NATIONAL OPEN UNIVERSITY OF NIGERIA

NSC 215

Nutrition in Health and Diseases

Module 2

NSC 215 (Nutrition in Health and Diseases) Module 2

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Module 2 Basic Knowledge in Nutrition

Unit 1 Carbohydrates

1.0 Introduction

Since you have gone through the historic background of nutrition and the ancestral nutritional behaviours before and after agricultural and industrial revolutions, you will be exposed to basic knowledge of food composition. Carbohydrates form part of the essential nutrients in food. This unit will expose you to the importance of carbohydrates, its classifications, functions and food sources.

2.0 Objectives

At the end of this unit, you should be able to:

- identify two types of carbohydrates
- describe simple carbohydrates
- list at least three functions of carbohydrates
- identify the end product of carbohydrates
- list four sources of carbohydrates.

3.0 Main Content

3.1 Types of Carbohydrates

There are two types of carbohydrates. They are simple and complex carbohydrates. Simple carbohydrates are easily digestible by humans and animals. Examples of simple carbohydrates are monosaccharides and disaccharides. The most important monosaccharides is glucose. Glucose is needed every second by the brain. The Disaccharides are two molecules of sugar, such as sucrose, maltose and lactose. Sucrose is broken down to fructose and glucose, while maltose is broken down to two molecules of glucose. Lactose is popularly referred to as milk sugar.

Upon digestion, it yields glucose and galactose. Galactose, fructose and fructose are examples of monosaccharides. Complex carbohydrates are polysaccha rides that contains as many as 2000 simple carbohydrates units in long chains. Starch, glycogen, and cellulose are examples of complex carbohydrates. Starch is found in seeds, and grains and tubers. Glycogen is a form of glucose storage in animals.

3.2 Functions of Carbohydrates

- It supplies energy which serves as body fuel to both internal and external activities.

- It spares protein from being used as a source of energy. One grain of carbohydrate will supply 4 kilocalories to the body.
- It supplies glucose to the body especially the brain
- It helps the body to burn body fat.
- It adds flavour to our diet.
- It helps in the formation of genetic materials (Deoxyribonuclei acid DNA and Ribonuclei acid RNA)

3.3 Digestion of Carbohydrates

Digestion of carbohydrates begins in the mouth and ends in the small intestine. In the mouth, the food is chewed and broken down into small pieces and mixed with saliva which contains salivary amylase pytalin. This enzyme splits disaccharides such as maltose. The digestion continues in the duodenum (the first part of the small intestine) that contains pancreatic amylase which continues to break down other disaccharides into the final end product which is glucose. The other enzymes in the intestine are maltase, sucrase and lactase.

Maltase breaks down maltose into two molecules of glucose. Lactase breaks down lactose into one molecule each of glucose and galactose and sucrase converts sucrose into one molecule each of glucose and fructose. Remember that the end product of carbohydrate is glucose.

3.4 Recommended Allowances for Carbohydrate

Since carbohydrate is a universally available, there is no basis for the formulation of dietary allowance for carbohydrate. However, it should be noted that carbohydrate and fats are suppliers of energy. Energy requirement is increased during pregnancy, lactation and infancy.

3.5 Food Sources of Carbohydrates

The major carbohydrates are found in sugars, cereal grains (corn, millet, wheat, rice, guinea corn, acha), and legumes (beans, soyabeans, groundnut, and dried fruits, tubers and vegetable).

4.0 Conclusion

In this unit, you have learnt about carbohydrate as an important nutrient needed for the body especially, the brain. You have also been exposed to the types of carbohydrates and examples of each type. The breaking down of carbohydrates has also been taught in this unit. You have also known some of the vital functions and sources of carbohydrates.

Remember that everything you eat contains carbohydrate and its digestion begins in the mouth and continues in the small intestines with specific enzymes. The end product of carbohydrate is glucose.

5.0 Summary

This unit has introduced you to one of the nutrients found in the food you eat. It has exposed you to two types of carbohydrates, their functions and digestion in the body. You have also learnt about the food sources of this important nutrient.

6.0 Self-Assessment Axercise

1. List five functions of carbohydrates.
2. Discuss, the journey of a piece of bread you have just taken in terms of its digestion.

7.0 References/Further Reading

Fleck, H. (1976). *Introduction to Nutrition*, 3rd Edition. London: MacMillan Publishing Co., Inc. Pp. 56.

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Unit 2 Protein

1.0 Introduction

Since you have gone through the types and functions of carbohydrates in Unit 1, you would have acquired a general view that carbohydrate is a protein sparer. This unit will help you to appreciate the importance of protein as a body builder and repairer.

