
10. Maintain the health and integrity of every cell in the body
11. Keep the blood stream liquid enough to flow through blood vessels
12. Help eliminate the byproduct of body metabolism, excess electrolytes (e.g sodium and potassium) and urea, which is a waste product formed through the processing of dietary protein

Conclusion

The human body can last weeks without food but only days without water. The body is made up of 50 to 75% water. Water forms the basis of blood, digestive juice, urine and perspiration and is contained in lean muscle, fat and bones. As the body cannot store water, you need fresh supplies everyday to make up for losses from the lungs, skin, urine and faeces. The amount you need depends on your body size, metabolism, the weather, the food you eat and your level of activity.

Summary

Athletes you need to increase your water intake. Water is an absolutely critical component to the muscle building process and to overall body health in general. Failing to keep yourself properly hydrated throughout the day will have a negative impact on literally every single process within your entire body. Most athletes do not drink enough water. If you really paid close attention to your water intake you would probably be surprised at how little you actually consume.

What makes proper water intake so amazingly important is that it is the most abundant element in your body. It is ranked only second to oxygen as being essential to life. Your body can survive for weeks without food, but without water you would be dead

in just a few days. Roughly 80% of your body is made up of water; the brain is 85% water and lean muscle tissue is 70% water.

Research has shown that being even slightly dehydrated can decrease strength and physical performance significantly. In fact, merely a 3-4% drop in your body's water levels will lead to a 10-20% decrease in muscle contractions. Not only will water increase your strength, but it also plays a large role in preventing injuries during training. Highly intensive training over a long period of time can put unwanted stress on your joints and connective tissue, and water helps to fight against this stress by lubricating the joints and forming a protective "cushion" around them.

Self-Assessment Exercises

1. One of the importance of water is to aids digestion and prevent constipation (a) true (b) false

2. Causes of dehydration includes (a) eating dry food (b) consumption of protein (c) recovering from burns (d) all of the above

3. When the water content of the body is too low, it may lead to (a) sleeplessness (b) dehydration (c) hypertension (d) all of the above

4. Water is a nutrient (a) true (b) false

5. Not drinking enough water can increase the risk of which of the following conditions in women (a)urinary tract infection (b) gastrointestinal tract infection (c)malaria (d) none of the following

6. Not drinking enough water can lower mental performance (a) true (b) false

7. The symptoms of dehydration do not include (a)lethargy (b)headaches (c)weakness (d) vomiting

8. The importance of water do not include (a) aids digestion (b) prevent constipation (c) body lubricant (d) prevention of disease

9. Water is not a solvent for the products of digestion (a) true (b) false

10. Water forms the basis of blood, digestive juice, urine and perspiration and is contained in lean muscle, fat and bones (a) true (b) false

Feedback

1. A
2. C
3. B
4. A
5. A
6. A
7. D
8. D
9. B
10. A

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MODULE 3

Importance of Adequate Diet in Health, Disease Prevention and Sports

Introduction to the Module

Our discussion in module 2 should enables you to synthesis the fact that the food you eat is composed of small units that provide nourishment to your body. These are required in varying amounts in different parts of the body for performing specific functions. This means that good nutrition is essential for good health. However, if your diet provides the important units in incorrect amounts, either very less or in excess of what is required, it results in an imbalance of nutrients in your body. The condition is responsible for various deficiency diseases and slow or no growth of the body. Good performance in sports depends heavily upon how healthy that body is. In module two you would have noticed that as we discussed the various food nutrients, I also called your attention to the health problems or diseases that are associated to not eaten enough or too much of the nutrients. In this unit therefore, we are going to examine the importance of adequate diet inform of quality and quantity to our health.

UNIT 1: Adequate Diet and Health of an Individual

1:0 Introduction

An adequate diet contains all nutrients necessary for maintaining good health and physical efficiency. The diet should provide adequate amounts of all nutrients: carbohydrate, protein, fat, minerals, vitamins and water. If these all are included in the diet, all nutritional needs for energy and nutrients will be met, the three specifications that an adequate diet must have are the following: Protein for growth and maintenance of

body cells, minerals, vitamins, and water for growth, maintenance, and regulation of body processes, fats and carbohydrates for energy.

2.0 Intended learning outcomes

After studying this unit, you should be able to

1. Explain the concept of adequate diet

2. Highlight the importance of adequate diet

3. Relate each class of food to body health requirements.

Adequate Diet

In module one we discussed on healthy diet that helps to promote good health. Adequate diet is another related terminology that has to do with food proportion. An adequate diet is the one which provides all the nutrients in required amounts and proper proportions. It can easily be achieved through a blend of the four basic food groups. The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status and physical activity.

An adequate diet should provide around 50-60% of total calories from carbohydrates, preferably from complex carbohydrates, about 10-15% from proteins and 20-30% from both visible and invisible fat. In addition, a healthy diet should provide other non-nutrients such as dietary fibre, antioxidants and phytochemicals which bestow positive health benefits. Antioxidants such as vitamins C and E, beta-carotene, riboflavin and selenium protect the human body from free radical damage. Other phytochemicals such

as polyphenols, flavones, etc., also afford protection against oxidant damage. Spices like turmeric, ginger, garlic, cumin and cloves are rich in antioxidants.

Importance of adequate diet

- Adequate diet leads to a good physical and a good mental health.
- It helps in proper growth of the body
- It increases the capacity to work
- It increases the ability to fight or resist diseases
- It helps in the maintenance of a healthy weight and reduce body fat
- It promotes good sleep and generally makes a person feel better.

Advantages of Healthy Diet

Lower cholesterol and blood pressure: High blood pressure and high cholesterol are among the leading causes of heart attack worldwide. If you consume high animal fats and salt, it cannot only promote weight gain, but also negatively affect your well-being, and even lead to premature ageing.

Clear skin: If you suffer acne, changing your nutrition to healthy foods will improve your skin condition and help it to be clear. Starting a healthy diet will help to improve the colour of your skin and the appearance of a natural, healthy shining that will allow you to look good even without makeup.

Boosted energy levels: Currently, people often complain of low energy levels and chronic fatigue. One of the reasons for low energy levels is poor nutrition. It will help increase one’s energy level and feel better.

Improved heart rate: Another benefit of adequate diet is to improve heart rate. Studies have shown that such prevention of heart disease is quite useful and it is recommended to

include the whole grains, vegetables, fruits as well as reduce the consumption of sugar, salt and saturated fat.

Healthy weight: A healthy weight is one of the most common reasons why many people choose adequate diet. A diet high in whole foods and low in processed and unhealthy foods will certainly help to maintain a healthy weight. A healthy weight, in turn, means that one will prevent health problems and reduce the risk of developing diabetes and heart disease

Conclusion

An adequate diet is the one which provides all the nutrients in required amounts and proper proportions. It can easily be achieved through a blend of the four basic food groups. The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status and physical activity.

Your health depends upon healthy diet, the interaction of your genes and your environment. The food you eat is part of your personal environment. Let food be your medicine. This statement points to the fact that preventive and therapeutic health values of food relative to the development of chronic diseases must be given attention.

Summary

Adequate diet is a diet that contains all the classes of food eaten in the proportions that provides nutrient to the body of the consumer putting into consideration the age of the consumer, body type, weight and health status. Adequate diet improves health of the individual, resist diseases and lower cholesterol level when taking appropriately.

Assessment

1. ……..can easily be achieved through a blend of the four basic food groups

a) Balance diet
b) Adequate diet
c) Nutritional diet
d) Balance diet and nutritional intake

2. The quantities of foods needed to meet the nutrient requirements vary with the following except ----------

a. Age
b. Gender
c. Physiological status

d. Social status

3. Adequate diet should provide around ----------of total calories from carbohydrates

a. 50-60%
b. 10-20%
c. 30-80%
d. 100%

4. ---------- protect the human body from free radical damage

a. Vitamin C & E
b. Antioxidants
c. Beta-carotene
d. Riboflavin.

5. Adequate diet does the following except ……

a. Improve one's skin colour
b. Improved heart rate
c. Increases healthy weight

d. Increase one's weight

6. One of the reasons why people should choose adequate diet is?

a. To maintain healthy weight
b. To be control eating habit
c. To boast energy level
d. All of the above

7. Adequate diet can be gotten from the following except

a. Carbohydrate
b. protein
c. Fats and oil
d. Fruits and vegetables

8. Protein helps our body in the following ways except

a. maintenance of body cells
b. Boast immunity
c. Helps in the repair of the body issue and organs
d. All of the above

9. The three specifications for an adequate diet are …..

a. Protein for growth and maintenance of body cells
b. Minerals, vitamins, and water for growth, maintenance.
c. Regulation of body processes, fats and carbohydrate
d. Protein, minerals, vitamins and water for growth, maintenance and carbohydrate.

10. The difference between adequate diet and healthy diet is that

a. Healthy diet contains all the classes of food while adequate do not
b. Adequate diet contains only four classes of food while healthy diet are not
c. Diet cannot be balance but can be appropriate when food are taking in right proportion to the need of the consumer
d. All

Feedback

1. B
2. D
3. A
4. B
5. D
6. D
7. D
8. D
9. D
10. C

UNIT 2: Health Problems That can Result From Excesses of Different Nutrients

Introduction

The major health problem from food is malnutrition. Malnutrition represenst unbalanced nutrition and may exist as either under nutrition or over nutrition, that is, an individual does not receive an adequate intake (under nutrition) or consumes excessive amount of single and multiple nutrient (over nutrition). Either condition can hamper health and athletic performance.

2.0 Intended Learning Outcomes (ILO)

At the end of the lesson students should be able to:

1. List health problems that can result from excesses of different nutrients.

2. Relate the cause of obesity to food

3. Highlight problems associated with obesity

4. State causes of overweight .

5. Differentiate between obesity and overweight.

Content:

Let us start this unit discussion by examining some new or confusing terms:

Obesity- higher amounts of fat that detrimentally affects health (BMI $\geq$ 30)

Overweight- deviation in body weight from some standard in relation to height

Overfat- body fat greater than some standard (BMI ≥ 25)

Sometimes people never know why they have one or more illnesses. If a medical reason cannot be found, then a person might form their own ideas, such as it being down to "bad luck" Examples of health problems are the following but not limited to the ones listed; Obesity, overweight, under-weight, scurvy, Kwashiorkor

Obesity: Obesity is excess fat in the body which can be as a result of excessive intake of saturated fat. A healthy body requires a minimum amount of fat for proper functioning of the hormonal, reproductive, and immune systems, as thermal insulation, as shock absorption for sensitive areas, and as energy for future use. But the accumulation of too much storage fat can impair movement, flexibility, and alter the appearance of the body.

Williams (2005) attributed the development of obesity to several factors such as genetics, nutrition, inactivity, endocrine function, hypothalamic function, drugs and social lifestyle. Physiological and psychological trauma, hormonal imbalance and alterations in homeostatic balance have also being implicated in the development of obesity.

However, as related to nutrition probable predisposing factors to excessive weight gain may include eating patterns, eating environment, food packaging, body image, biochemical differences related to resting metabolic rate, dietary induced adaptive thermogenesis, level of spontaneous activity (fidgeting) and basal body temperature.

Problem associated with Obesity

Studies have shown that obesity predisposes an individual to a number of problems. It complicates surgery and pregnancy resulting into pulmonary problems, heat intolerance and reduced fertility. Williams (2005) posited that obesity restricts mobility, increases fatigue and decreases overall body efficiency. It is also associated with number of diseases such as high blood pressure, coronary heart diseases, osteo-arthritis, atherosclerosis, certain cancer of colon, breast, rectum, ovaries prostate gallbladder and uterus as well as diabetes.

Excess Body Fat and Wellness

Health problems associated with excess body fat includes:

Increased risk of chronic disease and premature death;

Unhealthy blood fat levels

Impaired heart function

Heart disease and hypertension

Cancer

Impaired immune function

Gallbladder disease

Kidney disease

Skin problems

Sleeping problems

Overweight

Being overweight is generally caused by the intake of more calories (by eating) than are expended by the body (by exercise and everyday activity). Factors that may contribute to this imbalance include:

- Alcoholism
- Eating disorders (such as binge eating)
- Genetic predisposition
- Hormonal imbalances (e.g. hypothyroidism)
- Insufficient or poor-quality sleep
- Limited physical exercise and a sedentary lifestyle
- Poor nutrition
- Metabolic disorders, which could be caused by repeated attempts to lose weight by weight cycling
- Overeating
- Psychotropic medication (e.g. olanzapine)
- Smoking cessation and other stimulant withdrawal
- Stress.

Excess Fat and Diabetes

Obese people are more than three times as likely as nonobese people to develop diabetes.

Excess body fat is a key risk factor for the most common type of diabetes. Diabetes mellitus is disruption of normal glucose metabolism.

Type 1 diabetes the pancreas produces little or no insulin

Type 2 diabetes - the pancreas doesn't produce enough insulin, cells are resistant to insulin, or both

Gestational diabetes - develops in 2–5% of pregnant women

Pre-diabetes - elevated blood glucose levels

Symptoms of Diabetes:

Frequent urination

Extreme thirst and hunger

Unexplained weight loss

Extreme fatigue

Blurred vision

Slow wound healing

Tingling and numbness in hands and feet

Frequent Infection

Dry itchy skin

Diabetes: Prevention

Regular physical activity including endurance exercise and weight training

Moderate diet rich in whole grains, fruits, vegetables, legumes, fish, and poultry

Modest weight loss

For people with pre-diabetes, lifestyle changes are more effective than medication in preventing diabetes

Diabetes: Treatment

Keep blood sugar levels within safe limits through diet, exercise, and, if needed, medication

Monitor blood sugar levels with a home test

Lose weight if overweight

A little weight loss at a time can be very beneficial; focus on a healthy lifestyle including proper diet and exercise.

