

CHAPTER 10:

APPLY PRINCIPLES OF HUMAN NUTRITION

10.1 Introduction of the Unit of Learning / Unit of Competency

This unit specifies the competencies required to manage nutrition and dietetic services it includes: classifying different nutrients, demonstrate understanding of food metabolism, demonstrate understanding of the role of nutrition in disease occurrence and management, identifying factors that place client at nutritional risk and undertaking nutrition monitoring.

10.2 Performance Standard

By the end of this unit of learning/competency, the trainee should demonstrate ability to classify different nutrients and their metabolism based on nutritional composition and resource materials; relate the role of nutrition in disease occurrence and management as per nutritional standard requirement; provide dietary management in metabolic disorders in line with standard operating procedures (SOPs) and design systems that would help in nutrition monitoring a per SOPs and existing policies and guidelines.

10.3 Learning Outcomes

10.3.1 List of the Learning Outcomes

- i. Classify different nutrients
- ii. Demonstrate understanding of food metabolism
- iii. Understand role of nutrition in disease occurrence and management
- iv. Identify factors that place client at nutritional risk
- v. Undertake nutrition monitoring

10.3.2 Learning Outcome 1: Classify different nutrients

10.3.2.1 Learning Activities

Learning outcome	Specific instructions
i) Determine nutrient needs <ul style="list-style-type: none">Review factors that influence nutritional requirements	➤ Calculate individual nutrient requirements
ii) Assess macro and micro nutrients	➤ Distinguish between micronutrients and macronutrients ➤ Identify sources of micronutrients and macronutrients ➤ Calculate energy composition of the macronutrients
iii) Categorize types of Macro and micro nutrients Review <ul style="list-style-type: none">Types of macronutrientsTypes of micronutrients	➤ Apply knowledge of the macronutrients and micronutrients in meal planning ➤ Use macronutrients and micronutrients in diet therapy
iv) Determine concepts and basic principles of nutrition and dietetics as per nutritional standards	➤ Apply the basic principles of nutrition in meal planning for diet therapy
v) Determine energy levels of different foods as per client needs and standard nutritional requirement <ul style="list-style-type: none">Review factors that influence energy requirements	➤ Calculate energy levels of different foods ➤ Classify foods by energy composition

10.3.2.2 Information Sheet

Definitions

- Nutrition:** a process by which food and drink is taken, digested, absorbed, and used by the body for physical activity, growth, development, and health.
- Nutrients:** nourishing substances needed by the body for physical activity, growth, development, and health.
- Essential nutrients:** Nutrients that cannot be synthesized by the body and must be consumed through food.

4. **Macronutrients:** Nutrients that the body requires in large quantities and provide energy to the body. They are: Carbohydrates, fats, and proteins.
5. **Micronutrients:** nutrients needed by the body in very small amounts. They are: vitamins and minerals.
6. **Balanced or nutritious diet:** a combination of foods from different food groups that, when eaten, provides the energy and nutrients the body needs in the right amounts and quality to maintain health, growth, and development.
7. **Calorie:** a unit of energy yielded from food in the body

Essential Nutrients and their functions

The body must be provided with all nutrients to maintain the functions of the various systems. Nutrients perform key functions in the body, and failure to maintain a balance in their consumption leads to physiological problems, as seen in malnutrition.

Nutrients are categorized into:

- Carbohydrates (CHO)
- Fats (lipids)
- Proteins
- Vitamins
- Minerals
- Water

The six nutrients are further classified into organic and inorganic, depending on their chemical composition. Carbohydrates, fats (lipids), proteins and vitamins are organic nutrients because they contain carbon. The organic nutrients must be broken down before the body can be able to utilize them.

The minerals and water are classified as inorganic nutrients. They are easily utilized because they are consumed in their simplest form, except for water.

The essential Nutrients and their Functions

Organic Nutrients	Function
Carbohydrates	Provide energy
Fats	Provide energy
Proteins	Build and repair body tissues
	Provide energy
Vitamins	Regulate body processes
Inorganic Nutrients	Function
Minerals	Regulate body processes
Water	Regulate body processes

Macronutrients

These are nutrients which are required in large quantities in the body and they include carbohydrates, proteins and lipids

- **Carbohydrates**

These include starches, fibre, and sugars and are the primary source of energy in most diets, fuelling physical activity and basic body functions.

Grains/cereals (e.g., rice, millet, maize, sorghum, wheat), roots (cassava, potatoes), and starchy fruits and vegetables are rich in energy from carbohydrates. Whole grains contain the entire grain. They are richer in nutrients and fibre and a healthier choice than refined grains, which lose fibre, vitamins, and minerals in the milling process. Whole grains should be at least half of the grains consumed. Some refined grains are ‘enriched’ after being milled, to replace some lost nutrients, or ‘fortified’ to include additional nutrients. This does not replace lost fibre.

If purchasing refined grains, consumers should select ‘enriched’ and/ or ‘fortified’ grains. Although sweet foods such as sugar, jam, cakes, and drinks are a source of carbohydrates, they should be consumed minimally because they do not provide any other nutrients and may increase risk of overweight.

- **Fats (lipids)**

Fats are a concentrated source of energy. They also build body cells, support brain development of infants, help body processes, and facilitate the absorption and use of fat-soluble vitamins A, D, E, and K.

They are derived from both animal and plant sources.

Saturated fatty acids are solid at room temperature and include animal fats (butter, lard, tallow, ghee) and tropical oils (palm, coconut, palm kernel).

Trans fats are also solid at room temperature and include partially hydrogenated vegetable oils (margarine, shortening). Consumption of saturated fats and trans fats increases risk of heart disease. Unsaturated fatty acids are liquid at room temperature. These include monounsaturated and polyunsaturated fats and are found in vegetable oils such as sunflower, corn, soybean, canola, and olive oils. Replacing saturated fats with unsaturated fats lowers risk of heart disease.

- **Proteins**

These are body-building foods and are required for growth and development, maintenance and repair of tissues, production of enzymes, and formation of certain hormones.

Rich plant sources of protein include beans and lentils. Animal sources include meat, fish, poultry, dairy products, and eggs.