2.0 Objectives

At the end of this unit, you should be able to:

- identify the chemical elements in protein
- classify protein into three groups
- differentiate between animal and plant protein
- identify the difference between supplementary and complementary protein
- list at least two functions of protein
- identify the end product of protein
- list at least 3 food sources of protein that are cheap but of high value.

3.0 Main Content

3.1 Classification of Protein

The word "protein' simply means, to come first. This nutrient is the most indispensable nutrient that supplies essential and non-essential amino acids. These essential amino acids are necessary for body building and tissue repairs.

Protein can be simply grouped under two broad headings: animal and plant protein sources. Animal protein sources are usually referred to as complete protein because it contains all the essential amino acids (Isoleucine, Leucine, Lysine, methionine, phenylalanine, threonine, tryptophan, and valine). These eight essential amino acids are for adults. For infants, histidine is listed as 9th amino acid essential for them.

Proteins are majorly classified according to their solubilities and other physical properties. Three classes are used to categorise protein:

Simple proteins: These are protein substances that yield amino acids after complete hydrolysis. Albumen of egg, keratin of hair and globins of hemoglobin are examples of simple proteins.

Conjugal proteins: These are protein compounds with some other nonprotein molecules or molecules with metal upon hydrolysis. Examples are hemoglobin (protein + heine) of blood, casein (protein + phosphoric acid of milk and lipoprotein (protein + lipid) in blood plasma.

Derived proteins: These are products formed from the partial breakdown of proteins by the action of heat and other physical forces or by hydrolytic agents, peptones, polypeptides, and peptides (mixtures of amino acids with decreasing numbers of amino acids in the chains length).

3.2 Functions of Protein

The chief functions of protein are to:

- provide amino acids for the body to build new tissues, and normal growth of infants
- help to maintain body tissue and replacement of damaged or worn out tissues in both adults and children
- help in the formation of hormones, enzymes and antibodies
- serve as source of energy in the absence of carbohydrate.

3.3 Digestion of Protein

Protein digestion starts from the stomach. The long chains of proteins are split into smaller units by an inactive enzyme pepsinogen that is converted to pepsin upon being in contact with hydrochloric acid.

The main protein connective tissue, called collagen is digested by pepsin. The vast majority of protein digestion occurs in the duodenum. The liquefied mass of food called chime passes through the pyloric sphincter into small intestine where the activation of enterokinase, an enzyme that activates pancreatic trypsinogen into trypsin. Trypsin, chymotrypsin and carboxypolypetidase breakdown the links of polypeptide chains and further subdivide them into small polypetides. These result in free amino acids.

3.4 Recommended Allowance for Protein

For adult men and women 18 to 35 years of age, the recommended daily dietary allowance is one gram per kilogram of body weight. It is also recommended that the dietary allowance for infants should be increased as they grow up, while adult men and women should decrease their allowances as they add years. Extra protein needs are needed by pregnant women, lactating mothers, early adolescents, individuals under stress and post surgery patients.

3.5 Protein Deficiency Diseases

A deficiency disease of protein is called protein energy malnutrition

(PEM). It is used to be known as Protein Caloric malnutrition (PCM). The term energy refers to both calorie and fats. The patterns of PEM are, kwashiorkor, marasmus, marasmic – kwashiorkor and under nutrition. Other forms of protein deficiency in humans include nutritional liver disease. This deficiency is commonly observed in alcoholic patient and kwashiorkor children. The disease is characterised by an enlarged fatty liver and oedema.

3.6 Supplementary and Complementary Proteins

All animal proteins are first class protein because they contain all the essential amino acids. Plant proteins on the other hand are regarded as second class protein because they lack one or two essential amino acids.

When you add an animal protein to a protein from plant source, such a combination is regarded as supplementary protein. Examples include maize + meat, groundnut + crayfish etc. It is the animal protein that is supplying all the essential amino acids.

Complementary proteins are the combinations of two important plant protein sources. Examples are beans and rice, maize and groundnut. Grains are deficient in lysine and legumes are deficient in methionine. Rice, millet, maize and wheat are grains while beans and groundnut are legumes.

3.7 Food Sources of Protein

The food sources of animal proteins include fish, crayfish, eggs, milk, goat meat, pork, chicken, turkey, crab, breast milk etc. The major plant protein sources are cowpea seeds, soybeans, groundnuts, locust beans, pinto beans, red kidney beans and lima beans. Grains such as rice, wheat, maize, guinea corn, acha, millet are also fair sources of protein.

4.0 Conclusion

In this unit you have learnt that protein is an essential nutrient that makes up the building block of the body. More importantly, you have been introduced to classes of protein, its digestion, functions and food sources. You should be able to make up a complementary protein diet after you have been exposed to protein food sources.

