

MODULE

# *Maternal Nutrition*

Degree Program  
For the Ethiopian Health Center Team



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## Abbreviations

AIDS	= Acquired Immune deficiency syndrome
ARV	= Anti retroviral drug
ABCD	= Anthropometry, biochemical, clinical, dietary methods
ATP	= Adenosine triphosphate
BMI	= Body mass index
EBV	= Epstein barr virus
EDTA	= Ethylenediamine tetra acetic acid
ENA	= Essential nutrition action
HCT	= Hematocrit
HFA	= Height for age
HIV	= Immune deficiency virus
ICSM	= International council for standardization hematology
IDD	= Iodine deficiency disorder
IMCI	= Integrated management on childhood illnesses
IQ	= Intelligence quotient
IU	= Internation unit
IUGR	= Intrauterine growth retardation
MPN	= Most problem number
NCHS	= National center for health statistics
PCU	= packed cell volume
PEM	= protein energy malnutrition
RBC	= Red blood cell
SD	= Standard deviation
TB	= Tuberculosis
TSH	= Thyroid stimulations hormone
TT	= Tetanus toxoid
VCT	= Voluntary counseling and testing
WFH	= Weight for height
WHO	= World health organization

## Table of Contents

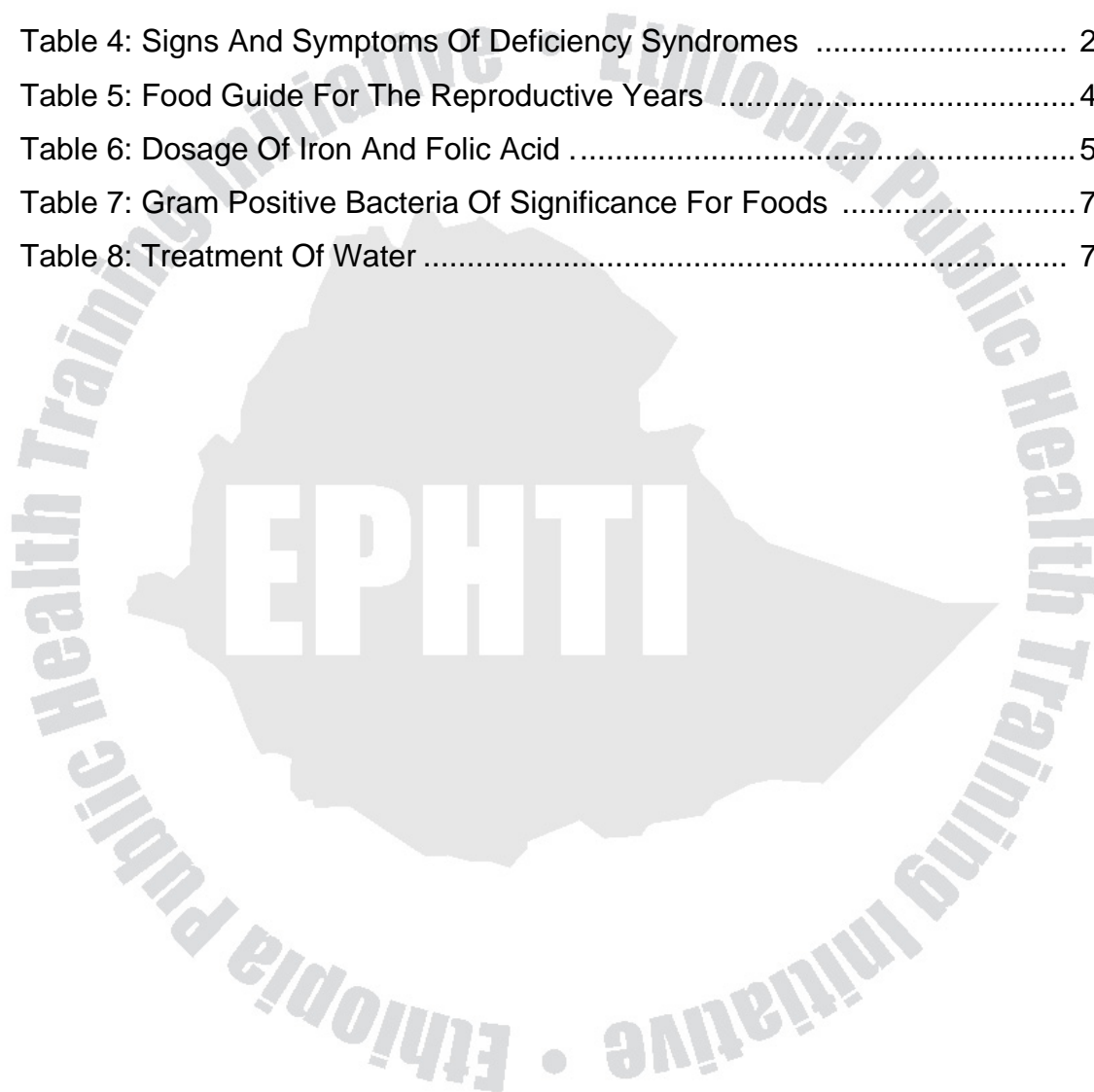
Acknowledgement.....	i
Abbreviations .....	ii
Table of Contens .....	iii
List Of Tables .....	vi
List of Figures .....	vii
<b>UNIT ONE: INTRODUCTION</b> .....	<b>1</b>
1.1. Purposes And Uses Of The Module.....	1
1.2. Direction.....	2
<b>UNIT TWO: Core Module</b> .....	<b>3</b>
2.1. Pre test .....	3
2.2. learning objectives .....	5
2.3. EPIDEMIOLOGY OF MATERNA NUTRITION .....	5
2.4. FACTORS AFECTING MATERNAL NUTRITION .....	7
2.5. The Role Of Maternal Nutrition In The Promotion Of Maternal Health.....	9
2.6. recommendations for mother During Pregnancy.....	10
2.7. The Maternal Nutritional Problems.....	11
2.8. Common Problems Related To Maternal Nutrition In Pregnancy.....	17
2.9. The Vicious Cycle Of Malnutrition And Hiv Pathogenesis.....	19
2.10. Maternal Nutritional Requirements.....	20
2.11. Assessment Methods.....	22
2.12. Nutritional Intervention .....	29
2.13. mechanisms of nutrition intervention.....	30
2.14. Essential Nutrition Actions Approach .....	35
2.15. CONTROL AND PREVENTION OF IODINE DEFICIENCY	
DISORDERS .....	40
<b>UNIT THREE: SATELLITE MODULE</b> .....	<b>41</b>
3. 1. Satellite Module For Health Officer Students On Maternal Nutrition .....	41
3.1.1. Introduction .....	41

3.1.2. Learning Objectives .....	42
3.1.3. What Are The Common Maternal Nutritional Problems? .....	42
3.1.4. Treatment And Prevention Of Vitamin A Deficiency.....	42
3.1.5. Prevention And Treatment Of Iron Deficiency.....	45
3.1.6. Assessment Of Maternal Malnutrition .....	45
3.1.7. Nutrition Intervention.....	45
3.1.8. Nutrition In Mothers.....	47
3.1.9. Supplementation .....	49
3.1.10. CASE STUDY .....	50
3.2. Satellite Module For Nursing Students On Maternal Nutrition.....	52
3.2.1. Introduction .....	52
3.2.2. Learning Objectives .....	52
3.2.3. Learning Activity.....	53
3.2.4. Major Maternal Nutritional Problems Of Public Health .....	55
3.2.5. Factors That Affect Maternal Nutritional Status.....	55
3.2.6. Assessment Of Maternal Nutritional Status.....	55
3.2.7. Intervention Against Maternal Nutritional Problems .....	55
3.2.8. Management Of Maternal Nutritional Problems .....	55
3.2.9. Management Of Nutritional Problems In Pregnancy .....	57
3.2.10. Prevention Of Maternal Nutritional Problems .....	62
3.3. Satellite Module For Medical Laboratory Students On Maternal Nutrition .....	63
3.3.1. Introduction .....	63
3.3.2. Learning Objectives .....	65
3.3.3. Learning Activities: Case Study .....	65
3.3.4. Laboratory Investigations Associated With Maternal Nutrition .....	66
3.3.5. Investigation For Blood And Intestinal Parasites.....	71
3.4. Satellite Module For Environmental Health Students On Maternal Nutrition .....	77
3.4.1. Introduction .....	77
3.4.2. LEARNING OBJECTIVES .....	78

3.4.3. Pre And Post Test .....	78
3.4.4. The Role Of Prevention Of Maternal Malnutrition .....	81
3.5. Satellite Module for Health Extension Workers on Maternal Nutrition.....	85
3.5.1 Introduction .....	85
3.5.2 Purpose and Use of The Module .....	85
3.5.3 Direction for Using This Module .....	85
3.5.4 Pretest for Health Extension Package Students .....	85
3.5.5 Learning Objectives .....	86
3.5.6 Learning Activity: Case Study .....	86
3.5.7 Causes of Maternal Nutrition .....	87
3.5.8 Factors Affecting Maternal Nutrition .....	87
3.5.9 The Role of Maternal Nutrition in the Promotion of Maternal Health ....	88
3.5.10 What Mothers do During Pregnancy .....	88
3.5.11 Common Maternal Nutritional Problems .....	88
3.5.12 Assessment of Maternal Nutritional Status .....	91
3.5.13 Essential Nutrition Actions Approach .....	92
<b>UNIT FOUR: AUTHORS.....</b>	<b>95</b>
<b>REFERENCES .....</b>	<b>96</b>

## List of Table

Table 1: Recommended Daily Dietary Allowances For Women .....	20
Table 2: Recommended Weight Gain In pregnancy .....	21
Table 3: Waterlow Classification .....	26
Table 4: Signs And Symptoms Of Deficiency Syndromes .....	28
Table 5: Food Guide For The Reproductive Years .....	48
Table 6: Dosage Of Iron And Folic Acid .....	55
Table 7: Gram Positive Bacteria Of Significance For Foods .....	73
Table 8: Treatment Of Water .....	75





## List Of Figure

Fig. 1. Cycle Of Malnutrition .....	12
Fig. 2. The Vicious Cycle Of Malnutrition And HIV Pathogenesis .....	19



# UNIT ONE

## INTRODUCTION

### 1.1. Purposes and uses of the module

For many years it has been known that the height and weight of the mother is closely related to infant birth weight and pregnancy outcome such as perinatal mortality, low birth weight and stunting are often due to chronic malnutrition during pregnancy. Mothers who enter pregnancy with sound reproductive physiology, and who have not suffered ill health or nutritional deprivation during pregnancy are more likely to have larger and healthier infants than mothers who do not have such advantages. Several studies provide evidence for the relationship between adult size reproductive efficiency and socio economic status.

Studies in the U.S. conducted by the National Institute of Health, have shown that mothers who weigh more than 68 kg at conception or who gain more than 13.6 kg in weight during pregnancy tend to have larger and healthier babies with a lower perinatal mortality as compared to mothers who weigh less than or gain less weight than above.

Mothers are often the primary care providers of the children in the household, community and country. They themselves have to be healthy and need the time, the knowledge and the right environment to carry out their duties.

The major maternal micronutrient deficiencies of public health importance in Ethiopia are iodine deficiency, vitamin A deficiency and iron deficiency. Other deficiencies, mainly related to iodine thiamine, vitamin C and fluoride are also observed sporadically in some parts of the country.

To bring a significant change in the reduction of maternal morbidity and mortality due to malnutrition, the presence of health professionals trained through use of appropriate teaching materials (modules) are mandatory. This module is expected to fill the gap and facilitate the activities of the health center team. Health science students, instructors and graduate professionals can use this module to improve maternal nutrition wherever they are.

## 1.2. Directions

- Attempt the pre-test questions.
- Go through the core module and ensure that you understand the epidemiology, causes, prevention and management of maternal nutrition.
- Each category of student is expected to:
  - Read the respective satellite module
  - Study and discuss the respective specific learning objectives and activities.
- Answer all post-test questions
- Compare your answers of the pre-test and post-test by checking against the key provided.

## UNIT TWO

### CORE MODULE

#### 2.1. Pre-test

1. Maternal nutrition is affected by:
  - a) Income
  - b) Culture
  - c) Heavy physical activities
  - d) All of the above
  - e) None of the above
2. One of the following does not affect maternal nutrition
  - a) Race
  - b) Pregnancy
  - c) Lactation
  - d) Digestion
3. The pregnant woman should take in \_\_\_\_\_ more calories than non pregnant woman. (Fill in the blank)
  - a) 150 kcal/day
  - b) 350 kcal/day
  - c) 1000 kcal/day
  - d) None of the above
4. The important cause(s) of malnutrition in women include the following except:
  - a) Ignorance
  - b) Uneven distribution of available food
  - c) Infectious disease
  - d) Insufficient supply of the necessary food
  - e) All of the above
  - f) None of the above
5. Insufficient food supply is due to:
  - a) Lack of food production
  - b) The families are unable to purchase the available food in the market
  - c) Poor communication
  - d) Change of weather conditions
  - e) All of the above
  - f) All except C
6. The following are underlying causes of retarded fetal growth except for:

- a. Poor maternal nutrition                      c. Acute and chronic illness  
b. Anemia    d. None of the above
7. Which method of nutrition intervention is least practiced in Ethiopia?  
a. Food fortification                              c. Supplementation  
b. Price policy                                      d. Nutrition education
8. One of the following is not an anthropometric measurement:  
a. Weight    c. Skin fold thickness  
b. Height    d. Biochemical tests
9. Which one of the following helps to detect chronic malnutrition (stunting)?  
a. Weight for height                              c. Weight for age  
b. Height for age                                      d. All the above
10. Adding a needed nutrient or nutrients to foods which are centrally produced and commonly eaten within a particular society for the purpose of preventing deficiency is:  
a. Fortification                                      c. Complementation  
b. Supplementation                                d. All of the above
11. Iodine deficiency disorder can be prevented at a national level by:  
a. Iodine capsule supplementation              c. Iodine injection  
b. Universal salt iodization                      d. All of the above
12. Which of the following is/are not consequence of maternal malnutrition?  
a. Infection    c) Decrease immune function  
b. Low productivity                                d) None of the above
13. The cause for anemia includes:  
a. Iron deficiency                                      c. Malaria  
b. Hookworm    d. All of the above
14. Which of the following statement(s) is/are true about well nourished HIV infected woman  
a. Delay HIV progression to AIDS                      d. All of the above  
b. Maintains body weight and strength  
c. Enhances response to anti-retroviral drugs

15. Which statement is true about maternal nutrition?
- Carbohydrate is the only calorie source for lactating mother
  - The nutritional requirement of lactating women is more than pregnant women.
  - Vitamin A should be given routinely to all pregnant women.
  - None of the above
16. The normal average weight gain in pregnancy is:
- 3.5kg
  - 8.0 kg
  - 10kg
  - 12.5kg

## 2.2. Learning Objectives

At the end of the course the student will be able to

- Discuss the role of nutrition in the promotion of maternal health
- Discuss some of the important causes of maternal malnutrition
- Identify the available intervention methods.

## 2.3. Epidemiology of Maternal Nutrition

According to the 1992 National Rural Nutritional Survey, among the more food secure households in rural parts of Ethiopia, prevalence of malnutrition is 50% higher, than urban. Pocket studies conducted in various parts of the country showed maternal malnutrition to be:

- 5.0% severely malnourished (BMI <16.0)
- 12.0% moderately malnourished (BMI 16.0-16.9)
- 33.0% mild malnutrition (BMI 17.0-18.4)

### Causes of maternal malnutrition

- Insufficient supply of the necessary food due to lack of food production, unavailability of food on the market or lack of money to purchase the available food on the market.
- Lack of knowledge about food, nutrition, safe and sanitary preparation, preservation of food, healthy life style at individual, household, community and national levels.
- Infectious disease

- Available land devoted to cash crop, too little for food crops.
- The amount of food for human consumption varies each year in Africa. The situation has worsened considerably during the last three decades. Drought has become wide spread; population growth in some countries has been more rapid than the increase in food production, e.g. Kenya and Ethiopia. In addition to drought, food production is affected by:
  - Suitability of the soil for certain crops/poor soil fertility/
  - Limited knowledge of agriculture
  - Available land devoted to cash crop
- Uneven distribution of the available food within the household and the community.