Fat Distribution and Disease Risk

Disease risk increases with total waist measurement of more than 100cm for men and 7.5cm for women. Likewise, disease risk increases with total waist-to-hip measurement above 0.94 for young men and 0.82 for young women

Main while, there is still problem if the body fat level is too low. Too little body fat (less than 10–12% for women and less than 5% for men) is associated with reproductive, circulatory, and immune system disorder.

Body Mass Index

The body mass index (BMI) is a measure of a person's weight taking into account their height. It is given by the following formula: BMI equals a person's weight (mass) in kilograms divided by the square of the person's height in metres and the units therefore are kg/m^2.

BMI provides a significantly more accurate representation of body fat content than simply measuring a person's weight. It is only moderately correlated with both body fat percentage and body fat mass ($r = 0.68$). It does not take into account certain factors such as pregnancy or bodybuilding; however, the BMI is an accurate reflection of fat percentage in the majority of the adult population.

BMI VALUES	INTERPRETATION
Below 18.5	Underweight
18.5-24.9	Normal
25-29.9	Overweight
30-34.9	Obese
35+	Very obese

4.0 Conclusion

Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. Today, we are faced with a host of health problems that require individual action. Bringing about that action requires nutrition education. Majority of the health problems discussed are preventable provided an individual is cognizance of his/her diet, behavior, and lifestyle and engages in physical activity.

5.0 Summary

. Health Problems can result from excesses of different nutrients. Examples of such health problems are the following but not limited to the ones listed; Obesity and overweight. Excess body fat decreases the ability to perform physical activities. Healthy diet and regular exercise improve body image and help in maintaining a wellness lifestyle.

Self-Assessment Exercises

1. The following are health problems except:

   a) Obesity
   b) Kwashiorkor
   c) Elephantiasis
   d) Scurvy

2. The lymphatic serves the following functions except----------

   a. Lipid absorption
   b. increase absorption of lipid
   c. Boast immunity
   d. Gaining of fluid

3. Diabeties can be prevented from the following except

a. regular physical activity

b. moderate diet rich in whole grains

c. regular intake of glycerol

d. modest weight loss

4. The Most commonly used measure to define obesity in an individual is known as

a. Hyperthyroidism
b. Basal metabolic rate
c. Body mass index
d. Body mass calorie

5. ---------- is a condition in which someone is overweight or obese but does not suffer from any other co-morbidity such as hypertension and diabetes

a. Cardiovascular irregularities
b. Insulin deficiency
c. Malignant obesity
d. Benign obesity

6. When is body fat level too low?

a. less than 10% for women
b. less than 10% for men
c. less than 15% for men
d. less than 15% for women

7. The body mass index (BMI) is a measure of a person's

a. weight and age

b . height and age

c. weight and height

d. Height and waist

8. Overweight is generally caused by the following factors except

a. Aerobic exercise

b. alcoholism

c. binge eating

d. poor-quality sleep

9. Storage and accumulation of excess fat causes the following except…..

a. Impaired movement
b. Increase flexibility and decrease blood flow
c. Alter flexibility
d. Alters the shape of the body

10. The accurate measurement of body fat in the body is through

a. BMI
b. Kg/m^2.
c. Skin fold calliper
d. Waist/hip ratio

Feedback

1. C
2. B
3. B

4. C

5. D

6. A

7. C

8. A

9. C

10. A

ACTIVITY 3.1

Calculate your BMI and use the norm table to interpret it.

Unit 3: Health Problems That Can Result From Deficiencies Of Different Nutrients

Introduction

In the previous unit 2 of this module, you have studied about health problems that can result from excesses of intake of some nutrients especially carbohydrate and fat. You have also learned how to measure or estimate the fat content of the body through the use of Body Mass Index. This unit will equip you more on other health problems that insufficient intake of some nutrients can cause.

Intended Learning Outcomes

At the end of the lesson students should be able to:

1. List health problems that can result from deficiencies of different nutrients.

2. Relate the cause of scurvy to food

3. Highlight problems associated with Kwashiorkor

Content:

Health problems that can result from deficiencies of different nutrients are common in most African Countries. Carbohydrate is the most common ingredient in any diet and it does not give us sufficient foods. This does necessarily mean that the food is not satisfying. But it lacks the nutrient we need even if we eat an enormous quantity.

Children eating mainly carbohydrate are generally bony and scaly. They will eventually develop pot belly in which case the other parts of the body are not proportional to the protruding tummy.

Protein is necessary for growth and maintenance. Children who suffer from a lack of protein lose weight. A lack of protein prevent people from fighting diseases, and in this may cause death.

Deficiency of vitamin A: Absence of this vitamin causes night blindness and a rough skin.

Deficiency of vitamin B thiamin: Lack of this vitamin causes beriberi and a loss of appetite

Deficiency of vitamin B riboflavin: Lack of this vitamin could cause angular stomatitis, a cracked and sore skin, the tongue becomes raw and sore and possibly coloured and growth is checked.

Deficiency of vitamin B nicotinic acid: Lack of this vitamin could cause digestive upset such as diarrhoea, a rough , and the tongue may also be affected. These are symptoms of the disease pellagra.

Deficiency of vitamin C: Lack of it cause ill health. Growth may be checked, scurvy may result, and the gum may become soft and spongy. The healing of sores and wound may be prevented.

Deficiency of vitamin D: Lack of this may cause bone a and teeth deformities such as rickets of of different forms. Hardening of bones may be slowed.

We shall now discuss fully three of the above listed health problems.

Marasmus: This is undernourishment causing a child's weight to be significantly low for their age.

Causes: Marasmus is caused by a severe deficiency of nearly all nutrients, especially protein, carbohydrates and lipids, usually due to poverty and scarcity of food. Viral, bacterial and parasitic infections can cause children to absorb few nutrients, even when consumption is adequate. Marasmus is one of the 3 forms of serious protein-energy malnutrition (PEM). The other 2 forms are kwashiorkor (KW) and marasmic KW. ... Marasmus is a condition primarily caused by a deficiency in calories and energy, whereas kwashiorkor indicates an associated protein deficiency.

Kwashiorkor

Kwashiorkor is a form of severe protein malnutrition characterized by edema, and an enlarged liver with fatty infiltrates. Sufficient calorie intake, but with insufficient protein consumption, distinguishes it from marasmus. Kwashiorkor cases occur in areas of famine or poor food supply.

Signs and symptoms

The defining sign of kwashiorkor in a malnourished child is pitting edema (swelling of the ankles and feet). Other signs include a distended abdomen, an enlarged liver with fatty infiltrates, thinning of hair, loss of teeth, skin depigmentation and dermatitis. Children with kwashiorkor often develop irritability and anorexia. Generally, the disease can be treated by adding protein to the diet; however, it can have a long-term impact on a child's physical and mental development, and in severe cases may lead to death.

Causes of Kwashiorkor

Kwashiorkor is a severe form of malnutrition, caused by a deficiency in dietary protein. The extreme lack of protein causes an osmotic imbalance in the gastro-intestinal system causing swelling of the gut diagnosed as an edema or retention of water. Victims of kwashiorkor commonly exhibit reduced ability to recover fluids, immune system failure, and low lipid absorption, all of which result from a state of severe undernourishment. Fluid recovery in the lymphatic system is accomplished by re-absorption of water and proteins which are then returned to the blood. Compromised fluid recovery results in the characteristic belly distension observed in highly malnourished children. Extreme fluid retention observed in individuals suffering from kwashiorkor is a direct result of irregularities in the lymphatic system and an indication of capillary exchange.

Scurvy

Scurvy is a disease resulting from a lack of vitamin C (ascorbic acid). Early symptoms of deficiency include weakness, feeling tired, and sore arms and legs. Without treatment, decreased red blood cells, gum disease, changes to hair, and bleeding from the skin may occur. As scurvy worsens there can be poor wound healing, personality changes, and finally death from infection or bleeding. It takes at least a month of little to no vitamin C in the diet before symptoms occur. In modern times, scurvy occurs most commonly in people with mental disorders, unusual eating habits, alcoholism, and older people who live alone. Scurvy currently is rare, it occurs more often in the developing world in association with malnutrition. Treatment is with vitamin C supplements taken by mouth, Improvement often begins in a few days with complete recovery in a few weeks. As discussed in module 2, sources of vitamin C in the diet include citrus fruit and a number of vegetables such as tomatoes and potatoes. Cooking often decreases vitamin C in foods.

Signs and symptoms of Scurvy

Early symptoms are malaise and lethargy. After one to three months, patients develop shortness of breath and bone pain. Other symptoms include skin changes with roughness, easy bruising and petechiae, gum disease, loosening of teeth, poor wound healing, and emotional changes (which may appear before any physical changes). Dry mouth and dry eyes may occur. In the late stages, jaundice, generalised edema, oliguria, neuropathy, fever, convulsions, and eventual death are frequently seen

Causes of Scurvy

Scurvy, including subclinical scurvy, is caused by a deficiency of dietary vitamin C since humans are unable to metabolically make this chemical. Scurvy is one of the accompanying diseases of malnutrition and thus is still widespread in areas of the world depending on external food aid.

Conclusion

Malnutrition represent unbalanced nutrition and may exist as either under nutrition or over nutrition. Under nutrition otherwise referred to as deficiency is when an individual does not receive an adequate intake, while consuming excessive amount of single and multiple nutrient results into over nutrition. Either condition can hamper health and athletic performance.

Summary

Malnutrition results from an unbalanced diet and a lack of nutritious food. Health problems that can result from deficiencies included marasmus, kwashiorkor, beriberi, scurvy, pellagra, rickets among others. If unattended to they can lead to health complications and premature death.

Self-Assessment Exercise

1. Malnutrition characterized by edema, and an enlarged liver with fatty infiltrates is known as

a.Obesity
b. Kwashiorkor
c. Maramus
d. Scurvy

2. Night blindness is caused by……

a. deficiency of thiamin
b. deficiency of nicotinic acid
c. deficiency of vitamin A
d. deficiency of vitamin C

3. Vitamin C is also known as

a. nicotinic acid
b. ascorbic acid
c. lactic acid
d. scurvy acid

4. The difference between marasmus and kwashiorkor is that

a. marasmus is caused by a deficiency in dietary protein
b. kwashiorkor is caused by a deficiency in dietary carbohydrate
c. Kwashiorkor is caused by a deficiency in dietary protein
d. marasmus and kwashiorkor are the same

5. Symptoms of the disease pellagra will include

   a. Diarrhoea

   b. sore skin

   c. lose weight

   d. rough skin

6. Malnutrition can best be defined as

   a. an unbalanced diet
   b. Inadequate diet
   c. Unhealthy diet
   d. All of the

7. Hardening of bones may be slowed as a result of deficiency in

   a. vitamin A
   b. vitamin B
   c. vitamin C
   d. vitamin D

8. Marasmus is said to be associated with ---------- during dry season

   a. Carbohydrate deficiency
   b. Protein insufficiency
   c. Malnutrition
   d. None of the above

9. Victims of kwashiorkor commonly exhibit the following symptoms except

   a. reduced ability to recover fluids

   b. immune system failure

c. no weight loss

d. low lipid absorption

10. Which one is not a health problem that can result from deficiencies of nutrients?

a. Obesity

b. Kwashiorkor

c. Maramus

d. Scurvy

Feedback

1. B
2. C
3. B
4. C
5. D
6. D
7. D
8. A
9. C
10. A

Unit 4: Adequate diet and disease prevention

1:0 Introduction

An adequate diet is a diet that helps to maintain or improve overall health. An adequate diet provides the body with essential nutrition: fluid, macronutrients, micronutrients, and adequate calories. For people who are healthy, adequate diet is not complicated and contains mostly fruits, vegetables, and whole grains, and includes little to no processed food and sweetened beverages. The requirements for adequate diet can be met from a variety of plant-based and animal-based foods, although a non-animal source of vitamin B12 is needed for those following a vegan diet.

2.0 Intended learning outcomes

After studying this unit, you should be able to

1. Define the concept of adequate diet

2. State classes of food

3. Explain how of adequate diet prevent disease

4. Highlight diseases that can be prevented through adequate diet

5. Explain how adequate diet improve obesity

A healthy lifestyle includes getting exercise every day along with eating adequate diet. Adequate and healthy lifestyle may lower disease risks, such as obesity, heart disease, type 2 diabetes, hypercholesterolemia, hypertension and cancer. It's undeniable that a well balanced diet goes hand in hand with a healthy lifestyle. What one chooses to eat, and what you choose not to eat, are factors in warding off many leading chronic illnesses and diseases.

Food choices make a huge impact on how one feel today, tomorrow and what the future holds in terms of promoting and maintaining good health. Adequate diet can help fight conditions and illnesses like heart disease, diabetes, osteoporosis, cancer and obesity among many others.

There are specialized healthy diets, called medical nutrition therapy, for people with various diseases or conditions. The World Health Organization (WHO) makes the following 5 recommendations with respect to both populations and individuals in a bid to reduce and prevent diseases among the general population.