Micronutrients

These are required by the body in small quantities and they include vitamins and minerals.

a. Vitamins

There are two categories of vitamins:

- i. **Fat-soluble vitamins:** They are stored by the body and require dietary fat to be absorbed. They include vitamins A, D, E, and K. Fat-soluble vitamins are necessary for development and maintenance of body tissues and their functions, e.g., eyes (vitamin A), bones (vitamin D), muscles, blood clotting (vitamin K), protection of cells (vitamin E), synthesis of enzymes, and absorption of essential nutrients. Dietary sources of fat-soluble vitamins include:
 - **Vitamin A:** Sources include: red and orange fruits and vegetables (e.g., carrots, peppers, pumpkin, mango, papaya), dark green leafy vegetables (e.g., sukuma wiki), liver, fish, and fortified dairy products, margarine, and oils
 - **Vitamin D:** Sources include: fortified dairy products, oily fish. The body also synthesizes vitamin D through exposure to the sun
 - **Vitamin E:** Sources include: vegetable oils, nuts, and seeds
 - **Vitamin K:** Sources include: green leafy vegetables and vegetable oils
- ii. **Water-soluble vitamins:** They are not stored in the body and must be consumed regularly. They include vitamins C (ascorbic acid), B1 (thiamine), B2 (riboflavin), B3 (niacin), B6 (pyridoxine), and B12 (cobalamin), as well as pantothenic acid and folic acid. Their functions include releasing energy, supporting utilisation of macronutrients, and synthesizing red blood cells. Dietary sources of water-soluble vitamins include fruits, dark leafy vegetables, whole grains, meat, fish, poultry, and fortified cereals, specifically:
 - **Vitamin C:** citrus fruits, red pepper, and other plant sources
 - **Thiamine:** whole grains, legumes, liver, enriched flours
 - **Riboflavin:** liver, eggs, legumes, dark green vegetables, whole grains, enriched flours
 - **Niacin:** peanuts, whole grains, enriched flours, liver, fish, poultry
 - **Vitamin B6:** whole grains and cereals, legumes, dark leafy greens, pork, poultry, and beef
 - **Vitamin B-12:** animal-source foods such as liver, kidney, eggs, milk, fish
 - **Folic acid:** dark leafy greens, whole grains, meat, fish, legumes, citrus fruit

b. Minerals

They contribute to a variety of body processes, including growth, development, water balance, and neurological processes. Although minerals are present in many foods, they are more easily absorbed from some foods than from others. Essential minerals include the following:

- **Iron:** essential component of blood and helps transfer oxygen to various tissues. Dietary sources include red meat, fish, poultry (easily absorbed), legumes, leafy green vegetables (less easily absorbed, but absorption increases if eaten with animal-source iron or vitamin C).
- **Calcium:** a key component of bones and teeth and is needed for a strong skeleton. Dietary sources include dairy products (most easily absorbed) and leafy greens (not well absorbed).
- **Iodine:** important for thyroid function and for mental development of children. The most important dietary source is iodised salt.
- **Zinc:** enhances and strengthens the immune system, helps wounds heal, facilitates digestion, and is an important component of skeletal muscle. Dietary sources include beef, seafood, liver, nuts, beans, and whole grains.
- Other minerals include: chromium, copper, fluoride, magnesium, manganese, molybdenum, nickel, potassium, phosphorus, sodium, and selenium.

Water

Water plays an important role in many body functions such as circulation, digestion, absorption, excretion and other body processes. Our bodies lose water through urination, sweating and in the form of humidity in breathing.

For optimum body function, our bodies must maintain a balance between water intake and water loss. If water losses exceed water intake, one suffers from dehydration. Sources of water include water itself, fruits and vegetables, beverages etc.

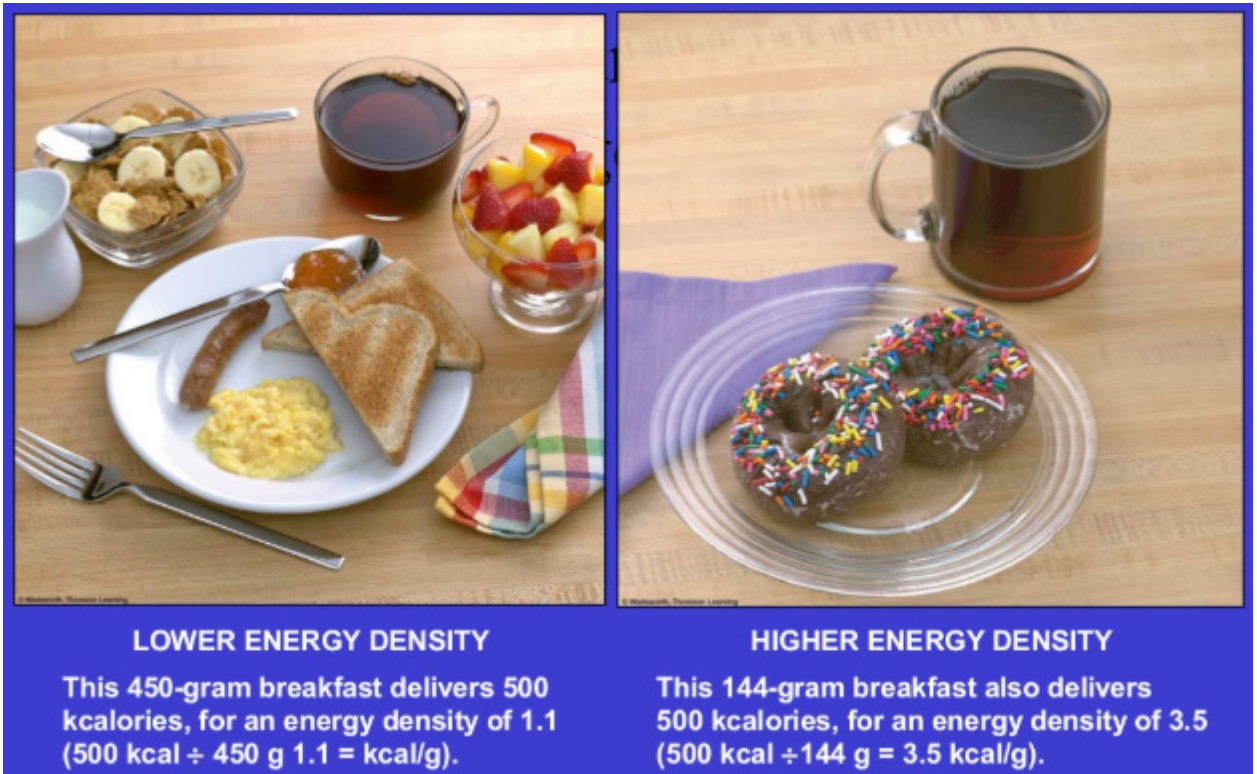
Energy measurement

Calorie is a unit of energy that food provides the body.