Within the household, nutritionally vulnerable groups have the lowest priority. Good food is always served to the head of the household. Mothers eat last or they are served with lower quality food.

Within the community and region as a whole, poor distribution of food in the country may be the result of a lack of certain foods in some areas, e.g.

- In the tsetse fly infested areas, there are no cattle and people cannot get animal products like milk and milk products as well as meat.
- In the arid zone, there are no vegetables and fruits, therefore, people do not take in vitamin rich food.
- In the areas where there is no sea, lake or big river, there is no fish available. People may not eat protein rich animal food. The localized shortages of foods are also aggravated by poor communication, transport, lack of storage and preservation facilities.
- There is a wide spread lack of understanding of the functions of foods. Some people do not know how to feed their children and adults according to their nutritional requirements.
- Infections and parasitic disease are prevalent in all countries of Africa and mothers and their children are especially affected. The nutritional condition of both children and mothers is affected and hence their physical and mental development may be retarded.

These four fundamental causes of maternal malnutrition are also, related to:

- Loss of foods through destruction by insects, fungi, rodents, birds and other animals because of poor storage.
- Soil erosion, often resulting from over grazing of cattle and indiscriminate burning of fields.
- Poor farming practices often due to lack of knowledge, skill, money, equipment and improved agricultural inputs.
- Lack of rain because of changes of weather conditions.
- Lack of time for women to prepare food properly and provide special dishes for herself and her children.

Among the time consuming and energy expending activities of the rural Ethiopian women are drawing and carrying of water from long distance, too heavy farm work, domestic works and hand grinding of cereals.

## 2.4. Factors Affecting Maternal Nutrition

### **Culture and beliefs:**

- ◆ Culture plays a significant role in the types of food eaten as well as feeling about diet and nutrition.
  - During periods of fasting, important nutrients are not consumed, such as animal products.
  - Pork may be forbidden for religious and cultural reasons.
  - Discrimination in feeding among family members; adult males (head of the household) eat before females and children are given left over food.

**Economy:** The type and amount of foods consumed during pregnancy and lactation depends upon the income of the family.

**Gender:** In the family and community, females are socially given lower priority and hence they are served with low quality and quantity foods.



## **Pregnancy and Lactation**

The pregnant and lactating woman's diet should include a substantial increase in calories, protein, calcium, folic acid, and iron. Pregnant women at particular risk for nutritional deficiencies are adolescents, underweight women, obese women, women with chronic nutritional problems, women who smoke or ingest alcohol or drugs, low income women, and women with chronic illnesses such as diabetes or anemia.

### **Life and habit**

Eating patterns are highly individualized and greatly determined by personal preference, for example:

- Pregnant mothers have limited motivation to cook and eat meals alone.
- Mixing foods, e.g. Injera with Wat prepared from cereals, legumes, vegetables and others.
- Eating of cereals in the form of kolo (roasted) and nifro (boiled)
- Eating Inset (false banana) which prevents constipation
- Drinking camels milk in the pastoral areas.
- Eating raw vegetables and cereals

The planning of food to meet special needs begins with the pregnant women, lactating mothers, infants and adolescents.

Infant malnutrition often begins at conception. When pregnant women consume inadequate diets, have excessive workloads, or are frequently ill, they give birth to smaller babies with a variety of health problems. Children born to malnourished mothers are more likely to die at infancy. If they survive, by the second year of life they may have permanent damage. For this reason, pregnant and breast-feeding women and children under two years of age should be priority target groups for nutrition intervention. The effect of early childhood malnutrition persists into the school years and even adulthood, lowering productivity and quality of life. Small adult women who were malnourished as children are more likely to produce small babies, and the cycle of malnutrition and illness continues.

## **2. 5. The Role of Maternal Nutrition in the Promotion of Maternal Health**

The state of the mother's physiology, especially reproductive physiology, at the time when pregnancy commences has considerable influence on the growth of the fetus. Several studies provide evidence for the relationship between adult size, reproductive efficiency and socio-economic status. In general, the baby of a short woman is lighter and has less vitality and a lower survival than that of a tall woman. Stunting in the mother cannot be overcome by a good diet in pregnancy and the same applies to reproductive efficiency.

The growth of the fetus may be regarded as a result of the interaction between its genetic potential and the intrauterine environment. Mothers who enter pregnancy with sound reproductive physiology and who have not suffered ill health or nutritional deprivation in childhood will have larger and healthier infants than mothers who do not have such advantages.

Our knowledge of maternal nutritional requirements for growth in the human fetus has developed from a variety of studies. The relationship between food intake in the mother and its effect on the offspring is best seen in animal experiment, especially in those species where the gestational period is relatively short and a correlation between dietary intake and maternal health or fetal growth can be readily seen. There have been epidemiological studies of women comparing birth weights in different social groups, and similar observations during famine and war, which show the effects of acute food shortage on fetal growth. For many years it has been known that the height of the mother is closely related to birth weight and pregnancy outcome, such as perinatal mortality.

There are more short mothers in the lower socio-economic groups, which means that inadequate nutrition and frequent illnesses prevent many girls in the social group from achieving optimal physique.

Studies in the U.S conducted by the National Institute of Health, have shown that mothers who weigh more than 68 kg at conception or who gain more than 13.6kg during

pregnancy tend to have larger and healthier babies with a lower perinatal mortality compared to mothers who weight less or gain less weight than above.

## **2.6. Recommendations for mothers during pregnancy**

- Weight gain during pregnancy is essential. Help clients understand the importance of adequate weight gain during pregnancy. Strongly discourage clients who are obese from attempting to lose weight during pregnancy.
- Encourage clients to plan meals carefully so that all of the nutrients needed during pregnancy can be included without excessive calories using a food guide for pregnancy is helpful.
- Caffeine intake should be limited.
- Instruct client to take only vitamins and minerals prescribed. Excessive amounts can be harmful.
- Advise clients that skipping meals is a poor practice, especially for the pregnant woman. The fetus needs a steady supply of nutrients.
- Encourage the pregnant mother to use high fiber foods and plenty of fluids to avoid constipation.
- Give priority to helping pregnant teenagers improve their eating habits. Together with the teenagers, plan meals and snacks that are nutritious and at the same time acceptable to the teenagers. Teen age pregnancy is undesirable.
- Take advantage of the client's high motivation during pregnancy to provide nutrition education for the family as well as for the pregnant woman.
- Alcohol consumption such as liquor, wine, beer, Tella, Teje, and Areki should be avoided during pregnancy. It could be associated with the risk of birth defects, as alcohol enters both the maternal and the fetal blood stream. Babies born to alcoholic mothers may develop Fetal Alcohol Syndrome. This disorder is characterized by low birth weight, slow growth and development and in some cases; there will be permanent mental retardation.

Many factors cause variation in weight at birth, but in developing countries the mother's health and nutritional status and her diet during pregnancy are probably most important.

One of the reasons for low birth weight is retarded fetal growth and this often occurs due to poor maternal nutrition. Moreover, the following factors should be known as causes for low birth weight or improving birth weight:

- Anemia
- Acute or chronic infection such as TB
- Effort to increase the amount of food available to pregnant and lactating mothers can be the most effective way of improving their health and that of their infants.
- To support lactation and maintain sufficient maternal reserves, most mothers in developing countries will need to eat about 650 additional kilo-calories (the equivalent of one extra meal) every/day.
- Mothers should eat a balanced diet (including fruits, and vegetables, animal products, and fortified foods, when possible) by consuming a variety of foods.
- Community and household members should be informed of the importance of making additional food available to women during pregnancy and lactation, as well as helping them reduce their workload and obtain adequate rest.

## **2.7. The Maternal Nutritional problems:**

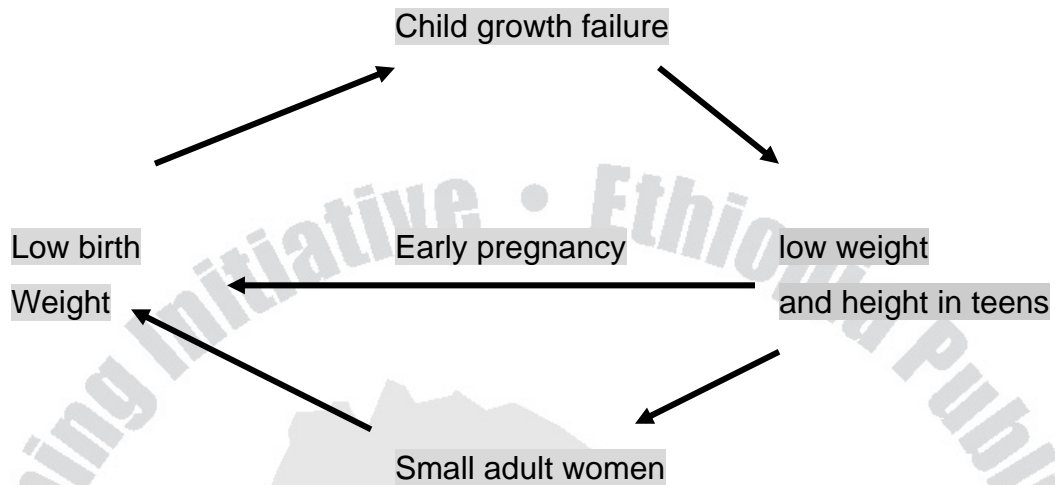
### 1. Types of malnutrition

#### Under nutrition

- a) Protein – Energy malnutrition
- b) Micronutrient malnutrition

#### Over nutrition – obesity

## 2. The integral cycle of malnutrition



**Figure 1: Cycle of Malnutrition**

## 3. Maternal malnutrition: a life cycle issue

### 3.1. Infancy and early childhood (From birth-24 months)

- Suboptimal breast-feeding practice
- Inadequate and inappropriate complementary feeding
- Infrequent feeding
- Frequent infections

### 3.2. Childhood (2-9yrs)

- Poor diet
- Poor health care
- Poor education

### 3.3. Adolescence (10-19 years)

- Increased nutritional demands
- Greater iron needs
- Early pregnancy

### 3.4. Pregnancy and lactation

- Higher nutritional requirements
- Increased micronutrient intake
- Closely spaced pregnancies

### 3.5. Throughout life

- Food insecurity
- Inadequate diets
- Recurrent parasitic infection
- Poor health care
- Heavy work loads
- Gender inequities

## 4. Consequences of maternal malnutrition on

### 4.1. Mothers

- High maternal mortality
- Increased infection
- Anemia
- Decreased immune function
- Lethargy and weakness
- Low productivity
- Obstructed labor

### 4.2. fetal/Infant health

- Increased fetal and neonatal death
- Intrauterine growth retardation
- Low birth weight
- Preterm delivery
- Decreased immune function
- Birth defects
- Cretinism and decreased IQ

### 4.3. Family and community

- Increased expenditure of resources (cost of medical/social costs)
- Affects the socioeconomic condition

## 5. The most common maternal nutritional problems

- Protein deficiency
- Iron deficiency
- Vitamin A deficiency

- Iodine deficiency
- Folic acid deficiency
- Zinc deficiency
- Vitamin B<sub>6</sub> and B<sub>12</sub> deficiency
- Protein energy malnutrition

#### 5.1. Protein energy malnutrition

It is due to deficiency of protein, fat and carbohydrate in the diet. Therefore, the body starts breaking down muscle to provide the needed energy if no carbohydrates are present for energy production

Consequences:

- Infection
- Obstructed labor
- Maternal mortality
- Low birth weight and IUGR
- Neonatal and infant mortality
- Maternal wasting
- Fatigue
- Increase in spontaneous miscarriage

#### 5.2. Iron deficiency

- It is the most common form of malnutrition
- It is the most common cause of anemia
- Other causes of anemia include hookworm, malaria
- Anemia is defined in first and third trimesters as hemoglobin concentration less than 11gm/100ml or Hematocrit less than 33% and in second trimesters hemoglobin less than 10.5gm/100ml or hematocrit less than 32%
- Causes of dietary iron deficiency
  - Low dietary iron intake
  - Low iron bioavailability.
  - Prohibitors consumption
- Parasitic infections like hookworm
  - Cause blood loss

- Increase iron loss
- Malaria
  - Destroys red blood cells
  - Leads to severe anemia
  - Increases risk in pregnancy
- Consequences of maternal anemia
  - Higher maternal death
  - Reduced transfer of iron to the fetus
  - Low birth weight
  - Higher neonatal mortality
  - Reduced physical activity and productivity
  - Impaired cognition

### 5.3. *Vitamin A deficiency*

- Causes
  - Inadequate intake of vitamin A rich foods
  - Recurrent infection
  - Short interval between births
- Consequences
  - Night blindness
  - Contributes to higher maternal mortality
  - Miscarriage
  - Stillbirth
  - Low birth weight
  - Reduced transfer of vitamin A to fetus
  - Low vitamin A concentration in breast milk

### 5.4. *Iodine deficiency*

- Causes
  - Living in the mountainous area where plant foods have inadequate iodine as there is little or no iodine in the soil.
  - Using cassava tuber as a food without detoxifying it and other chelating substances



- Not eating sea food
- Not consuming iodide salt
- Consequences
  - Impaired cognition
  - Poor school performance
  - Endemic cretinism
  - Goiter
  - abortion

#### 5.5. *Zinc deficiency*

- Causes
  - Conditions that decrease bio-availability like Phytates and dietary fibers and increase excretion of zinc
  - Poor zinc content in diet
- Consequences
  - Premature rupture of membrane
  - Prolonged labor
  - Preterm labor
  - Low birth weight
  - Maternal and infant mortality
  - Impaired wound healing
  - Dwarfism and hypogonadism
  - Skin lesion
  - Poor appetite
  - Impaired bone development in the fetus

#### 5.6. *Folic acid deficiency*

- Cause
  - Nutritional deficiency
  - Drugs that affects bioavailability
- Consequences
  - Maternal anemia
  - Infant neural tube defect

- Low birth weight

#### 5.7. Vitamin B<sub>6</sub> and B<sub>12</sub> deficiency

- Causes
  - INH drugs taken for long time
  - Vitamin B<sub>6</sub> inadequate intake
  - Low vitamin B<sub>12</sub> content in vegetarian diets
  - Low intake of animal products
- Consequences
  - Megaloblastic anemia
  - Impaired development of infant brain
  - Impaired neurological development of infants

## 2.8. Common Problems Related to Maternal Nutrition in Pregnancy

Health workers are likely to encounter a number of nutritional problems in day-to-day prenatal care.

### 1. Adolescent pregnancy

- They are at risk for preterm delivery, increased perinatal mortality and low birth weight.
- Due to concern about body image, the adolescent may take inadequate energy and nutrients resulting in low weight gain.
- Young adolescents are at high risk due to the growth demands of her own body as well as her fetus.
- The diet chosen by female adolescents are variable and deficient in micronutrients both in pregnancy and before pregnancy
- In adolescents pica, hyperemesis gravidarum, drug abuse and alcohol may be a problem.

### 2. Nausea, vomiting and hyperemesis gravidarum

- Usually occurs in the first trimester
- Causes discomfort and anxiety as well as weight loss, ketosis and dehydration in more severe cases.

### **3. Pica**

- The craving and eating of non-foods such as laundry starch and clay.
- It is common in some ethnic groups.
- The etiology is unknown but cultural belief and iron deficiency anemia are thought to be contributing factors.
- Pica replaces ingested nutritious food and may bind dietary iron, leading to anemia. There is also the possibility that the ingested substance is toxic

### **4. Heart burn and acid ingestion**

Common complaints in pregnancy that affect intake of nutrients.