1. Maintain a healthy weight by eating roughly the same number of calories that the your body is using.
2. Limit intake of fats. Not more than 30% of the total calories should come from fats. Prefer unsaturated fats to saturated fats. Avoid trans fats.
3. Eat at least 400 grams of fruits and vegetables per day (potatoes, sweet potatoes, cassava and other starchy roots do not count). A healthy diet also contains legumes (e.g. lentils, beans), whole grains and nuts.
4. Limit the intake of simple sugars to less than 10% of calorie (below 5% of calories or 25 grams may be even better).
5. Limit salt / sodium from all sources and ensure that salt is iodized. Less than 5 grams of salt per day can reduce the risk of cardiovascular disease

World Health Organization (WHO) stated that insufficient vegetables and fruit is the cause of 2.8% of diseases and deaths worldwide

The following recommendations from WHO will help to either reduce or prevent diseases:

- ensuring that the foods chosen have sufficient vitamins and certain minerals;
- avoiding directly poisonous (e.g. heavy metals) and carcinogenic (e.g. benzene) substances;

- avoiding foods contaminated by human pathogens (e.g. *E. coli*, tapeworm eggs);
- and replacing saturated fats with polyunsaturated fats in the diet, which can reduce the risk of coronary artery disease and diabetes
- Include adequate amounts of calcium in the diet; however, milk is not the best or only source. Good sources of calcium are collards, fortified soy milk, baked beans, and supplements containing calcium and vitamin D.
- Adequate intake of water over other beverages. Avoidance of sugary drinks, and limited intake of juices and milk. Coffee, tea, artificially-sweetened drinks, 100-percent fruit juices, low-fat milk and alcohol fit into a healthy diet but are best consumed in moderation. Sports drinks are recommended only for people who exercise more than an hour at a stretch to replace substances lost in sweat.
    - Drink alcohol in moderation. Doing so has health benefits, but is not recommended for everyone
    - Consider intake of daily multivitamin and extra vitamin D, as these have potential health benefits

Obesity: The scary truth is that obesity is becoming very prevalent in adolescents. Dietary habits that are established in childhood more often than not carry over into adulthood. This is why it's critical to instill good diet and nutrition practices in today's youth. Making sure children have the correct amount of nutrients and foods from major food groups is key to preventing obesity. Eating foods loaded with sugar, fats and calories can add extra weight to your body, weakening your bones and making your organs work harder. This automatically puts you at a higher risk for health problems down the road. Therefore, eating adequate diet helps in the prevention of overweight which resolves into obesity that is a big health problem among the population.

Heart Disease: Keeping blood pressure, cholesterol and weight under control are main components to preventing heart disease. Healthy eating habits are a way to keep these

numbers balanced. Focusing a diet on whole grains, fruits, veggies, and proteins, as well as limiting sodium and foods that are high in calories are good rules of thumb.

Diabetes: The best way to prevent type 2 diabetes is to eat a low-fat, well-balanced diet. Other diet tips include decreasing fat consumption to less than 30 percent of calories and saturated fat consumption to less than 10 percent of calories. Adding high-fiber foods to a diet regimen is also important to preventing this lifelong condition.

Cancer: Obesity increases the odds of developing cancer, and luckily there are many foods that can aide in prevention. Leafy greens, cruciferous vegetables, berries, whole grains and even green and black tea all help protect against various types of cancer. While no single food is a sure way to prevent cancer, the appropriate combination of vitamins and minerals along with a well-balanced diet can provide solid protection.

Osteoporosis: A diet lacking vitamin D and calcium can contribute to osteoporosis. In order to keep bones healthy and strong, a diet containing specific types of foods is recommended. This includes low fat versions of foods that are high in calcium, and those fortified with vitamin D. Calcium fortified products, like orange juice, cereals and soy-based foods are a good way to increase calcium in a diet. Without enough calcium, one's bones can become unhealthy, brittle and weak. This makes an individual more susceptible to osteoporosis. Therefore, a diet that is high in calcium can help *prevent* osteoporosis. The same holds true with saturated fat and cardiovascular disease. Too much saturated fat in an individuals' diet can lead to high cholesterol and high blood pressure, two major risk factors for cardiovascular disease

Summary

Adequate diet has proven to be potent in reducing health problems. Therefore, An adequate diet is the one which provides all the nutrients in required amounts and proper proportions. It can easily be achieved through a blend of the four basic food

groups. The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status and physical activity.

Assessment

1. Which of these is not true of fats?

a) More than 30% of the total calories should come from fats. Prefer unsaturated fats to saturated fats
b) Fat provides energy at rest
c) Fats are soluble and insoluble
d) Fats hinders athletes from performing well

2. Lack of adequate diet contribute the following to athletes performance except ----------

a. Increase the rate of performance of athletes
b. Initiate injury
c. High level of tiredness
d. Causes osteoporosis

3. These are good sources of calcium except…….

a. Fortified soy milk.
b. Baked beans
c. supplements containing calcium and vitamin D
d. None of the above

4. Eating foods loaded with sugar, fats and calories can add ---------- to athletes impeding performance

a. Extra weight
b. Extra skills
c. flexibility

d. All of the above

5. Adequate diet prevents the following except ……

a. Osteoporosis.
b. Diabetes:
c. Overweight
d. Increase lipoprotein in human

6. A diet lacking vitamin D and calcium can contribute to?

a. Development of cancer
b. Increase the weight of an individual
c. Causes osteoporosis
d. All of the above

7. Cholesterol and weight under control are main components to preventing--------

a. Heart failure
b. Heart disease
c. Backflow of blood at heart
d. Increases chance of being obese

8. To prevent diabetes, the following must be adhere to except

a. Eat a low-fat
b. Increase the intake of protein and carbohydrate
c. Decreasing fat consumption to less than 30 percent of calories and saturated fat.
d. Adding high-fiber foods to a diet regimen

9. The three specifications that an adequate diet contain are …..

a. Protein for growth and maintenance of body cells
b. Minerals, vitamins, and water for growth, maintenance.

c. Regulation of body processes, fats and carbohydrate
d. Protein, minerals, vitamins and water for growth, maintenance and carbohydrate.

10. The adequate diet suitable for consumption in the prevention of cancer are except

a. Leafy greens, cruciferous vegetables.
b. Whole grains.
c. Green and black tea
d. Sugar, fats and calories

Feedback

1. D
2. A
3. D
4. A
5. D
6. C
7. B
8. B
9. D
10. D

Unit 4: *Adequate Diet for Sport Performance*

1:0 Introduction

A number of factors contribute to success in sport, and diet is a key component. As you learned in module one unit two, an athlete's dietary requirements depend on several aspects, including the sport, the athlete's goals, the environment, and practical issues. In this unit we shall deal with the importance of some of these nutrients in the diet to athletes' performance. The importance of individualized dietary advice has been increasingly recognized, including day-to-day dietary advice and specific advice before, during, and after training and/or competition. Athletes use a range of dietary strategies to improve performance, with maximizing glycogen stores a key strategy for many.

2.0 Intended learning outcomes (ILOs)

After studying this unit, you should be able to

1. Define the concept of adequate diet for athlete

2. State the importance of carbohydrate to athletes' performance

3. State the importance of protein to athletes' performance

4. Explain the importance of vitamins and minerals to performance

5. Mention the importance of fluid consumption to athletes' performance

Adequate Diet for Athlete

Eating a good diet can help provide the energy you need to finish a race, or just enjoy a casual sport or activity. You are more likely to be tired and perform poorly during sports when you do not get enough: Calories, Carbohydrates, Fluids, Iron, vitamins, and other minerals.

Recommendations

The ideal diet for an athlete is not very different from the diet recommended for any healthy person.

However, the amount of each food group you need will depend on:

- The type of sport
- The amount of training you do
- The amount of time you spend doing the activity or exercise

People tend to overestimate the amount of calories they burn per workout so it is important to avoid taking in more energy than you expend exercising.

To help you perform better, avoid exercising on an empty stomach. Everyone is different, so you will need to learn:

- How long before exercising is best for you to eat?
- How much food is the right amount for you?

Importance of carbohydrates to athletes' performance

Carbohydrates are needed to provide energy during exercise. Carbohydrates are stored mostly in the muscles and liver. Carbohydrate loading aims to maximize an athlete's muscle glycogen stores prior to endurance exercise lasting longer than 90 minutes. Benefits include delayed onset of fatigue and improvement in performance.

Procedure for carbohydrate loading:

Initial protocols involved a depletion phase (3 days of intense training and low carbohydrate intake) followed by a loading phase (3 days of reduced training and high carbohydrate intake). However, muscle glycogen concentrations could also enhance a similar level without the glycogen-depletion phase. Likewise, 24 hours may be sufficient to maximize glycogen stores. There appears to be no advantage to increasing pre-exercise muscle glycogen content for moderate-intensity performance like, cycling or running of 60–90 minutes, as significant levels of glycogen remain in the muscle following

exercise. For exercise shorter than 90 minutes, 7–12 g of carbohydrate/kg of body weight should be consumed during the 24 hours preceding.

Carbohydrate eaten in about 2 to 3 hours prior to exercise (compared with an overnight fast) has been shown to increase muscle glycogen stores and carbohydrate oxidation, extend time to exhaustion, and improve exercise performance. In long duration events, carbohydrate improves performance primarily by preventing hypoglycemia and maintaining high levels of carbohydrate oxidation.

Importance of protein to athletes' performance

While protein consumption prior to and during endurance and resistance exercise has been shown to enhance rates of muscle protein synthesis (MPS), a recent review found protein ingestion alongside carbohydrate during exercise does not improve time–trial performance when compared with the ingestion of adequate amounts of carbohydrate alone. Protein is important for muscle growth and to repair body tissues. Protein can also be used by the body for energy, but only after carbohydrate stores have been used up both for athletes and non-athletes. Often, people who focus on eating extra protein may not get enough carbohydrates, which are the most important source of energy during exercise.

Importance of vitamins and minerals intake to athletes' performance

Supplement use in form of vitamins and minerals is widespread in athletes, with recent interest in the beneficial effects of nitrate, beta-alanine, and vitamin D on performance. However, an unregulated supplement industry and inadvertent contamination of supplements with banned substances increases the risk of a positive doping result. Nutrition can help enhance athletic performance. Eating a good diet can help provide enough vitamins and minerals you need as athlete. However, prolong endurance exercise, nitrate supplementation has been shown to increase exercise efficiency (4%–5%

reduction in VO_2 at a steady state; 0.9% improvement in time trials), reduce fatigue, and attenuate oxidative stress.

Importance of fluids intake to athletes' performance

Fluid consumption prior to exercise is recommended to ensure that an athlete is well-hydrated prior to commencing exercise. In addition, carefully planned hyperhydration (fluid overloading) prior to an event may reset fluid balance and increase fluid retention, and consequently improve heat tolerance. Fluid and electrolyte replacement after exercise can be achieved through resuming normal hydration practices. However, when rehydration is needed within 24 hours or more, substantial body weight has been lost (>5% of BM), a more structured response may be warranted to replace fluids and electrolytes. The purpose of fluid consumption during exercise is primarily to maintain hydration and thermoregulation, thereby benefiting performance. Fluid consumption prior to exercise is recommended to ensure that the athlete is well-hydrated prior to commencing exercise. Teenagers and adults should replace any body weight lost during exercise with an equal amount of fluids. For every pound (450 grams) you lose while exercising, you should drink 480 to 720 milliliters or 3 cups (720 milliliters) of fluid within the next 6 hours.

4.0. Conclusion

Carbohydrate intake during exercise maintains high levels of carbohydrate oxidation, prevents hypoglycemia, and has a positive effect on the central nervous system. The benefits of protein intake throughout the day following exercise are now well recognized. Athletes should aim to maintain adequate levels of hydration, and they should minimize fluid losses during exercise to no more than 2% of their body weight. Athletes' performance can be greatly improved and enhanced through adequate diet before competition, during competition and after competition but the diet must be administered by the experts so as to avoid diet that will lead to poor performance.

5.0. Summary

Athletes are always looking for an edge to improve their performance, and there are a range of dietary strategies available. Nonetheless, dietary recommendations should be individualized for each athlete and their sport and provided by an appropriately qualified professional to ensure optimal performance. Dietary supplements should be used with caution and as part of an overall nutrition and performance plan

Assessment

1. Athlete' dietary requirements depend on factors such as the following except?

a) The type of coach, income and the club
b) the types of sport
c) the athlete's goals
d) environment,

2. Carbohydrate intake during exercise helps athletes' in the following way except ----------

a. Increase athlete energy
b. enhance metabolic adaptations
c. It increase endurance level
d. prevents hypoglycemia

3. Carbohydrate is stored in ……. athletes

a. Liver and muscle
b. Brain
c. Organs
d. tendons

4. For any performance that is < than or equal to 90 minute, the carbohydrate consumption preceding the exercise should be

a. 12-15g
b. 4-10kg of CO_2
c. 7-12g of CO_2
d. All of the above

5. The only time protein is useful for athletes is .. ……

a. When carbohydrate is in excess
b. When carbohydrate has been used off by
c. When the athletes sustained injury
d. When the athletes is serious tired

6. Fluids consumption prior to exercise helps ------?

a. athlete well-hydrated
b. Resuming normal hydration practice
c. For overloading process
d. C &B

7. Adequate diet helps athletes' in the following ways except--------

a. Increases performance
b. Increase endurance level
c. Discourages coaches about the performance of their athletes
d. All of the above

8. Thermoregulation is the process of introducing ----------to athletes

a. carbohydrate
b. Increase the intake of protein
c. Introduction of fluid.
d. Oxidation of glycogen

9. The best time to load carbohydrate for athletes is . …..

   a. A day to competition
   b. Two days to competition.
   c. Some minute to the competition
   d. 62 hours to competition.

