

## UNIT ONE: General Nutrition

### Learning objectives

At the end of this unit, students will be able to:

- Define Food, Nutrition, Diet and Malnutrition
- Understand best practices and harmful traditions, which affect nutrition
- Explain the dietary guidelines
- Outline the important causes of malnutrition

### Introduction

Many children do not get enough of the right food to eat. They do not grow well, they become ill, many die or they do not grow up as clever, as healthy.

Causes and consequences of poor nutrition are better understood now, and so are the ways to prevent and manage it. Low food intake and infections are the immediate causes of malnutrition. **The underlying causes** are insufficient household food security, inadequate childcare and insufficient basic health services in the community. It includes poor living conditions, lack of education, heavy physical work, and frequent childbearing. **And the basic causes** are economic and political structure. The mortality among preschool children is extremely high in developing countries in general. Micronutrient deficiencies such as vitamin A, iodine and iron are the most prevalent and it affects mothers and children at large.

### Definitions

**Food:** is defined as any solid or liquid which when ingested will enable the body to carry out any of its life function.

Most foods are made up of several simple substances, which we call nutrients. There are six nutrients each of which has specific function in the body. Those that supply energy are the carbohydrates and fats. Those responsible for growth and repair of tissues cells are proteins. Those, which regulate chemical process in the body, are the vitamins and minerals. Water is present in most foods and is an indispensable component of our bodies. It is the means of transportation for most nutrients and is needed for all cellular activities.

**Nutrition:** is the sum total of the process by which living things receive and utilize the necessary materials for survival, growth and maintenance of worn-out tissues.

**Malnutrition:** is the condition that results from an imbalance between dietary intake and requirements. It includes under nutrition, which results from less food intake and hard physical work and over nutrition results from excess food intake and less physical activities.

**Diet:** is defined as food containing all the nutrients in a sufficient amount and in proper ratio.

**Roughage:** is defined as food fibers which enable the body to get rid of waste products, which would otherwise become poisonous to the body. It prevents gastrointestinal disorders (gastritis, appendicitis, gallbladder stone and constipation) and metabolic disorders (diabetes mellitus, hypertension, ischemic heart disease and colon cancer).

### **Dietary guidelines**

- Eat a wide variety of foods
- Maintain healthy weight
- Choose a diet low in fat, saturated fat, and cholesterol
- Choose a diet with plenty of vegetable, fruits and grain products
- Use sugar in moderation
- Use salt and sodium in moderation
- If you drink alcoholic beverage, do so in moderation.

### **Food groups**

- Milk, cheese, yoghurt
- Meat, poultry, fish and alternates
- Fruits and vegetables
- Bread and cereals
- Fats, sweets and alcohols

### **Why human beings need food?**

Human beings need food to provide energy for the essential physiological functions like:

- Respiration
- Circulation
- Digestion
- Metabolism
- Maintaining body temperature
- Growth and repair body Tissues

An adequate supply of nutrients is needed to maintain all the functions of the body and daily activities at maximum efficiency, thus ensuring healthy living. Health and nutrition are closely linked and to ensure proper development and life quality they must be adequate from early childhood on and most vulnerable groups are infants, young children, pregnant women and lactating mothers.

### **Diets in public health practice**

- Resettlement areas,
- HIV/AIDS patients,
- Displaced compatriots due to natural and man-made disasters.

It is important to make sure that any recommended ration scale is compared with acceptable standards and that its use is not likely to cause deficiency disease.

### **Major causes of malnutrition**

- Lack of knowledge in selecting foodstuff with high nutritive value
- Poverty and infectious diseases
- Drought
- Uneven distribution of the available foods
- Social arrest and civil conflicts,
- Transport problems (inaccessibility)
- Increased populations
- Inadequate weaning
- Farming technique-insufficient
- Poor management of resources
- Topographical differences in different regions (variation in productivity)
- Loss of food through destruction by insects
- Exploited land due to planting the same type of food crop for many years, erosion because of overgrazing and moreover the farmers could not use the fertilizers due to many reasons.

### **Harmful traditional practices with regard to nutrition**

1. During period of fasting important nutrients are not eaten, such as milk, eggs, butter, meat, fish, meal pattern, etc.
2. Cultural reasons
3. Lack of sun light (lack of Vitamin D)
4. Discrimination in feeding among family members, adults before children, males over females
5. Practising heavy meals once, may be twice a day
6. Delay to start complementary food
7. Refusing to give the child meat for fear of infection
8. Feeding children with diluted milk
9. Feed children with left over and may be contaminated food

### **Best practices which favor nutrition**

1. Breast feeding

2. Mixing of foods which prepared from (Cereals /Legumes /Vegetable)
3. Traditional use of dark green leaves
4. Additional high calories and protein diet for pregnant and lactating mothers
5. After the 7th day of delivery, the mother and the child warm in the sun every morning
6. Special care for children, lactating mothers and elders
7. Eating various fruits
8. Drinking milk
9. Honey mixed with butter in the morning
10. Good hospitality and sociability

Good nutrition must meet the needs of varying ages and activities and always with individual differences.