### **5. Constipation**

Can be treated by increasing dietary fibers, fluid intake, and exercise.

### **6. Vegetarianism**

The strict vegan lacks essential amino acids from animal proteins.

### **7. Food restriction**

- Dieting and fasting on a chronic basis can result in suboptimal fetal growth.
- Bulimia and anorexia nervosa reflect extreme forms of food restriction and malnutrition

### **8. Ingestion of caffeine**

Caffeine is contained in foodstuffs like coffee, chocolate and cola beverages.

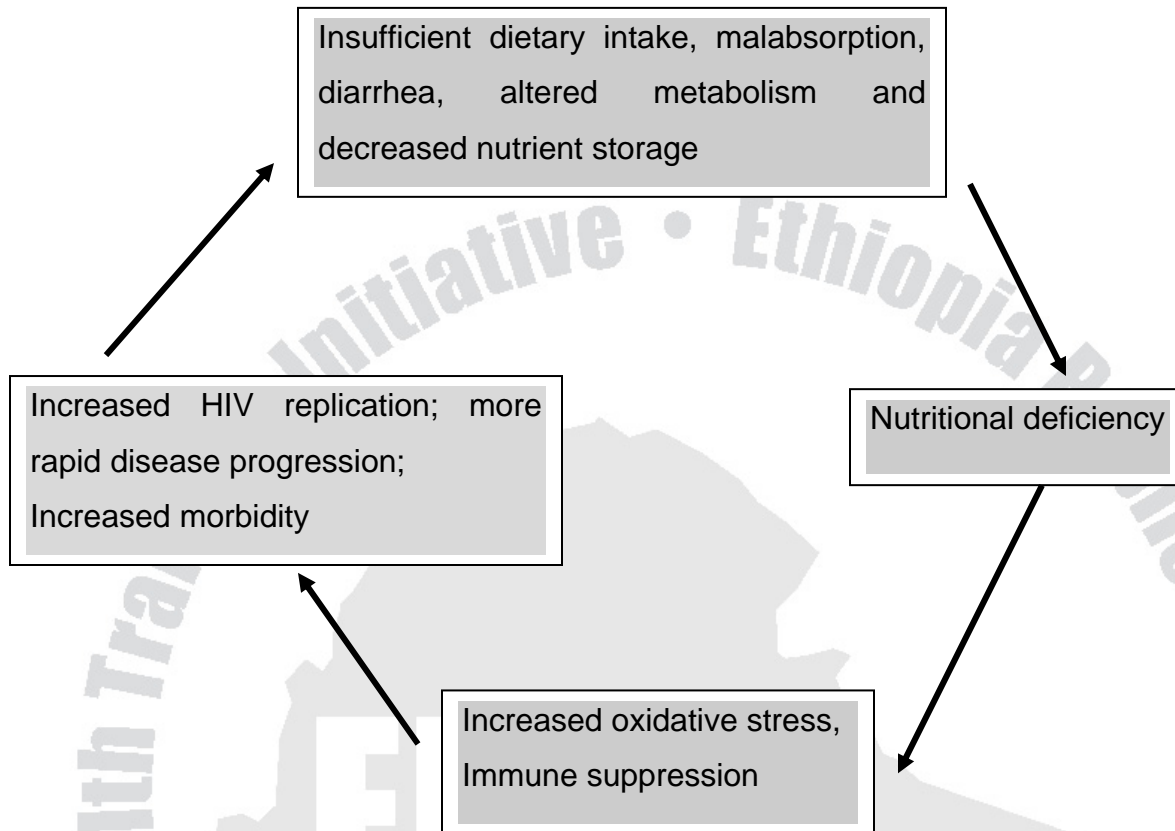
Problems – withdrawal symptoms including nausea, lethargy, malaise and headache, insomnia, acid indigestion, reflux and urinary frequency.

**9. Ptyalin (Amylase)** – increased production of saliva probably induced most of the times by consumption of starch.

### **10. HIV/AIDS and maternal nutrition**

Malnutrition affects the natural progression of HIV and HIV/AIDS affects the nutritional status of a woman.

## 2.9. The Vicious Cycle of Malnutrition and HIV pathogenesis



**Figure 2: Vicious Cycle of Malnutrition and HIV pathogenesis**

- Good nutrition delays HIV progression to AIDS, maintains body weight and strength, and enhances response to therapy
- Antiretroviral drugs (ARV) and food/nutrient can interact.

## 2.10. Maternal Nutritional Requirements

**Table. 1: Recommended Daily Dietary Allowances for Women Before and During Pregnancy and Lactation.**

<i>Nutrients</i>	<i>Non-pregnant</i>	<i>Pregnant</i>	<i>Lactating</i>	<i>Food</i>
Energy (kcal)	2200	2500	2600	Protein, carbohydrate and fat
Protein (gm)	50-55	60	65	Meat, fish poultry and dairy
Vitamin A ( $\mu\text{g}$ )	800	800	1300	Fruits, liver and vegetables (yellow and green)
Vitamin D ( $\mu\text{g}$ )	5	10	12	Fortified dairy products
Vitamin C ( $\mu\text{g}$ )	60	70	95	Citrus fruit and tomato
Thiamin ( $\mu\text{g}$ )	1.1	1.5	1.6	Enriched grains and pork
Riboflavin ( $\mu\text{g}$ )	1.3	1.6	1.8	Enriched grains, meat and liver
Niacin (mg)	15	17	20	Meat, nuts and legumes
Vitamin B <sub>12</sub> (mg) (Cobalamin)	2	2.2	2.6	Meat
Vitamin B <sub>6</sub> (mg) (pyridoxine)	1.6	2.2	2.1	Meat, enriched grains and liver
Folate ( $\mu\text{g}$ )	180	400	280	Leafy vegetable and liver, grains
Calcium (mg)	800	1200	1200	dairy products
Phosphorus (mg)	1200	1200	1200	Meat
Magnesium (mg)	280	320	355	Seafood, legumes and grains
Iron (mg)	15	30	15	Seafood, meat, grains and
Zinc (mg)	12	15	19	Meat, seafood and eggs.
Iodine ( $\mu\text{g}$ )	150	175	200	Iodized salt and seafood

## 1. Diet during pregnancy and lactation

Make sure the type of food used to prepare woman's meals and snacks are enough to provide the daily energy requirement needed; non-pregnant woman 2200 kcal, pregnant women 2,500 kcal and lactating woman 2600 kcal or feed her four times in a day.

## 2. Weight gain during pregnancy

Table 2: *The recommended weight gain in pregnancy is 11.5 to 16kg, the average is 12.5kg for women with normal pre - pregnancy body mass index (BMI)*

<i>Pre pregnancy BMI</i>	<i>Recommended total gain (kg)</i>
Low (BMI < 18.5)	12.5 – 18
Normal (BMI 18.5 – 25)	11.5 – 16
High (BMI > 25 - 30)	7 – 11.5
Obese (BMI >30)	< 7

### Remember:

- Low weight gain is associated with low birth weight and preterm delivery
  - Excessive weight gain causes macrosomia and increased cesarean delivery
  - Components of weight gain during a normal pregnancy are:
    - Fetus, placenta, amniotic fluid = 4750 gm
    - Uterus and breasts = 1300 gm
    - Blood = 1250 gm
    - Water = 1200 gm
    - Fat = 4000 gm
- Total**                      **12500 gm**

### Assessment of maternal nutritional status

Nutritional assessment is the process of estimating the nutritional status of an individual or group, at a given point in time, by using proxy measurement of nutritional adequacy. It provides an indication of the adequacy of the balance between dietary intake and metabolic requirement.

## Uses of Nutritional Assessment

It should aim at discovering facts to guide actions intended to improve nutrition and health.

- a) Diagnostic tool (individual and group):
  - Identify whether a problem exists
  - Type of problem
  - Magnitude of the problem
  - Who is affected by the problem
- b) Monitoring tool (individual and group)
  - Requires repeated assessment over time
  - Has the situation changed?
  - Direction and magnitude of change
- c) Evaluation tool (individual or group): To what extent has the intervention, treatment, or program had the intended effect (impact)

## 2.11. ASSESSMENT METHODS

### ***Assessment of maternal nutritional status***

Maternal nutritional status can be assessed using the ABCD (Anthropometry, biochemical, clinical and dietary methods).

### **Anthropometric assessment**

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

Two types:

- Growth measurement
- Body composition (body fat, and fat-free mass)

Indices can be derived directly from a single raw measurement;

- Height for age
- Weight for height

## Anthropometric assessment of growth

Common measurements include:

1. Stature (height)
2. Body weight
3. Skin fold

## Indices derived from growth measurements

### 1. Weight-for-height:

- Sensitive index of current nutritional status

Limitations:

- edema may complicate

### 2. Height-for-age:

- Estimates the past or chronic nutritional status
- Valuable as an index of stunting

Stunting:

- Slowing of skeletal growth and stature
- End result of a reduced rate of linear growth
- Results from an extended period of inadequate food intake and high morbidity
- Depends on genetic/ethnic factors
- Accurate measurement technique is essential because of narrow distribution of height measurement at a given age
- Used to assess children's nutritional status which is a reflection a reflection of the nutritional status of the household.

### 3. Weight changes:

- a reflection of changes in protein, water, mineral and/or body fat content.

### 4. Weight/height ratio:

- Frequently used for adults
- Measures body weight corrected for height

Two types:

- Relative weight
- Power type indices



Relative weight expresses the weight of a given subject as a percentage of the average weight of persons of the same height.

Power-type indices express weight relative to some power function of height or height relative to some power function of weight.

$$\text{BMI} = \text{Wt}/(\text{Ht})^2$$

Body muscle, composed largely of protein, is a major component of the fat-free mass and serves as an index of the protein reserves of the body. These reserves become depleted during chronic under-nutrition and is known as muscle wasting.

Triceps skin-fold:

- Measured at the mid-point of the back of upper left arm

Biceps skin-fold:

- Measured as a thickness of a vertical fold on the front of upper left arm directly above the center of cubital fossa, at the same level as triceps skin-fold

Sub-scapular skin-fold:

- Measured just below and lateral to the angle of the left shoulder blade, with the shoulder and left arm relaxed

Supra-iliac skin-fold:

- Measured in the mid-axillary's line immediately superior to the iliac crest

Mid-axillary's skin-fold:

- Measured at the mid-axillary's line at the level of the xiphoid process

### **Methods of Dietary assessment**

Two major groups of methods:

1. Quantitative daily consumption method:

- Recalls or records designed to measure quantity of the individual food consumed over a one day period

## 2. Dietary history and food frequency:

- Retrospective information on the patterns of food use during a larger, less precisely defined time period (questionnaire).

### Twenty-four hour recall period:

- Interview based
- Recall of exact food intake during the previous 24 hours or preceding day
- Detailed description of all foods and beverages including cooking methods and brand names.
- Use of vitamins and minerals as supplements also noted
- Appropriate for assessing average intake of foods and nutrients for large groups

### Limitations

- Persons with poor memory and young children
- Flat slope syndrome i.e. overestimation of low intakes and underestimation of increased intakes

### Weighed food records

- Subject weighs all foods and beverages consumed
- Occasional foods eaten away from home recorded including description of amounts (probable weight determined by investigator)
- More precise measurement compared to the estimated record method

## 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').

Waterlow recommends that individuals should be classified according to the degree of wasting and the degree of stunting. He provides a two-way table and suggests how the cut-off points should be chosen.

## Classification of all degree of protein energy malnutrition

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

WFH = 80% of the Reference standard or  
–2SD below the median

HFA = 90% or – 2SD below the median

**Table. 3: Waterlow classification**

<i>Height</i>	<i>Weight</i>		
		Above	Below
Above		Normal	Acute malnutrition
Below		Nutritional Dwarfism	Chronic Malnutrition

## BIOPHYSICAL METHOD

It includes radiographic examination and tests of physical functions.

Limitation: tests can be complex, requires expensive equipment and highly trained staff.

Examination: bone density, scurvy, osteomalacia and fluorosis.

Function test includes those of dark adaptation, physical performance and muscle coordination.

## Assessing Protein energy malnutrition in women

- Height less than 1.45m
- Weight less than 45kg
- BMI less than 18.5 (thinness)
- Pregnant – weight gain less than 1.5kg/month in the second and third trimesters (or less than 10.5kg gained over full course of pregnancy)

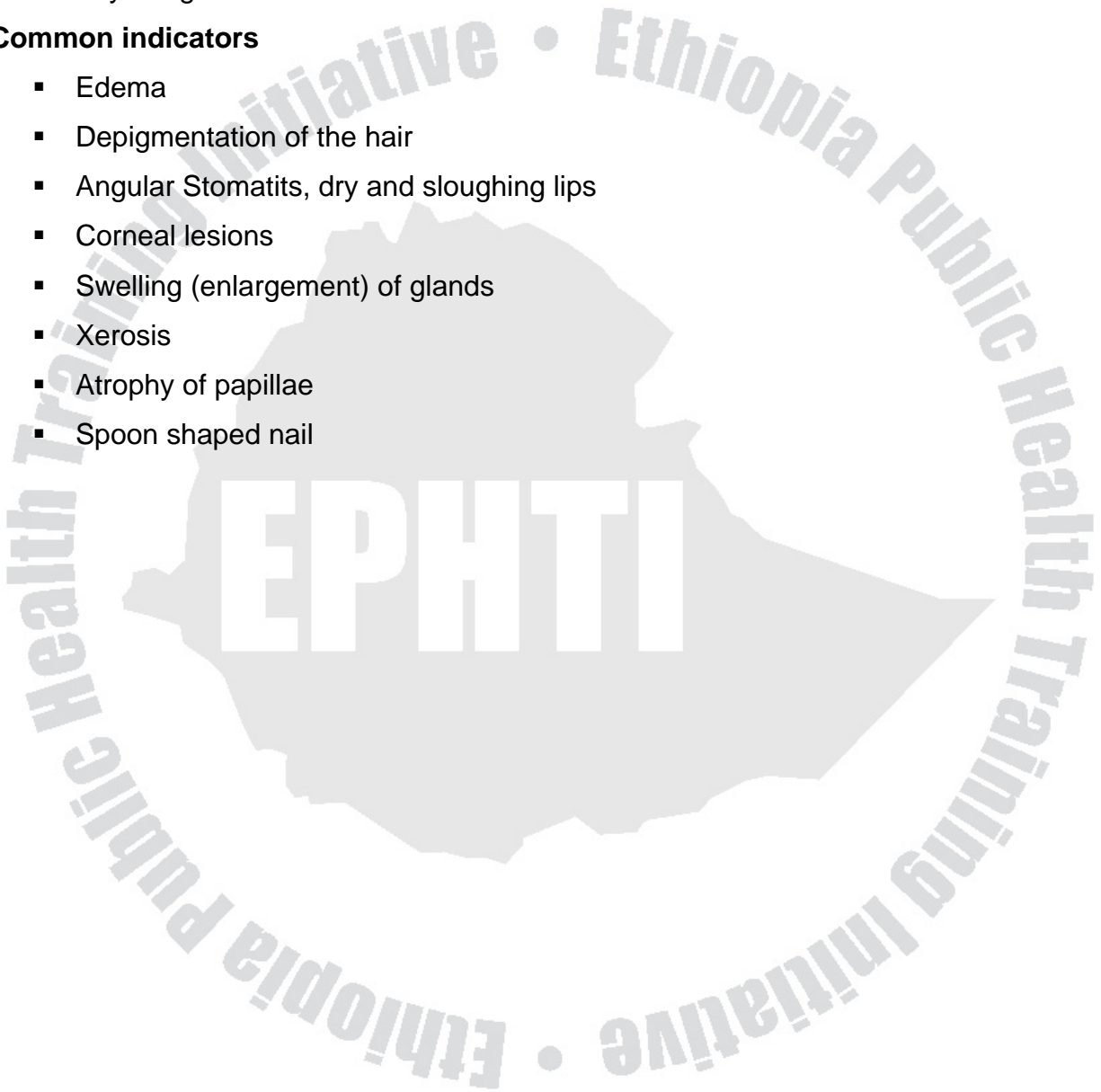
## Clinical method

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
- Tongue, nail
- Thyroid gland

#### **Common indicators**

- Edema
- Depigmentation of the hair
- Angular Stomatits, dry and sloughing lips
- Corneal lesions
- Swelling (enlargement) of glands
- Xerosis
- Atrophy of papillae
- Spoon shaped nail



**Table 4: Signs and Symptoms of Deficiency Syndromes**

<b>Sign/Symptom</b>	<b>Nutritional Abnormality</b>
Inability to see during the evening or dim light	Vitamin A deficiency: Night blindness (Nyctalopia)
Easy bruising of skin Spongy bleeding gums	Scurvy (vitamin C deficiency)
Pale: palms, conjunctiva, tongue Easy fatigability, loss of appetite, shortness of breath	Anemia: which may herald, deficiency of: iron, vitamin B12, folic acid, copper, protein (main causes of nutritional anemia)
Dental caries and frequent dental cavity formation	Fluoride deficiency or increased consumption of carbohydrates or decreased intake of fluoride which decrease the P <sup>H</sup> of the mouth below critical level i.e. 5.5 causing the enamel to dissolve
Increased dental staining, increased dental fragility of bone and teeth	Fluoride excess (fluorosis)
Edema Weight for age 60-80% of the NCHS ® reference standards Skin: Lesions (dermatosis), hyper (hypo) pigmentation Loss of appetite, apathy, indifference Hair changes: gray easily pluckable, flag sign, forest sign, koilonykia (spoon-shaped nails). Tongue (atrophy of papillae) Dry sloughed lips	Protein energy malnutrition, particularly kwashiorkor  Iron deficiency anemia Vitamin B (thiamin/riboflavin) deficiency

® NCHS = National Center for Health Statistics, USA.