1 Kilo-calorie (Kcal) = 1000 calories

The energy value, also known as caloric density of a food is the amount of calories it contains. Foods vary in caloric density as follows:

Carbohydrates	4kcal/g
Protein	4kcal/g
Fat	9kcal/g



Energy Density of two Breakfast Options Compared

10.3.2.3 Self-Assessment

1. List the six classes of nutrients
2. Identify one function of the following nutrients:
 - A. Zinc
 - B. Vitamin C
 - C. Vitamin A
3. Indicate the amount of energy yielded from the following :
 - A. 50 g of protein
 - B. 300g of carbohydrate
 - C. 40g of fat
4. Which one of the following is not a macronutrient?
 - A. Fat
 - B. Zinc
 - C. Carbohydrates
 - D. Proteins

5. Which one of the following is a water soluble vitamin?
 - A. Vitamin K
 - B. Vitamin D
 - C. Vitamin C
 - D. Vitamin E
6. _____ is important for thyroid function
 - A. Calcium
 - B. Vitamin D
 - C. Iodine
 - D. Vitamin C
7. _____ are nutrients that cannot be synthesized by the body and must be consumed through food.
 - A. Micronutrients
 - B. Macronutrients
 - C. Supplements
 - D. Essential nutrients
8. The following are energy giving nutrients except
 - A. Protein
 - B. Fat
 - C. Vitamin D
 - D. Carbohydrates

10.3.2.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- Stationery
- WHO guidelines
- MOH
- Ministry of Education
- Skills lab
- Use of LCDs, video clips, charts and other teaching aids
- Invitation of competent expertise

- Computers with internet
- Library and resource centre

10.3.2.5 References

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10.3.3 Learning Outcome 2: Demonstrate understanding of food metabolism

10.3.3.1 Learning Activities

Learning outcome	Specific instructions
i) Describe Digestion in the GIT	<ul style="list-style-type: none">➤ Draw and label the GIT➤ Apply knowledge of digestion in disease management➤ Consider factors that affect digestion and absorption of the micronutrients and micronutrients
ii) Determine GIT sites of secretions and absorption	<ul style="list-style-type: none">➤ Educate on sites of secretions in the digestive system➤ Apply knowledge of secretion sites in disease management
iii) Explain factors affecting digestion, absorption and utilization.	<ul style="list-style-type: none">➤ Consider factors affecting digestion, absorption and utilization➤ Plan a diet for diseases that affect digestion, absorption and utilization
iv) Explain factors affecting bioavailability of macro and micro nutrients.	<ul style="list-style-type: none">➤ Enhance bioavailability of macro and micro nutrients
v) Assess factors that hinder metabolism <ul style="list-style-type: none">• Define metabolism• Review types of metabolic reactions	<ul style="list-style-type: none">➤ Enhance metabolism through diet

10.3.3.2 Information Sheet

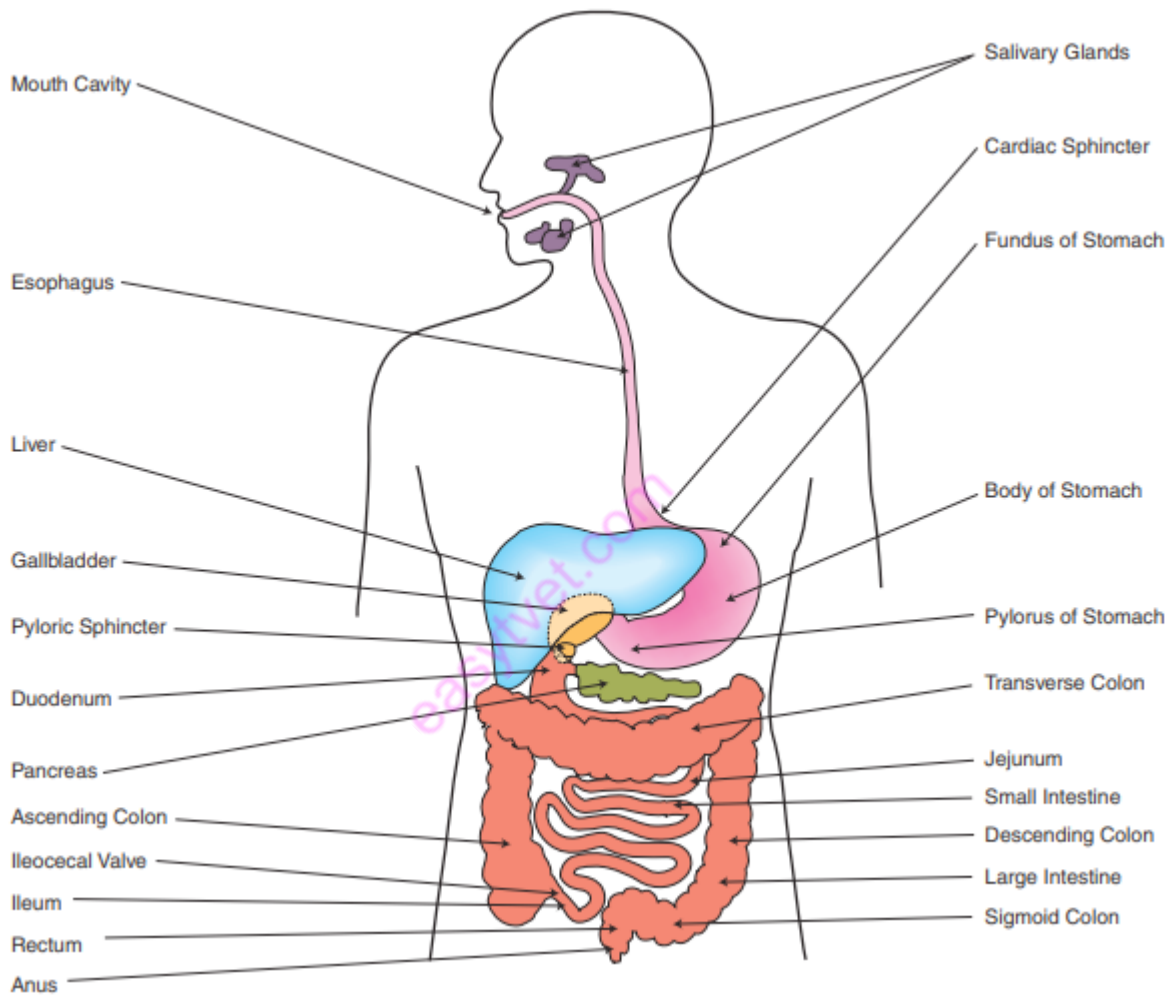
Definitions

- **Digestion:** the process whereby food is broken down into smaller parts, chemically changed, and moved through the gastrointestinal system
- **Absorption:** passage of nutrients into the blood or lymphatic system
- **Bioavailability:** refers to the proportion of a nutrient that is absorbed from the diet and used for normal body functions