This unit has also provided you information on the need for higher protein allowances for pregnant and lactating women, infants and early adolescents.

5.0 Summary

This unit, being a part of basic knowledge in nutrition has exposed you to the importance of protein in the growth and maintenance of body tissue. It has listed the function of proteins and the uniqueness of amino acids in the formulation of complementary and supplementary protein.

6.0Self-Assessment Exercise

1. Differentiate between classes of proteins.
2. List the essential amino acids for children and adults
3. Briefly describe the differences between supplementary and complementary proteins with specific examples.

7.0 References/Further Reading

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Unit 3 Lipids (Fats and Oils)

1.0 Introduction

Since you have gone through the first two units and you have general overview of the importance of carbohydrates and proteins in human health, in this unit, you will also learn the importance of fat as an essential nutrient for good health of all ages.

2.0 Objectives

At the end of this unit, you should be able to:

- define lipids
- differentiate between fats and oils
- list at least two essential fatty acids
- list at least four functions of fats
- identify the end product of fats
- list the food sources of fats.

3.0 Main Content

3.1 Types of Lipids

The term lipid is a descriptive rather than a chemical name such as carbohydrates or proteins. The term refers to fats or fat like substances. Lipids are classified into two groups, simple and compound lipids. Simple lipids are the esters of fatty acids and alcohol. Examples of ester of fatty acids include animal and vegetable fats.

Compound lipids are esters of fatty acids containing groups in addition to an alcohol and a fatty acid. Examples of these lipids include phospholipids such as Lecithin found in egg yolk and milk sterol, such as cholesterol. Generally, lipids are fats and oils. There is a difference between fats and oils. Fats are solid at room temperature, whereas, oils are liquid. Fats and oils are greasy or oily to the touch and they are commonly found in plants and animals. The amount of energy in fats and oils doubles that of protein and carbohydrate. One gram of carbohydrates and protein will yield 4 kcal, each but fats will yield 9 kcal.

3.2 The Essential Fatty Acids

Fatty acids can be described as the building blocks of lipids (fats and oils). Like proteins and carbohydrates, they are made up of hydrogen carbon (CH) but they differ by having a carboxyl group (COOH) at the end. Animal fats contain more of saturated fatty acids. This is one of the reasons for animal fats to be solid at room temperature. These fatty acids are long chains with all the carbon chains fully filled with hydrogen ions.

The oils are liquid at room temperature because they contain unsaturated fatty acids. This means some of the carbons are not filled. Some of these unsaturated fatty acids are essential

to humans because the body system cannot provide them enough to meet body requirements. Some of these essential fatty acids are linolenic and linoleic.

3.3 Functions of Fats

- One of the chief functions of fats is to supply energy
- Fat helps the body to transport fat soluble vitamins (A, D, E and K)
- Fat helps in protecting the internal organs of the body by serving as cushion pad, for example the kidney
- Oils provide the essential fatty acids which help in preventing excessive loss of water
- Fat gives taste and feeling of satisfaction in a meal. Without fats food will be too dry to eat
- Dietary fat stored as adipose tissue in man helps man to survive without food for some weeks
- Fat is used by food manufacturers for smoothness and tenderness.

3.4 Digestion of Fats

The digestion of fats begins in the small intestine. The fats are splitted by the bile and the pancreatic lipase. The bile is secreted by the liver. It is the bile fluid, the bile salts serves as emulsifying agent. These bile salts also accelerate the pancreatic lipase (enzyme that breaks fats) and it also neutralises the acidity of the chime. The end products of fats are fatty acids, glycerol and glycerides.

3.5 Food Sources of Fats and Oils

Rich sources of oils are available in plants, such as corn oil, groundnut oil, melon oil, soybean oil and palm oil. Palm oil contains a lot of palmitic acid which is made up of saturated fatty acids. Rich sources of fats are mainly from animal food sources such as pork, meat, whole milk and cheese.

4.0 Conclusion

In this unit, you have learnt that lipids are oils and fats and they can be classified into two groups, simple and complex lipids. You have also been exposed to those fatty acids that are essential to human health. You now know that the main difference between oils and fats is their fatty acid composition whether saturated or unsaturated ones. Functions of fats have also been expatiated in this unit. It is hoped that by now, you should be able to examine your fat choices. Are they mostly from plant or animal food sources?

5.0 Summary

This unit has provided you the meaning of lipids, their classification, and composition, digestion, functions and food sources. It has also explained the importance of essential fatty acids.

6.0 Self-Assessment Exercise

1. List five functions of fats
2. Why is fat solid at room temperature but oil is liquid?
3. Give at least two examples each of fats and oils.

