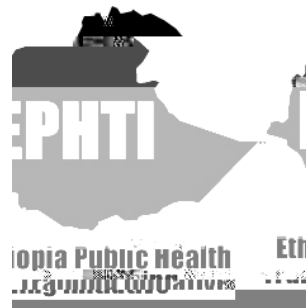


LECTURE NOTES

Nutrition

For Health Extension Workers



Melkie Edris

Debu University

In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center,
the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education

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This material is intended for educational use only by practicing health care workers or students and faculty in a health care field.

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The development of this lecture note for training Health Extension workers is an arduous assignment for Ato Melkie Edris at University of Gondar

Essentially, it required the consolidation and merging of existing in depth training materials, examination of Health Extension Package manuals and the Curriculum.

Recognizing the importance of and the need for the preparation of the lecture note for the Training of Health Extension workers THE CARTER CENTER (TCC) ETHIOPIA PUBLIC HEALTH TRAINING INITIATIVE (EPHTI) facilitated the task for University of Gondar to write the lecture note in consultation with the Health Extension Coordinating Office of the Federal Ministry of Health.

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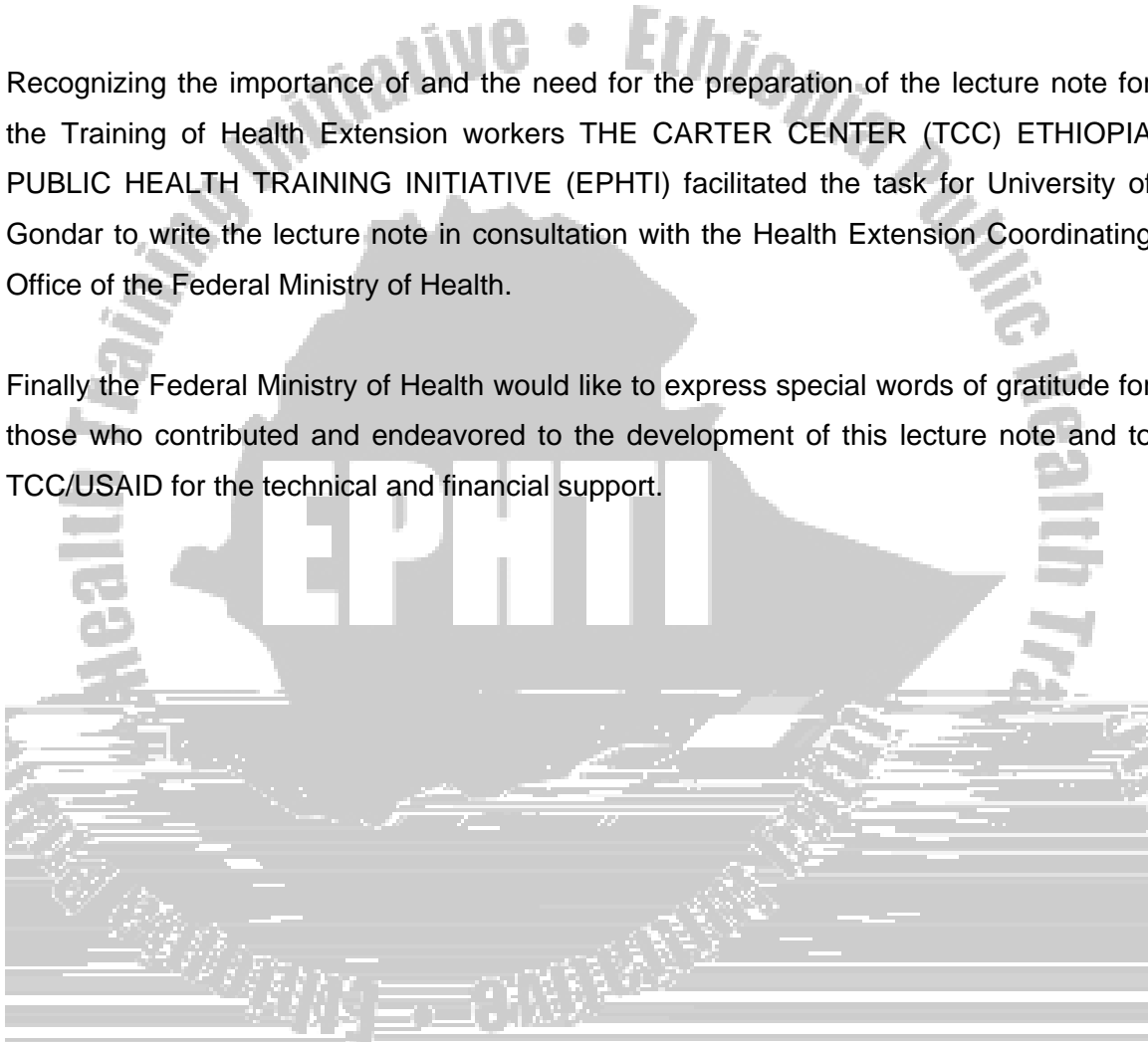


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Abbreviations

ABCD = Anthropometry biochemical clinical and dietary methods

AIDS = Acquired Immuno Deficiency syndrome

BMR = Basal Metabolic Rate

CO₂ = Carbon Dioxide

EAA = Essential Amino Acids

EBF = Exclusive Breast Feeding

ENA = Essential Nutrition Actions

EPI = Expanded Program of Immunization

FP = Family Planning

GDP = Gross domestic product

GMP = Growth Monitoring Programme

HDL= High Density Lipoprotein

HFA = Height For Age

HIV = Human Immuno Deficiency Virus

IDD = Iodine Deficiency Disorder

IEC = Information, Education and Communication

IMCI = Integrated management of Child Illness

LBW= Low birth weight

LDL = Low Density Lipoprotein

NSI = Nutrition Surveillance Information

PEM = Protein Energy Malnutrition

PMTCT = Prevention Mother to Child Transmission

PUFA= Poly Unsaturated Fatty Acids

RDI = Required Dietary Intake

STI = Sexual Transmitted Infections

TWS = Timely warning system

WFH = Weight For Height

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 structure, political and ideological superstructure.

The mortality among preschool children is extremely high in developing countries in general and in Ethiopia in particular. It is quite clear that malnutrition in combination with infection, more often than not is, the cause of high morbidity and mortality in Ethiopia. Micronutrient deficiencies such as vitamin A, iodine and iron are the most prevalent in Ethiopia and it affects mothers and children at large.

The entire efforts in the preparation of this lecture note require that the elements of nutrition should be understood by Health Extension



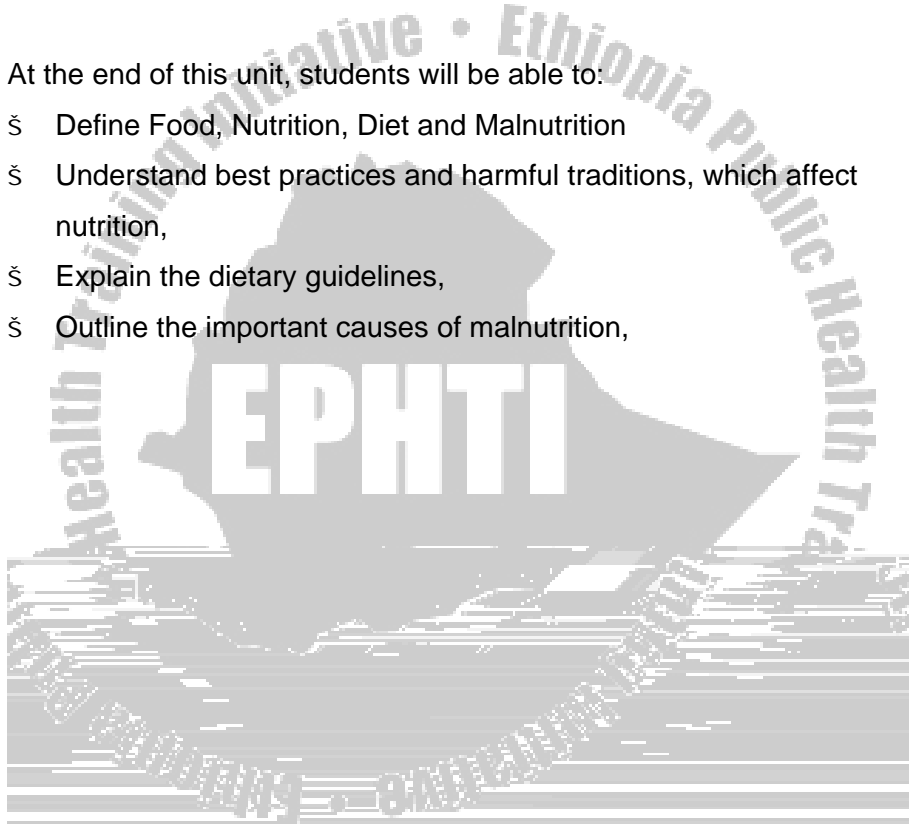
UNIT ONE

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,



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 fibres 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
- §