- **Metabolism:** the sum total of chemical processes that occur in the body
- **Peristalsis:** a rhythmic contraction of the muscular walls of the tract.

Digestion

The gastrointestinal tract is a system that ingests digests, absorbs food and rids the body of waste matter in food. It is made up of several organs and structures which transform whole food into absorbable and useful substances. It starts in the mouth and ends at the anus.



The digestive system

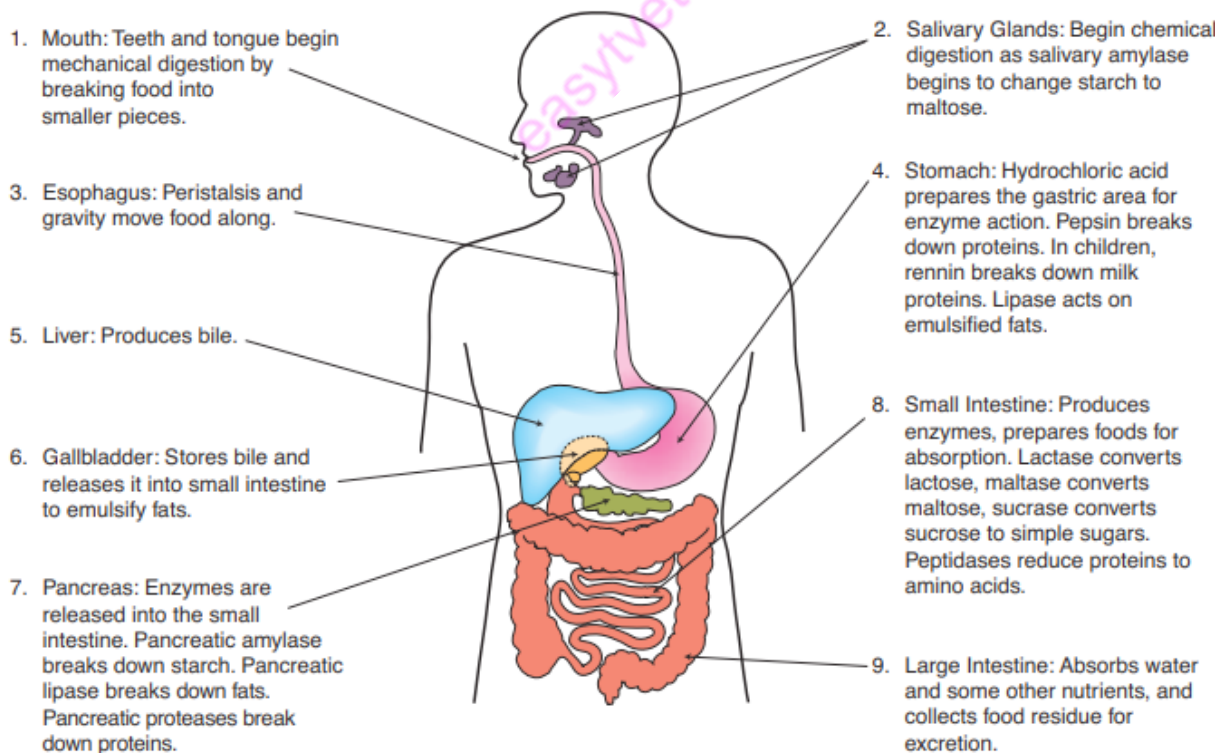
There are two types of action during digestion;

- Mechanical digestion: Food is mechanically broken down into smaller pieces by teeth and moved through the oesophagus through peristalsis.
- Chemical digestion: Chemical reactions involving digestive enzymes and water help break down food into absorbable molecules. Such enzymes include salivary enzymes, pancreatic enzymes, intestinal enzymes as well as gastric enzymes

Enzymes and foods acted upon

Source	Enzyme	Food Acted Upon
Mouth	Salivary amylase	Starch
Stomach	Pepsin	Proteins
	Rennin	Proteins in milk
	Gastric lipase	Emulsified fat
Small intestines	Pancreatic amylase	Starch
	Pancreatic proteases (trypsin, chymotrypsin, carboxypeptidases)	Proteins
	Pancreatic lipase (steapsin)	Fats
	Lactase	Lactose
	Maltase	Maltose
	Sucrase	Sucrose
	Peptidases	Proteins