10. The suitable meal for athletes prior, during and after competition is

   a. Carbohydrate
   b. Fats and oil
   c. Adequate diet
   d. Vitamins and multivitamins

Feedback

1. A

2. B

3. A

4. C

5. B

6. A

7. C

8. C

9. A

10. C

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MODULE IV

Planning the Athlete's diet, Content of Diets and Meals, Nutritional Demands Before, During and After Training and Composition

INTRODUCTION

You should remember that in Module 2 we discussed classes of food. As an athlete if your diets are not well planned you might not be able to get best out of their functions. Also in Module 1 we compared the various food needs of different people especially the athlete. In this module therefore, we shall examine how to plan the athlete's diet before, during and after training or competition. Every athlete whether professional or amateur, wants to be superior among his race and strives to be the best. But to thrive, he/she or his/her handlers must understand that proper nutrition is the basis any athlete must build from in order to achieve peak performance. This module will help you to put the principles of sports nutrition into practice.

It is the position of the American Dietetic Association and the American College of Sports Medicine that physical activity, athletic performance and recovery from exercise are enhanced by Optimal Nutrition, Energy Requirements, Energy Balance and Energy Availability.

An appropriate energy intake is the cornerstone of the athlete's diet since it supports optimal body function, determines the capacity for intake of macro-nutrient and micro-nutrients and assists in manipulating body composition.

UNIT 1: PLANNING THE ATHLETE'S DIET

1.0 Introduction

When one is engaged in any form of physical activity, the body

needs some form of energy. If this is not provided it is like a car running on empty gas tank. Prior to strenuous activity it is imperative that the body has the

required amounts of nutrients to carry out activities. There are three basic keys to athlete's healthy eating. They include the following:

- Variety – there is no one magic food
- Moderation – all foods can fit into a well-balanced diet
- Wholesomeness – choose natural or lightly processed foods as often as possible

2.0 INTENDED LEARNING OUTCOMES (ILOs)

In this study students should be able to:

(a) Draw an athlete's diet plan.

(b) Mention active male/female daily calorie need.

(c) Ascertain the content of athlete's diet plan.

(d) State five daily calorie need for athletes.

(e) Mention five of the caloric content of athlete's diet.

CONTENT

Sports nutrition focuses on what you need to be fueled and hydrated during exercise, and to promote rapid recovery after exercise. But what are you eating the rest of the time, when you're not exercising? Cutting-edge sports nutrition is founded on healthy eating.

3.0 DAILY CALORIE NEED FOR ATHLETES

- Calorie Needs
  - Healthy active women need approximately 1800-2800 Calories/day
  - Healthy active men need approximately 2600-3400 Calories/day
  - Individual needs may be higher or lower depending on metabolic rate, gender and level of physical activity.
  - Calorie – this is defined as a unit of heat equal to the amount of heat required to raise the temperature of one kilogram of water by one degree at one atmospheric pressure; used by nutritionists to characterize the energy-producing potential in food.
- Calorie Composition-
  - ~55-65% Calories from high-quality carbohydrates
  - ~15-20% Calories from lean proteins
  - ~20-30% Calories from mostly unsaturated fat

Nutritionists of today simplify this into an equation of 40% carbohydrates, 30% fats, and 30% protein that the entire day's meals of an apparently healthy adult should be divided into. This is referred to as 'my plate'. The total calorie intake must increase for active persons from 2200 to 2200 plus the total number used while exercising. This will ensure replenishment of the body system.

Benefits of Sports Nutrition During Training

1. Enables you to train longer and harder.
2. Delays the onset of fatigue.
3. Enhances performance.

4. Improves body composition and strength.

5. Enhances concentration.

6. Helps maintain healthy immune function.

7. Reduces the potential for injury.

8. Promotes optimal recovery and adaptation to your workouts.

9. Reduces the risk of heat cramps and stomach aches.

As an athlete you need to note that some nutrients are promoter that led to progression of disease (e.g. excessive) alcohol and some are antipromoters that deters the initiation process from progressing to a serious health problem (eg vitamins). Therefore, you need to choose wisely.

4.0 CONCLUSION

Athlete's food should not just be provided or eaten haphazardly. It must be properly planned. During training and competitions, qualified nutritionists should be consulted to plan the athlete's diet in resonance with three basic keys to athlete's healthy eating. Doing this will enhance optimum performance.

5.0 SUMMARY

Athletes, coaches and the technical crew should be aware of the need to plan their athletes' nutrition. This will go a long way to assist such athletes in achieving desired objective and long term goals. Ignoring athletes' diet plan may yield otherwise therefore,handlers must understand that proper nutrition is the basis any athlete must build f rom in order to achieve peak physical performance.

SELF ASSESSMENT EXERCISE

1. The three basic keys to athlete's healthy eating include the following except:
a. Variety – there is no one magic food
b. Moderation – all foods can fit into a well-balanced diet
c. Consistency
d. Wholesomeness – choose natural or lightly processed foods as often as possible

2. What is the approximate daily caloric need of a healthy active woman
    a. 1200-1300 calories/day
    b. 500-700 calories/day
    c. 1800-2800 Calories/day
    d. 1000-1200 calories/day

3. What is the approximate daily caloric need of a healthy active man
    a. 1200-1300 calories/day
    b. 500-700 calories/day
    c. 1800-2800 Calories/day
    d. 2600-3400 Calories/day

4. Individual nutrition needs may be higher or lower depending on the following except: a. metabolic rate

    b. level of physical activity

    c. gender

    d. Masculinity

5. When one is engaged in any form of physical activity, the body needs some form of---------

    a. relaxation

    b. concentration

    c. food

    d. balance

6. Modern nutritionists simplify the entire daily meal into which of these equations:

    a. 40% carbohydrates, 30% fats, and 30% protein

    b. 45% carbohydrates, 40% fats and 5% protein

    c. 20% carbohydrates, 40% fats and 40% protein

    d. 35% carbohydrates, 40% fats and 25% protein

7. The equation in question 6 above is referred to as:

a. my meal

b. my food

c. my ration

d. my plate

8. The total calorie intake of an active person must increase from:

a. 2200 to 2200 plus the total number used while exercising.

b. 2000 to 2300 plus the total number used while exercising.

c. 2200 to 2100 plus the total number used while exercising.

d. 2200 to 2200 without the total number used while exercising

9. What advantage has question 8 above?

a. It will cause damage to the tissues

b. It will ensure replenishment of the body system.

c. It will enhance speed for the active person

d. It will deplete hydration in the active person

10. Proper nutrition is the basis any athlete must build from in order to:

a. Achieve medium physical performance

b. Achieve basic physical performance

c. Achieve general physical performance

d. Achieve peak physical performance.

FEEDBACK

1. C
2. C
3. D
4. D
5. C
6. A
7. D
8. A
9. B
10. D

References/Further Reading:

www.healthline.com

www.info.com

www.emeals.com

www.chatelan.com>diet

UNIT 2: CONTENT OF ATHLETES' DIET

1.0 INTRODUCTION

In unit 1 of this module we considered what is the adequate daily calorie need for athletes, in this unit we shall have a look at the content of the diet that will meet up with that requirement. Prior to strenuous activity it is imperative that the body has the required amounts of nutrients to carry out activity.

2.0 INTENDED LEARNING OUTCOMES (ILOs)

In this Unit, students should be able to:

(a) mention high quality carbohydrates needed in the athlete's diet;

(b) state sources of lean protein that should be in the athlete's diet;

(c) identify importance of protein in athlete's diet;

(d) suggest adequate breakfast for athletes;

(e) state effect of skipping breakfast.

CONTENT

3.0HIGH-QUALITY CARBOHYDRATES FOR ATHLETES

- Whole grain breads
- Whole-wheat pasta
- Brown rice
- Whole-grain cereals
- Some vegetables

- Athletes should take mostly unsaturated fats. Limit saturated fats to less than 20 grams per day or less than 10% of Total Calories
  - Avoid trans fats whenever possible
  - Obtain majority of fats from vegetable oils, nuts, lean proteins and non-/low-fat dairy
- LEAN PROTEIN
- Protein in athletes' meals should be mostly of lean meat (meat with no fat) like:
  - Grilled chicken breast
  - Tuna and other fish
  - Turkey
  - Lean cuts of beef

- Lean ground turkey or beef
- Eggs/egg-whites
- Non-fat/low-fat milks and cheeses
- Cottage Cheese
- Non-fat/low-fat yogurt
- Beans
- Tofu
- Hummus
- Edamame (green boiled soya beans)

PROTEIN NEEDS OF ATHLETES

- Athletes require more protein than sedentary individuals because of wear and tears of body cells and tissues during performance.
- Strength athletes require 1.6 to 1.7 g/kg/day
  - Adequate caloric intake is more important than elevated protein intake.
  - One-half kilogram of muscle per week requires only 14 additional grams of protein per day.
- Endurance athletes require 1.2 to 1.5 g/kg/day
  - The high carbohydrate diet recommended for endurance athletes spares protein.

BREAKFAST

- A balanced breakfast provides significant amounts of Calories and other nutrients in the daily diet of the physically active person.
- A breakfast high in fiber with an average amount of protein will also help prevent the onset of mid-morning hunger.
- Skipping breakfast could produce hypoglycemia with resultant symptoms of weakness and possible impairment of training.

BASIC ATHLETE'S MEAL PLAN

Athletes should Fuel to boost activity performance on a daily basis and to decrease the risk of injuries during training. As athlete you should eat food that taste good, foods you enjoy, foods that can be prepared easily, and foods you feel confident in eating.

EXAMPLE OF MEAL PLAN

Breakfast

1 cup of orange juice

1 cup of oatmeal/liquid Eko/Akamu/

4 bean cake fried

1 banana

Fig 4.1 Athletes breakfast of pap and bean cake

For Lunch

1 serving of fried/white /jollof rice

2 fish

1 cup of Soy Milk

OR

1 Ham & Cheese Sandwich (containing a slice of ham, slice of Swiss cheese, a leaf lettuc e, slice of

Tomato, and 2 slices of whole wheat bread)

1 cup of 2% milk

For Dinner

1 apple

1 serving of spaghetti w/ tomato sauce and parmesan cheese

2 slice of whole wheat bread

½ cup of ice cream w/strawberries, Snacks carrots and dip.

- Athletes MUST eat breakfast!
- Spread Calories out throughout the day for maximum energy – ideally, 3 meals plus 2-3 snacks a day.
- Planning is paramount.
- Frozen fruits and vegetables can come in handy during times when getting to the store is impossible.
- Canned goods like tuna, fruit in juice, no-salt added vegetables, and beans are also good staples to have on hand.

4.0 CONCLUSION

During times of high physical activity, energy and macronutrientneeds (especially carboh ydrate and protein intake) must be met in order to maintain body weight, replenish glycog en store and provide adequate
protein for building and repair of tissues. Fat intake should be adequate
to provide the essential fatty acids and fat-
soluble vitamins, as well as to help provide adequate energy for weight maintenance.
Apart from planning the athletes' diet, the meal should also be adequately planned in normal proportion.

5.0 SUMMARY

The energy athletes get from meal plan helps the body to reduce inflammation, fight disease, and continue to develop power and speed through physical activity. Many supplements exist on the market to help improve athletic performance, but none of these products may useful it is taken without effective meal plan.

SELF ASSESMENT EXERCISE

1. High-quality carbohydrates include the following except

    a. Brown rice
    b. Whole-grain cereals
    c. Fruits
    d. Whole wheat pasta

2. The following are examples of lean protein except
a. Grilled chicken breast
b. Tuna and other fish
c. Turkey/Lean cuts of beef Eggs/egg-whites
d. Vegetable

3. Strength athletes require protein of 1.6 to 1.7 g/kg/day

    True/False

4. Athletes require more protein than sedentary individuals.

    True/False

5. Abnormal meal plan is very essential to enhance optimum athletic performance

    True/False

6. One of the following is true of breakfast

    a. Skipping breakfast could produce hypoglycemia with resultant symptoms of weakness and possible impairment of training.

b. Skipping breakfast could reduce hypoglycemia with resultant symptoms of weakness and possible impairment of training.
c. Skipping breakfast could produce lightness of body weight and promotion of good performance.
d. Breakfast could produce hypoglycemia with resultant symptoms of weakness and possible impairment of training.

7. All of the following statements about athlete meal are wrong except one
    a. Adequate caloric intake is more important than elevated protein intake.
    b. Adequate caloric intake is less important than elevated protein intake.
    c. Elevated protein intake is more important than adequate caloric intake.
    d. Elevated protein intake alone can take an athlete to perform to maximum

8. Athletes MUST NOT eat breakfast!

    True/False

9. Endurance athletes require 1.2g/kg/day to 1.5 g/kg/day

    True/False

10. The high carbohydrate diet recommended for endurance athletes spares protein.

True/False

FEEDBACK

1. **D**
2. **D**
3. **TRUE**
4. **TRUE**
5. **FALSE**
6. **A**
7. **A**
8. **FALSE**
9. **TRUE**
10. **TRUE**

References/Further Reading:

www.healthline.com

www.info.com

www.emeals.com

www.chatelan.com>diet

UNIT 3. NUTRITIONAL DEMANDS BEFORE EXERCISE AND TRAINING

INTRODUCTION

The knowledge that you have acquired from the previous modules shows that there are steps to follow by you as athlete to know what your nutritional demands before exercise and training should be. This unit discusses the nutritional demands of athletes before exercise and training.