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

- § During period of fasting important nutrients are not eaten, such as milk, eggs, butter, meat, fish, meal pattern, etc.
- § Pork is forbidden for religious and cultural reasons
- § Lack of sun light (lack of Vitamin D) during infancy to protect the child from the “evil eyes”

Nutrition

- § Discrimination in feeding among family members, adults before children, adult males over adult females
- § Practising heavy meals once, may be twice a day
- § Giving butter to neonate to swallow, hoping to keep the intestine smooth
- § Delay to start complementary food
- § Refusing to give the child meat for fear of infection
- § Feeding children with diluted milk
- § Feed children with left over and may be contaminated food

Best practices which favor nutrition

- § Breast feeding
- § Mixing of foods E.g. Injera with wat prepared from
 - Cereals
 - Legumes
 - Vegetable
- § Traditional use of dark green leaves “Hbesha Gommen.”
- § Eating cereals in the form of kolo (roasted) and nefro (cooked)
- § Additional high calories and high protein diet for pregnant and lactating mothers
- § After the 7th day of delivery the mother and the child warm in the sun every morning
- § Eating inset (false banana) which prevents constipation
- § Special care for children and lactating mothers
- § Drinking sour milk and cured milk

Nutrition

- § Local beverages are constituted from different cereals
- § Eating wild fruits from the forest e.g. Enjory, Kega, Sholla,
- § Honey mixed with butter is eaten in the morning
- § Giving to children a tea-like drink made out of Abish (fenugreek) is rich in protein (27 gm/100gm)
- § Good hospitality and sociability
- § Eating of raw vegetables and cereals
- § Taking care of elders.

Good nutrition must meet the needs of varying ages and activities and always with individual differences. Therefore, 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 extending the active and vigorous period of life.

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 restrict outdoor activities.

In general feeding is dependent on the controlling centres, appetite and satiety in the brain. There are a variety of stimuli, nervous, chemical and thermal, which may affect the centres and so alter feeding behaviour.

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 adults calorie requirements depend on the degree of physical activities

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

Carbohydrates provide a great part of the energy in all human diets. In the diet of poor people, especially in the tropics, up to 85% of the



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

Monosaccharides:

- § Glucose
- § Fructose
- § Mannose
- § Galactose

Disaccharides:

- § Sucrose (a disaccharide present taste sugar)
- § Lactose (a disaccharide present in milk)
- § Maltose (a disaccharide present in starch)

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.

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 microorganisms. If you keep honey for a long time, it will not be spoiled because of antibiotics.

Glycogen: is the animal equivalent of starch present in the liver and muscle. In most foods of animal origin it is a negligible source of dietary carbohydrate. The glycogen in the liver is a reserve fuel and it serves between meals and over night. The breakdown of glycogen in the liver is facilitated by the hormone glucagons.

Starch: is one form of carbohydrate that is stored in granules in the roots and seeds of plants.

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 Ptyalin (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:

- § Amylase
- § Lactase
- § Sucrase
- § Maltase

- § Dextrin is degradation products of starch in which the glucose chains have been broken down to smaller units by partial hydrolysis.
- § Dextran is a carbohydrate polymer obtained from bacterial cell wall. This has no part in dietetics but is used in medicine as plasma expander.

Table. 2. Summary of carbohydrate digestion

Site of action	
	

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

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 glucagons

§ Insulin is secreted by the beta cells of the islets of Langerhans and the secretion is stimulated by:

- Hyperglycemias
- Parasympathetic nervous activity

Function of insulin

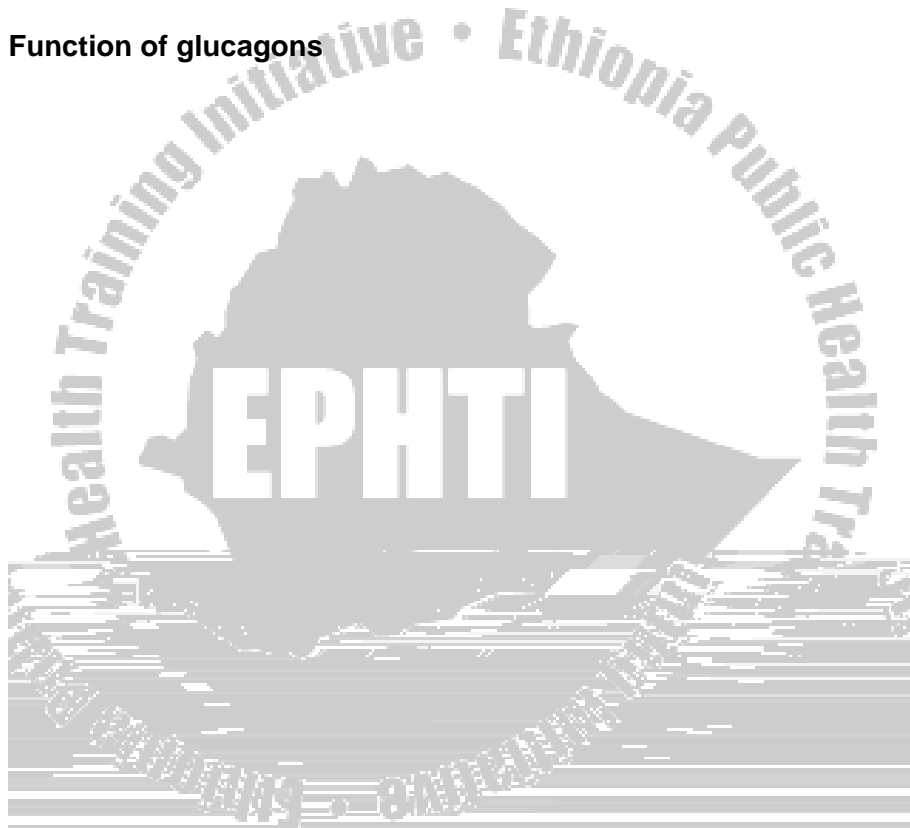
- ⌘ To facilitate glucose transport to the liver and muscle cells
- ⌘ To facilitate formation of glycogen in the liver and muscle cells
- ⌘ To incorporate formation of protein from the amino acids.

Nutrition

Glucagons is secreted by the alpha cells of the islet of Langerhans and the secretion is stimulated by

- ⊠ Hypoglycaemia
- ⊠ Sympathetic nervous activity

Function of glucagons



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 have long been recognized as fundamental structural elements of every cell of the body. Specific proteins and protein derivatives have been recognized as functional elements in certain specialized cells glandular secretion, enzymes and hormones.

Proteins in natural foods differ widely in the number and the proportion of the 22 or more amino acids. A good quality or a complete protein is the one that supplies all the essential amino acids in sufficient quantities and in proper ratio for normal growth and maintenance. In general all proteins from animal source, such as meat, poultry, fish, eggs, milk and milk products provide good quality proteins.

Source of proteins

- ⌘ Milk and milk products such as cheese, ice cream all derive their protein from milk.
- ⌘



- § Chemotrypsinogen is secreted by pancreatic juice and activated by the active trypsin
- § Peptidase intestinal juice

Table 3 Summary of protein digestion

Site of action	Protein	Enzyme	End – Product
Stomach	Protein polypeptides	Pepsin in acid Trypsin chemotrypsin	Large peptide poly peptides
- Small intestine	Polypeptide dipeptides	Peptidase (secreted by mucosal cells of small intestine ↓ Enter portal blood ↓ Liver	Polypeptides Dipeptides Amino acids
		↓ Body tissues	Peptides Amino acids Portal

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 fraught with 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 peasant society of developing countries, however, parents are generally are unaware of the dietary needs of children, and several customs associated with weaning are likely to give rise to nutritional deficiencies.

In the traditional society of Ethiopia, weaning is commonly abrupt and unplanned. Often it is brought by the occurrence of another

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
- ✘ Unfavorable family condition,
- ✘ Inadequate water supply and sanitary facilities,
- ✘ Certain traditional attitudes during pregnancy, prenatal period, breast-feeding and weaning periods, and
- ✘ 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

Nutrition

- § There may be mental change
- § Hair and skin color change
- § Diarrhea and vomiting
- § Sign of other micronutrient deficiencies

Skin changes

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

Hair changes

Hair changes are classified into three categories

- Mild: beginning of visible color and structural changes
- Moderate: color 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



After discharge management of PEM

- § To prevent relapse and future deterioration, through nutrition education and demonstration of the parents.
- § To achieve long term follow up by health extension workers with the view of helping child and the family.