Basic functions of the digestive system



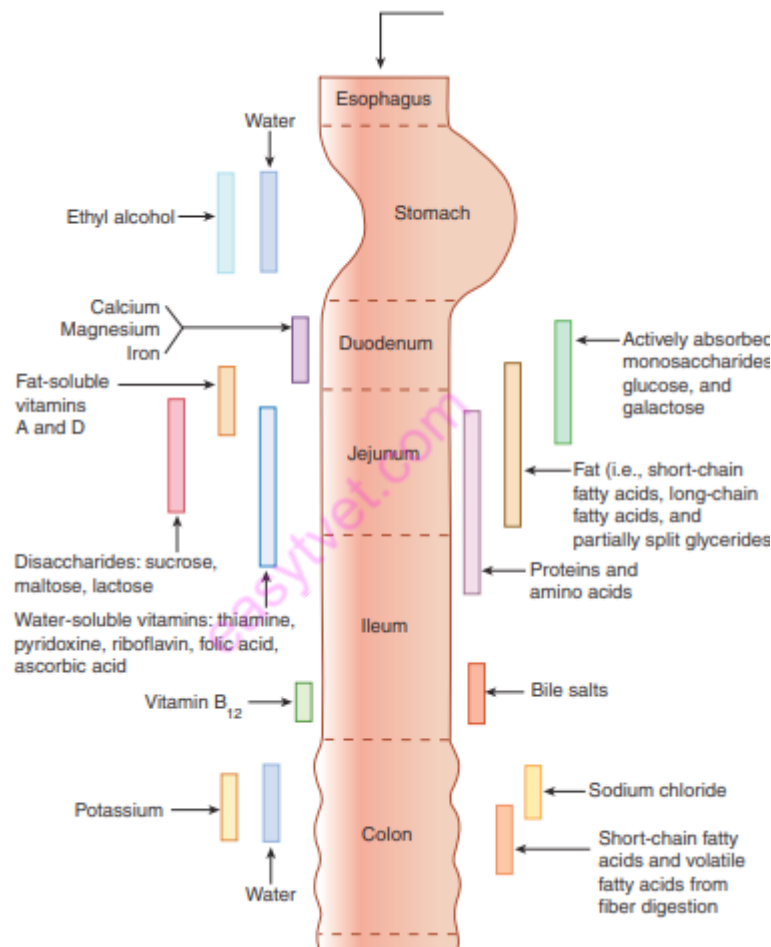
Basic Functions of the digestive system

Absorption

Absorption takes place when food has been broken down through a combination of mechanical and chemical digestion. The smaller molecules are then utilised for various purposes in the body. Carbohydrates are absorbed in the form of glucose, fructose and galactose, proteins are absorbed in the form of amino acids, while fats are absorbed as fatty acids and glycerol.

Absorption mainly takes place in the small intestines, although the mouth, the stomach and large intestines also play a significant role.

Nutrients are absorbed at different sites in the body as shown in the following figure.



Absorption sites in the GIT

Factors affecting digestion and absorption

- **Psychological influences:** The psychological status of an individual has a significant effect on the rate of digestion and absorption. For example, short term stress can lead to diarrhoea and stomach ache.
- **Chemical influences:** Types of food differ in physical and chemical properties and this determines the rate of reaction with digestive secretions and the rate of absorption too.

- **The stomach content:** The volume of a feed has a significant influence on the rate of digestion and absorption. Food consumed on an empty stomach has more contact with digestive enzymes and therefore the rate of digestion is higher than when one is fuller
- **Drugs:** Certain medications have a direct effect on the digestive system and therefore affect the rate of digestion and absorption. For example, antacid medication reduce acidity and therefore may lower the rate of absorption of calcium, magnesium and Vitamin B12. Diuretics may cause one to lose excess water and water soluble nutrients, which can put one at risk of deficiency.
- **Bacterial influences:** When harmful bacteria are allowed to populate the digestive tract, they may wreak havoc, leading to inflammation and peptic wounds. Bacteria may also produce excessive gas, causing bloating and abdominal discomfort.

Metabolism

Food that is absorbed enters the body cells, where it is processed to produce energy. This is metabolism. Some nutrients provide more energy than others, owing to their differences in chemical composition. Metabolism involves changes which either use or generate energy. These changes are categorised into:

Anabolic changes: These are reactions in which small molecules are used to create larger molecules. This process requires energy. Examples include; synthesis of glycogen, triglycerides and proteins.

Catabolic changes: These reactions involve the breakdown of complex compounds to yield simple ones. Catabolic reactions release energy. Examples of such reactions in the body include; breakdown of glycogen to yield glucose, breakdown of triglycerides and protein.

Metabolic reactions require enzymes and coenzymes to facilitate their action. Enzymes are protein compounds that facilitate chemical reactions in the body. Coenzymes on the other hand facilitate enzyme activity.

Factors Which Influence Metabolism Rate

- Body size
- Age
- Sex
- Climate
- Nature of the work
- Individual activity

Bioavailability of nutrients

Bioavailability is the rate at which a nutrient is absorbed and used by the body. Bioavailability determines the supply of nutrients in the body and thus has an important effect on individual nutritional status and health.

Nutrient bioavailability varies depending on various factors. Macronutrients generally have a high bioavailability, as high as more than 90%. Micronutrients on the other hand have a widely varying bioavailability.

Bioavailability of a nutrient may be influenced by the following factors in the metabolic pathway:

- How a nutrient is released from the physicochemical dietary matrix
- Effects of digestive enzymes in the digestive system
- Binding and uptake by the intestinal mucosa
- Movement across the gut wall to the blood or lymphatic circulation
- Systemic distribution
- Nutrient deposition or storage
- Metabolic and functional use
- Excretion in urine and faecal matter

How Inhibitors Reduce Bioavailability

- a. Binding the nutrient: The nutrient changes its form and thus is not recognised by the uptake systems in the intestinal cells
- b. The inhibitor may render the nutrient insoluble and therefore unavailable for absorption
- c. Competing for the same uptake system. For example, pulses, whole grains, nuts and seeds are high in phytic acid which bind minerals such as zinc and calcium, making them unavailable for absorption

Calcium interferes with the absorption of non-heme iron by blocking the surface of absorptive cells in the intestines, therefore reducing bioavailability

10.3.3.3 Self-Assessment

1. Define digestion
2. Identify one function of the following parts of the digestive system:
 - a. Gall bladder
 - b. Pancreas
3. Discuss the factors that influence digestion and absorption

4. Match the following enzymes with the organ that produces them

ENZYME	SOURCE
1. Salivary amylase	
2. Pepsin	
3. Rennin	
4. Gastric lipase	
5. Pancreatic amylase	
6. Pancreatic proteases	
7. Pancreatic lipase	
8. Lactase	
9. Maltase	
10. Sucrase	
11. Peptidases	

10.3.3.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- WHO guidelines
- MOH
- Ministry of Education
- Skills lab
- Use of LCDs, video clips, charts and other teaching aids
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

10.3.3.5 References

1. Sullivan, R. J., & Cooley, D. A. (2009). Nutrition and major nutrients. In *Digestion and Nutrition* (1st ed., pp. 33-75). New York, NY: Infobase Publishing.
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10.3.4 Learning Outcome 3: Understand role of nutrition in disease occurrence and management