### **An advantage of this method**

It does not require elaborate equipment or a laboratory; several of the signs and symptoms can be evaluated by minimally trained personnel.

Limitations:

- (a) Specificity is low; many of the signs are associated with a number of nutritional disorders as well as non-nutritional disorders.
- (b) Sensitivity is low; sign may appear in the recovery as well as the deficiency state

### **Use of vital statistics**

Malnutrition influences morbidity and mortality rates for certain disease. E.g. high rate of child mortality is associated with poor nutritional status, diarrheal disease and measles. Therefore, we can use the vital statistics as indicators to determine the nutritional status of the community.

### **Other epidemiological and ecological indicators**

Agriculture, market price of foodstuff, weather.

## **2.12. Nutritional 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. Factors to be considered in the planning of intervention are:

1. Identify the specific problem
2. Decide the necessary intervention
3. Plan for the intervention- this includes gathering the necessary resources and manpower.
4. Implement the plan or intervention
5. Evaluate the effectiveness of the intervention

### ***Methods of nutrition intervention***

- Food fortification
- Food for work
- Price subsidization

- Supplementation
- Family planning
- Integration of nutrition with health
- Price policy
- Primary health care

### **2.13. Mechanisms of nutrition interventions**

There are five principal mechanisms through which all interventions work.

1. Availability of food at local or regional level, making the required foods more available with respect to place and time. This includes:
  - Food storage
  - Agriculture diversification
  - Food imports
  - Community and home gardens
  - Small livestock production schemes
  - Distribution of specific nutrients
  - Food fortification
2. Making the required foods more accessible and available to the households. This includes:
  - Supplementation of the necessary foods to pre-school, school children and women.
  - Price subsidization
  - Appropriate technology for food preparation and preservation
  - Food for work programme
  - Family planning
  - Integration of nutrition with health services
  - Technical changes in agricultural practices
  - Food stamp programme
  - Price policy programme.
3. Food utilization at household level, making better use of available foods, via food processing like fermentation, preparing weaning food. This includes:

- Nutrition education (face to face, mass media),
  - Breast feeding promotion
  - Food formulation
4. Distribution within the household:
- Intrahousehold distribution of food
  - Supplementation
  - Education
5. Physiological utilization
- Health service activities
  - Primary health care
  - Environmental health

### **Physical assessment**

**General observation** – general observation provides important information on nutritional status. An adequately nourished person should appear robust, vital, energetic and should have erect posture, skin, hair and nails should appear healthy.

Biochemical data can be used to confirm a diagnosis, help determine the necessary dietary modification or help identify specific nutritional deficiencies before clinical signs appear.

The most common laboratory data used are hemoglobin, serum protein, serum transferrin, and total lymphocyte count, T 3, T 4, TSH, thyroxine. For example, decreased hemoglobin value indicates decreased iron intake or decreased iron reserves.

### **When should we intervene?**

Many babies are born malnourished due to poor maternal nutrition before and during pregnancy.



## **Key Interventions to Improve Maternal Nutrition**

### Improving Maternal Nutrition

- Ensure access to and consumption of salt fortified with iodine in every household
- Distribute a high dose of vitamin A within six weeks after delivery
- Distribute iron supplements during the last six months of pregnancy
- Delay first pregnancy s/teen age girls/
- Increase birth intervals
- Increase food intake during pregnancy and lactation
- Increase access to labor saving devices

### Rationale for supplements or fortified food products for mothers

- Certain nutrients in breast milk can be affected by maternal diet (vitamin A, thiamin, riboflavin, vitamin B6, vitamin B12, iodine, selenium)
- First choice is improvement of mothers diet, but cost constraints limit options
- Adequate micronutrient intake during lactation can benefit both mother and infant.

## **Health Sector and Maternal Actions to Improve Maternal Nutrition in Africa:**

### **1. Adequate food intake during pregnancy and lactation**

#### *Essential Health Sector Actions*

- Encourage increased food intake during pregnancy and lactation
- Monitor weight gain in pregnancy
- Counsel on reduced energy expenditure

#### *Maternal Actions*

- Eat at least one extra serving of staple food per day during pregnancy and the equivalent of an extra meal per day during lactation
- Gain at least one kilogram per month in the second and third trimesters of pregnancy
- Rest more during pregnancy and lactation

### **2. Adequate Micronutrient intake during pregnancy and lactation**

#### *Essential Health Sector Actions*

- Counsel on diet diversification

- Prescribe and make accessible iron/folic acid supplements or multiple micronutrient supplements
- Anti helminthic after 3<sup>rd</sup> months of pregnancy
- Assess and treat severe anemia in women
- Distribute vitamin A to postpartum women

#### *Maternal Actions*

- Increase daily consumption of fruits and vegetables, animal products, and fortified foods, especially during pregnancy and lactation
- Consume daily supplements (iron/folic acid - 60mg iron + 400mg folic acid or multiple vitamin/mineral supplements) during pregnancy and the first three months postpartum as long as breast feeding.
- If anemic, consume a daily dose of 120mg iron and at least 400mg folic acid for three months
- Consume a high dose (200,000 IU) of vitamin A immediately after delivery or within the first eight weeks after delivery

### **3. Reduction of malaria infection in pregnant women in endemic areas**

#### *Essential Health Sector Actions*

- Prescribe and make accessible anti-malarial curative and/or prophylactic drugs for pregnant women (according to local recommendations)
- Treat clinical infections
- Promote use of insecticide treated materials

#### *Maternal Actions*

- In the second and third trimesters, take anti-malarial drugs as a curative treatment regardless of symptoms or take weekly anti-malarial prophylaxis starting at first antenatal visit
- Seek treatment for fever during pregnancy; take drugs to treat malaria and reduce fever; take iron/folic acid supplements to treat anemia
- Use insecticide-treated materials, such as bed nets

### **4. Reduction of hookworm infection in pregnant women in endemic areas**

#### *Essential Health Sector Actions*

- Counsel on preventive measures (sanitation and foot-wear)

- Prescribe and make accessible antihelminthic medication after first trimester of pregnancy

#### *Maternal Actions*

- Wear shoes and dispose of feces carefully to prevent infection
- Take a single dose of albendazole (400mg) or a single dose of mebendazole (500mg) in the second trimester of pregnancy as a treatment of hookworm. If hookworms are highly endemic (>50 percent prevalence), take an additional dose in the third trimester of pregnancy.

### **5. Birth spacing of three years or longer**

#### *Essential Health Sector Actions*

- Promote optimal breastfeeding practices
- Promote family planning as a health and nutrition intervention; counsel on the need for a reproductive period to build energy and micronutrient stores
- Consider breastfeeding status when prescribing contraception

#### *Maternal Action*

- Initiate breastfeeding in the first hour after birth, breastfeed exclusively for about six months, and continue breastfeeding for two years or more
- Practice family planning to space births for at least three years; delay pregnancy so that there are at least six months between the period of breastfeeding and the subsequent pregnancy
- Use contraceptives that are recommended when breast feeding
- Use condoms prior to the decision to become pregnant and during pregnancy and lactation if there is a risk of HIV transmission.

#### **Benefits of breastfeeding for the mother**

- Breastfeeding is a contraceptive method during the first 6 months after birth if breastfeeding is exclusive and menses have not returned
- Immediately putting the baby to the breast helps to expel the placenta because the baby's sucking stimulates uterine contractions, and thus reduces risks of post-partum hemorrhage

- Initiating breastfeeding soon after birth (within 1 hour) helps to promote breast milk production and lactation
- Immediate and frequent suckling helps to prevent breast engorgement
- Breastfeeding helps to reduce the mother's workload since breast milk is available at anytime and anywhere, is always clean, healthy and available at the right temperature
- Breastfeeding is economical
- Increases nurturing bond between mother and child
- May reduce risks of breast cancer

## **2.14. Essential Nutrition Actions (ENA) Approach:**

### **An action oriented approach to nutrition...**

If we use ENA approach to nutrition, estimated decrease of child mortality is 25% from the existing rate.

#### **Action Areas:**

##### **1. Women's nutrition:**

Key messages:

During pregnancy and lactation

- Increase feeding
- Iron/folic acid supplementations
- Treatment and prevention of malaria
- De-worming during pregnancy
- Vitamin A capsule after delivery

##### **2. Control of Vitamin A Deficiency:**

Key messages:

- Vitamin A rich foods (e.g. yellow and green vegetables)
- Maternal supplementation
- Food fortification

### **3. Control of Anemia:**

Key messages:

- Supplementation of women and children (IMCI)
- De-worming for pregnant women and children (twice/year)
- Malaria control
- Iron rich foods
- Fortification of food
- Vitamin C rich foods

### **4. Control of Iodine Deficiency Disorders:**

Key messages:

- Access and consumption of iodized salt by all families

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

#### **Critical contact points in the lifecycle**

##### **1. During Antenatal Care**

- Pregnancy: Tetanus toxoid (TT) vaccine and Voluntary Counseling and Testing (VCT)
- Antenatal visit, Iron/Folic Acid
- De-worming
- Maternal diet
- Exclusive breast feeding
- Family planning, sexually transmitted infection prevention
- Safe delivery
- Iodized salt

##### **2. Delivery**

- Safe delivery
- Exclusive breast feeding
- Vitamin A, iron/folic acid
- Diet, family planning and sexually transmitted infection, referral if any complication

### **3. Postnatal and Family Planning:**

- Exclusive breast feeding, diet, iron/folic Acid
- Family planning, sexually transmitted infection prevention
- Child's vaccination

### **4. Immunizations:**

- Vaccination, Vitamin A
- De-worming
- Assess and treat infant's anemia
- Family Planning, Sexually Transmitted Infection prevention, Referral

### **Recommendations for Maternal Nutrition**

- During Pregnancy Increase food and vitamin A intake
- Postpartum In areas where vitamin A deficiency is common, take a single high-dose (200,000IU) vitamin A capsule as soon as possible, but no later than eight weeks postpartum.
- During Lactation Increase food and vitamin A intake  
Plan for recuperative period between lactation and the next pregnancy
- All times Diversify the diet to improve vitamin A and other micronutrient intake

### **Priority Nutrition Activities in District Health Services**

#### District Level

- Monitor nutrition problems, identify sub-populations at high risk of nutrition problems, and direct additional resources to high risk areas
- Provide resources and tools to implement nutrition activities at health facilities and in communities
- Implement communication strategies to reinforce priority nutrition messages
- Implement special actions to supplement routine services, e.g., campaigns to distribute micronutrient
- Provide facilities for management of severe malnutrition and anemia

- Form partnerships with private service providers in the district

### **Health Facility Level**

- Carry out essential nutrition actions at these contact points with women: during pregnancy, at delivery and postpartum, and in the weeks following delivery
- Detect, treat/ refer severe anemia
- Build community partnership in the catchment areas
- Train and supply community workers; encourage private providers to follow appropriate guidelines
- Implement special actions to achieve coverage targets, e.g., local micronutrient distribution days
- Record and monitor the coverage of essential actions; conduct surveillance of nutrition problems

### **Community Level**

- Identify and support a system to follow all pregnant women at least through delivery and in the first few weeks postpartum
- Train and support birth attendants, women's groups, and other workers to give key nutrition services
- Support family planning choices
- Make community leaders and families aware of priority nutrition problems and needed actions
- Record and monitor key nutrition indicators

### **Vitamin A**

In areas where vitamin A deficiency is common, post partum women should be given a single high dose (200,000 IU), vitamin A capsule as soon after delivery as possible, but not later than eight weeks of postpartum. High dose vitamin A supplements should not be taken during pregnancy as it may harm the developing fetus. Since the risk of pregnancy for lactating women is very low during the first 45 days postpartum, this is the only time they should be given the high-dose capsule.

Target Group	Dosage (IU)	Frequency
Post partum women	200, 000	within 45 days after delivery

### **Iodine capsule**

As a short-term strategy in highly endemic areas, Lipiodol (iodized oil capsule), should be distributed on a one-time basis to individuals. This will cover the recipients for one to two years until salt iodization processes are in place.

Dosages are:           1 capsule for pregnant women  
                                   2 capsules for women in the reproductive age

### **Iron and folic acid**

Supplementation is necessary or recommended for pregnant and lactating women. Pregnant women require a much higher amount of iron than is met by most diets and therefore, it is important that they 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.

Iron 60 mg/day and folic acid 400 mg/day for universal supplementation for pregnant, lactating women and adolescents.

### **Food Fortification**

Food fortification means adding a needed nutrient or nutrients to foods, which are centrally produced and commonly eaten within a particular society. Food fortification is a major intervention in the effort to reduce iron, vitamin A and iodine deficiency in both developing and industrialized countries. A number of foods and condiments have been fortified with iron, and different forms of iron have been used. In a number of Latin American and Caribbean countries, including Venezuela, Ecuador, Brazil, and Grenada, wheat and corn flour are already fortified with iron and B vitamins. Investigators in India have played a leading role in researching salt fortification and Chile has used biscuits fortified with dried hemoglobin as well as full-fat milk powder fortified with iron and ascorbic acid as part of a school meal program.



The focus is on a range of commonly consumed staple foods. In addition, weaning foods, flat breads, curry powder, fish sauce, and a range of processed noodles lend themselves to iron fortification.

## **2.15. Control and prevention of iodine deficiency disorders (IDD)**

### **Strategies**

The main strategies to control and eliminate iodine deficiency are:

1. Universal iodization of salt for human and animal consumption
2. Supplementation of iodine capsules to populations in highly endemic areas

### **Universal Iodization**

IDD can be eliminated by daily consumption of iodized salt. Salt is used universally by all age, socio-economic, cultural, and religious groups. Iodized salt is both a preventive and corrective measure for iodine deficiency and is the most effective, low cost, long-term solution to a major health problem. Iodized salt should be used on a daily basis in an iodine deficient environment and the daily requirement for adults is 150 micrograms.

### **Supplementation of Iodine capsules**

As a short-term strategy in highly endemic areas, lipiodol (iodized oil capsules), should be distributed on a one-time basis to individuals. This will cover the recipients for one to two years until salt iodization processes are in place.