Child status after discharge from hospital

- § 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

- § What are the importance of proteins?
- §

Nutrition

- § Why is the child with PEM considered as an emergency?
- § Mention the criteria for referral.



Nutrition



Classification of lipids

Lipids are classified into 3 on the basis of their chemical structure.

- § Simple lipids = Fats and oils
- § Compound lipid = Phospho-lipids and lipoproteins
- § Derived lipids= fatty acids and sterols
- § Human beings cannot synthesize the Poly Unsaturated Fatty Acids (PUFA), hence they are termed as essential FA.
- § Saturated fatty acids tend to raise blood cholesterol level.
- § Polyunsaturated Fatty Acids lowers blood cholesterol and large amounts of unsaturated Fatty Acids are of vegetable origin and have lower melting point.

Phospholipids, sterols and lipoproteins

Phospholipids are structural compounds found in cell membranes. They are essential components of enzyme systems and are involved in the transport of lipids in plasma.

Sterols

- § These are precursors of vitamin D, which are found both in plants and animals. Cholesterol in animal's tissues, egg yolk butter. Ergosterol in plants
- § Lipids are transported in the blood in the form of lipoprotein (soluble fat protein complexes).
- § They are 25-30% proteins and the remaining as lipids

Lipoprotein

These are compound lipids that contain both protein and various types and amounts of lipids. They ar



Hereditary, diet, exercise, and other conditions affect blood cholesterol levels. Persons with high blood cholesterol levels appear to be more likely than those with normal levels to develop atherosclerosis.

No recommended dietary allowance has been established for total fat or essential fatty acids; however, the reduction in total fat is recommended.

The essential fatty acids are:

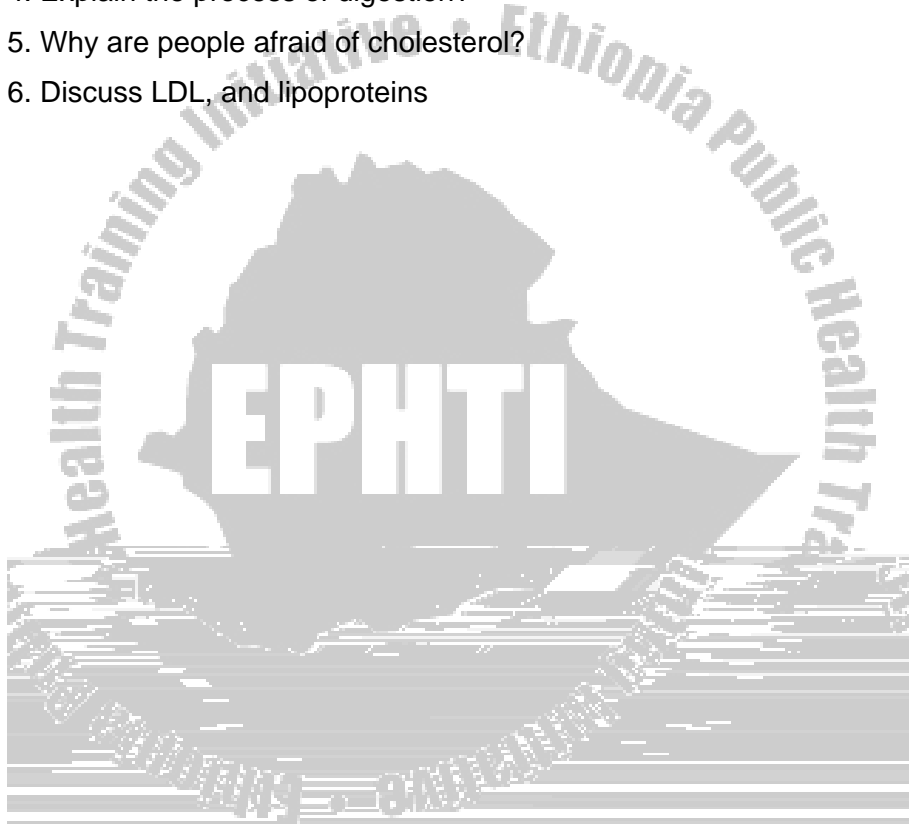
- ⌘ Linoleic acid
 - ⌘ Linolenic acid
 - ⌘ Arachidonic acid
- Essential Fatty Acids are needed for the normal functioning of all tissues
 - Essential Fatty Acids form a part of the structure of each cell membrane.
 - Essential Fatty Acids help transport nutrients and metabolites across the cell membrane
 - Essential Fatty Acids are also involved in brain development
 - Essential Fatty Acids are needed for the synthesis of prostaglandin

Linoleic acid:



Discussion questions

1. What are lipids and their importance?
2. How do you classify lipids?
3. What are the essential fatty acids?
4. Explain the process of digestion?
5. Why are people afraid of cholesterol?
6. Discuss LDL, and lipoproteins



UNIT FIVE

Basal Metabolism

Learning objectives

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

- ✕ Understand what basal metabolism is.
- ✕ Explain factors that affect basal metabolism.

Definition

Basal metabolism: is the energy required to carry on vital body processes at rest, which include all the activities of the cells, glands, skeletal muscles tone, body temperature, circulation, and respiration. In persons who are generally inactive physically, basal metabolic needs make up the largest part, about two thirds, of the total energy requirement.

Factors affecting basal metabolism

Size and shape

The greater the skin area, the greater will be the amount of heat lost by the body and, in turn, greater the necessary heat production by the individual. E.g. tall person needs more food than short person with the same weight.

Age and growth

They are responsible for normal variation in basal metabolism. The relative rate is highest during the first and second years and decreases after that, although it is still relatively high through the ages of puberty. During adult life there is a steady decrease in rate with a marked drop in old age.

Sex

Sex probably has little effect on metabolism. Women have a lower metabolism than men. Women usually have a less fat and less muscular development than men.

Climate

Climate has little effect on BMR, which is always measured in a room temperature.

Racial

Differences in metabolism have been noted. Eskimos have been reported to have a BMR above accepted standards.

State of nutrition

In starvation or under nutrition the BMR is lower.

Diseases

Diseases such as infection or fevers raise the BMR in proportion to the elevation of the body temperature.

The internal secretion of certain glands such as the thyroid and the adrenal, affect metabolism. Hyperthyroidism accelerates metabolism by increasing production of thyroxin.

Sleep,

Sleep varies depending on individuals, some are restless and others are quiet.

Pregnancy

After four months of gestation the BMR wihers

Sleep,

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Sleep,

UNIT SIX

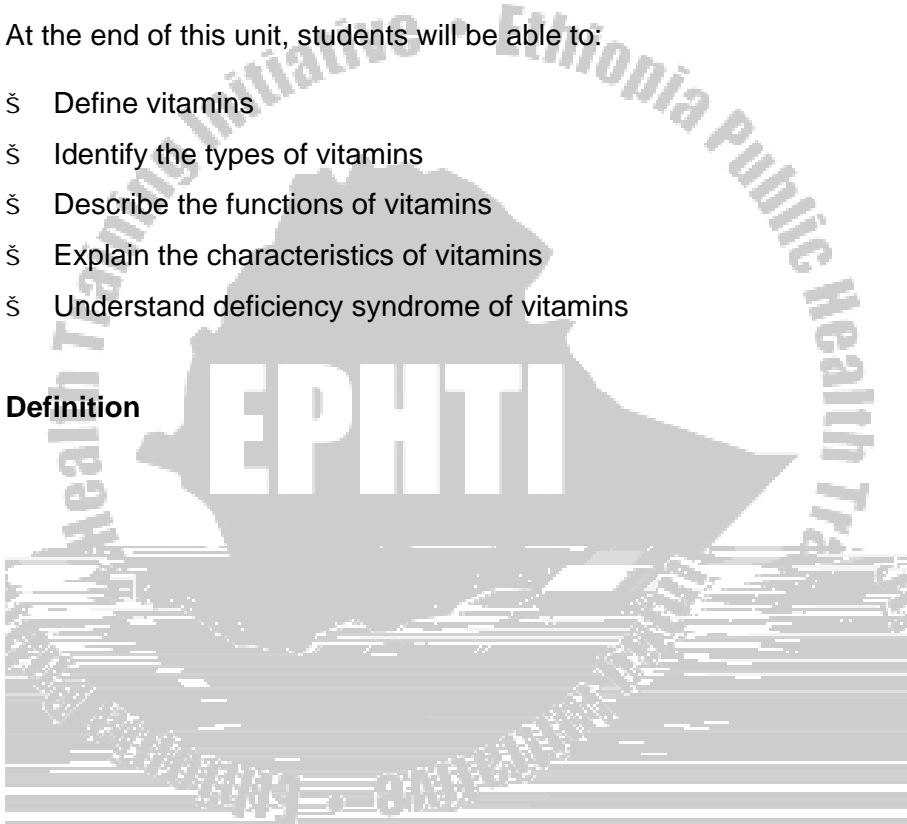
Vitamins

Learning objectives

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

- § Define vitamins
- § Identify the types of vitamins
- § Describe the functions of vitamins
- § Explain the characteristics of vitamins
- § Understand deficiency syndrome of vitamins