7.0 References/Further Reading

Fleck, H. (1976). *Introduction to Nutrition*, 3rd ed. London: Macmillan Publishing Co, Inc. Pp. 62-65.

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Unit 4 Minerals

1.0 Introduction

Since you have gone through units 1 to 3, you have learnt that carbohydrates, proteins and lipids are organic compounds made up of chemical elements such as carbon, hydrogen, nitrogen and oxygen. All these organic compounds with water make up about 96 per cent of your body weight and the remaining 4 per cent is made up of the minerals. In this unit, you will learn about classification of minerals, their functions, deficiencies and food sources.

2.0 Objectives

At the end of this unit, you should be able to:

- classify minerals into two major groups
- list ,at least five, of the major minerals
- identify the micro minerals
- describe the difference between major and trace minerals
- list, at least five, functions of minerals
- identify, at least two, mineral deficiencies
- list, at least three, macro and micro minerals each and their food
- sources.

3.0 Main Content

3.1 Classification of Minerals

Generally, minerals are inorganic elements, organic compounds; they cannot be changed during digestion. Once they are in the body, they are there until they are excreted. Minerals can be classified into two classes, macro and micro minerals. The macro minerals are those that the body needs in larger amounts than 5 grams (a teaspoon). These macro or major minerals include calcium, phosphorous, potassium, sulfur, sodium, chloride and magnesium. Calcium and phosphorous are the two major minerals needed by the body in high quantities. Micro minerals or trace minerals are those that the body needs in minute quantities less than 5 grams. These micro minerals are iron, zinc, copper, manganese, iodine, selenium. There are other nine trace minerals. These are cobalt, molybdenum, chromium, tin, vanadium, fluorine, silicon, nickel, and arsenic.

3.2 Functions of Minerals

Majorly, minerals function in two important roles as building and regulatory substances. Specifically, the functions of minerals are: They

- are building parts in the hard tissues of the body (bones and teeth)

- give rigidity to bones, teeth and the whole body
- are part of soft tissues (muscle, protein and nervous tissues are made up of sulfur and phosphorous)
- are components of essential hormones that contribute to healthy body system, For example, iodine is present in thyroxin and zinc is in insulin.
- contribute to the body fluids and tissues as electrolytes concerned with the maintenance of osmotic pressure, and acid-base balance.
- also contribute to membrane permeability and muscle irritability and oxygen transport (sodium, potassium, chloride, phosphorous, calcium, magnesium and iron)
- are essential for blood cloth formation
- are catalysts in enzymes and hormone system.
- make possible normal rhythm in the heart beat.

3.3 Adult Mineral Requirements, Main Function, Deficiency and Main Sources

This unit will be presented in the form of a table. The main functions, deficiencies and sources of each mineral will be indicated.

Table 1: Adult Mineral Requirements, Functions, Deficiency and Main Sources

Macro mineral	Chief functions	Deficiency symptoms	Adult minimum requirement	Chief food sources
Chloride	Part of hydrochloric acid, maintains normal fluid and electrolyte balance.	None	750mg/day	Table salt, moderate amounts in all foods.
Potassium	Assists in nerve impulse transmission muscle contraction, and maintains normal fluid and electrolyte balance	Muscular weakness, paralysis, confusion	2000mg/day	All whole foods, milk, fruits, grains and legumes
Calcium	The principal mineral of bones and teeth involves in muscle contraction and	Stunted growth in children, bone loss (Osteoporosis)	1000mg/day (19-50years)1200 mg/day(51 and above)	Milk, snail, fish with bones, greens and legumes

	relaxation blood clotting, blood pressure and immune defenses			
Phosphorus	Helps in the contraction of nerves and muscles. It helps in the synthesis of protein, functioning of immune system and also enzyme activator.	Weakness, confusion, if extreme, convulsion, hallucination, difficulty in swallowing in children & growth failure	420 mg/day (men 31years +, 320 mg/day women 31yrs+)	Nuts, legumes, whole grains
Magnesium	Helps in the contraction of nerves and muscles. It helps in the synthesis of protein, functioning of immune system and also enzyme activator.	Weakness, confusion, if extreme, convulsion, hallucination difficulty in swallowing in children, growth failure.	420mg/day men 31yr+ 320mg/day women 31+	Nuts, legumes whole grains.
Sodium	It improves the taste of foods, aids in transmitting electrical impulses in the body system maintains normal fluid and electrolyte balance.	Muscle cramps mental apathy loss of appetite	500mg/day	Table salt, in all foods.
Sulfur	It helps in the oxidation-reduction reactions, it is part of proteins, vitamin biotin and thiamine and the hormone insulin.	None	-	All protein food sources.