### **The planning of food to meet especial needs begins with**

- Pregnant women
- Nursing mothers
- Infants
- Adolescents and
- Adults

### **A well-nourished individual**

- Is alert mentally and physically fit
- Has optimistic outlook on life
- Has good resistance to infection
- Shows numerous other signs of good health such as an increased life span

### **The energy requirements of individuals depend on**

- Physical activities
- Body size and composition
- Age may affect requirements in two main ways
  - During childhood, the infant needs more energy because it is growing
  - During old age, the energy need is less because aged people are engaged with activities that requires less energy.
- Climate: both very cold and very hot climate restricts outdoor activities.

### **Daily calorie requirements of individuals**

- Infants 1 - 3 years need 1,000 cal/day
- Children 5 years need 1,500 cal/day
- Children 5 – 8 years need 1,800 cal/day

- Children 10 – 12 years need 2,000 cal/day
- For adolescents and adult's calorie requirements depend on the degree of physical activities

	Office worker	Heavy work	Very heavy work
From 13 – 20 years	2,800 cal/ day	3,500 cal/day	up to 4,000 cal/day
Adults	2,300-cal/day	2,700 cal/day	

- For pregnant woman, the daily figure must be increased by 150 calories for the first trimester and 350 for the second and third trimester. For the nursing mother the daily figure must be increased by 800 calories.

### Discussion questions

1. Define food, nutrition, diet and malnutrition
2. Explain the dietary guidelines
3. Why human beings need food? Discuss
4. Mention the fundamental causes of malnutrition
7. Discuss the traditions that favor the nutrition condition
8. Explain traditions that could be harmful to nutritional status.

## UNIT TWO Carbohydrates

### Learning objectives

At the end of this unit, the students will be able to:

- Mention the sources of carbohydrate
- Understand the different types of sugars
- Explain the digestion, absorption and metabolism of carbohydrates
- Describe the hormone responsible for metabolism

### Function of carbohydrates

- Carbohydrates provide fuel for the body in the form of glucose. Glucose is a sugar that is the primary source of energy for all of the body's cells. Adults should get about 45% of their calories from carbohydrates. (4 calories/ 1 g carb)
- Carbohydrates are components of body substances needed for the regulation of body processes. Heparin, which prevents blood from clotting, contains carbohydrate.
- Nervous tissue, connective tissue, various hormones, and enzymes also contain carbohydrate.
- Ribose, another carbohydrate is part of Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), the substance that carry the hereditary factors in the cell.
- Carbohydrate is also a component of a compound in the liver that destroys toxic substances.

- Carbohydrates are necessary for the proper use of fats. If carbohydrate intake is low, larger than normal amounts of fats are called on to supply energy. The body is unable to handle the excessive breakdown of fat. As a result, the fat does not burn completely, and abnormal amounts of certain breakdown products accumulate in the blood, causing a condition known as ketosis.

## Types of carbohydrates

### 1- Monosaccharides:

A monosaccharide is the basic dietary carbohydrate and has six carbons. Examples are:

- **Glucose:** Glucose is the sugar in blood.
- **Fructose:** Fructose is twice as sweet as glucose and found in fruits.
- **Galactose:** Galactose is less sweet than glucose and present in milk.
- **Mannose**

### 2- Disaccharides: Dietary Disaccharides form when two monosaccharides join together.

- **Sucrose** from **glucose + fructose** (present taste sugar)
- **Lactose** from **glucose + galactose** (presents in milk)
- **Maltose** from **glucose + glucose** (presents in starch)

### 3- Polysaccharides:

- **Starch:** is one form of carbohydrate that is stored in granules in the roots and seeds of plants.
- **Glycogen:** is the animal equivalent of starch present in the liver and muscle. The glycogen in the liver is a reserve fuel and it serves between meals and overnight. The breakdown of glycogen in the liver is facilitated by the hormone glucagon.

## Notes

- **Sugar alcohol:** is found in nature and also prepared commercially. Mannitol and dulcitol are alcohol derived from **mannose and galactose**. Both have a variety of uses in medicine and food manufacture.
- **Cellulose:** is one of several indigestible carbohydrates called fibre.
- **Honey:** is a mixture of **glucose and fructose**. It is a balanced diet as it contains all the nutrients in sufficient amount and proper ratio. Honey has also medicinal effect. The bees first cover the beehive with antibiotics to prevent the growth and multiplications of micro-organisms. If you keep honey for a long time, it will not be spoiled because of antibiotics.