Definition



Classification of vitamins

- ✕ Vitamin A (Retinol)
- ✕ Vitamin B₁ (Thiamine)
- ✕ Vitamin B₂ (Riboflavin)
- ✕ Vitamin B₆ (pyridoxine)
- ✕ Vitamin B₁₂ (Cyanocobalamine)
- ✕ Niacin
- ✕ Panthotonic Acid
- ✕ Folacin
- ✕ Biotin
- ✕ Vitamin C (Ascorbic acid)
- ✕ Vitamin D (Cholecalciferol)
- ✕ Vitamin E (Tocopherol)
- ✕ Vitamin K (Antihemorrhagic vitamin)

These vitamins are found in wholesome foods, milk, vegetables, fruits, eggs, meat, beans, wholegrain cereals etc.

Function of vitamins:

- § To promote Growth
- § To promote Reproduction
- § To promote Health & vigor
- § To promote Nervous activity
- § To promote Normal appetite
- § To promote Digestion

- § To promote Utilization
- § To promote Resistances to infection.

Groups of vitamins

- ⌘ Water soluble Vitamins are (C and B group)
- ⌘ Fat-soluble Vitamins are (A, D, E, and K)

Characteristics of water soluble vitamins

- § They are widely distributed in natural foods
- § B₁₂ is found only in animal products
- § Soluble in water and absorbed in the intestine
- § Excess will be excreted, thus not toxic.
- § Most functions of these vitamins are as co-enzymes
- § They are important for energy production
- § They are heat labile

Characteristics of fat - soluble vitamins

- § Metabolize along with fats
- § Resistance to heat
- § Stored in the liver and adipose tissue
- § Slow to develop deficiency syndrome
- § Present only in certain foods, mostly in animal products, oily foods, yellow and green vegetable
- § Excess can be toxic to the body.

Function of vitamin A

- § It controls the general state of the epithelial cells and reduces the risk of infection.
- § It is required for the regeneration of two pigments, visual purple in the rods of retina and visual violet in the cones of the retina. These two pigments are responsible for vision in dim and bright light
- § It aids growth and development during childhood
- § It helps to keep the cornea of the eye in healthy condition.
- ⌘ Dietary Vitamin A is required for the growth and survival of all animals and it is present in most biological tissues.
- § In the visual system the retina is dependent on Vitamin A and its metabolites.
- § In the auditory system vitamin A plays a role in the maintenance of the middle and inner ear and it also helps the olfactory system,
- § It is required for reproduction, embryonic development and bone formation.

Who is affected by Vitamin A deficiency?

Vitamin A deficiency is a major health problem in many developing countries. Many children do not survive. Recent research findings suggest that improving vitamin A status amongst deficient populations can significantly reduce young child mortality. The population groups

at highest risk of the deficiency are infants and young children under five years.

Vitamin A deficiency in Ethiopia

Vitamin A deficiency is a major public health problem in Ethiopia, where prevalence of Bitot's Spots is high.

Vitamin A deficiency occurs when vitamin A intakes (or liver stores) fail to meet daily metabolic requirements. The most common cause is inadequate consumption of vitamin A – rich foods. Deficiency also occurs when there is problem of absorption, conversion or utilization of vitamin A or when there are repeated infections of diseases such as measles or diarrhea. In the absence of foods containing oils or fats in the diet, vitamin A is not well absorbed and metabolized.

Animal source of vitamin A

The best sources of vitamin A is animal products such as organ meat like liver, whole milk and milk products, eggs, butter, cheese, and fish liver oils. Animal sources contain preformed active retinol, which can be used effectively by the body. The best source of vitamin A for infants is breast milk. The mother's secretion of vitamin A into breast milk, however, is related to her own vitamin A status.

Plant source of vitamin A

Plants contain beta-carotene that can be converted into vitamin A by the body. The best plant sources of vitamin A are orange, yellow colour fruits and vegetables (papaya, mango, pumpkin, tomatoes, carrots, yellow sweets potatoes) and dark green vegetables such as spinach (Kosta), kale (Gommen) and Swiss chard. Gommen is one example of a traditional plant source rich in vitamin A commonly consumed in the Ethiopian diet. Gommen is available to most poor people for at least 6 months in a year.

Table. 4. Vitamin A content of Foods of Animal Origin

Source (per 100 gm of food)	Vitamin A (Retinol) in Milligram)

Table: 5. Vitamin A content of foods of plant origin



major causes of child mortality, improved vitamin A status is likely to have a much greater role in reducing young child mortality.

The common symptoms of vitamin A deficiency

- ⌘ Night blindness: The child cannot see in the dark. He/she has to go in to the house early in the evening
- ⌘ Conjunctival xerosis: The conjunctival covering the white surface of the eyeballs become dry and rough instead of being moist, smooth and shining. The child cannot open and close his/her eyes because it is painful.
- ⌘ Bitot's spots: A foamy or cheesy accumulation, which forms in the inner quadrant of the cornea in the eyes. The cornea the central transparent part of the eye becomes cloudy. It reflects more advanced vitamin A deficiency, but tends to be reversible with treatment.
- ⌘ Corneal ulceration: an ulcer on the cornea may leave scar, which can affect vision.
- ⌘ Keratomalacia: The eyeballs become opaque and soft, jelly like substance; hereafter there will be a rapid destruction of the eyeball and no hope of recovery after the condition reached the stage of keratomalacia.

Diagnostic criteria for vitamin A deficiency at the community level, WHO identifies a vitamin A deficiency as a major public health

problem if prevalence of any one of the following in children below six years of age exceeds the prescribed levels.

Table: 6. Identifications of vitamin A deficiency at the community level

Vitamin A deficiency sign/symptoms	Who cut - off level for identifying a public health problem
Night blindness	>1%
Bitot's Spot(s)	>0.5%
Conjunctival Xerosis/ulceration/keratomalacia	>0.01%
Corneal scar	>0.05%

Source: WHO/UNICEF, 1994

Prevention of vitamin A deficiency

- § A diet containing plenty of vitamin A is the best.
- § Breast-feed infants for at least one year. Do not discard the 1st breast milk soon after delivery.
- § At 6 months start to feed infants with dark green vegetables, yellow and orange fruits and if possible, some finely chopped and well cooked liver.
- § Include some fats in the child's diet

Nutrition

- § Children with diarrhea, measles, respiratory and other serious infections need extra vitamin A.
- § Pregnant and lactating mothers should eat foods rich in vitamin A every day.
- § Tell families that night blindness is an early warning sign of xerophthalmia (Vitamin A deficiency).
- § Teach school children to look for night blindness in young children.
- § Learn which vitamin A rich food is available in the locality

Strategies to control and eliminate vitamin A deficiency

- § Universal supplementation of vitamin A
- § Food fortification
- § Food diversification

Universal supplementation of vitamin a capsules (short term strategy)

- § Children 6-59 months of age
- § Lactating mothers
- § Pregnant women
- § Targeted diseases i.e. Measles, diarrhea, acute respiratory infection, xerophthalmia and PEM.

Fortification of foods

Fortification of a widely consumed centrally processed staple food with a nutrient is one way of controlling deficiencies of certain

essential that the daily food intake should supply sufficient vitamin B₁. It occurs particularly in cereals but it is localized on the outer surface of the grain close to the sheath.

Vitamin B₁ deficiency

1. Acute Beriberi (Dry Beriberi)

Symptoms:

- ✕ Epigastric pain
- ✕ Nausea & Vomiting
- ✕ Urgent Cardiac sign of cardiac failure & death

2. Wet Beriberi

Symptoms:

- § Gradual onset
- § Loss of power of limbs
- § Gradually develops edema and ascitis

3. Chronic Beriberi

Symptoms:

- § Paralysis of the lower extremities
- § Cramping of the calf muscle
- § Coldness of the feet
- § Stabbing pain on walking
- § Absence of knee and ankle jerks.



- ⌘ Muscular weakness, fatigue and convulsion have been recorded in infants.

Vitamin B₁₂ (Cobalamin)

According to the present evidence this vitamin is found only in animal products.