10.3.4.1 Learning Activities

Learning Outcome	Specific instructions
i. Assess Prevalence of nutrition implications in disease occurrence	<ul style="list-style-type: none"> Consider the relationship between malnutrition and disease Identify common micro and macronutrient deficiencies.
ii. Evaluate client's nutrition assessment <ul style="list-style-type: none"> a. Review types of nutrition assessment 	<ul style="list-style-type: none"> Conduct nutrition assessment on client
iii. Determine dietary management in metabolic disorders and malnutrition <ul style="list-style-type: none"> a. Review types of metabolic disorders 	<ul style="list-style-type: none"> Guide clients on appropriate amount of nutrients to consume depending on their nutrition needs
iv. Explore Nutritional support <ul style="list-style-type: none"> a. Review types of nutritional support 	<ul style="list-style-type: none"> Provide nutritional support as per client requirement Choose appropriate nutritional support as per client requirements Justify choice of nutritional support for client

10.3.4.2 Information Sheet

Definitions

Malnutrition: A physiological condition that results from deficiency, excess or imbalance of nutrient intake

Nutritional status: The state of health of an individual as influenced by food intake

Nutrition Assessment: An evaluation of objective and subjective data to establish a person's nutritional status. The outcomes of an assessment lead to a plan for nutritional care to maintain and improve health status.

Types of Nutrition Assessment

- **Anthropometric assessment:** Measures the body's physical dimensions such as weight, height, Mid Upper Arm Circumference (MUAC), head circumference, waist circumference. These measurements are affected by nutrient intake and utilization and are a pointer to nutritional status.
- **Biochemical or laboratory assessment:** This method analyzes nutrient metabolites in blood, urine, feces and a variety of other components in blood and other tissues.

These components are an indicator of nutritional status. Examples include serum tests for lipids, albumin, hemoglobin level, urine test for sugar, blood; stool examination for intestinal parasites.

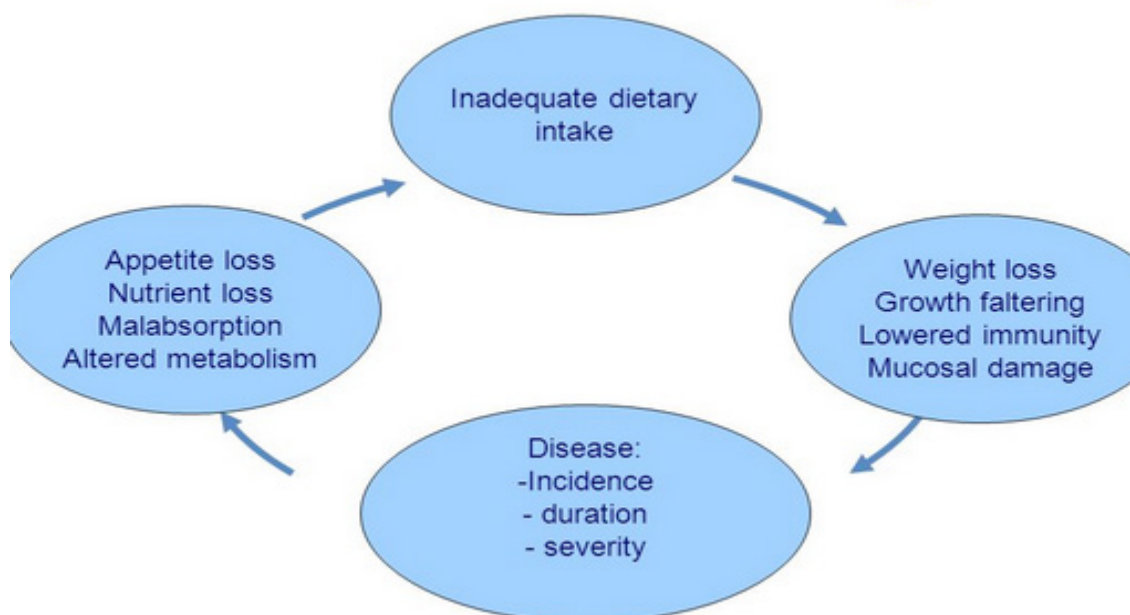
- **Clinical assessment:** This method includes reviewing the medical history and conducting a physical examination to detect signs and symptoms of malnutrition. Observations made include enlargement of salivary glands, loss of tooth enamel, loss of subcutaneous fat,
- **Dietary assessment:** This is dietary intake data which is used in conjunction with anthropometric, biochemical and clinical data to determine client nutritional status. There are various techniques of measuring diet. They are:
 - o 24 hours dietary recall
 - o Food frequency questionnaire
 - o Dietary history
 - o Food diary /record
 - o Food balance sheets

Malnutrition and Disease

Malnutrition increases susceptibility to infection. Infection on the other hand contributes to malnutrition. Dietary inadequacy leads to weight loss, impaired immunity, mucosal damage, pathogenic invasion and interferes with growth and development in children.

Disease worsens malnutrition through reduced nutrient intake, increased requirement and nutrient loss through vomiting and diarrhea. These complications further impair the body's defense mechanism and the vicious cycle of malnutrition and infection continues

Malnutrition and Infection Cycle



Malnutrition and Infection Cycle

Common Nutritional Deficiencies

Macronutrient Deficiencies:

1. Carbohydrates

Carbohydrates are the body's main energy source. They are broken down into their simple form, the monosaccharides. Functions of carbohydrates include:

- Source of energy
- Necessary for utilization of other nutrients
- Sugar enhances flavor of food as an additive
- Fibre provides bulk in diet

Deficiency of carbohydrates causes:

- Use of fat and protein as fuel source leading to weight loss
- Marasmus
- Mood swings
- Ketosis

2. Proteins

The building blocks of proteins are amino acids. Proteins are needed for the following functions:

Growth and development

- Repair and maintenance of body tissues
- Maintaining
- Synthesis of body compounds such as hormones, antibodies, enzymes
- Used for energy supply in the absence of carbohydrates and fats

The RDA for proteins is 0.8g/kg body weight. Individual protein requirement is determined by various factors such as age, physiological status, disease e.t.c

Consequences of Protein Deficiency

- Kwashiokor
- Poor growth and development in children
- Low birth weight
- Still birth
- Wasting/loss of weight
- Anaemia
- Susceptibility to infection
- Fluid imbalance

- Premature birth
- Mental deficiency

3. Fats

Fats are broken down into fatty acids and glycerol, which are then utilized for various purposes in the body. When consumed in excess, fat can cause cardiovascular diseases such as heart attack, stroke, atherosclerosis heart failure e.t..c

Functions of fat include:

- Provide a concentrated source of energy
- Form the structures of cell membranes(phospholipids)
- An insulator; helps regulate body temperature
- Protects the vital body organs e.g. kidney, liver and the heart.
- Essential for absorption of fat soluble vitamins
- Cholesterol is essential for synthesis of bile, hormones & Vitamin D.