Table 2: Adult Mineral Requirements, Functions, Deficiencies and Main Food Sources

Micro mineral	Chief functions	Deficiency symptoms	Adult minimum requirement	Chief food sources
Iron	Helps in the building of red blood cells, part of the hemoglobin, and myoglobin in muscles. It also helps in the conversion of hydrogen peroxide to oxygen and water	Reduced resistance to infection, productivity, physical fitness, anaemia in children and women, paled eyes.	Men (10mg/day) Women (15mg/day)	Red meat, fish, eggs, legumes, dried fruits.
Zinc	Constituents of many enzymes, it enhances insulin activities, part of materials in making genetic materials, helps to transport vitamins A. it improves mechanism and also helps in sexual maturation, improves appetite and promotes growth. Promotes rapid wound healing.	Growth retardation, DNA synthesis impaired taste and appetite, tiny and very short penis, chronic wound healing prolonged acute or severe diarrhea.	Men 15mg/day, Women 10mg/day	Protein food sources meat, fish, whole grain, sea foods.
Iodine	It is an essential component of thyroid hormone that helps to regulate growth and mental development. It also helps in the release of energy from the food consumed.	Growth retardation, cretinism and poor cognition in children. Severe form leads to goiter (enlarged thyroid gland).	150 ug/day	Iodised salt, sea foods.
Selenium	It is part of enzyme that work with vitamin E to fight	Degeneration of heart muscles, susceptibility to	70ug/day men, women 55	Sea foods, meat, onions,

	free radicals in the body. It prevents degeneration of heart muscles.	cancer	ug/day.	fruits.
Manganese	It serves as a cofactor activating a large number of enzymes, and also assists in the regulation of carbohydrate metabolism.	None yet	2-5mg/day	Widely present in foods
Copper	It is part of several enzymes, helps in mitochondria energy production, protects against oxidants and free radicals and plays a key role in iron absorption and mobilisation.	Anaemia, weakening the nervous system.	1.5-3.0 gm/day	Shell fish oysters, legumes, liver.
Chromium	It is part of insulin that helps to transport glucose. It helps in the release of energy from glucose.	Impaired growth, inability to use glucose normally	50-20 ug/day	Meat, liver, kidney, whole grains.

4.0 Conclusion

In this unit, you have leant that minerals can be classified under two groups, micro and macro minerals. You have also learnt the functions of these micro and macro minerals. The lists of these minerals have been introduced to you. By now you should know that minerals do not change in the body system, unlike organic compounds such as proteins and lipids. You should be able to select food sources for each of the minerals. More importantly, you should know the deficiencies of all these minerals.

5.0 Summary

This unit still being part of basic nutrition has taken you through the importance of macro and micro minerals in the promotion of good health. The unit has also illustrated the difference between micro and macro minerals. The chief functions, deficiencies and food sources have also been discussed. The next unit will discuss the vitamins, which are other important nutrients that promote quality health.

6.0 Self-Assessment Exercise

1. Distinguish between macro and micro minerals
2. Describe the principal functions of food sources and deficiencies of two each of macro and micro minerals.

7.0 References/Further Reading

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Unit 5 Vitamins

1.0 Introduction

Since you have gone through units 1-4, you should know that there is still one vital nutrient that you ought to learn because it is essential for normal metabolism, growth and development of the body. This essential nutrient is known as vitamins. This unit will help you to understand some key vitamins that your body needs for proper functioning. This unit will explain vitamin functions, classifications, deficiencies, and food sources.

2.0 Objectives

At the end of this unit, you should be able to:

- define and classify vitamins
- differentiate between vitamins and other large molecules
- describe, at least three functions, of the water soluble vitamins
- explain, at least two functions, of fat soluble vitamins
- name ,at least three deficiencies, of water and fat soluble vitamins
- list, at least three food sources each, of water and fat soluble vitamins.

3.0 Main Content

3.1 Definition of Vitamins

Vitamins are group of organic substances needed by the body in minute quantities but essential for normal metabolism, growth and development of the body. Vitamins like proteins, fats, oils, carbohydrates are organic substances but they differ from the large molecules. They are different because in their structures. Their individual units and are not linked in long chains. Vitamins do not yield any end product; they assist enzymes that yield glucose from carbohydrate, amino acids from protein and fatty acids, glycerol and glycerides from lipids. The amount of vitamins needed are measured in micrograms or milligrams instead of grams used for the large molecules.

3.2 Classification of Vitamins

Vitamins can be classified into two main groups. These two groups are fat and water - soluble vitamins. The fat- soluble vitamins are generally stable to heat and they can only be transported in the body in the presence of fat. The water- soluble vitamins on the other hand, are not always stable to heat. They are easily decreased by heat or long storage.