Source of vitamin B₁₂

The content of liver and kidney is high, the content of fish, milk and meat is medium, and however, the source of B₁₂ has not been widely investigated.

Deficiency of vitamin B₁₂:

- § The red blood cells are abnormally large and are reduced in number
- § Stomatitis
- § Lack of appetite
- § Poor coordination in walking & mental disturbance

Note: The body effectively regulates the vitamin from bile and other secretions. This accounts for its long biologic effectiveness.

Vegetarians who eat no animal products develop a vitamin B₁₂ deficiency only after 20 to 30 years.

Source of Niacin

- § Meat, liver, fish, poultry
- § Peanut, peas, beans, and whole grains
- § Milk, eggs, and cheese are poor source, however, they are good source of Tryptophan (one of the essential amino acids), which is converted to Niacin

Functions of Niacin

It affects a number of important metabolic activities needed for the maintenance of healthy skin and the proper functioning of the nervous and digestive system. Niacin is a coenzyme in energy metabolism along with other B-complex vitamins.

Deficiency of Niacin

Niacin deficiency is common in areas where the staple food is Maize because Maize is low in Niacin and Tryptophan one of the essential amino acids which is a precursor of Niacin.

Early signs and symptoms of Niacin deficiency

- § Fatigue, poor appetite,
- § Weakness, mild digestive disturbance,
- § Anxiety, irritability,
- § Pellagra (a prolonged niacin deficiency), which is characterized by the 4Ds which are:
 - Diarrhea

- Dermatitis
- Dementia and finally
- Death if the disorder is untreated. The skin is dry, scaly, and cracked and the condition is aggravated by exposure to heat or light.

Vitamin C (Ascorbic Acid)

- § Found in fresh vegetables and citrus fruits
- § Vegetables and fruits should not be left soaked in water for a long time since it is soluble in water
- § Cooking itself destroys about half of the vitamin C present in the food
- § The best way to make sure of a regular intake of vitamin C is to eat raw fruits or salad every day.

Functions of vitamin C

- § Helps the formation of various body tissues, particularly connective tissues, bones, cartilage and teeth.
- § Stimulates the production of red blood cells,
- § Helps resistance to infection and neutralizes poisons.

Vitamin C is unstable and easily destroyed. Foods lose almost half of

vitamin C. Potatoes boiled in their skin retain most of their Vitamin C. Therefore, to ensure a regular intake of vitamin C is to take fruits and vegetable every day.

Deficiency of Vitamin C

- § Weakness of the wall of the capillaries,
- § Gum bleeding,
- § Loosening of the teeth,
- § Browning of the skin and petechia
- § The bones become painful, swollen and brittle
- § General weakness and anemia may result if the disorder is not treated.
- § Skin abnormalities such as adult acne may be the earliest sign of scurvy
- § Hardening and scaling of the skin surrounding the hair follicles and hemorrhages surrounding the hair follicles also point to scurvy
- § The skin of the forearm, legs and thighs is most affected
- § Scurvy: symptoms include weakness, fatigue, restlessness, and neurotic behavior, aching bones, joints, and muscles.

Vitamin D (cholecalciferol)

Vitamin D is known as the antirachitic vitamin and chemically as calciferol. The two most important vitamin D compounds are ergocalciferol (vitamin D₂) and cholecalciferol (vitamin D₃). These

substances are formed from precursors in plants, animal and in the skin and are converted to vitamin D. by the ultraviolet rays of the sun.

Vitamin D is stored in the liver mainly; some is stored in the brain, bones and skin as well. It undergoes changes in the liver, and in the kidneys that convert it to active, hormone like form.

Functions of vitamin D

- § Absorption of calcium and phosphorous
- § The presence of vitamin D is essential to the activity of the parathyroid hormone in removing calcium and Phosphorous from the bone in order to maintain normal serum levels of calcium.
- § Stimulates the reabsorption of Calcium by the kidney when serum calcium level is low.
- § Bone formation

Source of vitamin D

- § Fish liver oil is a rich source of vitamin D.
- § A nonfood source is the sunlight for the action of sunlight on the skin changes the cholesterol to vitamin D.

Deficiency of vitamin D

It leads to rickets, which is characterized by weakness and deformity of bones. Rickets generally occurs between the six months to the second year of life, during the weaning period.

Nutrition

On examination the skull bone of rachitic child, we will find the following characteristics:

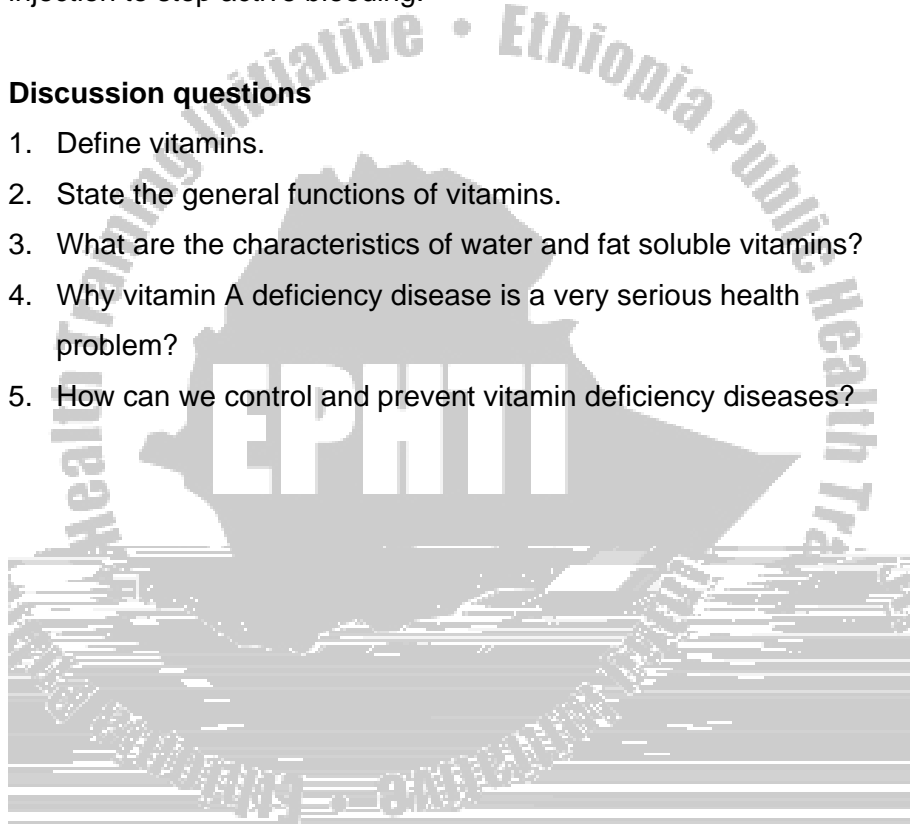


Deficiency of vitamin K

A person deficient in Vitamin K shows a tendency to bleed profusely whenever blood vessels are injured. The treatment and prevention is to provide with high content of vitamin K foods and give vitamin K injection to stop active bleeding.

Discussion questions

1. Define vitamins.
2. State the general functions of vitamins.
3. What are the characteristics of water and fat soluble vitamins?
4. Why vitamin A deficiency disease is a very serious health problem?
5. How can we control and prevent vitamin deficiency diseases?



UNIT SEVEN

Mineral Salts

Learning objectives:

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

- § Define minerals
- § Describe the functions of minerals
- § Understand the sources of minerals
- § Identify the deficiency of minerals
- § Explain the importance of water

Definition

Minerals: are inorganic elements occurring in nature. They are inorganic because they do not originate in animal or plant life but rather from the earth's crust. Although minerals make up only a small portion of body tissues, they are essential for growth and normal functioning of the body. The body can make most of the things it needs from energy foods and the amino acids in proteins but it cannot make vitamins and minerals.

Benefits of minerals

- § Minerals are essentials both as structural components and in many vital processes,
- § Some form hard tissues such as bones and teeth
- § Some are in fluids and soft tissues

- § For normal muscular activity the ratio between potassium and calcium in the extra cellular fluid is important.
- § Electrolytes, sodium and potassium are the most important factors in the osmotic control of water metabolism
- § Some minerals may act as catalysts in the enzyme system, or as integral parts of organic compounds in the body such as:
 - Ø Iron in hemoglobin
 - Ø Iodine in thyroxin
 - Ø Cobalt in vitamin B₁₂.
 - Ø Zinc in insulin and
 - Ø Sulfur in thiamine.

Plants, animals, bacteria, and other one celled organisms all require proper concentration of certain minerals to make life possible.

The principal minerals, which the body requires.