## UNIT THREE

### SATELLITE MODULE

#### 3.1. SATELLITE MODULE FOR HEALTH OFFICER STUDENTS ON MATERNAL NUTRITION

##### 3.1.1. Introduction

Under the normal conditions the mother's weight increases by 20% during pregnancy. In well-nourished mothers from industrial countries this corresponds to the average weight gain of 12.5 Kgs.

In developing countries, studies among poor mothers show that many of them gain only about 5 to 7 Kgs during pregnancy. Low weight gain during pregnancy of poor mothers may be due to mother's health and nutritional status when they enter pregnancy and their diet during pregnancy.

**Maternal Health:** Health workers are in a strong position to design and implement nutrition programs. They are also powerful motivators who can help change family practices and community beliefs about the care and feeding of women. The health workers will design programs to:

- Carry out essential nutrition actions at these contacts with women, during pregnancy, at delivery, and postpartum, and in the weeks following delivery.
- Detect severe anemia and refer the women if a blood transfusion is needed.
- Identify and support a system to follow all pregnant women at least through delivery and in the first few weeks postpartum.
- Train and support birth attendants, women's groups, and other workers to give nutrition services.
- Support family planning choice.
- Make community leaders and families aware of priority nutrition problems and needed actions.
- Record and monitor key nutrition indicators of maternal nutrition.

### **3.1.2. Learning objectives:**

At the end of the course the student will be able to:

- Discuss the role of nutrition in the promotion of maternal health.
- Discuss some of the important causes of maternal malnutrition
- Explain common maternal nutritional problems
- Identify the available intervention methods

### **3.1.3. What are the common maternal nutritional problems?**

*See Core Module.*

### **3.1.4. Treatment and prevention of vitamin A deficiency:**

Vitamin A deficiency is a major health problem in Ethiopia. Bitot's Spot was reported to be 0.8% nationwide in Ethiopia. WHO identifies the area as having a problem of public health significance if Bitot's Spot is greater than 0.5%.

Vitamin A deficiency occurs when vitamin A intake (or liver stores) fails 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 utilized.

Vitamin A deficiency has long been associated with blindness. Recent research reveals that vitamin A deficiency is associated with increased morbidity and mortality. In countries like Ethiopia, where diarrhea, acute respiratory infection, and measles are among major causes of child mortality, Vitamin A deficiency is of specific concern.

Rationale for action:

Improving vitamin A status:

- Prevents night blindness, xerophthalmia, corneal destruction, and blindness
- May reduce birth defects
- Prevents epithelial and perhaps other types of cancer

## **Strategies**

The main strategies, which have been adopted globally to control and eliminate vitamin A deficiency, are:

1. Supplementation
2. Dietary diversification and modification
3. Food fortification

In areas where vitamin A deficiency is common, post-partum women should be given a single high-dose (200,000 IU) Vitamin A capsule as soon after delivery as possible. This will help to build up vitamin A stores, improve the vitamin A content of breast milk, and reduce the risk of infection in mothers and infant.

High dose vitamin A supplements should not be taken during pregnancy as it may harm the developing fetus. Since the risk of pregnancy for lactating women is very low during the first 45 days postpartum, this is the only time that they should be given the high-dose capsule.

The dosage for vitamin A treatment to post-partum women within 45 days after delivery is 200,000 IU.

Health workers at health facilities and outreach posts can administer vitamin A capsules to women. Properly trained and adequately supervised volunteers, community health worker or health extension agents can administer vitamin A during campaigns.

## **Food Diversification for vitamin A**

Food diversification is an important long-term, sustainable strategy for prevention of vitamin A deficiency. Communities should be encouraged to grow and consume vitamin A rich food like tomato, green pepper, yellow fruits and green vegetables throughout the country at all times.

### **Animal sources of vitamin A**

The best food sources of pre-formed active retinol, which is most effectively used by the body, are animal foods. These include egg yolks, organ meats such as liver, whole milk, and milk products, small fish with liver intact, fish, cod-liver oil, butter, and ghee.

### **Plant sources of Vitamin A**

Plants contain beta-carotene that needs to be converted into retinol by the body. The best plant sources of vitamin A are dark orange or dark yellow fruits and vegetables such as papayas, mangoes, pumpkins, carrots, and yellow or orange sweet potatoes and dark green vegetables such as spinach, kale and Swiss chard. Gommen is an example of a traditional plant, which is rich in vitamin A and commonly included in the Ethiopian diet.

### **Food fortification with vitamin A**

This involves adding one or more vitamins to commonly consumed foods.

This strategy is beneficial for the whole population if many types of foods for human consumption were to be processed and fortified at the factory level. Unfortunately food fortification is not well known in Ethiopia. Some efforts are under way to fortify sugar and oils that are being produced in some of the larger factories.

### **Deficiency of Iron**

Causes of anemia are multiple and the main causes are nutritional deficiencies, which represent more than half of all cases. Other causes of anemia include blood loss through hemorrhage, destruction of red blood cells by infections, and genetic defects of red blood cells.

Causes of iron deficiency

- Insufficient iron in the diet
- Blood loss during menstruation
- Heavy load of intestinal parasites such as schistosomiasis, tricuriasis and, ascariasis

**Consequences:** Anemia leads to reduced work capacity, decreased mental performance and intolerance to infections. When the level of hemoglobin concentration falls below 4g/dl it may cause death from anemic heart failure. Iron deficiency anemia can also cause increased maternal mortality due to adverse immune reaction, and maternal anemia can cause prenatal infant loss, low birth weight and prematurity.

### **3.1.5. Prevention and treatment of iron deficiency**

**The main strategies are:**

- Supplementation of iron tablets with folates preferably with vitamin B<sub>12</sub> 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
- De-worming of intestinal infection
- Control of febrile and chronic diseases
- Prenatal iron supplementation

Pregnant women require much higher amount of iron than is met by most diets. Therefore, it is important that pregnant women routinely receive iron supplements. In areas where anemia prevalence is high, supplementation should continue into the postpartum period, to ensure adequate stores of iron.

### **3.1.6. Assessment of maternal malnutrition:**

See core module

### **3.1.7. Nutrition Intervention**

When there is a serious nutritional problem in a community, we will try to intervene. For intervention we need many things, such as manpower, logistics and resources. When we secure the necessary things for the intervention, we will choose methods that are the most appropriate and design strategies for the intervention program.

## **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.

These diseases occur most often in children between one and three years of age, after they have been taken off the breast. There are two principle theories regarding the etiology of kwashiorkor that have both opposing and overlapping aspects, the old classical view of protein deficiency and the new theory of different noxae (e.g. infections, toxins, medications, trauma etc.) leading to free radical damage by an impaired state of the body's anti-oxidant defense mechanism (lack of vitamin A, E, C, protein, zinc, copper, selenium and manganese).

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 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 mothers and children, Example:

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

Proteins assist in regulating the fluid balance of the cells. Plasma protein molecules are so large that they cannot pass through the capillary membrane thus they remain in the blood vessels. The presence of these large molecules in the blood vessels create the pressure needed to draw fluid back out of the cell so that it does not accumulate in the tissues. In protein deficiency, the number of plasma proteins in the blood is reduced,

and consequently, the pressure they exert also is reduced. When there is insufficient pressure to remove fluid from the tissues, edema results.

**Nutrition Education should focus on:**

- Cultural malpractices and beliefs in feeding pregnant and lactating women.
- Intra household mal-distribution of food (age bias, sex bias,)
- Effects of emotional deprivation and neglect
- Breast feeding and its benefits (policy issues posed by HIV)
- Hygiene (sanitation of food cooking and storage utensils, personal hygiene, food hygiene etc)

**3.1.8. NUTRITION IN MOTHERS**

**Goals:**

- Help women understand the importance of adequate weight gain during pregnancy. Strongly discourage women who are obese from attempting to lose weight during pregnancy. Weight gain during pregnancy is essential
- Encourage clients to plan meals carefully so that all of the nutrients needed during pregnancy can be included without excessive calories, using a food guide for pregnancy is helpful. Strongly discourage the pregnant woman from drinking alcohol.
- Caffeine intake should be limited.
- Instruct client to take only vitamins and minerals prescribed, excessive amounts can be harmful.
- Advise clients that skipping meals is a poor practice, especially for the pregnant woman. The fetus needs a steady supply of nutrients.
- Encourage the use of high fiber foods and plenty of fluids to avoid constipation.
- Give priority to helping pregnant teenagers improve their eating habits. Together with teenagers, plan meals and snacks that are nutritious and at the same time acceptable to the teenagers.
- Take advantage of the client's high motivation during pregnancy to provide nutrition education for the family as well as for the pregnant woman.



**Table 5. Food Guide for the Reproductive years need number of daily serving**

Food group of category	Food	Major nutrients provided
Protein sources	Meat Fish Cheese Eggs Beans, legumes Nuts, seeds Nut butters	Protein, iron, riboflavin, niacin, phosphorus, zinc, iodine, vitamin B <sub>6</sub> and B <sub>12</sub> Emphasize those low in fat protein, iron, thiamin, phosphorus, magnesium, zinc, vitamins B <sub>6</sub> , vitamin B <sub>12</sub> , E, and folic acid
Calcium – rich foods	Milk Fortified soy milk Yogurt Cheese Dry milk	Calcium, phosphorus, riboflavin, vitamins D, A, E, B <sub>6</sub> , B <sub>12</sub> , magnesium, zinc, protein (not all of the foods listed provide all of these nutrients)
Grain products	Whole –grain bread cereal, dry Wheat germ Pasta or rice	Thiamin, niacin, riboflavin, iron, phosphorus, zinc, fiber
Vitamin C sources (fruits and vegetables)	Orange Grapefruit Strawberries Tomatoes Greens Peppers Cabbage	Ascorbic acid, folate
Leafy green vegetables	Cabbage Green pepper	Folate, vitamins A, E, B <sub>6</sub> , riboflavin, iron, magnesium
Other fruits and vegetables		Vitamins A, B complex, and E, magnesium, zinc, phosphorus

## **ALCOHOL CONSUMPTION SUCH AS:**

- Liquor      -Tella
- Wine        -Teje
- Beer        -Areki

Alcohol mentioned above should be avoided during pregnancy. Use of alcohol is associated with the risk of birth defects, as alcohol enters both the maternal and the fetal bloodstream. Babies born to alcoholic mothers may develop fetal alcohol syndrome. This disorder is characterized by low birth weight, and slow growth and development. In some cases there may be permanent mental retardation.

### **3.1.9. Supplementation**

This refers to an administration of a nutrient in the form of a tablet, a capsule or an injection. For example some of the nutrients that are considered in the supplementation programmes in Ethiopia are: -

- Vitamin A for children under five year old and lactating mothers
- Iron for pregnant mothers and any anemic person
- Folic acid for pregnant mothers and any person with macrocytic (megaloblastic) anemia
- Iodine for everybody in the goiter endemic area in the form of iodized salt
- Vitamin K (Menadione) for pre-term newborns and other people with vitamin K dependent clotting factor deficiency.

## **STRATEGIES**

The main strategies are:

1. Supplementation of iron and folic acid
2. Treatment of severe anemia
3. Dietary diversification (increased production and Consumption of locally available iron rich food)
4. Fortification of food with iron and vitamin A
5. Control of malaria (prophylaxis and treatment), Helminthiasis and schistosomiasis.

## **Fortification**

For fortification to be opted as a strategy to address special nutrient problems the following concerns need to be addressed:

- The staple food should be centrally produced by firms
- Consumption of the staple food should not vary from day to day
- The target nutrient must be bioavailable from the vehicle food
- The vehicle be culturally accepted
- The fortification nutrient should not alter the color, taste, shelf life, or cost of the vehicle
- There should be a law to enforce the implementation of consumption of the fortified product
- There should be a quality control mechanism as to the quality of the fortified product in terms of its nutrient content.

### **3.10. Case Study (learning activity)**

A 30-year-old woman came to the health center with complaints of weakness, swelling of the lower extremities, and sometimes of the face. She has four children and her husband is not living with her. She is a daily laborer and is responsible for taking care of her children. Their daily diet consists mainly of cereals.

1. Based on the above information, what is your diagnosis?
2. What are the possible causes of her complaint?
3. What diagnostic work would be appropriate?
4. Describe your treatment.

### **Treatment of malnourished mothers:**

- Efforts to increase the amount of food available to pregnant and lactating mothers can be the most effective way of improving their health and that of their infants.
- To support lactation and maintain sufficient maternal reserves, most mothers in developing countries should eat about 650 additional kilocalories per day.
- Mothers should eat a balanced diet including fruits, vegetables, animal products, and fortified foods when possible.

- Community and household members should be informed of the importance of making additional food available to women during pregnancy and lactation, as well as helping them reduce their workload and obtain adequate rest.
- During pregnancy and lactation increase caloric intake, iron/folic acid supplementations, and de-worming.
- Vitamin A capsule after delivery.



## **3.2 Satellite Module for Nursing Students on Maternal Nutrition**

### **3.2.1. Introduction**

Nutrition plays an important role in maintaining health, preventing disease, promoting normal growth and development and supports daily activity. For this reason everybody is expected to get adequate nutrition, especially woman's of child bearing age.

The nutritional status of the mother is important to her own as well as to her infant's well-being.

#### **1. Purpose and use of the module**

This satellite module is prepared for nursing students to equip them with the knowledge and practice needed for identification and management of maternal nutritional problems using the nursing process and providing appropriate nursing care.

#### **2. Directions for using this satellite module**

For better understanding of the module, students are advised to follow the following directions

- After completion of the core module go through the satellite module
- Do pre and post test questions
- Do the learning activity – case study and critical thinking exercise

### **3.2.2. Learning Objectives**

After you have read this satellite module, you are expected to:

- Discuss the major maternal nutritional problems of public health significance in Ethiopia
- Develop skills regarding assessment and management of maternal nutritional problems
- Manage clinical nutritional problems during pregnancy and lactation

- Use the nursing process to identify and take action against maternal nutritional problems.

### 3.2.3. Learning Activities

#### Case study and Critical Thinking Exercise

##### **Case study**

W/ro Zebider, 30 years old gravida XI, para X with VII children. She is the wife of a farmer and walking on bare feet. In her current pregnancy, she has a strong desire and craving to eat clay. She never had antenatal care in previous pregnancies, but because of her current problem, she visited the prenatal clinic at her 3<sup>rd</sup>, 7<sup>th</sup> and 9<sup>th</sup> month of pregnancy. At this time, her weight was 40kg, 43kg, and 43.5kg respectively. At delivery, the neonate had a weight of 2kg.

1. What additional information is important to reach to a certain diagnosis?
2. What are the problems of this woman?
3. How do you assess the problem of this pregnant woman?
4. What intervention would you recommend for her?

##### **Critical thinking exercise**

A mother, who is the head of the household, age 19 years, comes to your health institution to get medical advice for her sick 1-year-old child. She is 4 months pregnant and is from an economically disadvantaged family consisting of her and three children, aged 1, 3, 5 years. When you take her nutritional history, she states she often only eats two times per day and does not get her meal some times. Her weight is 43kg and height 1.44m. She has repeated vomiting since last month. Her children are always starved and poorly dressed. She gets her income by working as daily laborer in the factory when she is apparently healthy. In her culture, unless there is a husband, a woman will not eat meat even if she can afford.

Taking the above information into consideration:

- Identify the mother's problems
- List the underlying cause for that problem

- How do you manage her problems as a nurse?
- What points should be included when counseling the mother?