2.0 INTENDED LEARNING OUTCOMES (ILOS)

In this unit you should be able to:

(1) state types of meals for athletes before exercise;

(2) state nutritional demands for athletes;

(3) mention types of meals needed before exercise;

(4) state meals and snacks, not right before a match;

(5) identify nutritional demands of athletes beforeexercise.

CONTENT

Steps to follow for nutritional demands of athletes before and during performance will include:

Start training fully hydrated and fueled;

Carbohydrate load when necessary;

Match your sweat rate and know what to hydrate;

with during training;

Refuel as needed during training;

Promote full recovery after training using adequate diet.

MEALS NEEDED BEFORE EXERCISE

Proper nutrition during training is one of the keys to success in sports,

because energy expenditure increases during the training period. Therefore, the caloric intake needed to maintain body weight may increase considerably and additional 500-1000 Calories or more per day may be needed. Since, some people prefer early morning work-out (exercise) their last dinner can interfere with source of energy for performance in the morning.

MEAL AT NIGHT BEFORE COMPETITION

- The meal eaten the night before (or even two nights before) competition is more important than the meal eaten right before competition.
- The meal the night before competition should be heavy on carbohydrates, light to moderate in protein and low in fat.
- Examples include:
    - Plantain-fry with chicken over rice
    - Pasta with lean ground meat sauce

PRE-COMPETITION MEAL

- It is a well-established fact that the ingestion of food just prior to competition will not benefit physical performance in most athletic events.
- However, the pre-competition meal should do the following:
  - allow for the stomach to be relatively empty at the start of competition
  - help to prevent or minimize gastrointestinal stress
  - help avoid sensations of hunger, lightheadedness, or fatigue
  - provide adequate fuel supplies, primarily carbohydrate, in the blood and muscles
  - provide an adequate amount of body water
- In general, a solid meal should be eaten about 3 to 4 hours prior to competition.
- Composition of meal:
  - high in carbohydrate, low in fat, and low to moderate in protein, providing for easy digestibility
  - avoid gas formers (beans), spicy foods, and bulk foods (bran products)
  - 500-600 Calories
- Meals other than the pre-competition meal eaten on the same day should not be skipped.

PRE-COMPETITION MEAL AND THE USE OF LIQUID MEALS AND SPORTS BARS

- Advantages of liquid meals over solid meals for pre-competition nutrition:
  - well balanced in nutritional value
  - high carbohydrate content
  - no bulk, easily swallowed and digested
  - practical, may be taken closer to competition
- Advantages of sports bars:
  - good source of carbohydrate
  - convenient

However, liquid meals and sports bars should not be used to replace healthy meals and snacks.

Before exercise, it is imperative that the body has the required amounts of nutrients to
carry out activity. At the latest reference it is recommended that a person consume a n average of 2200 mg of calories, 60 g of fat, less than 5000 IU of vitamin A, more tha n 60 mg of vitamin C, 400 IU of vitamin D, more than 2000 mg of potassium, 2000 m g of sodium, 65 g of protein, 1.5 mg of thiamin, 1.7mg of riboflavin, 20mg of niacin, a nd 18mg of iron.
Nutritionists of today simplify this into an equation of 40% carbohydrates, 30% fats, and 30% protein that the entire day's meals should be divided into. The total calorie i ntake must increase for active persons from 2200 to 2200 plus the total number use d while exercising. This will ensure replenishment of the body's system. Prior to exercise an athlete must be sure that the meal or snack taken should do the following:

- provide sufficient fluid to maintain hydration,
- be relatively low in fat and fiber to facilitate gastric emptying and minimize gastrointestinal distress,
- be relatively high in carbohydrate to maximize maintenance of blood glucose,
- be moderate in protein, be composed of familiar foods, and be well tolerated by the athlete.

- Eating balanced and adequate meals and snacks throughout the day will result in adequate energy during workouts.
- To avoid cramping or stomach problems during workouts, athletes should avoid eating immediately before a workout.
- This is the time to experiment with meals and snacks, not right before a game or match.

CONCLUSION

By starting workouts/ training fully hydrated. You'll be able to train harder and achieve better workouts. You'll be able to compete at a higher level for longer. Likewise, make up for any fluid deficits from prior workouts and consume 400–600

ml of water or a sports drink 2–3 hours before training or competing. Keep hydrating as needed during warm-ups. Monitor your hydration status before training by checking the color of your urine (light-yellow color is consistent with adequate hydration). If urine is the color of apple juice, more fluids are needed.

SUMMARY

Before exercise, a meal or snack should provide sufficient fluid
to maintain hydration, be relatively low in fat and fiber to facilitate gastric emptying and minimize gastrointestinal distress, be relatively high in carbohydrate to maximize mainten ance of blood glucose, and be moderate in protein.In general, no vitamin and mineral sup plements should be required if an athlete is consuming adequate energy from a variety of foods to maintain body weight.

SELF ASSESMENT EXERCISE

1. The meal eaten the night before (or even two nights before) competition is more important than the meal eaten right before competition.

   True/False

2. The meal the night before competition should not be heavy on carbohydrates, heavy to moderate in protein and low in fat

   True/False

3. Meals other than the pre-competition meal eaten on the same day should not be skipped.

   True/False

4. Eating balanced and adequate meals and snacks throughout the day will result in adequate energy during workouts.

   True/False

5. Liquid meals and sports bars should be used on a regular basis to replace healthy meals and snacks.

   True/False

6. To avoid cramping or stomach problems during workouts, athletes should eat immediately before a workout.

   True/False

7. It is always an advantage for athlete to experiment with meals and snacks, before a competition.

   True/False

8. Athlete should be relatively high in carbohydrate to maximize maintenance of blood glucose,

   True/False

9. Athlete's pre-competition meal should be relatively low in fat and fiber to facilitate gastric emptying and minimize gastrointestinal distress.

True/False

10. At pre-competition athlete need not be moderate in protein, be composed of familiar foods, and be well tolerated.

True/False

FEEDBACK

1. **TRUE**
2. **FALSE**
3. **TRUE**
4. **TRUE**
5. **FALSE**
6. **FALSE**
7. **FALSE**
8. **TRUE**
9. **TRUE**
10. **FALSE**

References/Further Reading:

www.healthline.com

www.info.com

www.emeals.com

www.chatelan.com>diet

UNIT4: NUTRITIONAL DEMANDS DURING EXERCISE AND TRAINING

INTRODUCTION

During exercise, the primary goals for nutrient consumption are to replace fluid losses an d

provide carbohydrate for the maintenance of blood glucose levels. These nutrition guidelines are especially important for endurance events lasting longer th an one hour, when the athlete has not consumed adequate food or fluid before exercise, or if the athlete is exercising in an extreme environment.

INTENDED LEARNING OUTCOMES

It is expected that after reading and studying this unit, youshould be able to:

(1) state types of meals for athletes during exercise;

(2) state nutritional demands during exercise;

(3) mention types of meals needed during exercise;

(4) state meals and snacks, not right during the competition;

(5) identify nutritional demands of athletes during

Exercise.

MEAL DURING COMPETITION

There is no need to consume anything during most types of athletic competition with the possible exception of carbohydrates, water and electrolytes/energy gels depending on the events or competition.

- Carbohydrate may provide additional supplies of the preferred energy source during prolonged exercise (example is glucose in Gatorade, energy gels, etc.)
- Water intake may be critical for regulation of body temperature when exercising in warm environments.

During exercise, the primary goals for nutrient consumption are to replace fluid losses an d

- provide carbohydrate for the maintenance of blood glucose levels.
  These nutrition guidelines are especially important for endurance events lasting lo nger than one hour, when the athlete has not consumed adequate food or fluid befo re exercise, or if the athlete is exercising in an extreme environment.
- **During exercise**

- Athletes can consume 25 to 30 gm of carbohydrate for every 30 minutes of exercise.

Carbohydrate gels + electrolytes + vitamins

- Athletes should drink 30cl to 40cl of water or sports drink for every 10 to 15 minutes of exercise.

Sport drinks

During high physical activity, like marathon race training or performance, energy and macro-nutrient needs (especially carbohydrate and protein intake) must be met in order to maintain body weight, replenish glycogen stores, and provide adequate protein for building and repair of tissues. Fat intake should be adequate to provide the essential fatty acids and fat-soluble vitamins, as well as to help provide adequate energy for weight maintenance. Consuming adequate food and fluid before, during, and after exercise can help maintain b lood glucose during exercise, maximize exercise performance, and improve recovery tim e. The human body uses carbohydrate as the primary source of energy for sustained, strenuous physical activity. In fact, some fifty percent of the energy the body uses comes from carbohydrates, specifically glucose, and its storage form, glycogen. That is the energy used while exercising. The body will however burn more fat for energy when at rest.

CONCLUSION

During times of high physical activity, energy and macronutrient needs (especially carbohydrate and protein intake) must be met in order to maintain body weight, replenish glycogen stores, and provide adequate protein for building and repair of t issues. Fat intake should be adequate to provide the essential fatty acids and fat soluble vitamins, as well as to help provide adequate energy for weight maintenance.

SUMMARY

During exercise, the primary goals for nutrient consumption are to replace fluid losses an d provide carbohydrate for the maintenance of blood glucose levels. These nutrition guid elines are especially important for endurance events lasting longer than an hour, when the

athlete has not consumed adequate food or fluid before exercise, or if the athlete is exerci sing in an extreme environment.

SELF ASSESMENT EXERCISE

1. One of the following answers is right about nutrient consumption during exercise

    a. During exercise, the primary goals for nutrient consumption are for the maintenance of blood glucose levels only.
    b. The primary goals for nutrient consumption are to replace flud losses and provide carbohydrate for the maintenance of blood glucose levels.
    c. Tthe primary goals for nutrient consumption are to replace fluid losses onl y.
    d. None of the above is correct.

2. Two of the following options are more appropriate when athlete has not consumed adequate food or fluid before exercise.

    a. Nutrition guidelines are especially important for endurance events lasting l onger than one hour.
    b. Nutrition guidelines are especially important for endurance events when the athlete is exercising in an extreme environment.
    c. Nutrition guidelines are especially important only for endurance events
    d. Nutrition guidelines may not be very necessary for endurance events lasting longer than one hour, when the at hlete has not consumed adequate food or fluid before exercise, or if the at hlete is exercising in an extreme environment because the athlete should have known what he needs.

3. Meal during competition requires that

    a. There is no need to consume anything during most types of competition

    b. Athlete consumes carbohydrates, water and electrolytes/energy gels

    c. There is no need to consume anything during most types of athletic s

    competition with the possible exception of carbohydrate, water

d. There is no need to consume anything during most types of athletic competition with the possible exception of carbohydrate, water and electrolytes/energy gels depending on the events or type of competition.

3. One of the following statements is more appropriate about carbohydrate during exercise

a. carbohydrate is digested more easily than any other class of food

b. Carbohydrate may provide additional supplies of the preferred energy source during prolonged exercise (example is glucose in Gatorade, energy gels, etc.)

c. carbohydrate is the most difficult to get in all classes of food

d. the energy level provided by carbohydrate is less effective than any other classes of food.

5. Water intake may be critical for regulation of body temperature when exercising in warm environments.

True/False

6. During times of high physical activity, energy and macronutrientneeds (especi ally carbohydrate and protein intake) must be met in order to maintain body weight,

True/False

7. Fifty percent of the energy the body uses comes from carbohydrates, specifically a. Fats
   b. Glucose.
   c. Lactose
   d. Galactose

8. Carbohydrates is stored in the form of one of the following

    a. Sugar
    b. Riboflavin
    c. Glycogen
    d. Glucose

9. ----- is the energy used while exercising.
    a. Galactose
    b. Lactose
    c. Glucose
    d. Fat

10. The body will however burn more ----- for energy when at rest.
    a. Galactose
    b. Lactose
    c. Glucose
    d. Fat

FEEDBACK

1. **B**
2. **A&B**
3. **D**
4. **B**
5. **TRUE**
6. **TRUE**
7. **B**
8. **C**
9. **C**
10. **D**

References/Further Reading:

www.healthline.com

www.info.com

www.emeals.com

www.chatelan.com>diet

UNIT 5: NUTRITIONAL DEMANDS AFTER EXERCISE AND TRAINING

INTRODUCTION

After exercise, the dietary goal is to provide adequate energy and carbohydrates to replac e muscle glycogen and to ensure rapid recovery. Protein consumed after exercise will provide amino acids for the building and repair of muscle tissue. Therefore, athletes should consume a mixed meal providing carbohydrates, protein, and fat after a strenuos c ompetition or training session.

INTENDED LEARNING OUTCOMES

When you finish this unit, you should be able to:

(1) state types of meals for athletes after performance;

(2) nutritional demands of athletes after exercise;

(3) mention five types of meals needed after exercise;

(4) state meals and snacks, not right after a match;

(5) identify nutritional demands of athletes after exercise.

MEAL AFTER EXERCISE

- The goal of post-workout meal/snack is to replenish glycogen stores and provide adequate protein to repair worn-out muscle tissues. Water should be consumed immediately after the performance.
- The body system may find it difficult to tolerate heavy meals immediately after strenuous exercise. However, the body should be able to accommodate meal after 30-60 minutes of a heavy workout
- I would like to recommend that you consume an easy-to-digest, carbohydrate-based snack (about 40–60 grams of carbs) 30–60 minutes after exercise, along with fluids.