Calcium	Chlorine	Iron
Phosphorus	Sodium	Iodine
Magnesium	Potassium	Sulfur

Animals, in trace quantities, use minerals and these are: Copper, Manganese, Cobalt, Zinc, and Fluorine. Other trace elements are present in animal tissues, but their functions are uncertain and these are Aluminum, Arsenic, Boron, Cadmium, and Silicon.

In natural foods, minerals present in various forms mixed or combined with:

Nutrition

- § Protein
- § Fats and
- § Carbohydrate

Iron

Sources of Iron

- § Beef, liver, egg yolk
- § Wheat and Teff
- § Dark green vegetables, onions & fresh fruits.

Daily requirements for men and women are 8 to 10mg and 10 to 18 mg respectively. For pregnant and lactating mother the requirement increases to 20mg. Absorption of iron is enhanced in the presence of vitamin C.

Functions of Iron

It is an essential component of hemoglobin, responsible for the red coloring of blood and for the transportation of oxygen to the tissues.

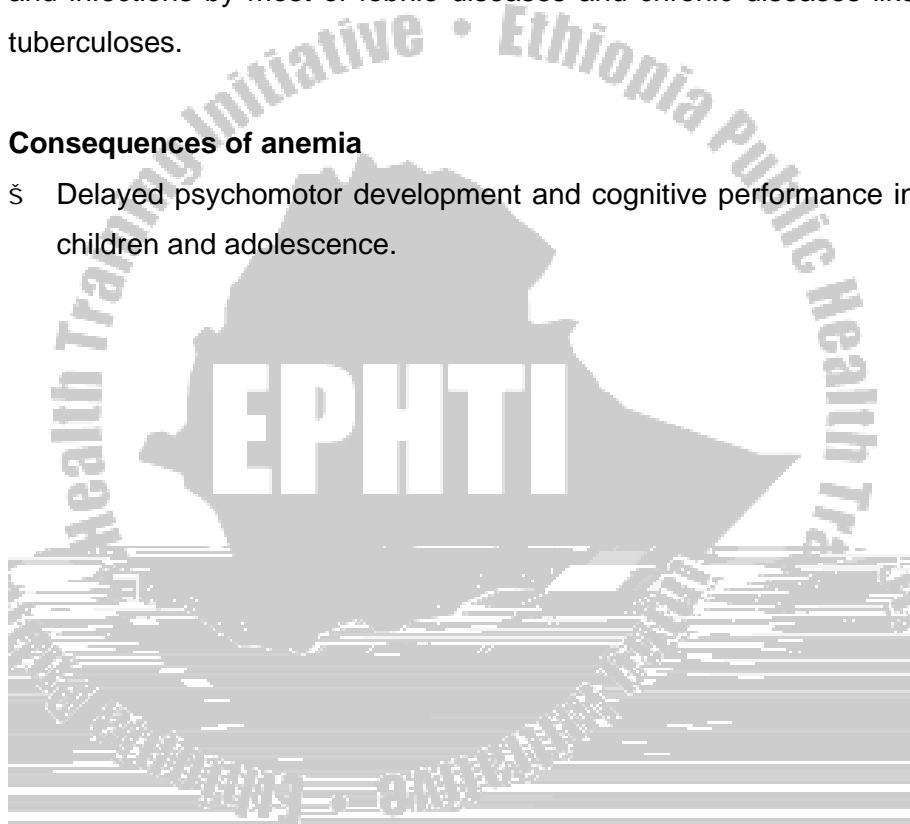
Causes of Iron Deficiency

- § Insufficient iron in diet
- § Blood loss during menstruation
- § Hook worm infestation

Causes of anemia are multiple and the main causes are nutritional deficiencies, which represent more than half of all cases, blood loss through hemorrhage, destruction of red blood cells by infections such as malaria and parasitic infections, genetic defects of red blood cells and infections by most of febrile diseases and chronic diseases like tuberculoses.

Consequences of anemia

- § Delayed psychomotor development and cognitive performance in children and adolescence.



Strategies for prevention and treatment of iron deficiency

- § Supplementation of iron tablets (with folates) preferably with vitamin B₁₂ and vitamin C
- § Dietary improvement of iron rich foods
- § Changing of dietary habits and food preparation practices through nutrition education
- § Fortification of foods with iron
- § Control of malaria infection
- § Control of febrile and chronic diseases,
- § Promotion of hygiene and sanitation,
- § Education, information and communication on iron supplementation,
- § Networking and collaborating with relevant sectors on issue,

Who needs more iron?

- § Pregnant women require much higher amount of iron than is met by most diets.
- § Many infants beyond 6 months of age need more iron than is available in breast milk and common weaning foods.
- § Infants with low birth weight have less iron stores, and are thus at a higher risk for deficiency after two months of age.

Therefore, it is important that pregnant women routinely receive iron supplements. In places where anemia prevalence is high,

supplementation should continue into the postpartum period, to enable them acquire adequate stores of iron.

Iodine

Iodine is one of the micronutrients, which is highly essential for regulation of physical growth and neural developments.

Iodine is an essential component of the thyroid hormones, thyroxin.

Failure to have adequate level of iodine in the blood leads to



Nutrition

soil erosion and flooding, thus the crop we grow for food do not have iodine in them and as a result leads to iodine deficiency. People of all



How long do we need to use iodized salt?

Iodized salt has to be used on a daily basis as long as one lives in an iodine deficient environment. This is the only safe and long-term solution to a problem that affects many Ethiopians.

The benefits of iodized salt

- § Universal Salt Iodization can lead to an increase of the average intelligence of the entire school age population.
- § The Iodization of salt will mean saving hundreds of thousands of Ethiopian children.
- § Iodine enhances intellectual and cognitive development of whole generations.

The major consequences of iodine deficiency

- § Mental retardation
- § Defects in the development of nervous system
- § Goiter
- § Physical sluggishness
- § Reduced work capacity
- § Impaired work performance
- § Decreased average intelligence
- § Loss of memory
- § Inability to produce enough milk for offspring
- § Lower birth weight
- § Growth retardation

Nutrition

- § Dwarfism
- § Deaf-mutism
- § Cretinism
- § Reproductive failures (abortion, prematurity, stillbirth)
- § Increased childhood morbidity and mortality
- § Economic stagnation and
- § Impotency.

Discussion questions

1. What are the functions of minerals?
2. What are the causes of iron deficiency anemia?
3. What are the prevention and control methods of iron deficiency anemia?
4. What are the causes of iodine deficiency?
5. What are the outcomes of iodine deficiency?
6. What are the prevention and control methods of iodine deficiency?



Nutrition

- § Fresh vegetables and fruits are 80% to 90% water; meat is 50% to 60% water, and even bread is about 35% water,
- § The sensation of thirst usually is a reliable guide to water intake. Except in infants and sick persons, especially comatose person who cannot respond to the thirst stimulus.
- § If losses are not replenished, heat exhausting and possibility heat stroke may occur,
- § Dehydration can occur rapidly in comatose patients and in disabled or elderly persons with brain impairment that are unable to respond to the sensation of thirst,
- § Other conditions, such as fever, diabetes mellitus, vomiting, diarrhea, and the use of drugs such as diuretics also increase water need.

Body water

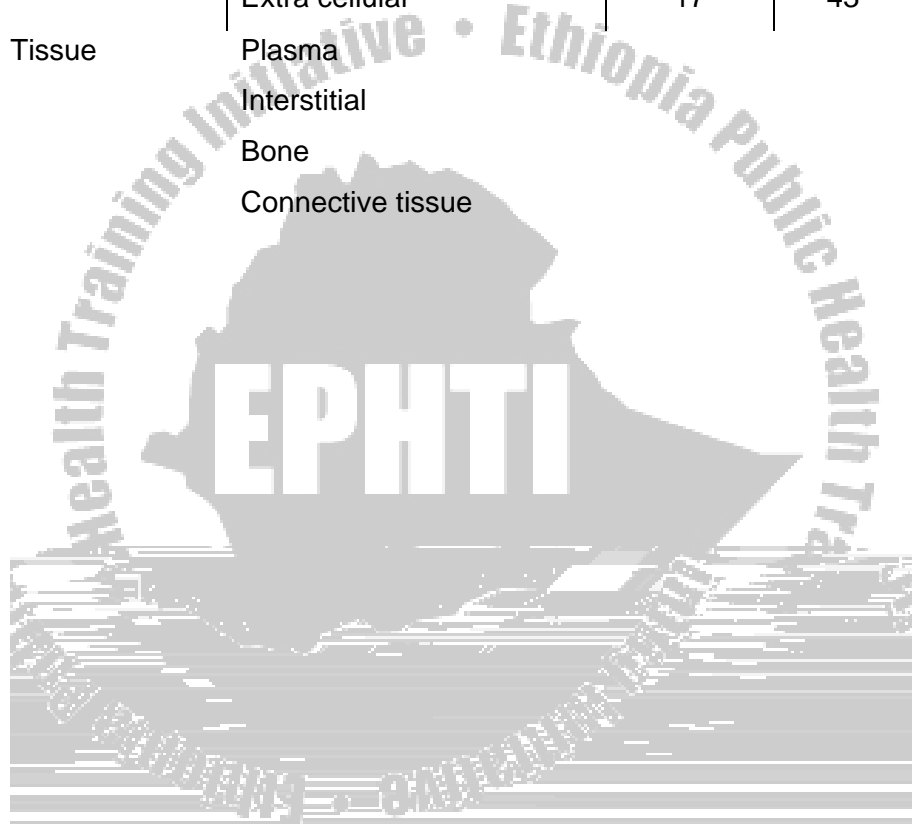
- § About half of the adult body weight is water 55% for man and 47% for woman.
- § About 2000 to 2500 cc of water is eliminated every day from the body carrying waste products with it.
- § The lost water has to be replaced in the form of fluid or foods containing water.
- § Although some water is formed, as end products of food metabolism, from 6 to 8 glass of water should be drunk every day,