Consequences of fat /lipid deficiency

- Deficiency in fat-soluble vitamins
- Cognitive deficiency in children
- Poor vision

4. Water

Water is considered a macronutrient because it is required in considerably high amounts, although it does not contribute to energy.

Functions of water include:

- It is an essential component of body fluids e.g blood and lymph
- Moisture is necessary for the normal functioning of every organ in the body.
- Water is the universal medium in which the various chemical changes of the body take place.
- As a carrier, water aids in digestion, absorption, circulation and excretion.
- Waste products are transported in the blood in watery solution and eliminated by the kidneys.
- Maintains blood volume
- It is essential in the regulation of body temperature.
- Lubrication of joints and viscera in the abdominal cavity

Insufficient water intake leads to dehydration, which can lead to death. Dehydration occurs

when water loss exceeds water intake. Signs of dehydration:

- Thirst
- Loss of appetite
- Decreased blood volume
- Decreased urination
- Impaired physical performance
- Impaired temperature regulation
- Muscle spasms(involuntary contraction)
- Increased pulse and increased respiration
- Rate
- End in death if not corrected.

Micronutrient Deficiency

Vitamins

Vitamin	Consequences of deficiency
Fat-soluble vitamins	
Vitamin A	<ul style="list-style-type: none"> - Keratomalacia - Night blindness
Vitamin D	<ul style="list-style-type: none"> - Rickets - Osteomalacia
Vitamin E	
Vitamin K	<ul style="list-style-type: none"> - Hemorrhage
Water-soluble vitamins	
Vitamin C	<ul style="list-style-type: none"> - Scurvy
Vitamin B1	<ul style="list-style-type: none"> - Beriberi
Vitamin B2	<ul style="list-style-type: none"> - Ariboflavinosis
Vitamin B3	<ul style="list-style-type: none"> - Pellagra
Vitamin B5	<ul style="list-style-type: none"> - Digestive and neurological disturbances
Vitamin B6	<ul style="list-style-type: none"> - Anemia, Smooth tongue, - Central nervous system disturbances
Vitamin B7	<ul style="list-style-type: none"> - Skin rash - Hair loss - Neurological disturbances
Vitamin B9	<ul style="list-style-type: none"> - Anaemia - Neurological disturbances - Birth defects in newborns

Vitamin B12	<ul style="list-style-type: none"> - Anaemia - Nerve damage and paralysis
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10.3.4.3 Self-Assessment

1. Discuss types of nutrition assessment
2. Outline the functions of water
3. Identify five signs and symptoms of dehydration
4. Which one of the following is not an anthropometric assessment?
 - A. Weight
 - B. Height
 - C. Oedema
 - D. Mid Upper Arm Circumference (MUAC)
5. The following are types of dietary assessment except:
 - A. Food frequency questionnaire
 - B. Dietary history
 - C. Food balance sheets
 - D. Food security assessment
6. Which one of the following is caused by protein deficiency ?
 - A. Deficiency in fat-soluble vitamins
 - B. Mood swings
 - C. Ketosis
 - D. Kwashiokor
7. Deficiency in Vitamin D causes
 - A. Scurvy
 - B. Marasmus
 - C. Rickets
 - D. Night blindness
8. Which one of the following is not part of clinical assessment?
 - A. Enlargement of salivary glands
 - B. Head circumference
 - C. Loss of tooth enamel
 - D. Loss of subcutaneous fat

10.3.4.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- WHO guidelines
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- Ministry of Education
- Skills lab
- Use of LCDs, video clips, charts and other teaching aids
- Invitation of competent expertise
- Computers with internet
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10.3.4.5 References

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<https://www.msmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>

10.3.5 Learning outcome 4: Identify factors that place client at nutritional risk

10.3.5.1 Learning Activities

Learning activity	Specific instructions
i) Report problems which may affect the client's ability to eat or drink to the dietitian and/or other relevant health professional <ul style="list-style-type: none">Review nutrition related complications	<ul style="list-style-type: none">Identify nutrition related problems experienced by clientsDocument nutrition related problems experienced by clientsManage problems which may affect client's ability to eat or drink
ii) Document and report client food intake	<ul style="list-style-type: none">Carry out nutritional screeningRecord client's food intakeAddress emerging issues that affect food intake
iii) Provide feedback about changes to nutrition support requirements to catering/food services	<ul style="list-style-type: none">Collaborate with the interdisciplinary healthcare team
iv) Inform client of the dietary recommendation	<ul style="list-style-type: none">Establish rapport with clientEducate client on their individual dietary needsJustify the need for dietary modification

10.3.5.1 Information Sheet

Definitions

Nutrition screening: a process used to identify nutritional problems and risk factors

Nutrition status: a measurement of the extent to which an individual's physiologic need for nutrients is being met

Nutrition risk can be assessed in populations by evaluating such factors as food intake, income, functional status, socialization, acute and chronic illness, and use of medications. This is because these factors pose a great risk to the nutritional status of individuals.

An individual's nutrition status reflects the degree to which physiologic needs for nutrients are being met. Nutrient intake depends on actual food consumption, which is influenced by factors such as economic situation, eating behavior, emotional climate, cultural influences,

effects of various disease states on appetite, and the ability to consume and absorb adequate nutrients.

There are several factors that influence nutrient intake including physiologic stressors such as:

- Infection
- Acute or chronic disease processes,
- Fever, or trauma;
- Body maintenance and well-being;
- Normal anabolic states of growth such as pregnancy or rehabilitation;
- Psychological stress.

Persons at nutritional risk can be identified on the basis of screening information that is routinely obtained at the time of admission to a hospital or nursing home or after returning to home-based care. Information obtained in the nutrition assessment is used to design an individual nutrition care plan.