These fat- soluble vitamins are Vitamin A (Retinol), Vitamin D (Chocalcapherol), Vitamin E (Tocopherol), and Vitamin K (Menadione). The water- soluble vitamins are easily destroyed by heat. The water- soluble vitamins are vitamins B1 (Thiamin), vitamin B2, (Riboflavin),

vitamin B5 (Niacin or Nicotinic acid) vitamin B6, (Pyridoxine), vitamin B9 (Folic acid), vitamin B12 (Cobalamin) and vitamin C (Ascorbic acid),

3.3 Stability, Key Functions, Deficiency, Food Sources and Requirements of Fat- Soluble Vitamins

Table 3: Stability, Key Functions, Deficiency, Food Sources and Requirements of Fat- Soluble Vitamins

Name	Stability	Key functions	Key deficiency	Food sources	Requirements
Fat soluble Vitamin A (Retinol)	Stable and destroyed by oxidation and ultraviolet radiation heat	Essential for normal growth, reproductive system and normal vision, function as antioxidant.	Night blindness, poor tooth formation and severe deficiency leads to xerophthalmia	Liver, egg yolk, palm oil, green and yellow leafy vegetables, yellow fruits.	5000 IU
Vitamin D Calciferol	Stable to heat oxidation acid and alkali	Influences absorption and metabolism of phosphorus and calcium. Essential for normal growth, formation and maintenance of bones and teeth.	Bowlegs, poor teeth, knock knees, severe form leads to rickets in children and osteomalacia in adults.	Fortified milk, sunshine, liver, fish.	5-15mg or 400IU
Vitamin E Tocopherol	Stable to heat, in the absence of oxygen destroyed by alkalis	It is a strong anti-oxidant. Protects red blood cells from haemolysis, plays role in reproduction (in animals)	Increase in lipid peroxidation of the cell membrane, changes in balance and coordination. Sterility in animals	Wheat-germ, almond, plant oils, ground nut.	10-30 mg
Vitamin k Menadione	Resistant to heat, oxygen but	Helps in the production of prothrombin, a compound	Lead to haemorrhage, increased incidence of	Leafy green vegetables, carrot,	120 mg

	destroyed by ultra violet light	necessary for blood clothing. It is also involved in bone metabolism.	hip fracture and slow clotting time.	soybean.	

Table 4: Stability, Key Functions, Deficiency, Food Sources, and Requirement of Water- Soluble Vitamins

Vitamin C (Ascorbic acid)	Unstable to heat, destruction by air, light and metals.	Important in wound healing, immune responses allergic reactions, collagen, formation, strengthening capillaries	Impaired wound healing, bleeding, gums, sore joints.	Citrus fruits, tomato	90mg for male 75 for female
Vitamin B1 (Thiamine)	Stable in acid solution	Assist in carbohydrate metabolism. Essential for growth, normal appetite, digestion and healthy nervous system	Loss of appetite, numbness in legs, irritability, depression and fatigue. Severe deficiency leads to beriberi.	Milk and dairy foods, organ meals green leafy vegetables.	1.1-1.3 mg
Vitamin B2 (Riboflavine)	Unstable to heat, light and alkaline (> pH 7)	Helps in the metabolism of carbohydrates, amino acids, and lipids. Essential for growth. Helps in digestive system. Acts as hydrogen ion transport.	Cheilosis, loss of visual activity, contributes to cataract formation	Milk and dairy foods, organ meals green leafy vegetables.	1.1-1.3 mg
Vitamin B5 (Niacin or Nicotinic acid)	Stable in presence of heat, oxygen, acid, and alkali, light.	Part of coenzymes that help in the metabolism of carbohydrates and amino acids. Helps in healthy gastrointestinal	Indigestion and anorexia, general weakness and tiredness, dermatitis, diarrhea and dementia. The	Fish, liver, eggs, groundnuts, legumes.	14-16mg

		tract and nervous system.	severe form is pellagra.		
Vitamin B6 (Pyridoxine)	Unstable to heat & light.	Essential for normal growth. As a coenzyme, it helps in the metabolism amino acids and unsaturated fatty acids from essential fatty acids. It aids in the conversion of tryptophan to niacin.	Convulsive seizures, anemia, weakness sleeping and poor mental perception.	Pork, yeast, banana and liver	1.3-1.7 mg
Vitamin B9 (Foliate Folic acid)	Stable in presence of light when in solution, but unstable in presence of heat in acid media.	It helps in synthesis of genetic materials (DNA, RNA). It aids in the prevention of neural tube defects in early fetal development. Important in normal maturation of red and white blood cells.	Impaired biosynthesis of DNA and RNA. It leads to megaloblastic, macrocytic anemia. Neural tube defects.	Green-leafy vegetables, organ meats, legumes, oats.	400 mg
Vitamin B12 (Cobalamin)	Stable in acid, alkaline & heat but destroyed by oxidation & light (UV)	It aids in the normal blood formation. Important in the synthesis of genetic material. Promotion of growth and healthy nervous system.	Malabsorption leads to perinicious anemia, neurologic abnormalities.	Liver, milk, eggs, fish.	30 mg