**Table. 1. Carbohydrate content of some food**

Food	Carbohydrate
Sugar	100%

White Flour	80%
Honey	76%
Biscuit, semi-sweet	75%
Jam	69%
Chocolate, milk	59%
White bread	50%
Potatoes	21%
Apple	12%
Peas	11%
Carrots	5.4%
Milk	4.7%

### Digestion and absorption of carbohydrates

The digestion of carbohydrates begins in the mouth by amylase produced by the salivary glands. No carbohydrate digestion takes place in the stomach. Digestion occurs mainly in the small intestine through the action of pancreatic and intestinal juices:

The pancreatic amylase converts starch to maltose, while the intestinal enzymes convert sucrose, lactose and maltose:

Sucrose to glucose + fructose

Lactose to glucose + galactose

maltose to glucose

- In Health and with normal diet, the available carbohydrate is digested and absorbed completely in the small intestine. If an excess of unabsorbed carbohydrate arises due to a disorder of the absorption mechanisms or occasionally to excessive intake, the osmotic pressure leads to retention of fluids in the lumen and as the result there will be diarrhea.

- The tissues use as fuel a mixture of glucose and fatty acids. But the brain normally uses only glucose and requires around 80g daily.

- In starvation glucose may be provided by gluconeogenesis from the amino acids in tissues proteins, mainly from muscle proteins, but fats cannot be converted into glucose. With prolonged starvation the brain adapts and can then utilize fatty acids and ketone.

**The two hormones, which control the metabolisms of carbohydrates, are insulin and glucagon:**

1- **Insulin:** is secreted by the beta cells of the islets of Langerhans and the secretion is stimulated by:

- Hyperglycaemia
- Parasympathetic nervous activity

#### Function of insulin

- To facilitate glucose transport to the liver and muscle cells
- To facilitate formation of glycogen in the liver and muscle cells
- To incorporate formation of protein from the amino acids.

2- **Glucagon:** is secreted by the alpha cells of the islets of Langerhans and the secretion is stimulated by:

- Hypoglycaemia
- Sympathetic nervous activity

#### Function of glucagon

- To facilitate the breakdown of glycogen in the liver and muscle cells into glucose

#### Discussion questions

1. What are carbohydrates and their importance?
2. What are the sources of carbohydrates?
3. Discuss the digestion and absorption of carbohydrates.

### UNIT THREE Proteins

#### Learning objectives

At the end of this unit, students will be able to:

- Understand the importance of proteins
- Describe the digestion and absorption
- Understand the signs and symptoms of protein energy malnutrition
- Explain criteria for referral of PEM cases to the nearest health facility.

Proteins are chemically composed of hydrogen, carbon, oxygen and nitrogen, which distinguishes them from fats and carbohydrates, so they are called nitrogenous compounds. Amino acids constitute the basic structure of the synthesis of proteins, as the association of several amino acids gives a protein substance.

The human body needs 22 amino acids, 13 of which can be synthesized by itself, while there are 9 amino acids that cannot be synthesized, called essential amino acids that must be received with food.

## Function of Proteins

- Proteins are nutrients that are the most important function is their role in the growth and repair of body tissue such as the skin, the internal organs, and muscle.
- They are also the major components of our immune system, enzymes and hormones.
- They serve as a source of energy (4 calories / 1 g protein).

## Types of proteins

Proteins in natural foods differ widely in the number and the proportion of the 22 or more amino acids.

- 1- **Complete Proteins:** protein from animal sources meats, fish, chicken, eggs, milk and milk products contain all 9 essential amino acids and provide good quality proteins. A good quality or a complete protein is the one that supplies all the 9 essential amino acids in sufficient quantities and in proper ratio for normal growth and maintenance.
- 2- **Incomplete Proteins:** protein from plant sources such as beans lack one or more essential amino acids.

## Source of proteins

- Milk and milk products such as cheese, ice cream all derive their protein from milk
- Meat, poultry, and fish are all forms of animal tissues
- Eggs are in a class by themselves a protein food of high nutritive value
- Vegetables are poor source of protein
- Legumes provide more than 4 or 6 percent. They are listed as meat alternates in the four-food group chart because they provide one of the better-quality plant proteins
- Bread and cereals make an important contribution to the protein of the diet, the protein of uncooked grain ranges 7 to 14 percent

## Digestion and absorption of protein

The digestion of protein in the alimentary tract is accomplished by the action of several proteolytic enzymes in the gastric, pancreatic and intestinal juices. Any of these enzymes that have the power to attack native proteins must be secreted in an inactive form to prevent damage to the tissues where they are formed.

**In the stomach:** gastric secretions play the primary role in breaking down proteins:

pepsin enzyme: breaks down long protein chains into short amino acids, each called a peptide chain.