Nutrition



Table. 7. Body water components in the reference man

Model	Compartment	Kg	%
Molecular	Total body H ₂ O	40	100
Cellular	Intra cellular	23	57
	Extra cellular	17	43
Tissue	Plasma		
	Interstitial		
	Bone		
	Connective tissue		



Abnormally

- § Due to kidney disease
- § If there is excessive perspiration due to high environmental temperature.
- § Due to diarrhea and vomiting
- § Due to hemorrhage and burn

Dehydration

The term dehydration implies more than changes in water balance. There are always accompanying changes in electrolyte balance. When the water supply is restricted or when losses are excessive the rate of water loss exceeds the rate of electrolyte loss. Then the extra cellular fluid becomes concentrated and osmotic pressure draws water from the intra-cellular fluid into the extra-cellular fluid to compensate. This condition is called extreme thirst and dehydration.

Discussion questions

1. Discuss the distribution of water in the body.
2. Mention the importance of water,
3. Describe the factors causing dehydration.



Causes for low weight gain during pregnancy

- § Low food intake,
- § Many women continue to do hard physical activities like carrying wood and water, and do other strenuous jobs until childbirth.

Many factors cause variation in weight at birth, but in developing countries the mothers' health and nutritional status and her diet during pregnancy are probably most important. Low birth weight (LBW) is defined as being below 2.5kg. There are two main reasons for L.B.W:

- § Premature or early delivery
- § Retarded fetal growth

Causes of premature delivery

- § Poor maternal nutrition,
- § High maternal blood pressure
- § Acute infections
- § Hard physical work
- § Multiple pregnancies
- § In many cases the cause is unknown

Causes of retarded fetal growth

- § Fetus, due to infections such as Rubella and syphilis
- § Placenta, if it is abnormally small or with blockage
- § Mother, maternal nutrition and health
- § Anemia
- § Acute or chronic infections such as TB

Mothers are often the key care takers for the children in the household. They have to be healthy and need the time, the knowledge and the right environment to carry out their duties.

Proper care of children

- § Appropriate hygiene and sanitation
- § Safe food preparation and storage
- § Successful breast feeding and adequate weaning practice
- § Psychosocial care such as attention, affection and encouragement
- § Equitable health services and a healthy environment,
- § Spacing of child birth.

Children at risk

High risk factors which often have influences on a child's nutritional states are the followings:

- § Low birth weight
- § Twins or multiple births
- § Many children in the family
- § Short intervals between births
- § Poor growth in early life
- § Early stopping of breast milk < 6 months
- § Introduction of complementary feeding either too early or too late
- § Many episodes of infections
- § Illiterate mothers,

- ⌘ Evaluation tool (individual or group). To what extent has the intervention, treatment, or programme had the intended effect (impact)

Anthropometrics assessment

It is the measurement of the variation of physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition.

Anthropometrics assessment of growth

Common measurements include;

- Stature (height)
- Body weight
- Skin fold
- Mid Upper Arm Circumference (MUAC)

Indices derived from growth measurements;

- Weight-for-height,
- Height-for-age,
- Body Mass Index (BMI) = Weight in Kg divided by Height in metre square that is $Wt/(Ht)^2$

The Waterlow Classification

Waterlow pointed out two different types of deficit: a deficit in **WEIGHT-FOR-HEIGHT** (wasting) and a deficit in **HEIGHT-FOR-AGE** ('stunting').

1. Waterlow has suggested classification based on wasting (current malnutrition) or stunting (chronic malnutrition)

WFH = 80% of the Reference standard or
 -2.5D below the median

HFA = 90% or - 2.5D below the median

Table: 8. Waterlow classification

		Weight	
		Above	Below
Height	Above	Normal	Acute malnutrition
	Below	Nutritional Dwarfism	Chronic Malnutrition

Identification malnutrition superficially

Changes in the superficial tissues or in organs near the surface of the body, which are readily seen or felt upon examination. These include changes in:

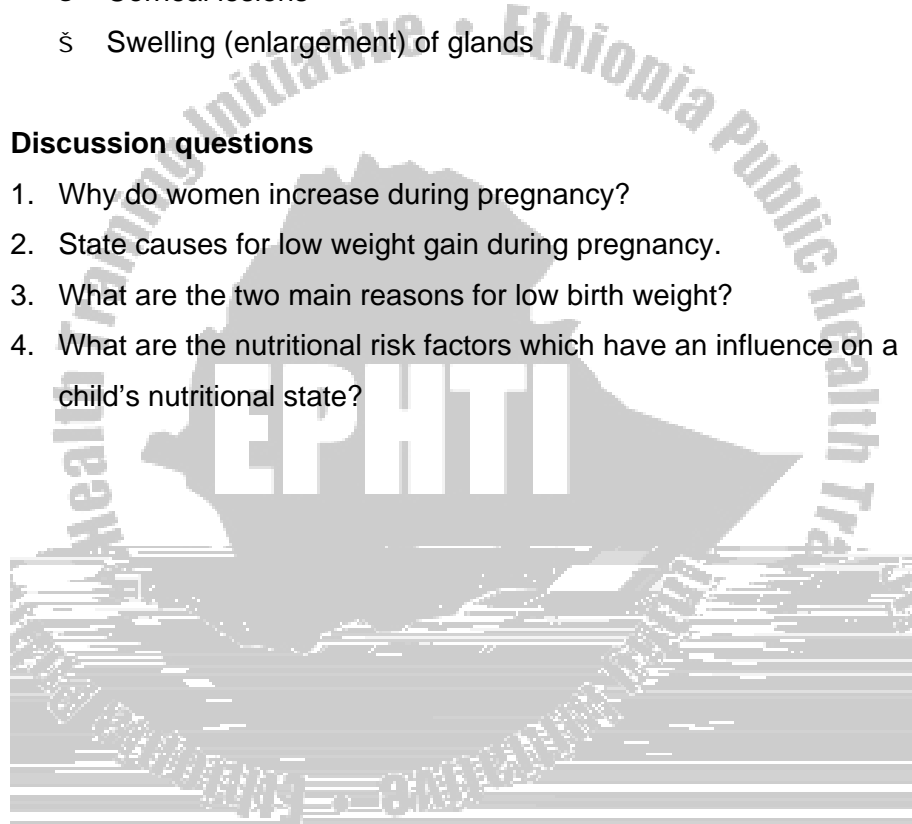
- Eyes
- Skin
- Hair
- Thyroid gland

Common indicators

- § Edema
- § Dyspigmentation of the hair
- § Angular Stomatitis
- § Corneal lesions
- § Swelling (enlargement) of glands

Discussion questions

1. Why do women increase during pregnancy?
2. State causes for low weight gain during pregnancy.
3. What are the two main reasons for low birth weight?
4. What are the nutritional risk factors which have an influence on a child's nutritional state?



UNIT TEN

Nutritional Surveillance

Learning objectives

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

- ✕ Understand the objectives of nutritional surveillance
- ✕ Describe the uses and users of Nutritional Surveillance
- ✕ Explain the nutritional outcome indicators
- ✕ Understand timely warning and coping mechanisms.

Nutritional surveillance: is defined as the measurement of the frequency and distribution of nutrition related diseases or problems using regularly collected and available information. It comprises the compelling and analysis of nutrition information for decision making relative to national or regional polices or programme planning. Nutritional surveillance could be concerned with everything that affects nutrition, from food production, distribution, and intake to health status itself.