Nutrition risk factors

Category	Factors
Food and nutrient intake patterns	<ul style="list-style-type: none"> - Calorie and protein intake greater or less than that required for age and activity level - Vitamin and mineral intake greater or less than that required for age - Swallowing difficulties - Gastrointestinal disturbances - Unusual food habits (e.g., pica) - Impaired cognitive function or depression - Nothing by mouth for more than 3 days - Inability or unwillingness to consume food - Increase or decrease in activities of daily living - Misuse of supplements - Inadequate transitional feeding, tube feeding or parenteral nutrition, or both - Bowel irregularity (e.g., constipation, diarrhea) - Restricted diet - Feeding limitations

Psychological and social factors	<ul style="list-style-type: none"> - Language barriers - Cultural or religious factors - Emotional disturbances associated with feeding difficulties (e.g., depression) - Limited resources for food preparation or obtaining food and supplies - Alcohol or drug addiction - Limited or low income - Lack of or inability to communicate needs - Limited use or understanding of community resources
Physical conditions	<p>Extreme age: adults older than 80 years, premature infants, very young children</p> <p>Pregnancy: adolescent, closely spaced, or three or more pregnancies</p>

Nutrition screening precedes the nutrition care process. The purpose of a nutrition screen is to quickly identify individuals who are malnourished or at nutritional risk and determine whether a more detailed assessment is warranted. Regardless of the information gathered, the goal of screening is to identify individuals who are at nutritional risk, those likely to become at nutritional risk, and those who are likely to get into nutritional risk.

Nutrition in Collaboration with Other Disciplines in Healthcare

A nutritionist must be able to work with members of the medical care team for effective delivery of services. Collaboration ensures effective teamwork and eases communication between professionals. The different professions learn with, from and about each other with the objective of improving quality of care.

Inter-professional Roles of a Nutritionist:

- Directly communicates with the healthcare team about the patient's health status
- Share knowledge with other members of the health team
- Keeps in touch with the current scientific advancements in the field of medicine and nutrition; should therefore attend conferences, seminars and other related meetings.
- Work as policy makers to improve guidelines.

10.3.5.3 Self-Assessment

1. Outline factors that influence food choice
2. Outline the inter-professional roles of a nutritionist
3. Categorise the following risk factors as *Food and nutrient intake factors, psychological and social factors or physical conditions*
 - a. Nothing by mouth for more than 3 days
 - b. Inability or unwillingness to consume food
 - c. Limited resources for food preparation or obtaining food and supplies
 - d. Alcohol or drug addiction
 - e. Extreme age: adults older than 80 years, premature infants, very young children
 - f. Pregnancy
 - g. Adolescent
 - h. Closely spaced, or three or more pregnancies
 - i. Increase or decrease in activities of daily living
 - j. Misuse of supplements
 - k. Inadequate transitional feeding, tube feeding or parenteral nutrition, or both
 - l. Limited or low income
 - m. Lack of or inability to communicate needs

10.3.5.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- WHO guidelines
- MOH
- Ministry of Education
- Skills lab
- Use of LCDs, video clips, charts and other teaching aids
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

10.3.5.5 References

- Bloch, A. S. (2007). *Issues and Choices in Clinical Nutrition Practice*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Mahan, L.K., & Escott-Stump, S. (2008). *Krause's Food & Nutrition Therapy* (12th ed.). Philadelphia: Saunders.
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10.3.6 Learning Outcome 5: Undertake nutrition monitoring

10.3.6.1 Learning Activities

Learning outcome	Specific activity
I. Identify the nutrition status of clients a. Review types of nutrition assessment	<ul style="list-style-type: none">• Carry out anthropometric assessment to determine nutritional status• Interpret biochemical outcomes• Conduct clinical assessment• Conduct dietary assessment
II. Follow Systems designed by a dietitian to monitor client nutritional status	<ul style="list-style-type: none">• Conduct follow up on client• Record client progress
III. Evaluate progress of client nutritional status that is reported to the dietitian, and/or other health professional	<ul style="list-style-type: none">• Compare client nutritional status and goals of nutrition care• Record client progress• Identify discrepancies from the ideal

10.3.6.2 Information Sheet

Definitions

- **Monitoring:** an ongoing review of nutrition intervention outcomes to assess the process of achievement of the goals set at planning. It assesses progress by measuring pre-determined indicators.
- **Evaluation:** Evaluation is the systematic process of assessing the relevance, effectiveness, efficiency and impact of a nutrition intervention against set goals. The outcome helps to make the decision to discharge the client or to modify the care plan.

Types of Monitoring;

- **Process monitoring:** Assesses the 'how' of nutrition intervention. It queries the flow of activities towards the set goals while noting discrepancies
- **Impact monitoring:** assesses the impact of the nutrition intervention. Impact monitoring focuses on changes such as behaviour change and change in nutrition indicators of interest.

Importance of Monitoring in Nutrition Care

- Helps in decision making on the continued interventions
- To determine programme strengths and weaknesses
- To assess resource utilization
- Used to measure programme outcomes
- To review strategies
- To observe the trends of the programme
- It helps the nutritionist to improve their effectiveness and efficiency in addressing nutrition problems

Types of Evaluation:

- **Context evaluation:** Context evaluation is concerned with the assessment of existing information of the funding agency, the target group and the general programme environment.
- **Formative evaluation:** This is the day to day running of the programme towards acquisition of short term objectives therefore assess programme input, output or services and the general events in the programme environment
- **Impact evaluation:** Determine the ultimate effect on the beneficiaries in the long term. It is concerned with ultimate programme indicators.

Importance of Evaluation:

- Provide useful information for other ongoing or future interventions
- To provide useful information to the interdisciplinary medical care team
- To determine whether the intervention was successful or not

10.3.6.3 Self-Assessment

1. Discuss the two types of monitoring
2. Outline the importance of monitoring
3. Outline the importance of evaluation
4. _____ is an ongoing review of nutrition intervention outcomes to assess the process of achievement of the goals set at planning. It assesses progress by measuring pre-determined indicators.
 - A. Monitoring
 - B. Evaluation
 - C. Assessment
 - D. Situation analysis

5. Indicate whether the following statements are true or false about evaluation:
- A. Context evaluation is concerned with the assessment of existing information of the funding agency, the target group and the general programme environment.
 - B. Formative evaluation determines the ultimate effect on the beneficiaries in the long term. It is concerned with ultimate programme indicators.
 - C. Impact evaluation examines the day to day running of the programme towards acquisition of short term objectives therefore assess programme input, output or services and the general events in the programme environment

10.3.6.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- WHO guidelines
- MOH
- Ministry of Education
- Skills lab
- Use of LCDs, video clips, charts and other teaching aids
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

10.3.6.5 References

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