4.0 Conclusion

This unit has defined and classified Vitamins. The unit has also shown that vitamins are organic substances like the three large molecules (carbohydrates, proteins & lipids) but they are different from them. Vitamins have been grouped into two major groups (fat and water soluble). Their functions, deficiencies, food sources and vitamin requirements were

explained in this unit. By now you should begin to pay attention to your food intake as to whether it supplies you all the vitamins for your optimal health.

5.0 Summary

This unit still being part of basic knowledge of nutrition, has expatiated on the importance of vitamins in assisting other nutrients to promote and sustain healthy body system. The unit has also discussed the two groups of vitamins, their functions, deficiencies and food sources.

6.0 Self-Assessment Exercise

1. Describe the general differences between fat and water soluble vitamins.
2. Which of the B vitamins are associated with energy and protein metabolisms and list, at least two deficiencies, of these vitamins.

7.0 References/Further Reading

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Unit 6 Water as An Essential Nutrient

1.0 Introduction

Since the first five units have introduced you to basic nutrition, you should by now appreciate that all the nutrients are needed for the well being of humans from the womb to old age. Apparently, when discussing about nutrients, for planning adequate nutrition, water is often left out as one of those nutrients to be reckoned with. Human being can survive a longer period without food than without water. In fact water is present in every part of the body and it makes up about 65 per cent of the body weight. This unit intends to discuss the importance of water, its classification, functions and sources.

2.0 Objectives

At the end of this unit, you should be able to:

- define water, in your own words
- describe the classification of water
- identify, at least three functions, of water
- explain the effects of water on nutritive value of foods
- list two sources of water
- describe Daily Recommended Allowances for water.

3.0 Main Content

3.1 Definition of Water

Water is defined as tasteless, colourless, odourless and clear fluid that is made up of hydrogen and oxygen.

3.2 Classification and Sources of Water

Water can be classified as either hard or soft. Water is either hard or soft depending on the source of the water. The two main sources of drinking water are surface and ground water. Surface water comes from lakes and rivers. The ground water, on the other comes from underground rock. The vast majority of the people in rural and some parts of the urban areas draw water from the well. The two sources of water are exposed to contaminated wastes, pesticides, chemicals and poorly disposed household solvents. The level of chemical present in water will determine the level of the hardness of the water.

3.3 Functions of Water

- Water supports life, without it human being cannot survive.
- Water serves as intracellular and extracellular fluid.

- It forms a good medium for removing heat from the body because it has great ability to hold heat.
- It helps to remove waste products from the body.
- It serves as lubricant in the knees and joints of the body.
- It is used for the construction of every cell.
- water forms the major part of foods and human body.
- It serves as a solvent for nutrients; it liquefies food so that it can be properly digested.

3.4 Effect of Water on Nutritive Value of Food

The quantity of water in a food has a great effect upon other nutrients in such food. Fruits and some green leafy vegetables, have higher quantity of water and lesser energy and other nutrients than dried fruits and leafy green vegetables. The quantity of water, affects the total energy value in the food because of dilution. The same principle applies to protein and other nutrients.

3.5 Recommended Daily Water Requirements for Water

You should remember that almost two thirds of the body is made up of water, hence the need for daily regular intake of water is compulsory. An average individual requires about two litres or eight cups of water on daily basis. You should also note that water is also abundant in some foods such as fruits and leafy green vegetables (cucumber, lettuce, raw tomatoes, orange, grape, water leaf, okra). The body also makes its own water from the byproduct of carbohydrates, fats and protein metabolisms.

4.0 Conclusion

This unit has actually discussed water as the sixth important nutrient that is required by the body for optimal functioning, whereas, most health experts ignore water as a nutrient. By now, you should know that water is even the most important nutrient for the body. Water has been classified into two groups and its functions have been well listed in this unit. The Recommended Daily water Requirement has been put at 2 litres or 8 cups. Other sources of water from the food metabolisms and fruits and leafy green vegetables have also been explained. The effect of water on nutritive value of food is not left out in this unit.

5.0 Summary

Water as an important and as an indispensable nutrient have been examined in this unit. Its functions, sources, effect on nutritive value of food and daily requirement have been presented in this unit.