- Try liquid carbohydrate sources in place of solid foods. (Ogi/Custard/oats porrage) especially before or after early morning exercise
- Ideas for quick-to-digest, carbohydrate-based options include:
- Fruit smoothie or meal-replacement beverage
- Performance Energy bar, Energy Gel,
- Small roll or sandwich made with a banana and honey
- Low-fat or nonfat yogurt or frozen yogurt, ripe but unsoft pawpaw
- Likewise, carbohydrate with a small amount of protein can be taken. Examples include:
    - ❑ Yogurt and fruit
    - ❑ Bagel with peanut butter
    - ❑ Energy bar
- Follow the above post-workout snack with a balanced meal (lunch or dinner) within 60-90 minutes

POST-COMPETITION MEAL

Even if the competition lasted for days an adequate and balanced diet is all that is necessary to meet your nutrient needs and restore your nutritional status to normal. However, simple sugars eaten immediately after a hard workout may help restore muscle glycogen fairly rapidly, but the addition of protein to the carbohydrate source may be even more effective.

Therefore, athletes should consume adequate diet

- To replace muscle glycogen stores
- To prevent gradual depletion of muscle glycogen stores over time caused by repetitive daily bouts of heavy exercise
- To decrease muscle breakdown

NUTRITIONAL SUPPLEMENTS FOR ATHLETES

Our discussion so far in this course points to the fact that the nutrient intake of individual athlete will be well above recommended levels, indicating there probably would not be any advantage to take nutrient supplements. However, dietary supplements appear to be very popular among athletes and others attempting to increase muscle mass, strength and endurance. This wide usage was attributed to the use of advertisement to support this contention and not to the truth underlying the alleged performance-enhancement mechanism of these supplements.If you really think that pills, powders and drink mixes are going to increase your performance you are in for a huge disappointment! It continues to amaze me

how much value and emphasis the majority of trainees place on "the latest

breakthrough pill". Bellow are the factors that aided performance:

PERFORMANCE INFLUENCING FACTORS

- Genetics
- Training and Conditioning
- Good Nutrition.

1994 Dietary Supplement Health and Education Act define supplement as any product that contains vitamins, minerals, amino acids, herbs, botanicals or a concentrate, metabolite, constituent, extract or combination of any of these ingredients used to fortified food.

A supplement is just the meaning of that word… a supplement. That is it is there just to supplement your diet by filling in the missing gaps and by providing you with greater amounts of specific nutrients that will slightly speed up your progress. Supplements are NOT there to do the work for you and will only play a small role in your overall success in the training.Stop falling for the multi-million naira advertisements that talk about the latest "revolutionary discovery" that will allow you to increase your performance.

As advanced as we've become as a society, the basic rules of hard work and dedication still apply. If you want to improve your performance, then hard training on the field and a consistent diet plan is the only true way to get there. Now, this doesn't mean that I am AGAINST the use of supplements; I'm merely against the over-use and over-emphasis of supplements. There are a few

good, solid, effective products out there that can be recommended, but only as asmall part of your overall approach.

However, let us still pick each nutrient for discussion:

CARBOHYDRATE LOADING

Carbohydrate loading, commonly referred to as carb-loading or carbo-loading, is a strategy used by endurance athletes, such as runners, to maximise the storage of glycogen in the muscles and liver. Carbohydrate loading is also used in healthcare to optimise the condition of patients prior to colorectal surgery.

- Increases the body's pre-exercise glycogen stores by 50 to 100%
- Benefits endurance athletes who compete for longer than 90 minutes
    - Can increase endurance up to 20%
    - Can increase performance by 2 to 3%

EXAMPLE OF CARBOHYDRATE LOADING TABLE

Days prior to event	Exercise duration	Carbohydrate intake
6	90 minutes	5 gm/kg/day
5	40 minutes	5 gm/kg/day
4	40 minutes	5 gm/kg/day
3	20 minutes	10 gm/kg/day
2	20 minutes	10 gm/kg/day
1	rest	10 gm/kg/day

PROTEIN SUPPLIENTATION

- Athletes require more protein than non-athletes, but this increase should be supplied by dietary protein and not from amino-pills or herbs.
    - 12 to 18% of total calories should come from protein
    - Protein intake should be tailored to type of training
        - 1.2 to 1.4 gm/kg/day recommended for endurance athletes
        - 1.7 to 1.8 gm/kg/day recommended for strength athletes
- Average diet/meal provides 1.4 gm/kg/day
- Adequate calorie intake is just as important as adequate protein intake for building muscles
- Too much protein intake can be bad
    - Excess protein calories are excreted from the body in form of ammonia in urine
    - Excess protein intake can lead to dehydration and may contribute to kidney problems.

FAT

- Major source of energy
- 25 to 30% of total calories should come from fat
    - Less than 10% of total calories should come from saturated fats
- Cholesterol intake should be less than 300 mg/day
- Average American diet provides 37% of total calories from fat

VITAMINS AND MINERALS

- Essential nutrients
    - Human body needs these to produce energy
- No evidence yet in studies that taking vitamin and mineral supplements improves athletic performance
- Vegetarian athletes are at risk for being deficient in vitamins B12, D, riboflavin, iron, zinc and calcium

- Athletes who are strict vegetarians should take a multivitamin to prevent deficiencies and a calcium supplement (1000 mg/day) to help prevent bone loss.

CONSLUSION

In general, An adequate and balanced diet is all that is necessary to meet your nutrient needs and restore your nutritional status to normal following competition, or daily hard physical training.

The energy one gets from food helps the body to reduce inflammation, fight disease, and continue to develop power and speed through physical activity. Despite the fact that many supplements exist on the market to help improve athletic performance, but none of these products may be as effective as the nutrients provided from whole foods. Many athletes overemphasize carbohydrate, protein, and fats, and focus too little on foods rich in micronutrients. Some micronutrients can greatly impact performance and recovery. The following five food groups provide essential vitamins and minerals. They're also packed with healthy fats, proteins, and enzymes that regulate bodily functions and keep our cells healthy:

- fruits
- vegetables
- nuts
- seeds and
- whole grains

SUMMARY

The energy one gets from food helps the body to reduce inflammation, fight disease, and continue to develop power and speed through physical activity. Many supplements exist on the market to help improve athletic performance, but none of these products may be as effective as the nutrients provided from whole foods.

SELF ASSESSMENT EXERCISE

1. Two of the following options are more appropriate in dietary goals after exercise
    a. It is to provide adequate energy and carbohydrates to replace muscle

b. It is to provide athlete fullness of belly to recover
c. It is to provide glycogen to ensure rapid recovery.
d. It is to provide lactose for full recovery

2. Protein consumed after exercise will provide amino acids for the building and repair of muscle tissues.

True/False

3. Athletes should consume a mixed meal providing carbohydrates, protein and fat soon after a strenuous competition or training session.

True/False

4. Meal after exercise should be consumed

a. 10-20 minutes after heavy workout
b. Immediately after heavy workout
c. 5-15 minutes after heavy workout
d. within 30-60 minutes of a heavy workout

5. All the following are correct about carbohydrate loading except

a. Carbohydrate loading is a strategy used by endurance athletes, such as runners
b. It is used to maximise the storage of glycogen in the muscles and liver of athletes.
c. It is used in healthcare to optimise the condition of patients prior to colorectal surgery.
d. It is used mostly by sedentary people to maximise life.

6. Draw up, in a tabular form, an example of carbohydrate loading

7. Mention five food groups that provide essential vitamins and minerals.

8. Vegetarian athletes are at risk for being deficient in which of the following vitamins?

a. B12, D, riboflavin, iron, potassium and zinc
b. D, C, riboflavin, iron, zinc and calcium
c. B12, D, riboflavin, iron, zinc and calcium

d. B12, D, iron, zinc, magnesium, Riboflavin and calcium

9. Water is not the most important nutrient for athletes

   True/False

10. Excess protein intake can lead to dehydration but cannot contribute to kidney problems

    True/False

FEEDBACK

1. **A&B**
2. **TRUE**
3. **TRUE**
4. **D**
5. **D**

6.

Days prior to event	Exercise duration	Carbohydrate intake
6	90 minutes	5 gm/kg/day
5	40 minutes	5 gm/kg/day
4	40 minutes	5 gm/kg/day
3	20 minutes	10 gm/kg/day
2	20 minutes	10 gm/kg/day
1	rest	10 gm/kg/day

7. **Fruits, vegetables, nuts, seeds and whole grains**
8. **C**
9. **FALSE**
10. **FALSE**

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MODULE 5:

FOOD SOURCES AND FACTORS AFFECTING FOOD SELECTION

INTRODUCTION TO THE MODULE

The food that you eat is part of who you are, it is a personal characteristic, it is part of your identity and it can embody several feelings. We make different choices when it comes to food. In module 1 we looked at healthy diet and food needs of different people. These two concepts depend on how you source, select, preserve and prepared the food. This module describes food sources, its importance, and factors affecting food selection.

UNIT 1

SOURCES OF FOOD

Introduction

The term 'food' brings to our mind countless pictures. Food plays an important role in our lives and is closely associated with our existence. Food is the fuel of life. Without food, humans cannot survive. It is important for you to know where your food actually comes from. In this unit you will learn about why food is essential, its functions and components. After which we shall discuss the factors affecting food selection and the amounts required by different individuals.

Intended Learning Outcomes:

After studying this unit, you should be able to:

1. describe food;
2. state important components of food;
3. describe how food is been manufactured by plant;
4. explain food materials and the sources of food.

Main Content

Food

The term ‘food’ refers to anything that you eat and which nourishes the body. It includes solids, semi-solids and liquids. Thus, two important features for any item to be called food are:

(i) It should be ‘edible’. Edibility may be defined by criteria that include absence of poisonous effects on humans and desirable taste and aroma.

(ii) It must nourish the body. That means it must contain nutrient(s).

Food is an essential element for life. Historically, humans have depended on natural sources for food. Rapid population growth, particularly during the last few decades, has driven the need to increase food supply to meet with the fast-rowing demand. However, emphasis has been given to provision of staple foods, rather than a totality of diet, which is composed of several foods to provide the various constituents that the body needs for proper functioning. In addition, Food is any substance normally eaten or drunk by living things. Nearly everything we eat comes from plants and animals (birds, fish and other sea creatures like shell-fish). We can eat the edible parts of many plants like roots and leaves as well as things plants produce like fruits and seeds. We can also eat various parts of animals as well as things animals produce like milk. In many

parts of the world (including Nigeria) people also eat insects (insects-termites, cricket and caterpillars)and things they produce like honey.

Edible Insects in Nigeria.

Before the development of agriculture, people got food from plants and animals in the world around them. They dug up roots, gathered fruits and seeds, hunted and trapped animals and birds and used spears and nets to catch fishes. They also collected shell-fish and other seafood as well as insects and bird's eggs, and in many parts of the world people still do all these things. Around ten thousand years ago agriculture began to develop when people in the Middle East, Asia and South America began cultivating plants and domesticating animals and birds. They cultivated grasses that produced grains like rice and wheat, and grew plants that produced vegetables, nuts and beans. They also grew fruit trees and kept poultry for meat and eggs and raised animals for meat and milk, and around eight thousand years ago people also

began making dairy foods like cheese and yoghurt from sheep and goat milk. As agriculture developed, farmers began producing more and more different types of food, and now we see a huge range of foods in supermarkets. The term food also includes liquid drinks. Food is the main source of energy and of nutrition for animals, and is usually of animal or plant origin.

Food Materials and Sources

There are two sources of food – plants and animals. All of the food we eat comes from either of these two. The processed food we eat in our daily lives (like chips, cakes, pizzas, sandwiches) is a combination of various ingredients that are sourced from either plants or animals. Most food has its origin in plants. Some food is obtained directly from plants; but even animals that are used as food sources are raised by feeding them food derived from plants. For instance, cereal grain is a staple food that provides more food energy all over the world than any other type of crop. Corn (maize), wheat, and rice – in all of their varieties – account for 87% of all grain production worldwide. Most of the grain that is produced worldwide is fed to livestock.

Some foods not from animal or plant sources include various edible fungi, especially mushrooms. Fungi and ambient bacteria are used in the preparation of fermented food like leavened bread, alcoholic drinks, cheese, pickles and yogurt. Another example is blue-green algae such as Spirulina. Inorganic substances such as salt, baking soda and cream of tartar are used to preserve or chemically alter an ingredient.

Plants sources

Much of the food we eat comes from plants, trees, crops, leaves and sometimes even roots. After we grow them, they are harvested.

Plants: are fruits and vegetables. All of the fruits and vegetables grow on plants.

Trees: Fruits and seeds from some trees that are edible include palmtree, walnuts and kolanuts.

Crops: These are rice, wheat, maize, millets, barley etc. which are the seeds of the crop plants.

Leaves: There are some plants which leaves are edible raw or boiled.

Root: Edible roots include tubers. They are of various types of modified plant structures that are enlarged to store nutrients. They are used by plants to survive the winter or dry months, to provide energy and nutrients for regrowth during the next growing season, and as a means of asexual reproduction.

Let us take examples of some foods we get from plants and their different parts.



- Fruits: Oranges, Bananas and Pawpaw



- Leaves: Spinach, Coriander, Ugwu, Lettuce, Ewedu



- Root: Yam, Cassava, Sweet potato, Irish potato, Carrots, Turnips



- Seeds:

Beans, Maize, Nuts (groundnut, peanuts, almonds)

From the list above you will notice that seeds of plants are a good source of food for animals, including humans, because they contain the nutrients necessary for the plant's initial growth, including many healthful fats, such as omega fats. In fact, the majority of foods that you consumed are seed-based foods. Edible seeds include cereals (corn, wheat, rice), legumes (beans, peas, lentils), and nuts. Seeds are typically high in unsaturated fats and, in moderation, are considered a health food. However, not all seeds are edible. Large seeds, such as those from a lemon, pose a choking hazard, while seeds from cherries and apples contain cyanide which could be poisonous only if consumed in large volumes.