### PreTest

1. What are the doses of Iron/Folic Acid supplementation recommends for the pregnant women to prevent anemia?
  - a. Iron 200mg/day and Folic Acid 200mg/day
  - b. Iron 40mg/day and Folic Acid 300mg/day
  - c. Iron 60mg/day and Folic Acid 400mg/day
  - d. Iron 120mg/day and Folic Acid 800mg/day
2. Which of the following **is not** a cause for anemia?
  - a. Hookworm infestation
  - b. High zinc in the body
  - c. Malaria
  - d. Iron deficiency
3. A lady came to you with intractable vomiting at gestational age of 8 weeks. Which one is true about this patient?
  - a. She should eat small and frequent meals
  - b. She doesn't need psychological support
  - c. Hyperemesis gravidarum can be diagnosed in this patient
  - d. A and C
4. One **is not** true about the advice that will be given for a mother with constipation
  - a. Decrease the amount of food taken
  - b. Increase fiber intake
  - c. Increase fluid intake
  - d. None
5. Which micronutrient deficiency causes goiter?
  - a. Iron
  - b. Iodine
  - c. Folic acid
  - d. Zinc

### 3.2.4. Major maternal nutritional problems of public health significance in Ethiopia

Refer to the core module

### 3.2.5. Factors that affect maternal nutritional status

Refer to the core module

### 3.2.6. Assessment of maternal nutritional status

Refer to the core module

### 3.2.7. Intervention against maternal nutritional problems

Refer to the core module

### 3.2.8. Management of Maternal Nutritional Problems

#### 1. Management of protein energy malnutrition should attain:

- Rapid regeneration of tissues & institute cure of malnutrition
- Treat complications and reduce case fatality
- Rehabilitation on a well balanced diet
- Prevent relapse and future deterioration, through education
- Long-term follow up with the view of helping individual family members and community.

#### 2. Management of micronutrient deficiencies

##### I. Iron deficiency anemia

a) Iron/Folic acid supplements for the pregnant women to prevent anemia

Table 6. Dosage of iron and folic acid

Doses of Iron/Folic acid	Duration
Iron 60mg/day Folic acid 400 mg/day	<ul style="list-style-type: none"><li>▪ Six months during pregnancy where anemia prevalence is &lt; 40%</li><li>▪ Six months during pregnancy &amp; months post partum where anemia prevalence is <math>\geq</math> 40%</li></ul>



b) Treatment of severe anemia in women

1. Definition of severe anemia

- Hemoglobin <7gm/dl or Hematocrit <20%
- Associated with extreme pallor of conjunctiva, oral mucosa, palm or nail beds or breathlessness at rest

2. Decide whether to treat or refer cases of severe anemia Criteria for referral to a hospital

- Gestational age >36wks
- Any women with signs of respiratory distress or cardiac abnormality (labored breathing and edema)
- If their conditions show no improvement on follow up.

c) Cases that are not referred should be treated as follows

- 120mg iron + 800mg folic acid daily for 3 months in one dose or divided doses?

d) Follow up of cases treated for Anemia

- One and four weeks after iron supplementation is initiated

e) Nursing intervention for iron deficiency anemia:

Advise the client that:

- Liver and red meats are the best sources of iron
- Iron absorption from plant sources can be maximized by eating them with a rich source of vitamin C or with red meat
- Iron absorption from plant sources is impaired when food is consumed with coffee and tea
- Take iron supplements as prescribed

f) Presumptive treatment for parasites in pregnant and lactating women is recommended to prevent anemia.

**1. Hook worm**

1.1. In endemic areas with 20-30% prevalence or greater, give antihelminthic treatment in the second trimester

1.2. In highly endemics areas with >50% prevalence, repeat antihelminthic treatment in the third trimester

1.3. Types of antihelminthic treatment after first trimester:

- a) Albendazole 400mg single dose
- b) Mebendazole 500mg single dose
- c) Levamisole 2.5mg/kg single dose, best if second and third dose repeated on next two consecutive days
- d) Pyrantel 10mg/kg single dose, best if dose repeated on next two consecutive days

## **2. Malaria**

In endemic area where transmission is high; give anti malaria prophylaxis to the woman according to the local recommendation

### **II. Vitamin A deficiency**

#### a) Prevention

Immediately after delivery give one oral dose of 200,000 IU vitamin A to all mothers.

#### b) Treatment for night blindness or bitot's spot in reproductive age, pregnant or not

- 5,000-10,000 IU vitamin A/day po for at least four weeks
- Daily dose should never exceed 10,000 IU and weekly dose not exceeding 25,000 IU

#### c) Treatment for corneal xerophthalmia in reproductive age, pregnancy or lactation with doses of oral vitamin A 200,00IU each, one dose on the day of diagnosis, one dose the next day and one dose two weeks later.

### **III. Iodine deficiency**

- Daily consumption of iodinated salt
- Supplementation with iodine capsules in endemic areas.

One capsule for pregnant women in early pregnancy and children under five. Two capsules for women of reproductive age and children 5 to 14 years of age

## **3.2.9. Management of nutritional problems in pregnancy**

### **1. Adolescent pregnancy**

- Assess nutritional status, physical and emotional maturity, dietary habits, educational status
- Provide on-going nutritional counseling

- Substitute additional energy food, protein and calcium to meet growth needs as well as to provide increased calories and nutrients for the growing fetus

## **2. Nausea and vomiting**

- Symptomatic reassurance
- Eat small and frequent meal consisting of dry, starchy foods and avoidance of spicy food.
- Vitamin B6 25mg three times per day
- In severe cases (Hyperemesis Gravidarum)
  - Hospitalization
  - Rehydration
  - Glucose
  - Antiemetics
  - Followup
- Psychological counseling
- Avoid drinking liquids with meals
- Avoid coffee, tea, and spicy foods
- Avoid high fat foods because they delay gastric emptying time

## **3. Pica**

- Detection of practice
- Determine what is being ingested.
- Screen for and treat iron deficiency anemia
- Counseling to discourage or at least minimize the ingestion of non-food substances
- Show economical ways to obtain an adequate diet
- Encourage a high-fiber, high-fluid diet if the client experiences constipation
- Observe for diarrhea and vomiting which may indicate parasitic infection or lead poisoning

## **4. Heartburn and Acid indigestion**

Eat small, frequent, dry meals separate from fluid intake, avoid greasy foods, wearing loose-fitting clothing can produce some relief

- Antacids can be taken for symptomatic relief but they may bind iron in gastrointestinal tract and excess use should be discouraged
- Eat small frequent meals and avoid liquids immediately before and after meals to avoid gastric distention
- Avoid coffee, high fat foods, and spices
- Advise not to lie down or bend over for two hours after eating
- Avoid gas-forming foods

### **5. Constipation**

- Treat by increasing dietary fibers, fluid intake and exercise  
E.g. whole grains, legumes and fresh fruits and vegetables
- Drink 6-8 glasses of liquid daily
- Encourage the client to try hot water with lemon or fruit juice on waking to stimulate peristalsis

### **6. Nursing management**

#### **Nursing Process**

It is a systematic, client-centered, goal oriented method of caring that provides a framework for nursing practice. Nurses should always use the nursing process to identify and solve a client's problem.

#### **1. Assessment**

##### **a. Subjective data**

- assess 24-hour intake according to the daily food guide
- Gastrointestinal side effects of pregnancy
- Dietary changes made in response to pregnancy or diet-related complications of pregnancy
- The frequency of eating; assess for periods of fasting
- Cultural, familial, religious, and ethnic influences on eating habits
- The use of vitamin and/or mineral supplements
- The client's nutritional knowledge and ability and/or willingness to implement dietary changes
- The client's knowledge and plans regarding breast-feeding
- The client's use of alcohol, tobacco, caffeine, drugs, and artificial sweeteners

- Economic status

#### **b. Objective Data**

- Height
- Pre pregnancy weight
- Present weight
- Calculate BMI
- Blood pressure
- Hemoglobin and Hematocrit

### **2. Nursing Diagnosis**

- Poor health seeking behaviors, as evidenced by a lack of knowledge of appropriate diet before pregnancy, during pregnancy and during lactation and a desire to learn
- Altered nutrition: Less than body requirements, related to poor bioavailability
- Altered oral mucus membrane

### **3. Planning**

After the diagnosis and related factors are identified, client goals and interventions are planned

#### **Client Goals**

The client will:

- Explain the importance of diet for her health and for fetal growth and development
- Plan - days' menus that are nutritionally adequate, using the daily food guide for pregnancy
- Consume an adequate, varied, and balanced diet based on the daily food guide for pregnancy
- Consume three meals per day plus two to three nutritious snacks
- Gain weight within the recommended range and rate, as determined by her assessment data
- Have an absence of nutrition related problems or complications of pregnancy

#### **4. Intervention**

##### ***Diet Management***

- Set a mutually agreeable weight gain goal (range), based on the client's base line pre pregnancy weight for height
- Promote the intake of a varied, nutrient dense diet based on the dietary food guide
- Modify the diet as needed to avoid or alleviate nutrition related problems or complications of pregnancy

##### ***Client Teaching***

Instruct the client and family

- About the importance of adequate nutrition and weight gain for maternal and infant health
- About how to achieve nutritional adequacy by using the daily food guide for pregnancy
- To take supplements only as prescribed by the physician because megadoses of some vitamins and minerals may cause fetal malformations
- That cravings during pregnancy do not always have a physiologic basis; rather, they are likely to be influenced by culture, geography, social traditions, the availability of foods, and previous experience
- About how to modify her diet to alleviate or avoid nutrition related problems and complications of pregnancy

#### **6. Evaluations and Monitoring Progress**

- Evaluation is ongoing and monitors the patient for the following;
- Monthly weight gain. Weight gains less than 2.2 kg per month by obese women or less than 4.4 kg for all other women warrants further investigation
- Food intolerances, especially lactose intolerance, and the overall impact on diet adequacy
- Ongoing compliance and tolerance of diet; evaluate adequacy and the need for further diet counseling

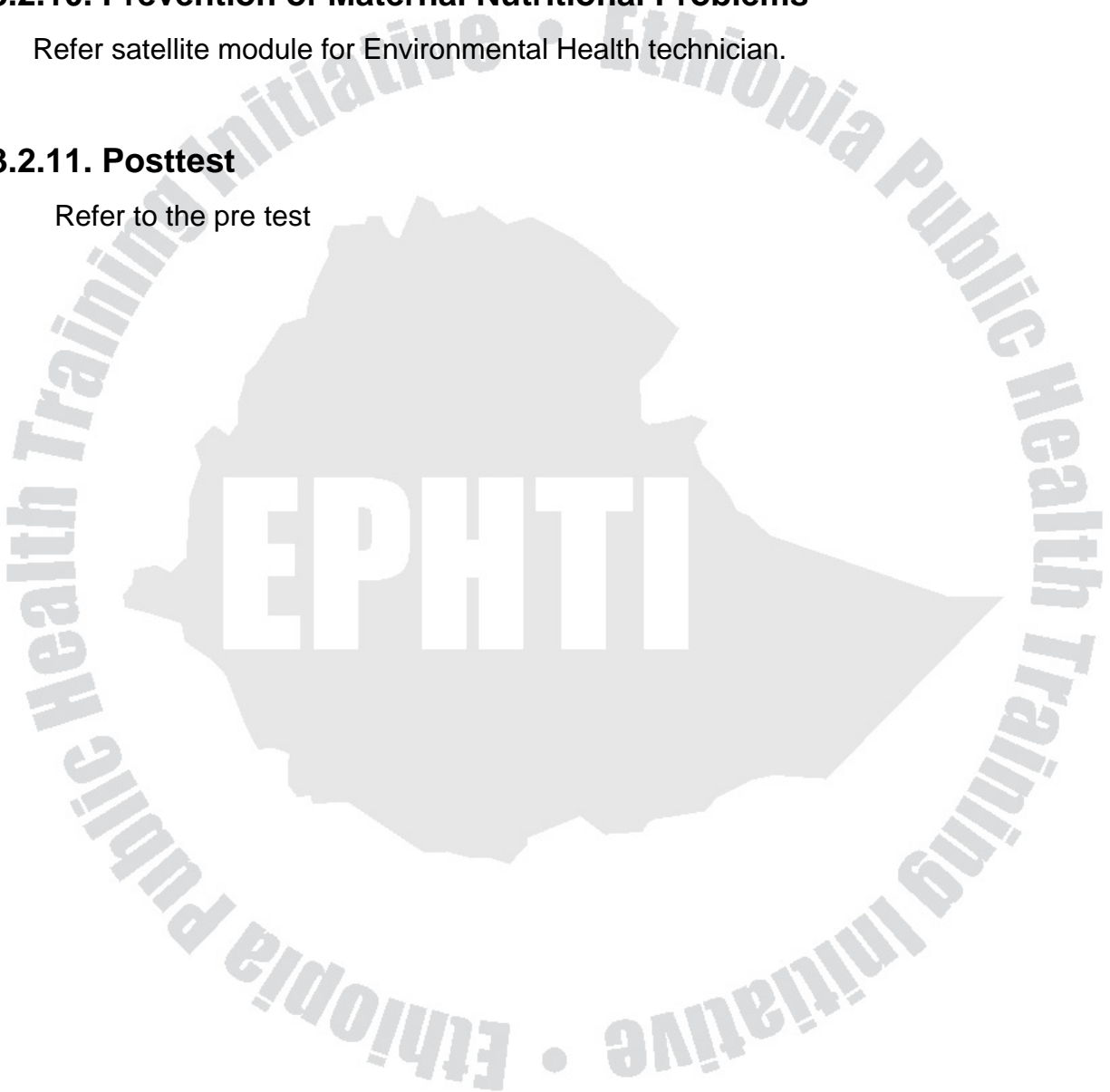
- Other specific signs of nutritional problems like edema, wasting, weight loss at any time during pregnancy, failure to gain any weight for one month, excessive weight gain, etc.

### **3.2.10. Prevention of Maternal Nutritional Problems**

Refer satellite module for Environmental Health technician.

### **3.2.11. Posttest**

Refer to the pre test



### 3.3. Satellite Module for Medical Laboratory Technology Students on Maternal Nutrition

#### 3.3.1. INTRODUCTION

##### **Purpose of the module**

This module helps laboratory technology students know their specific tasks and roles in the diagnosis and management of maternal nutrition. The module is prepared with consideration of the tasks, roles and responsibilities of laboratory technologists with B.Sc. degrees and instructors. Moreover, all types of laboratory workers may find the module helpful.

##### ***Direction for using the satellite module***

For a better understanding of this module the laboratory technology students are advised to follow the following directions.

- Do the pre test
- Read the core module thoroughly
- Understand the contents of the satellite module
- Evaluate yourself by completing the posttest

##### **Pretest**

1. Which one of the following is not an anticoagulant?
  - a. Ethylenediamine Tetra acetic acid (EDTA)
  - b. Tri sodium citrate
  - c. Double oxalates
  - d. Heparin
  - e. None of the above
2. Identify the wrong statement
  - a. Folate deficiency is characterized by a macrocytic megaloblastic anemia
  - b. Laboratory diagnosis of vitamin A deficiency is made by measuring serum retinal and serum retinal binding protein
  - c. Proteins are biochemical compounds with high molecular weight
  - d. Glycogen synthesis adds glucose to the peripheral blood
  - e. None of the above



3. Normal mature red blood cells are:
- a. Discocytes
  - b. Macrocytes
  - c. Megalocytes
  - d. Microcytes
  - e. All of the above
4. Micro-organisms manifest their presence in one of the following except:
- a. They can cause spoilage
  - b. They can cause food borne illness
  - c. They can transform a food's properties in a beneficial way-food fermentation
  - d. None of the above
5. List five gram-positive bacteria of significance for foods.
- a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_
  - e. \_\_\_\_\_
6. List three groups of fungi identified as a food contaminant.
- a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
7. Indicate the two principal laboratory techniques for counting fecal coliforms from water samples.
- a. \_\_\_\_\_
  - b. \_\_\_\_\_

### 3.3.2. Learning objectives

After completion of this module students will be able to:

- Describe how to collect, handle and label blood specimen.
- Describe the concept of laboratory diagnosis associated with maternal nutrition.
- List the biochemical tests used in the diagnosis of anemia.
- Describe and demonstrate the red blood cell morphology.
- Classify anemia based on red blood cell morphology.
- Describe the concept of laboratory diagnosis of micronutrient deficiency in relation to maternal nutrition.
- Describe microbiological analysis of food and water

### 3.3.3. Learning activities: case studies

**Case-1.** Abebech Tessema is a 35 year old woman who lives in Teda rural town, 25 km south from Gondar Town. She has six children and currently she is six-months pregnant. Abebech's husband, Ato Assefa Alebachew, is a poor peasant who has a small farmland around Teda Town but has no even a single house animal. One day the pregnant woman went to Teda Health Center for Maternal follow up. On examination the woman's palms are pale and she is underweight. The clinician's investigation (clinical data) indicates that the mother is not properly nourished and has swelling around the neck region. Based on the above information answer the following questions.