Objectives of nutritional surveillance

- § To provide information so that decision can be more favorable to nutrition
- § To increase the allocation of resources to improve the nutrition of the malnourished in drought and famine condition.

Potential users of Nutritional Surveillance Information (N.S.I)

- § Ministry of health
- § Ministry of agriculture,
- § Government and nongovernmental organizations.

Nutritional outcome indicators

- § Prevalence of malnutrition among preschool children (<80% WFH)
- § Prevalence of birth weight infants (<2.5kg)
- § Prevalence of stunting in school entrants (<90% HFA)
- § Estimate of infant and/or child mortality rate.
- § Quality of housing
- § Water supply
- § Sanitation and literacy rate.

Discussion questions

1. Define nutritional surveillance
2. What are the objectives of nutritional surveillance?
3. What are the uses and who are the users of nutritional surveillance information?
4. What are the nutritional outcome indicators used in nutritional surveillance?

UNIT ELEVEN

Nutrition Intervention

Learning objectives:

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

- § Understand methods of intervention
- § Mechanisms of intervention
- § Describe the criteria for successful intervention

When there is a nutritional problem in a community, if the magnitude and the causes of the problem are known, we will plan to do intervention.

Methods of nutrition intervention

- § Food fortification
- § Food for work
- § Price subsidization
- § Supplementation
- § Family planning
- § Integration of nutrition with health
- § Price policy

Mechanisms of nutrition interventions

There are five principal mechanisms through which all interventions work.

Nutrition

- § Availability of food at local or regional level. Making the required foods more available with the respect to place and time.
- § Accessibility to food and availability of foodstuff at the household level. Making the required foods more accessible and available to the households
- § Food utilization at household level. Making better use of available foods. Food processing such as fermentation, preparing weaning food.
- § Distribution within the household.
 - Ø Intra household distribution of food
 - Ø Supplementation
 - Ø Education
- § Physiological utilization
 - Ø *ff*Itilioinjervn eb.4(oingJ1on ofntatlabiholilabTT7 1 Tf-0.7978 -1D0. TD0 T

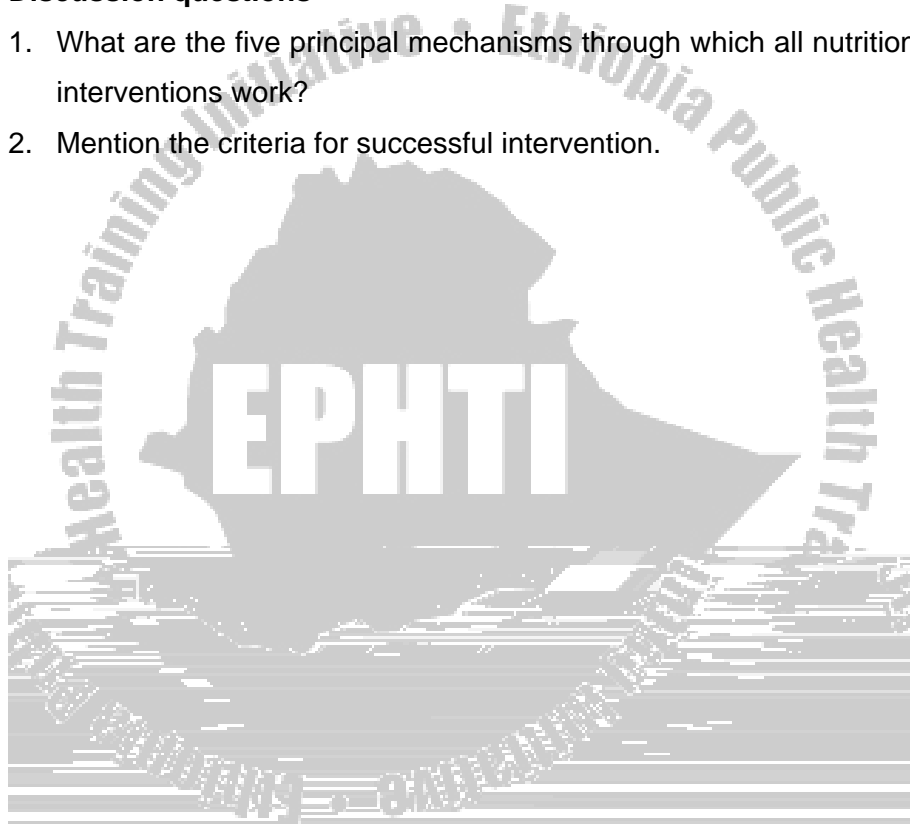


Nutrition

- § Ease in evaluation
- § Long-term continuation

Discussion questions

1. What are the five principal mechanisms through which all nutrition interventions work?
2. Mention the criteria for successful intervention.



UNIT TWELVE

Essential Nutrition Actions Approach

An action oriented approach to nutrition...

If we use ENA approach to nutrition, estimated decrease of child mortality is 25%. The seven essential actions and the six contact points should be included in the curricula of all health science students.

There are seven action areas:

1. Promotion of Breastfeeding

Key messages

- Timely initiation of breastfeeding (1 hour of birth)
- Exclusive breastfeeding until six months
- Breastfeed day and night at least 10 times
- Correct positioning & attachment
- Empty one breast before switching to the other

Estimated decrease of child mortality is 13% if the child is optimally breastfed

2. Appropriate Complementary Feeding

Key messages:

- Introduce appropriate complementary foods at 6 months
- Continue breastfeeding until 24 months & more

- Increase the number of feeding with age
- Increase density, quantity and variety with age
- Responsive feeding
- Ensure good hygiene (use clean water, food and utensils)

3. Feeding of the sick child

Key messages:

- Increase breastfeeding and complementary feeding during and after illness
- Appropriate Therapeutic Feeding.

4. Women's nutrition:

Key messages:

- During pregnancy and lactation
 - Ø Increase feeding
 - Ø Iron/folic Acid Supplementations
 - Ø Treatment and prevention of malaria
- De-worming during pregnancy
- Vitamin A Capsule after delivery

5. Control of Vitamin A Deficiency:

Estimated decrease of child mortality is 2%

Key messages:

- Promote breastfeeding: source of vitamin A
- Vitamin A rich foods

- Maternal supplementation
- Child supplementation
- Food fortification

6. Control of Anaemia

Key messages:

- Supplementation of women and children (IMCI)
- De-worming for pregnant women and children (Twice/year)
- Malaria control
- Iron rich foods
- Fortifications

7. Control of Iodine Deficiency Disorders:

Key messages

Access and consumption by all families of iodized salt

How the Essential Nutrition Actions expands coverage of nutrition support in the health sector:

There are six critical contact points in the lifecycle

1. During Antenatal Care

- Pregnancy: TT
- Antenatal visit, Iron/Folic Acid
- De-worming
- Maternal diet
- EBF

- Risk signs, FP, STI prevention
- Safe delivery, iodized salt

2. Delivery;

- Safe delivery,
- EBF,
- Vitamin A, Iron/Folic Acid
- Diet, FP and STI, Referral

3. Postnatal and Family Planning:

- EBF, Diet, Iron/Folic Acid
- FP, STI prevention
- Child's vaccination

4. Immunizations:

- Vaccination, Vitamin A
- De-worming
- Assess and treat infant's anemia
- FP, STI, Referral

5. Well child and GMP:

- Monitor growth
- Assess and counsel on feeding
- Iodized salt
- Check and complete vaccination
- Vitamin A/de-worming

6. Sick child:

- Monitor Growth
- Assess and treat per IMCI

Nutrition

- Counsel on feeding
- Assess and treat for anemia,
- Check and complete vitamin A
- Immunization/de-worming

Need to integrate ENA into other health programme

1. a) Child survival EPI+
b) Community IMCI
c) Health facilities IMCI
2. a) Reproductive Health
b) Women's Nutrition
c) Lactational Amenorrhea Method
3. a) National immunization Days Polio and Measles
4. a) Nutrition programme positive deviance community
GMP
5. a) Infectious Diseases, Control of Malaria,
Tuberculosis HIV/AIDS (PMTCT)
exp GMP

Nutrition

2. a) Agriculture, food diversification
 - b) Food security
 - c) Women's farmers clubs
3. a) Emergency women to women support
4. a) Sanitation, clean water & sanitation
 - b) Public health education
 - c) Prevention of diarrhoea, malaria, ARI
5. a) Micro-credit, income generation
 - b) Nutrition education

The most visible evidence of good nutrition is a taller, stronger, healthier child who learns more in school and become productive, happy adults who participate in society.

Malnutrition does not need to be severe to pose a threat to survival. Worldwide, fewer than 20% of deaths associated with childhood malnutrition involve severe malnutrition; more than 80% involve only mild or moderate malnutrition.

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