6.0 Self-Assessment Exercise

1. Define water in your own words
2. List two classes of water
3. Enumerate 5 functions of water.

7.0 References/Further Reading

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Unit 7 Fibre as an Essential Nutrient

1.0 Introduction

Since you have been exposed to other 6 important nutrients, you will realise that all these nutrients are in the foods that you consume and all of them have specific roles they play in nourishing the body. This unit shall illustrate the importance of fibre, an essential nutrient that is under appreciated and often mentioned as part of components of adequate nutrition intake. Burkitt and Trowell (1972), had earlier proposed that many Western diseases such as cardiovascular diseases, diabetes, some forms of cancers and obesity were due to lack of dietary fibre in the diet. This unit will explain the types of dietary fibre, its health benefits and food sources.

2.0 Objectives

At the end of this unit, you should be able to:

- define dietary fibre in two ways
- differentiate between fibre and starch
- list, at least three health benefits, of dietary fibres.
- identify, at least two major food sources of each type of,dietary

fibre.

3.0 Main Content

3.1 Definition of Dietary Fibres

Trowell (1972) defined dietary fibre, as "components of the plant cell wall that resist digestion by secretions of the human eliminatory tract". The Life Science Research Office (1987) also defines dietary fibre as "the endogenous components of plant materials in the diet which are resistant to digestion by enzymes produced by humans".

Whitney, Cataldo and Rolfes (1998) also defined dietary fibre as the structural parts of plants and are found in all plant – derived foods – vegetables, fruits, grains, and legumes".

Wardlaw also defines dietary fibres as "a class made up of polysaccharides, but they differ from starches in so far as the chemical links that join individual sugar units cannot be digested by human enzymes in the gastrointestinal (GI) tract".

3.2 Differences between Starch and Fibre

In plants, glucose is stored as starch in the plant cells, just as the human body stores glucose as glycogen. Although both starch and fibre are polysaccharides, fibres differ from starch because the bonds between their monosaccharides units cannot be broken down by human digestive enzymes. Starch, on the other hand, is digested by human digestive enzymes. The connecting chains in starch are in spiral form, whereas, in fibre it is straight.

3.3 Classification of Dietary Fibres

Total dietary fibre can be broadly divided into two, non-starch polysaccharides and lignin. Lignin is a non-polysaccharides fibre that gives the plant its strength. Lignin is an insoluble fibre, examples are whole grains, parts of vegetables such as carrots or the small seeds of fruits.

The non-starch polysaccharides are further divided into non-cellulose polysaccharides and cellulose. Like starch, cellulose is made up of glucose units. They are connected in a long chain and this chain does not branch. The bonds holding the glucose units together resist digestion by human digestive enzymes. Cellulose is the primary constituent of plant cell walls and hemicelluloses are the main composition of cereal fibres (wheat, brown rice, vegetables). Both cellulose and hemicellulose are insoluble in water.

It is apparent from the above that further division of dietary fibre can be grouped under soluble dietary fibre. The soluble dietary fibres include peetins, guins, and mucilages. Pectins are found in vegetables and fruits, especially citrus fruits, apples, banana, oranges, carrots, oats, and kidney beans. Remember that gums and mucilages are the secretion that comes out when a branch of plant is cut.

3.4 Functions or Health Benefits of Dietary Fibre and Food Sources

The health benefits of soluble dietary fibre include:

- delaying the stomach's emptying and the transit of chyme (through the intestine
- delay glucose absorption
- lower blood cholesterol.

The health benefits of insoluble dietary fibre include:

1. speed up the transit of chyme through the intestine (whole grains)

increase fecal weight

2. slow starch breakdown and delay glucose absorption into the blood.

4.0 Conclusion

This unit has shown that dietary fibres are important nutrient but unrecognised in human diet. Four different definitions have been given. At this juncture, you should define your dietary fibres in your own words. The unit has expatiated between starch and dietary fibre. It has also classified dietary fibres. The functions or health benefits of dietary fibres have been illustrated under soluble and insoluble dietary fibres with specific examples of food sources.

5.0 Summary

This unit being part of the last one to end up knowledge of basic nutrition, has taken you through the meaning of dietary fibres, compositions, difference between starch and dietary fibre and health benefits of soluble and insoluble dietary fibres together with their food sources. It is hoped that you will make good use of this basic knowledge in Nutrition as you move to the next module.

6.0 Self-assessment exercise

1. Describe the differences between starch and dietary fibres.
2. Give specific examples of food sources of dietary fibres and their classification.
3. List three health benefits of dietary fibres.

7.0 References/Further Reading

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