1. What do you understand from the paleness of the palms of the woman?
2. What type of laboratory investigations would you do to diagnose the paleness of the patient?
3. The most probable reason for the swelling around the neck region is goiter. List the causes of goiter.

**Case-2.** Aykele is a small town 60 km west from Gondar Town and down towards Aykele is a small village, Seraba, with a population of about 2000. Even though Seraba is considered a town, there are no satisfactory water sources and electricity. Moreover,

the majority of the people living in Seraba use open fields for waste disposal, including human feces. In this small town there is one junior secondary school with a student population of 400 and all the students share a water source of an unprotected well. At one time many of the students were suffering from bloody diarrhea, vomiting and fever. The school director reported the condition to Aykele Health Center and the health institution organized a team consisting of a health officer, nurse, laboratory technician and sanitarian that went to Seraba junior secondary school.

Based on the above information answer the following questions.

1. Discuss the role of the laboratory technician in addressing the above problem.
2. What are the possible etiological agents for the problem?
3. List the important laboratory investigations for this particular problem.
4. The condition observed can be considered as an outbreak of diarrheal disease (epidemic) and one way of managing such epidemics is identifying the etiological agent from the water source. List all considerations while conducting bacteriological water analysis.

#### **3.3.4. Laboratory Investigations Associated with Maternal Nutrition.**

Depending upon the level of the laboratory various types of hematological, biochemical and parasitological investigations can be performed in the laboratory to evaluate maternal nutrition.

The most important laboratory tests used to investigate maternal nutrition are:

1. Hemoglobin determination
2. Packed cell volume determination
3. Micro nutrients such as foliate, iodine, vitamin A, vitamin D and iron determination.
4. Serum protein determination
5. Serum glucose determination
6. Investigation for blood and intestinal parasites.
7. Red blood cell morphology
8. Urinalysis

## Blood collection

- The proper collection and reliable processing of blood specimens is a vital part of the laboratory diagnostic process.
- Blood is used:
  - To assess the morphology of red blood cells
  - To measure the hemoglobin content
  - To measure packed cell volume (PCV)
  - To evaluate protein, glucose and micronutrient concentration
  - To investigate hemoparasites
- Blood can be collected from capillary/ peripheral blood-micro blood samples and from venous.

## Hemoglobin determination

- Hemoglobin is a globular chromo protein consisting of four globin chains (four polypeptide chains formed by two dissimilar pairs) each containing over 100 amino acids and each linked to a prosthetic heme group.

The functions of hemoglobin include:

1. Transport of O<sub>2</sub> from the lungs to the tissues and of CO<sub>2</sub> in the reverse direction.
  2. Assisting in acid-base regulation by eliminating CO<sub>2</sub> in the lungs and by the buffering action of the imidazole histidine groups of hemoglobin.
- The hemoglobin content of blood may be estimated by several methods:
    - By measurement of its color
    - By measurement of its power of to combine with oxygen or carbon monoxide
    - By its iron content

**Note:** Students are advised to refer to common hematology textbooks for detailed understanding of each method and procedures in all cases of this satellite module. Moreover, referral of specimens to the respective institutions for advanced tests is indispensable.

### ***Determination of packed cell volume (PCV) or hematocrit (HCT)***

The PCV, also commonly called hematocrit, is a measure of the ratio of the volume occupied by red blood cells to the volume of whole blood in a sample of capillary or venous blood. The ratio is measured after appropriate centrifugation and is expressed by a decimal fraction or as percentage.

There are two methods, micro hematocrit and macro hematocrit methods. Although the macro Hematocrit method is recommended by the international council for standardization in hematology (ICSH) as an alternative method, it is no longer in routine use because of technical problems.

### **Micronutrient determination**

#### **A. Folate**

- Folate deficiency is usually detected by hematological abnormalities.
- A macrocytic megaloblastic anemia and often-milder signs such as hyper-segmented neutrophil characterize folate deficiency.
- Measurement of serum folate levels also enables diagnosis

#### **B. Iodine**

- Diagnosis for iodine deficiency is based on blood tests
- Low levels of iodine and thyroid hormones or a high level of thyroid stimulating hormone (TSH) can be observed
- T<sub>4</sub> and T<sub>3</sub> in dried blood spots exposed to natural environment are less stable, lasting only a few days.
- Uses of dried blood spot technology has now been applied to field conditions
- Rapid development in the technology for the measurement of T<sub>4</sub>, T<sub>3</sub> and TSH by immunoassay have occurred with improved sensitivity, precision, greater convenience and reduced costs.
- Measurement of urine iodine excretion also provides the best single measurement of iodine intake of the population, which can be used for both initial and follow up assessment.

### **C. Vitamin A**

- Measuring serum retinol and serum retinol binding protein provides for laboratory diagnosis of vitamin A deficiency.
- Measuring breast milk retinol shows the vitamin A status of the mother and that of the breast-feeding infant.

### **D. Vitamin D**

Measurement of blood plasma 25-OH D, blood plasma calcium, and blood plasma parathyroid hormone enables diagnosis of vitamin D deficiency.

### **E. Zinc**

Zinc status in human subjects is assessed by measurement of zinc in plasma, erythrocytes, neutrophils, lymphocytes and hair. Available data indicate that zinc in neutrophil and the assay of activity of alkaline phosphates in neutrophil may be the best tools for the diagnosis of zinc deficiency.

### **F. Iron**

Examination of the full blood count and blood film will suggest the diagnosis of iron deficiency anemia. Tests that are useful for laboratory assessment of iron status are:

- Hemoglobin measurement
- Packed cell volume (PCV) or hematocrit (HCT)
- Red blood cell count
- Erythrocyte protoporphyrine
- Serum iron
- Transferrins
- Transferrins saturation
- Bone marrow biopsy
- Serum ferritin
- Transferrin receptor and body iron stores
- Red blood cell morphology

### **Serum protein determination**

- Proteins are biochemical compounds with high molecular weight. They are present in the cytoplasm and cell membrane of all cells
- In disease conditions, both the total serum protein and the ratio of individual protein fraction may be changed independent of one another.
- Common methods for the determination of total Proteins present in serum include:
  - Kjeldahel's method
  - Kingsley's Biuret method
  - Dye-binding method
  - Electrophoresis

### **Serum glucose determination**

Glucose is a monosaccharide that releases energy in the form of ATP by a process called glycolysis.

The blood glucose level is maintained within certain physiological limits by two factors:

#### **1. Factors that add glucose to the blood**

- Glycogenolysis (breakdown of glycogen)
- Gluconeogenesis (Formation of glucose from proteins)
- Intestinal absorption of glucose

#### **2. Factors that remove glucose from blood**

- Glycogen synthesis
- Glycolysis
- Lipogenesis
- Amino acid synthesis

Blood glucose concentration can be measured by:

- Alkaline ferric cyanide method
- Copper reduction method
- O-Toluidine method
- Glucostixs

### 3.3.5. Investigation for blood and intestinal parasites.

- Malaria is a major public health problem and cause of suffering and premature death in tropical and subtropical countries.
- Malaria is endemic in 91 countries with about 40% of the world's population at risk
- Malaria is becoming more difficult to treat particularly in areas of multi drug resistance.
- Wide spread species: - Plasmodium falciparum  
- Plasmodium vivax
- Less wide spread species: - Plasmodium malaria  
- Plasmodium ovale
- In areas of stable malaria transmission, a pregnant woman will have acquired partial immunity to malaria.
- In areas of unstable malaria transmission, pregnant women lack protective immunity.
- Untreated malaria infection can result in abortion, stillbirth, premature labor or low birth weight.
- The laboratory diagnosis of malarial parasites include:
  - Detecting and identifying malaria parasites microscopically in blood films
  - Concentrating parasites in venous blood by centrifugation when they cannot be found in blood films.
  - Using a rapid malaria antigen or enzyme test.
  - Intestinal parasites such as hookworms causes iron deficiency anemia.
  - The laboratory diagnosis of intestinal parasite infection can be performed by either direct microscopic examination of feces or concentration techniques.

#### Examination of red blood cell morphology

- Examination of stained thin blood films helps for morphologic classification of RBC's.
- Normal mature cells (discocytes) have diameters within 6.0 to 8.0  $\mu\text{m}$  (normocytic – normochromic RBCs).



- Red blood cells may show variation in size (Anisocytosis) and included are:
  - Macrocytes
  - Megalocytes
  - Microcytes

### Urinalysis

- The production and composition of urine depends on glomerular filtration, tubular reabsorption and tubular secretion.
- Changes can occur in the volume, appearance, constituents, and mass density (specific gravity) of urine.
- Common laboratory tests on urine specimens include:
  - Protein (albumin)
  - Glucose
  - Ketones
  - Bilirubin
  - Uroblinogen
  - Nitrites
  - Specific gravity
  - pH
  - Microscopic examination of urine sediment.
  - Urine culture and sensitivity test
- Currently all chemical tests can be conducted by using N - multistixs.

### Microbiological analysis of food

- The foods that we eat are rarely if ever sterile, they carry microorganisms.
- The microorganisms present will originate from the natural micro flora of the raw material and those organisms introduced in the course of harvesting, processing, storage and distribution.
- In most cases the micro flora has no discernible effect and the food is consumed without objection and with no adverse consequences.
- In some instances microorganisms manifest their presence in several ways.

- They can cause spoilage
- They can cause food borne illness
- They can transform a food's properties in a beneficial way (example food fermentation).

**Table 7: Gram-positive bacteria of significance for foods**

Morphology	Type genera
Rods, no spores	<ul style="list-style-type: none"> <li>▪ Corynebacterium</li> <li>▪ Lactobacillus</li> </ul>
Rods, with spores	<ul style="list-style-type: none"> <li>▪ Bacillus</li> <li>▪ Clostridium</li> </ul>
Coccus	<ul style="list-style-type: none"> <li>▪ Micrococcus</li> <li>▪ Staphylococcus</li> <li>▪ Streptococcus</li> </ul>

1. **Corynebacterium diphtheria**-Pathogen occasionally spread by food.
2. **Listeria monocytogenes**- Psychrotrophic (grows well at refrigeration temperature)
  - Most non-sporing gram-positive rods are food spoilers
  - Since some of the gram-positives are thermo resistant (thermoduric) they can be detected in pasteurized products: Milk and egg products
3. **Bacillus species**- are usually found as spoilers of heated foods, especially canned foods
  - B. Cereus cause enteritis or gastroenteritis
4. **Clostridium species**- Often spoil heated, canned foods.
  - Cl. Botulinum forms a deadly toxin in foods
  - Cl. Perfringens causes enteritis when present in high numbers
5. **Lactobacilli Species** – Are two type:
  - Homofermentative (produce only lactate)
  - Heterofermentative (produce small quantities of lactate as well as ethanol, acetate, and carbon dioxide)

## 6. Staphylococcus and Micrococcus species

- Micrococci are spoilage organisms commonly found in cured meats
- Staphylococcus aureus produce potent enterotoxin

## 7. Streptococci

- S. Pyogenes cause food transmitted sore throat
- Enterococci are indicator organisms and produce vasoactive amine compounds which cause sudden changes in blood pressure
- Enterococci are relatively thermophilic and may survive in pasteurized milk and egg products

## 8. Gram- negative bacteria of significance in foods and water

1. Acetobacteriaceae
2. Legionella pneumophila and other legionella spp. are hazards in food
  - Will not be encountered using normal culture media
3. Enterobacteriaceae

## 9. Lactose fermenter indicator organisms

- Escherichia coli
- Citrobacter
- Enterobacter
- Erwinia
- Klebsiella

## 10. Non-lactose fermenters

- Salmonella
- Shigella
- Proteus
- Morganella

## 11. Viruses identified as a food contaminants

- Epstein-Barr virus (EBV)
- Hepatitis A virus
- Rota viruses

Systematic overview of analytical precautions that are essential to obtain reliable and reproducible results in the microbiological examination of food samples.

1. Sampling
2. Handling before examination
3. Preparation for examination
4. Drawing of sub samples (aliquots)
5. Preparation of macerate and dilutions
6. Monitoring of culture media
7. Resuscitation procedures
8. Enumeration procedures

### Microbiological analysis of water

- The World Health Organization has estimated that up to 80% of all sickness and disease in the world is caused by inadequate sanitation, polluted water, and unavailability of water.
- A useful way of determining whether a water supply is fecally polluted and could possibly contain enteric pathogens dangerous to health is to test for the presence of normal fecal organisms.
- To search directly in water samples for the presence of specific enteric pathogens is impractical for routine control purposes.
- A single laboratory examination of any water does not justify the conclusion that all is well and that the supply is suitable for drinking

**Table: 8 – Treatment of water**

	Number of bottles	ml of broth	Strength of broth
Treated	1	50	Double
Water samples	5	10	Double
Untreated	1	50	Double
Water samples	5	10	Double
	1	5	Single

**Note:** Double strength refers to broth made by using twice the normal amount of broth powder

- Each bottle of broth must contain an inverted Durham tube for the collection of gas
- Refer to medical laboratory manual for tropical countries for estimating the most probable number (MPN) of fecal coliform bacteria.

Post test

Refer pretest



## **3.4. Satellite Module for Environmental Health Students on Maternal Nutrition**

### **3.4.1. Introduction**

*Prevention of maternal malnutrition:* consists of dietary practices and interventions directed towards the reduction of disease risk and/or improvement in health outcomes. It is a critical component of the preventive medicine that seeks to prevent disease rather than treat the condition after it manifests clinically. Examples of preventive maternal malnutrition are the inclusion of iron in foods for the prevention of anemia in the pregnant mother and the inclusion of vitamin B complex, vitamin A, iodized salt and calcium in staple foods, such as grain products, milk, and cereals, for the prevention of essential nutrition –related deficiencies. These maternal nutrition strategies have been underway as part of public health policy for more than a generation and have been shown to be extremely effective, especially in developed countries.

#### **Purpose and use of the satellite module**

The purpose of this satellite module is to help the environmental health officers to be involved in the prevention of maternal malnutrition with the other team members.

#### *Directions for using the module*

For better understanding of the module, the sanitarians are advised to follow the directions given below.

- Do the pretest first and then read the core module. After that, do the posttest and make sure that you have understood the core module.
- Do the pretest in the satellite module then go through thoroughly the satellite module including the learning activity.
- Finally, evaluate yourself by doing the post Test.

### **Case study**

W/ro Wubalech Damtew was born and raised in Belesa District of North Gondar zone. She is 31 years of age and came to Arbaya health center with complaint of dizziness, fatigue, and headache. She had a history of repeated delivery, Poor diet and she usually walks barefoot. There is no latrine facility in the village. The health officer in the health center suspected anemia and requested blood and stool examination. Her History, physical examination and laboratory findings confirm anemia as her main problem.

### **Answer the following question based on the above case study**

1. What are the probable causes for anemia in this particular patient?
2. What measures should you take to prevent anemia?
3. What would be the role of the environmental health officer in alleviating the problem of the community where this pregnant mother is living?

### **3.4.2. Learning objectives**

After completion this module the environmental health officer should be able to:

- Identify the causes of maternal malnutrition
- Describe the different risk factors that are associated with maternal nutrition.
- Implement environmental friendly methods to solve maternal malnutrition using the different intervention strategies.
- Actively participate in the prevention of maternal nutrition.