Hydrochloric acid: contributes to the conversion of pepsinogen into pepsin.

**In the small intestine:** proteins are under the influence of intestinal and pancreatic enzymes:

Trypsin: The pancreatic converts peptide chains into shorter chains and into dipeptides.

Chymotrypsin: It complements the action of trypsin by breaking down the remaining chains.

Carboxy peptidase: It releases some amino acids.

Dipeptidase and aminopeptidase: enterogenic enzymes that complete the breakdown of peptide chains into free amino acids ready for uptake.

### **The Amino Acid Pool**

The amino acids from the food or from the body tissues enter a common pool, which is drawn upon for the synthesis of proteins, hormones, enzymes, blood protein and nucleic acids, or some of the amino acids are degraded for energy needs. Proteins are absorbed as **amino acids**. Ideally, they are used to build or maintain body proteins. If carbohydrates and fats are not meeting the energy needs of the body, amino acids can be used to provide energy.

### **Danger of the weaning period**

The weaning period is full of dangers for a large proportion of the world's children and nutritional disorders are common at this time of life. In the West a general awareness of the nutritional needs of the weanling, together with the ability of the average family to provide the necessary foods, have helped to remove most of the dangers of the weaning period. In the developing countries, however, parents are generally being unaware of the dietary needs of children, and several customs associated with weaning are likely to give rise to nutritional deficiencies.

### **Protein energy malnutrition (PEM)**

PEM is today the most serious nutritional problem in Africa and other developing countries. Its two clinical forms are **Kwashiorkor and Marasmus**. The diseases occur mostly in children between one and three years of age.

#### **❖ Kwashiorkor**

Although there is no final clarity about the etiology of **kwashiorkor** in biomedical terms, it is nevertheless, clear that it is related to nutritional deficiencies. Therefore, all **factors that could possibly contribute to the child malnutrition in general** should be avoided. These include:

- ✓ Seasonal food shortage
- ✓ Unfavourable family condition,
- ✓ Inadequate water supply and sanitary facilities,
- ✓ Certain traditional attitudes during pregnancy, prenatal period, breast-feeding and weaning periods,
- ✓ All infectious diseases, which generally reduce immunity.

Other diseases may sometime play an important role in precipitating the onset of kwashiorkor in already malnourished child. E.g.

- Gastrointestinal tract infection
- Diarrhea
- Intestinal worms share the diet and cause other ill- health and poor appetite
- Constipation
- Childhood diseases such as measles, whooping cough, etc,

#### **Signs and symptoms of kwashiorkor**

- Growth failure occurs always
- Wasting of muscle is also typical but may not be evident because of edema
- There may be mental change
- Hair and skin colour change
- Diarrhea and vomiting
- Sign of other micronutrient deficiencies

#### **Skin changes**

- Mild: localized hyper pigmentation and skin cracks
- Moderate: skin peels off
- Severe: superficial ulceration, bleeding

#### **Hair changes**

- Mild: beginning of visible colour and structural changes
- Moderate: colour and structural changes, loss of hair
- Severe: loss of hair together with ulceration of head

#### **Physiological functions of the various systems are markedly disturbed with**

- Diarrhea
- Electrolyte disturbance
- Circulatory insufficiency
- Metabolic imbalance
- Poor renal functions

Hence the child with kwashiorkor should be thought of as an emergency in need of referral to the nearest health facility.

#### **❖ Nutritional Marasmus**

- There is a failure to thrive
- Irritability, restlessness and diarrhea are frequent.
- Many infants are hungry, but some anorexic.
- There are little or no subcutaneous fats.

- The weight is much below the standard for age.
- Temperature may be subnormal.
- The abdomen may be shrunken or distended with gas.
- Because of the thinness of the abdominal wall, peristalsis may be easily visible.
- The muscles are weak and atrophic and this makes the limbs appear as skin and bone
- Evidence of vitamin deficiencies may or may not be found.

#### **After discharge management of PEM**

- Nutrition education and demonstration of the parents to prevent relapse and future deterioration
- Follow up by health extension workers with the view of helping child and the family
- Mental state has improved as shown by smiling, response to stimuli, awareness, and interest in the surroundings
- Appetite has returned and he/she is eating well
- Shows physical activity
- Temperature is normal
- No vomiting or diarrhea
- No edema
- Starting to gain weight

#### **Discussion questions**

1. What is the importance of proteins?
2. Mention the source of proteins and type of amino acids
3. Discuss the digestion and metabolism of protein
4. Why is weaning period crucial?
5. Protein Energy Malnutrition is very serious in developing countries, why?
6. What are the signs and symptoms of Kwashiorkor and Marasmus?
7. Why is the child with PEM considered as an emergency?
8. Mention the criteria for referral.