Fruits are the ripened ovaries of plants, including the seeds within. Many plants and animals have coevolved such that the fruits of the former are an attractive food source to the latter, because animals that eat the fruits may excrete the seeds some distance away. Fruits, therefore, make up a significant part of the diets of most cultures. Some botanical fruits, such as tomatoes, pumpkins, and eggplants, are eaten as vegetables. The majority of processed foods like flour, bread, biscuits etc. That you consume is sourced from crop plants.

Animals sources

Animals are used as food either directly or indirectly by the products they produce. Meat is an example of a direct product taken from an animal, which comes from skeletal muscles (flesh) or from organs. Other animal foods, such as eggs, milk and honey, are produced by animals over their lifetime.

Dairy products

Foods from animal source are high in protein; they usually are also high in fat. Vitamin B12 and vitamin D are also present in many animal foods; these vitamins are not found in plant foods. Not all of our food comes from plants. A good portion of the food we eat comes from animals, mostly cattle. Cattle are farmed animals, which are specifically raised to be butchered for our food requirements. There are a few animals that are hunted (killed in their natural habitat) like deer or rabbits or even kangaroos.

Some examples of such meat and their sources are:




- Chicken (poultry)
- Bacon/pork which comes from pigs
- Mutton - lambs
- Fish
- Venison from deer
- Beef from cows and buffalos
- Chevon - goat meat

Animals that only eat food obtained from plants are known as herbivores. Some examples are cows, zebras, hippos, giraffes, buffalos etc. Then humans who only rely on foods from plants are referred to as vegetarians.

Another source of food is seafood. This is fishes and other sea creatures like crabs, lobsters, oysters etc that we catch. They too are consumed by humans and are an important source of food in coastal regions especially. Then we come to the dairy products. This is milk, curd, cream, cheese, butter, eggs etc. These are also sources of food we get from animals. All of these are made from milk and/or eggs which come from animals such as

cows, buffalos, goats etc. Honey is also another food we get from animals, namely bees. The animals which eat other animals are carnivores like lions, tigers, leopards etc. And an animal that eats both animals and plants are omnivores like dogs and cats. People who consume meat or fish are generalized as non-vegetarians.

Conclusion

Food is what we eat for survival. In conclusion, food products produced by animals include milk produced by mammary glands, which in many cultures is drunk or processed into dairy products (cheese, butter, etc.). In addition, birds and other animals lay eggs, which are often eaten, and bees produce honey, reduced nectar from flowers, which is a popular sweetener in many cultures. Some cultures consume blood, sometimes in the form of blood sausage, as a thickener for sauces, or in a cured, salted form for times of food scarcity, and others use blood in stews such as jugged hare. However, your selection should obey the food pyramid:

Food pyramid offers guidelines for eating a balanced diet.

Summary

This unit examined food, how food came about, features of food. Also, the unit also looked into different types of food; two main sources of food were also described.

Self-Assessment Exercise

1. Criteria that include absence of poisonous effects on humans and desirable taste and aroma is known as _____
   a.) Irritability of food
   b.) Eligibility
   c.) Aroma
   d.) Edibility
2. _____ during the last few decades has driven the need to increase food supply to meet with the fast growing demand.

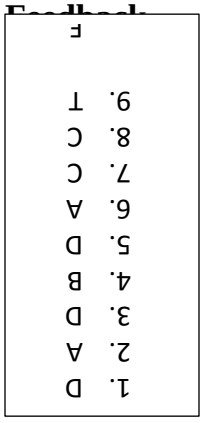
a. Rapid population growth
b. Rapid food consumption
c. All of the above
d. None of the above

3. Before the development of agriculture, people got food from _____in the world around them.
   a. The bush
   b. Water
   c. Plantation
   d. The plants and animals
4. Most food has its origin in _____
   a. Water
   b. Plant
   c. Stones
   d. Sand
5. The term food also includes liquid_____
   a. Fruits
   b. Salad
   c. Water
   d. Drinks
6. A wide variety of dried seeds are often called_____

a. Nuts
b. Seed
c. Baked
d. Dehiscent

7. Dairy products are usually_____ food products
   a. Draining
   b. Fortified
   c. High energy-yielding
   d. Appearing
8. People who consume meat or fish are generalized as_____
   a. Ovovegetarian
   b. Lactovegetarian
   c. Non-vegetarian
   d. Vegetarian
9. Meat is a direct product taken from an animal, which comes from muscle, systems or from organs. True/False
10. Foods from plants are mostly high in fat. True/False

Feedback



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UNIT 2

IMPORTANCE OF FOOD

Introduction

The health of a person depends on the quality and quantity of food consumed. Good nutrition is essential for a person to grow and develop normally and to remain healthy throughout life. When a person does not eat proper food, there are chances of the body not developing normally. There are chances that some organs of the body may start malfunctioning or there may be some disease. Poor nutrition may also influence the mental and social well-being adversely.

Intended Learning Outcomes

Working through this course unit, you should be able to:

1. Explain the functions of food in detail
2. Explain the importance of each classes of food
3. State end product of each classes of food

Main Content

Food is an essential part of everyone's lives. It gives you the energy and nutrients to develop and also grow, be healthy and active, to move, work, play, think and learn. Our body is just like a machine; like an engine burning fuel, the work of the body due to energy supplied from food. The food we take acts as a fuel to generate energy in the mitochondria. Glucose from food interacts with oxygen to form energy, Carbon dioxide, and water molecules (called tissue respiration $C_6H_{12}O_6+60_2$--- $C0_2+ H_2O$ + ATP). Our body uses consumption of food in order to generate the driving forces to keep the lungs breathing, the heart beating, and the limbs functioning. You go to the gym and do strenuous exercise for bodybuilding, in this process, you need protein. So gym instructors give you the advice to take those nutrients to consume a high diet containing foods. For this purpose, protein-rich foods such as pulses, milk, eggs, vitamin-rich vegetables, and meat are recommended to help build enough muscles and get the perfect body. Food contains proteins which provide amino acids for digestion. These amino acids build

proteins and fill a variety of roles, from supporting metabolism to protecting our heart and proteins are life-sustaining macronutrients which act to build body cells and other tissues to maintain shape and function. Your body also uses amino acids for energy when you lack carbohydrates and fats.

When we feel sick, we take food and medicine to be cured and healed, if we eat sufficient food, our immunity boosts up and we feel relieved from a cough, cold-like symptoms to a recognizable extent. Even in most infections, diseases or illnesses, the patients become very weak because they have stopped or are reluctant to eat. Nutrition deficiency is a sort of diseases wherein lack of food or excess food causes the disorder. Lack of sufficient diet along with administration of drugs leads to many problems like drug accumulation, development of resistance to the drug by microbes etc. This is because the food is an enzyme inducer. Thus on metabolism drugs become more water soluble and get excreted from urine. Food gives strength to the body to accommodate a drug and medicine safely and also metabolize them after their action in the body. Many oil soluble medicines are well absorbed in the presence of fatty foods. During a wound, bone fracture or inflammation, consuming sufficient diet helps to overcome the pain and inconvenience during the healing process. It indicates that food is also used as medicine drugs, without food drugs fail to overcome some diseases like tuberculosis, sunstroke, gastric ulcers, skin diseases, muscle pains etc. So, one of the best techniques to overcome diseases is to eat a reasonable amount of food.

Many people under stress and depression neglect food. But interestingly the same food can relieve stress and strain. So, if you are having any tension, then ask him to consume enough food and you will see that he gets some relief from stress and depression. By the way, the importance of food is obvious.

The body needs a variety of the following nutrients - protein, carbohydrate, fat, vitamins and minerals - from the food we eat to stay healthy and productive. Protein - is needed to build, maintain and repair muscle, blood, skin and bones and other tissues and organs in the body. Foods rich in protein include meat, eggs, dairy and fish.

Carbohydrate - provides the body with its main source of energy. Carbohydrates can be classified into two kinds; starches and sugars. Food rich in starches include rice, maize, wheat and potatoes and food rich in sugars include fruit, honey, sweets and chocolate bars. Fat - This is the body's secondary source of energy. Fat actually provides more energy/calories per gram than any other nutrient, but is more difficult to burn. Food rich in fats are oils, butter, lard, milk, cheese and some meat. Vitamins and Minerals - Vitamins and minerals are needed in very small amounts and are sometimes called

micronutrients, but are essential for good health. They control many functions and processes in the body, and in the case of minerals also help build body tissue such as bones (calcium) and blood (iron). In addition to the above nutrients Fibre and Water are also essential for a good healthy diet.

There are basically three important functions of food:

1. Social Function: Food and eating have significant social meaning. Sharing food with any other person implies social acceptance. Food is also an integral part of festivity everywhere in the world. **Have you noticed that certain occasions such as birth of a child or a marriage or birthdays, are celebrated by having feasts and serving delicacies?** Food also has a specific significance and meaning in the religious context.

2. Psychological Function: We all have emotional needs, such as need for security, love and affection. Food is one way through which these needs are satisfied. For example, how do you feel when your mother prepares your favourite food or dish? You feel that she loves you and cares for you. Food is often served as a reward also. Do you recall giving a chocolate because someone had been good to you? Similarly, certain foods become associated with sickness, such as pap and bland foods. Sickness is an unpleasant experience; hence, even the food items served during this state may be associated with unpleasant feelings.

3. Physiological Function: There are three physiological functions performed by food. These are energy giving, body building, regulating body processes and providing protection against diseases. Let us see them in detail.

   (i) Food provides energy: Everybody needs energy to do work. Energy is required for walking, studying, eating, working in the house or outside. You get this energy from the food that you eat. You need energy even when you are resting. Can you tell why? Different organs inside your body are always working, for example, heart is pumping blood, stomach is digesting food, lungs are breathing in air, etc. All these organs need energy for their respective functions and food provides that energy.

   (ii) Food helps in body building. **Have you ever wondered how a small child grows into an adult?** Our body is already made up of thousands of small cells. New cells are added to these to help the body to grow. Food is needed for the formation of new cells. Cells also die or are damaged due to injury. New cells need to be formed and this repair work is done with the help of food.

(iii) Food regulates body processes and provides protection against diseases Regulatory functions refer to the role of food in controlling body processes, for example, our body temperature is maintained at 98.60 F or 37_0C. Similarly, the heart beats are also maintained at 72 beats per minute. Excretion of waste products from the body is also regular. If not, the body suffers from a disease called constipation which can lead to further complications. All these processes are regulated by the food that you eat. The food that we eat gives us strength to fight against disease.

Conclusion

Food is an important element in building the human body to:

1. eliminate hunger
2. provide energy for the body
3. fight germs
4. build our body
5. keep our body in shape
6. regulate the activities of the body
7. strengthen mutual friendship.

Summary

Working through this course unit, the functions of food were explained in details. Also, it perused the importance of each classes of food. End products of each classes of food were examined.

Self-Assessment Exercises

1. Energy from food is generated in the
   a. Golgi body
   b. Rectum
   c. Colon

d. Digestive system
e. Mitochondria

2. Our body uses consumption of_____ in order to generate the driving forces to keep the lungs breathing the heart beating, and the limbs functioning.
   a. Air
   b. Water
   c. Breeze
   d. Food
   e. All of the above
3. _____ help build enough muscles and get the perfect body.
   a. Carbohydrates
   b. Proteins
   c. Fats and oil
   d. Vitamins
   e. All of the above
4. _____are life-sustaining macronutrients which act to build body cells and other tissues to maintain shape and function.
   a. Carbohydrates
   b. Fats and oil
   c. Proteins
   d. Roughages
   e. Vitamins
5. _____is a sort of diseases wherein lack of food or excess food causes the disorder.
   a. Kwashiorkor
   b. Marasmus
   c. Nutrition deficiency
   d. Binge eating
   e. All of the above
6. Lack of sufficient diet along with administration of drugs does not lead to any problems like drug accumulation. True or False
7. Food is an enzyme inducer Yes or No
8. Many oil soluble medicines are well absorbed in the presence of starchy foods. True or False
9. Sharing food with any other person implies social acceptance. True or False
10. Food performs three major functions which are_____, _____ and _____

a. Body building, weight lifting and sprinting
b. Social, body building and muscles repair
c. Social, weight lifting and strength
d. Social, psychological and physiological
e. Muscles endurance, social and cardiovascular endurance

Feedback

D

9. T
8. F
7. Y
6. F
5. C
4. C
3. B
2. D
1. E

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UNIT 3

FACTORS AFFECTING FOOD SELECTION

Introduction

Food selection refers to how people decide on what to buy and eat. A complex set of factors that vary from person to person and depend on culture, heritage and up-bringing. Food selection is the study of those factors that influence choice. This unit focuses on food selection as being a function of the interactive combination of the person, the product and the situation in which a food selection is made. Consumption of food is a universal and necessary act, and a variety of factors influence its selective choice. We are commonly tempted to think the reason we choose a particular food is that it is healthy and tastes good. Upon closer examination of our senses, we might better be able to understand why we show a preference for some tastes but not others. What causes children's reluctance to try new foods and how might sensory education help overcome such 'food neophobia'? How do culture-specific products or flavours exert an influence on our food choice – and how stable are these influences? This unit addresses these questions.

Intended Learning Outcomes

Working through this course unit, you should be able to:

1. Explain the concept of food selection and choices
2. List factors that determine food selection
3. Identify the food requirements of various people in your house hold.

Main Content

Food has long assumed a role in our society beyond filling empty stomachs – it permeates many facets of our life. A healthy nutrition intake is a welcome excuse for our passion about such sensory enjoyments. A review of the literature demonstrates that sensations for taste differ in individuals and hence influence their selection. These differences are in part rooted in our evolutionary and genetic heritage that can be ascribed to our physiological necessity to consume food. Moreover though, our food choice is shaped by our socio-cultural context as well as through our own cognitive appraisals. Conversely, in consuming food that suits our gusto we reach beyond its primary nutritional function and portray much about our own culture and style within the societal context.

One difficulty in studying food selection is that it is nearly impossible to control for all factors that might influence choice in a real food choice setting, such as a restaurant or supermarket, or even in the home. A number of factors have been shown to influence food choice, these include:

- Habitual behaviors can influence food usage, in certain instances even more so than food acceptability.
- Familiarity with specific foods, obtained with prior experience, is a strong contributor to food selection, especially for people who are slightly neophobic. Attitudes and traits and expectations also influence acceptability and choice. Persistent negative expectations or stereotypes are important in understanding the critical evaluations of institutional foods and other foods that are regularly criticized.

In addition, several of the attitudes and traits described earlier (e.g., food neophobia, dietary restraint) also function to drive food choice behaviour. The key driver for eating is of course hunger but what we choose to eat is not determined solely by our physiological or nutritional needs. Some of the other factors that influence selection of food which may include:

- Biological determinants such as hunger, appetite, and taste
- Economic determinants such as cost, income, availability
- Physical determinants such as access, education, skills (e.g. cooking) and time
- Social determinants such as culture, family, peers and meal patterns
- Psychological determinants such as mood, stress and guilt
- Attitudes, beliefs and knowledge about food

- Age and Health Status

The complexity of food selection is obvious from the list above, which is in itself not exhaustive. Food selection factors also vary according to life stage and the power of one factor will vary from one individual or group of people to the next. Thus, one type of intervention to modify food choice behaviour will not suit all population groups. Rather, interventions need to be geared towards different groups of the population with consideration to the many factors influencing their decisions on food selection.

ACTIVITY 5.1

Make a list of restaurant/fast food joints within a radius of one kilometer to your house and the various food choices available.

Biological determinants of food

Hunger and satiety: Our physiological needs provide the basic determinants of food choice. Humans need energy and nutrients in order to survive and will respond to the feelings of hunger and satiety (satisfaction of appetite, state of no hunger between two eating occasions). The central nervous system is involved in controlling the balance between hunger, appetite stimulation and food intake. The macro-nutrients i.e. carbohydrates, proteins and fats generate satiety signals of varying strength. The balance of evidence suggests that fat has the lowest satiating power, carbohydrates have an intermediate effect and protein has been found to be the most satiating. The energy density of diets has been shown to exert potent effects on satiety; low energy density diets generate greater satiety than high energy density diets. The high energy density of high-fat and/or high-sugar foods can also lead to 'passive overconsumption', where excess energy is ingested unintentionally and without the consumption of additional bulk. An important satiety signal may be the volume of food or portion size consumed. Many people are unaware of what constitutes appropriate portion sizes and thus inadvertently consume excess energy.

Palatability: Palatability is proportional to the pleasure you experiences when eating a particular food. It is dependent on the sensory properties of the food such as taste, smell, texture and appearance. Sweet and high-fat foods have an undeniable sensory appeal. It is not surprising then that food is not solely regarded as a source of

nourishment but is often consumed for the pleasure value it imparts. There is an increase in food intake as palatability increases. Increasing food variety can also increase food and energy intake and in the short term alter energy balance. However, effects on long-term energy regulation are unknown.

Sensory aspects: 'Taste' is consistently reported as a major influence on food behaviour. In reality 'taste' is the sum of all sensory stimulation that is produced by the ingestion of a food. This includes not only taste per se but also smell, appearance and texture of food. These sensory aspects are thought to influence, in particular, spontaneous food choice. From an early age, taste and familiarity influence behaviour towards food. A liking for sweetness and a dislike for bitterness are considered innate human traits, present from birth. Taste preferences and food aversions develop through experiences and are influenced by our attitudes, beliefs and expectations.

Economic and physical determinants of food choice

Cost and accessibility: There is no doubt that the cost of food is a primary determinant of food choice. Whether cost is prohibitive depends fundamentally on a person's income and socio-economic status. Low-income groups (who have no nutrition education) have a greater tendency to consume unbalanced diets and in particular have low intakes of fruit and vegetables. However, access to more money does not automatically equate to a better quality diet but the range of foods from which one can choose should increase. Accessibility to shops or fresh food is another important physical factor influencing food selection, which is dependent on resources such as transport and geographical location. Healthy food tends to be more expensive when available within towns and cities compared to village-markets on the outskirts. At the village -market foods are fresh and less expensive.

Education and Knowledge: Level of education can influence dietary behaviour during adulthood. In contrast, nutrition knowledge and good dietary habits are not strongly correlated. This is because knowledge about health does not lead to direct action when individuals are unsure how to apply their knowledge. Furthermore, information disseminated on nutrition comes from a variety of sources and is viewed as conflicting or is mistrusted, which discourages motivation to change. Just as we discussed in module 4 that a lot of information for food supplement adverts have low correlation to the expected outcomes. Thus, it is important to convey accurate and consistent messages through various media, on food packages and of course via health professionals.

Social determinants of food choice

Influence of social class: What people eat is formed and constrained by circumstances that are essentially social and cultural. Population studies show there are clear differences in social classes with regard to food and nutrient intakes. As discussed in module 3 poor diets can result in under- (micronutrients deficiency) and over-nutrition (energy over consumption resulting in overweight and obesity); problems that face different sectors of society, requiring different levels of expertise and methods of intervention.

Cultural influences: this leads to the difference in the habitual consumption of certain foods and in traditions of preparation, and in certain cases can lead to restrictions such as exclusion of meat and milk from the diet. What is food in your culture (area/town) might be forbid in my culture. For example dog is a good source of protein in Ondo State while its use as meat is not allowed in some other states in Nigeria. Cultural influences are however amenable to change: when moving to a new country individuals often adopt particular food habits of the local culture.

Social context: Social influences on food intake refer to the impact that one or more persons have on the eating behaviour of others, either direct (buying food) or indirect (learn from peer's behaviour), either conscious (transfer of beliefs) or subconscious. Even when eating alone, food choice is influenced by social factors because attitudes and habits develop through the interaction with others. The family is widely recognised as being significant in food decisions. Because family and friends can be a source of encouragement in making and sustaining dietary change, adopting dietary strategies which are acceptable to them may benefit the individual whilst also having an effect on the eating habits of others.

Social setting: Although the majority of food is eaten in the home, an increasing proportion is eaten outside the home, e.g. in schools, during ceremony, at work and in restaurants. The venue in which food is eaten can affect food choice, particularly in terms of what foods are on offer. The availability of healthy food at home and 'away from home' increases the consumption of such foods. However, access to healthy food options is limited in many work/school environments. This is particularly true for those with irregular hours or with particular requirements, e.g. vegetarian.

Meal patterns: People have many different eating occasions daily, the motivations for which will differ from one occasion to the next. The effects of snacking on health have been debated widely.However, snack composition may be an important aspect in the ability of individuals to adjust intake to meet energy needs. Helping young adults to choose healthy snack poses a challenge to many health professionals. In the home, rather than forbidding unhealthy snacks, a more positive approach may be the introduction of healthy snack options over time. Moreover, healthy food choices outside the home also need to be made more readily available.

Psychological factors

Stress: Psychological stress is a common feature of modern life and can modify behaviours that affect health, such as physical activity, smoking or food choice. The influence of stress on food choice is complex not least because of the various types of stress one can experience. The effect of stress on food intake depends on the individual, the stressor and the circumstances. In general, some people eat more and some eat less than normal when experiencing stress.

Mood: Food influences our mood and mood has a strong influence over our choice of food. Interestingly, it appears that the influence of food on mood is related in part to attitudes towards particular foods. The ambivalent relationship with food – wanting to enjoy it but conscious of weight gain is a struggle experienced by many. Women more commonly report food cravings than do men. Depressed mood appears to influence the severity of these cravings. Reports of food cravings are also more common in the premenstrual phase, a time when total food intake increases and a parallel change in basal metabolic rate occur. Thus, mood and stress can influence food choice behaviour and possibly short and long term responses to dietary intervention.

Attitudes, beliefs and knowledge about food

Eating disorders: Eating behaviour, unlike many other biological functions, is often subject to sophisticated cognitive control. One of the most widely practised forms of cognitive control over food intake is dieting. Many individuals express a desire to lose weight or improve their body shape and thus engage in approaches to achieve their ideal body mass index. However, problems can arise when dieting and/or exercise are taken to extremes.

Focus on cost: Household income and the cost of food is an important factor influencing food choice, especially for low-income consumers. The potential for food wastage leads to reluctance to try 'new' foods for fear the family will reject them. In addition, a lack of knowledge and the loss of cooking skills can also inhibit buying and preparing meals from basic ingredients.

Time constraints: Lack of time is frequently mentioned by students for not following nutritional advice, also among out-of-school youth and well educated. People living alone or cooking for one seek out convenience foods rather than cooking from basic ingredients. This need has been met with a shift in the food market from loose to pre-packed, prepared and ready-to-cook products. These products are more expensive than loose products but people are willing to pay the extra cost because of the convenience they bring. Developing a greater range of tasty, convenient foods with good nutritional profiles offers a route to improving the diet quality of these groups.

Age and Health Status: Food selection can be determined by the state of an individual. As discussed in Module one, the nutritional status and intake of the mother during pregnancy, the body requirement for food differ from those of a normal, non-pregnant woman.

a. Nutrition in pregnancy: during the course of pregnancy, the total energy cost of the storage plus maintenance amount to approximately 80,000kcal. The energy cost of pregnancy then is about 300kcal a day.

b. Nutrition during lactation: the preparation for assuming adequate supply of good quality breast milk must begin with the onset of pregnancy. Most of the dietary essentials are increased, over and above the requirement during pregnancy, to meet the demands of milk production for an infant who doubles in birth weight in five months.

c. Nutritional needs of school-age children: proper nutrition is one of the most important influences on children's well-being. Food preferences are developed early in life, mostly during early and middle childhood and once they are established, they are hard to break. Children's total energy needs increases as the middle year progresses and thus their food intake rises, especially as they approach puberty.

d. Nutritional needs of the elderly: one of changes encountered as we age is the loss of taste and smell. The buds that detect sweet and salt go first leaving those that

detect sour and bitter. This can make food less appealing and more difficult to select.

e. Nutritional needs of the sick: the sick are individual who have to be treated as whole persons and according to their particular condition, their age, their emotional sensitivity and mental status

Conclusion

A number of environmental or situational variables have been shown to influence food selection. Increased effort required to obtain food leads to decreases in food selection of that item, and often increased selection of another item to take its place. The presence of other people leads to increased consumption, probably because meals are longer when eaten with other people present. Food packaging, the information contained on the package or on the food shelf, as well as the placement of the food in relation to other products can influence selection. Finally, the décor, design, and visual and auditory elements of the food selection can influence choice.

Summary

This unit perused food selection and choices, factors that determine food selection were identified. Determinants of food selection were explained.

ACTIVITY 5.2

Make a list of people in your house hold, then go to your food store and match the available raw-food with the category of people listed. Link your findings with the unit objective 3.

Self-Assessment Exercises

1. _____ has been found to be the most satiating.
    a. Carbohydrates
    b. Proteins
    c. Fats and oil
    d. Vitamins
    e. All of the above
2. Low energy density diets generate greater _____ than high energy density diets.
    a. Satiety
    b. Consumption
    c. Selection
    d. Preference
    e. None of the above
3. _____ have greater tendency to consume unbalanced diets and in particular have low intakes of fruit and vegetables.
    a. Internally displaced persons
    b. Sick people
    c. People with terminal diseases
    d. Low-income groups
    e. All of the above
4. Accessibility to shops is an important physical factor influencing food selection, which is dependent on resources such as _____ and _____
    a. Cost and supply
    b. Supply and demand
    c. Affordability and supply
    d. Supply and monitoring
    e. Transport and geographical location
5. The venue in which food is eaten cannot affect food choice, particularly in terms of what foods are offered. True or False
6. Evidence shows that snacking cannot have effects on energy and nutrient intakes and on body mass index. True or False
7. Psychological determinants of food selection include such as mood, stress and guilt Yes or No
8. _____ is proportional to the pleasure someone experiences when eating a particular food.

a. Palatability
b. Satisfaction
c. Disposition
d. Optimism
e. Hunger

9. Eating behaviour, unlike many other biological functions, is often subject to sophisticated _____ control.
   a. Psychological
   b. Social
   c. Physiological
   d. Cognitive
   e. Biological
10. Food selection is determined by the state of an individual. Some of these conditions are _____ and _____
   a. Teething and travellers
   b. Drivers and hard labourers
   c. Pregnant and lactating mothers
   d. Children and babies
   e. None of the above

Feedback

1. B
2. A
3. D
4. E
5. F
6. F
7. Y
8. A
9. D
C

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