### **3.4.3. Pretest for the Environmental Health satellite module**

1. Which one of the following microbial food poisoning show the following signs and symptoms fatigue, dizziness, double vision and muscle paralysis and cause death with short period of time?
  - a. Staphylococcus aureus
  - b. Clostridium botulinum
  - c. Salmonella
  - d. Environmental toxins.

2. Which of the following is/are environmental toxin/s?
  - a. Zinc
  - b. Copper
  - c. Lead
  - d. All of the above
3. According to WHO standards, growing edible fruits and vegetables using waste water would be possible if and only if the coliform and E- coli measurement at:
  - a. 10,000-coliform/10ml and 100 E - coli/100ml of waste water.
  - b. 50000 coliform/1ml and 500 E - coli/100ml of waste water
  - c. 1000-100000 coliform/100ml and of 100 E – coli 100/ml of waste water
  - d. 100,000-coliform/ ml and 500 E - coli/100ml of waste water.
4. The sanitarians have a paramount role in the prevention of maternal malnutrition. State some of the practical maternal malnutrition prevention measures?
5. Explain clearly the different pre questions to be taken while processing foods starting from cultivation until consumption.

### **Significance and Brief Description of Maternal Malnutrition Prevention**

Maternal nutrition is critical to the health of the mother. All the essential nutrients should be processed and provided in a sanitary manner.

In developed countries significant advances have been made in food safety. Inadequate practices and surveillance systems persist in developing countries such as Ethiopia. The primary focus in our country should be on concerted actions consistent with current scientific knowledge and developing technologies. The other focus should be on the promotion of legislation and public education about the importance of food safety. Persistence of dangerous and unsafe practices that severely compromise the sanitary quality of food is to be avoided.

Examples of poor sanitary quality of food items can be witnessed from.

- People practice of adulteration of milk, different inert addition on food and spices.
- Adding unknown additives
- Manufacture of food stuffs in unapproved areas,
- The growing of vegetables using polluted water for irrigation.

Vegetation that is edible should be grown in wastewater of coli form count, 100-100,000/100ml and E-coli count of <100 E-coli/ 100ml of wastewater.



To determine water contamination levels, undergo:

a) Physical analysis (organoptical)

Taste

Color

Smell

b) Bacteriological analysis of water

- Multiple tube test to check gas production and color change
- Membrane filtration technique
- Counting colonies and further culture of the colonies at 44<sup>0</sup>c to check presence of E-coli

c) Chemical analysis of water

- To assure its chemical quality especially for iron, fluoride etc by using the available laboratory facility.
- Frequent transportation of perishable foods exposed to chemical and biological contaminants in open and un-refrigerated manner.

Gastroenteritis caused by viral, bacterial agents, typhoid, hepatitis, cholera and parasitic disease are commonly contracted from unsanitary establishments.

To have proper maternal nutrition the food should be processed safely starting from production, preparation, storage, transportation and services. Food should be free from chemicals that may cause acute or chronic problem to the mother.

- During cultivation
- During growth
- During storage
- During transportation
- During preparation in the kitchen before eating.

### **3.4.4. The Role of the Environmental Health Officer in the Prevention of Maternal Malnutrition**

#### ***I. Food poisoning and food infection control***

##### ***A. Food poisoning: -***

It is more likely to affect people with lowered resistance to disease than healthy people who might show mild symptoms or none at all. Elderly or sick people, pregnant mothers, babies and young children are particularly vulnerable to food poisoning. They should seek treatment if they have symptoms. Extra care should also be taken when preparing food for these vulnerable groups to minimize the risks of their coming in contact with food poisoning bacteria.

Food poisoning is contamination of any food or drink by toxins from microorganisms, environmental toxins or naturally occurring toxins in the food itself.

##### **1. Microbial toxins**

The most common microorganisms to cause food poisoning are:

- Clostridium botulism (common in canned food)
- Clostridium perfringens
- Staphylococcus aureus

##### **2. Naturally occurring toxins**

These groups of toxins are naturally found embedded in the edible portion of the food. E.g. mushroom,

##### **3. Environmental toxins**

These get access to our food or drink from the containers we are using or via leaching of agro-chemicals into the water bodies and contaminating the food or drink, e.g. heavy metals like copper, zinc, mercury and lead.

- Copper and zinc dissolve into drinks or canned watery foods from damaged containers.
- Mercury, found in fishes, originates from chemicals used in agriculture.
- Lead occurs in paints and dust and gets incorporated into food.

***B. Food infection:*** - the entry and development of an infectious agent in the body of human or animal.

Germs can get into our food at any point in the food chain from the time when an animal or food is in the field to the moment food is put on to the table to eat.

In the case of salmonellosis/salmonella infection, the Environmental Health Officer can prevent or control it by educating people on proper storage of food, thorough cooking food, eliminate rodents or pets and poultry, water and meat sanitation. Advise not to eat raw beef.

## II. Educating the mother

### ➤ *Personal hygiene of food handler*

- Adequate cooking of products to assure destruction of pathogenic organisms
- Thorough washing and storage of fruits and vegetables.
- Proper washing of equipment and utensils as follows.
- frequent washing of hands with soap and water.

#### Wash

- T ° 110-120°F

Hot water

- Use detergent  
such as chlorine

#### Rinse

- immerse in hot

water

#### Sanitize

- T° - 170°F for 2min

- 212°F for 30 sec

- use chlorine solution  
50 PPM for 2 min.

#### Drying

- air drying

- *Dietary diversification, supplementation* of different nutrients should be recommended to the mother by working with the agricultural office in the specific woreda
- *Environmental sanitation*: - pregnant women may have the following problems: PEM, Vit. A deficiency, Fe-deficiency and iodine deficiency. These can be due to physiologic condition or associated with malaria and parasitic infection. Therefore, to prevent these problems, the following major interventions need to be conducted by the environmental health officer together with the health center team and the community.

### **A. Prevention of Anemia**

- a) **Hookworm** – In communities where hookworm is endemic,
  - Construction of latrines and education on their proper use
  - Wearing of shoes

- Anthelmintic / deworming / drugs given to all anemic persons to eliminate the intestinal worms.

b) **Malaria**, especially in areas where *P.falciparum* and *P.Vivax* are endemic, the different physical methods of control such as filling in ditches, draining stagnant water, clearing bushes, drying marshy areas, using bed net, etc should be demonstrated. The different chemical control methods such as, Abate, DDT should also be recommended apart from administering the proper treatment.

The pregnant mother should be advised to eat iron rich foods to prevent iron deficiency anemia through the following mechanisms:

#### *Iron-deficiency Anemia*

1. Dietary diversification – promotion of a diet with a wider variety of iron containing foods especially meat and/or fish, Teffe etc.

Generally it can be addressed to the Ethiopian population by economic approach (promotion of agriculture) i.e. improving the incomes of the target community as a solution to their nutritional problems.

**(Refer to the core module)**

2. Fortification

Fortification of staple food such as wheat or other grains is likely to increase iron intake **(Refer to the core module)**

3. Supplementation **(Refer to the core module)**

#### **B. PEM prevention**

Nutrition education on:

- Traditional malpractice and beliefs about feeding pregnant and lactating mothers.
- Intra household distribution of food
- Personal hygiene of the cook, cleanliness of utensils and the living environment at large.
- Cultivation of leafy green vegetables that contain iron.

**(Refer to core module)**

### C. Iodine deficiency prevention

- Educating people to take iodized salt in their food
- Undergoing chemical analysis of water to check the concentration of iodine so that possible preventive step will be taken.
- In areas where the soil formation is rocky and far from seawater, people should be aware that they need to take iodized salt.

### D. Vitamin A deficiency prevention

- Vitamin A deficient may affect the eye and lead to blindness, therefore, the EHO/sanitarian should be actively involved in the education of people, especially mothers, in recognizing vitamin A deficiency as early as possible. Horticultural development (i.e. green, yellow vegetables & fruits) that contains vitamin A should be cultivated and consumed.

Finally, the environmental health officer is should educate people about preservation of perishable foods as follows, depending on the availability of technology and resource.

- Fruits - canning, bottling, drying, crystallizing, refrigeration.
- Vegetables – drying, canning, bottling, refrigeration
- Eggs – refrigeration at less than 1°C
- Milk – refrigeration, pasteurization, condensing.
- Fish – salting, pickling, canning, freezing, chilling, and drying.
- Meat- salting, pickling, canning, freezing, chilling, drying

### 3.4. 5. Post test

Refer to pre test

## 3.5 Satellite Module For Health Extension Workers on Maternal Nutrition

### 3.5.1. Introduction

The Health Extension Package is a newly designed program designed to deliver health services to the community. Health extension package students are expected to take courses that are important to the prevention of prevalent disease and problems in the country.

### 3.5.2. Purpose and use of the module

This module is prepared for health extension package students to equip them with the knowledge and practice on identification and prevention of common maternal nutritional problems.

### 3.5.3. Direction for using this module

For better understanding of the module, students are advised to follow these directions:

- Do the pretest
- Read the module thoroughly
- Understand the contents of the module
- Evaluate yourselves by doing the posttest.

### 3.5.4. Pretest for health extension package students.

1. During assessment of maternal nutritional status we mostly focus on all of the following points **except**.
  - a) Weight
  - b) Height
  - c) Hemoglobin
  - d) Race
2. Which micronutrient deficiency causes night blindness?
  - a) Iron
  - b) Iodine
  - c) Vitamin A
  - d) Zinc

3. Which of the following is not a method to prevent iron deficiency anemia?
  - a) Giving antihelmenthic
  - b) Proper waste disposal
  - c) Increase iron intake from diet
  - d) None
4. The following are causes of maternal malnutrition **except**:
  - a) Cultural malpractice
  - b) Infection
  - c. Lack of knowledge
  - d. None of the above
5. Which of the following is/ are cause/s for anemia?
  - c) Hook worm
  - d) Malaria
  - c. Iron deficiency in diet
  - d. All of the above
4. A woman in her pregnancy should gain on average:
  - a) 10.5 kg
  - b) 7.5 kg
  - c) 12.5 kg
  - d) 5 kg

### 3.5.5. Learning objectives

After completion of this module, students will be able to:

- Discuss the major maternal nutritional problems of public health significance in Ethiopia.
- Develop skills for assessment and prevention of maternal nutritional problems.
- Identify causes of maternal malnutrition

### 3.5.6. Learning activity: case study

Desta Meshesha is a 35 year old pregnant woman who lives in Gendmethya, a rural village 12 km north of Gondar town. The woman always walks barefoot and she gets her income by working as daily laborer on the farmland and in the homes of other people. She states that she often eats two times per day but may not get this every day. She has a history of repeated attacks of malaria and has been previously treated with anti-malaria drugs. On examination, the woman's palms and conjunctiva are pale and she is underweight. Based on the above information answer the following questions.

1. What major health problems could you identify for this patient?
2. What do you understand from the pallor of the palm and conjunctiva of the woman? How do you help prevent such problems as health extension package students?
3. List two important intestinal parasites that can be prevented by wearing shoes.

### **3.5.7. Causes of maternal malnutrition**

- Lack of knowledge
- Infection
- Cultural malpractices
- Poverty
- Manmade and natural calamities
- Social unrest (war)
- Poor food production
- Uncontrolled population growth
- Poor marketing, storage and distribution

### **3.5.8. Factors affecting Maternal Nutrition**

#### **1. Culture and beliefs**

- During period of fasting important nutrients are not consumed, such as animal products.
- Discrimination in food distribution among family members; adult males before females and feeding of children with leftover food.

#### **2. Pregnancy and Lactation**

The pregnant woman's diet should include a substantial increase in calories, protein, calcium, folic acid, and iron.

Pregnant women at particular risk of nutritional deficiencies are adolescents, underweight women, obese women, women with chronic nutritional problems, women who smoke or ingest alcohol or drugs, low income women and women with chronic illnesses such as diabetes or anemia.

#### **3. Gender:**

In the family and community, females are given lower priority and hence they are served with low quality and low quantity foods.

#### **4. Economics:**

The type and amount of foods consumed during pregnant and lactation depends up on the income of the family.



### **3.5.9. The Role of Maternal Nutrition in the Promotion of Maternal Health**

The growth of the fetus can be regarded as a result of the interaction between its genetic potential and the intrauterine environment. Mothers who enter pregnancy with sound reproductive physiology, and who have not suffered ill health or nutritional deprivation in childhood, will have larger and healthier infants than mothers who do not have such advantages.

There are many short mothers in the lower socio economic groups, which may mean that inadequate nutrition and different illness prevent many girls in the social group from achieving optimal physique.

### **3.5.10. What mothers do during pregnancy**

- Help clients understand the importance of adequate weight gain during pregnancy. Strongly discourage clients who are obese from attempting to lose weight during pregnancy. Weight gain during pregnancy is recommended.
- Using a food guide for pregnancy, encourage clients to plan meals carefully so that all of the nutrients needed during pregnancy can be included without excess calories. Strongly discourage the pregnancy woman from using alcohol.
- Caffeine intake should be limited. Instruct client to take only vitamins and minerals prescribed, excessive amounts can be harmful.
- Advise clients that skipping meals is a poor practice, especially for the pregnant woman. The fetus needs a steady supply of nutrients.
- Encourage the pregnant mother take in high fiber foods and plenty of fluids to avoid constipation.
- Give priority in helping pregnant teenagers improve their eating habits. Additionally, teenagers need snacks that are nutritious and at the same time acceptable to them.
- Take advantage of the client's high motivation during pregnancy to provide nutrition education for the family as well as for the pregnant woman.

### **3.5.11. Common Maternal Nutritional Problems**

- Protein energy malnutrition
- Iron deficiency

- Vitamin A deficiency
- Iodine deficiency

### **5.1. Protein energy malnutrition**

It is due to deficiency of proteins, fat and carbohydrate

Consequences - Infection

- Obstructed labor- how?
- Maternal mortality
- Low birth weight and IUGR
- Neonatal and infant mortality

### **5.2. Iron deficiency**

- Anemia is defined in first and third trimesters as a hemoglobin concentration less than 11gm/100ml or hematocrit less than 33% and in second trimester, hemoglobin less than 10.5gm/100ml or hematocrit less than 32%.
- It is the most common form of malnutrition
- It is the most common cause of anemia
- Other causes of anemia are parasitic infections and malaria
- Causes of dietary iron deficiency
  - Low dietary iron intake
  - Low iron bioavailability.
- Parasitic infections like Hookworm
  - Causes blood loss
  - Increase iron loss
- Malaria
  - Destroys red blood cells
  - Leads to severe anemia
  - Increases risk in pregnancy
- Consequences of maternal anemia
  - Maternal death
  - Reduced transfer of iron to the fetus
  - Low birth weight

- Neonatal mortality
- Reduced physical activity and productivity
- Impaired cognition

### **5.3. Vitamin A deficiency**

- Causes
  - Inadequate intake
  - Recurrent infection
  - Reproductive cycle
- Consequences
  - Night blindness
  - Maternal mortality
  - Miscarriage
  - Still birth
  - Low birth weight
  - Reduced transfer of vitamin A to fetus
  - HIV vertical transmission
  - Low vitamin A concentration in breast milk

### **5.4. Iodine deficiency**

- Causes include:
  - Living in the mountainous area where plant foods have inadequate iodine
  - Taking cassava tuber as a food with out detoxifying it and other Oxposure to chelating substances
  - Not eating (or “having access”) to sea foods
- Consequences include:
  - Impaired cognition
  - Poor school performance
  - Endemic cretinism

### 3.5.12. Assessment of maternal nutritional status

Power-type indices express weight relative to some power function of height or height relative to some power function of weight.

#### Assessing PEM in women

- Height less than 1.45m
- Weight less than 45kg
- BMI less than 18.5 (thinness)
- Pregnant – weight gain less than 1.5kg/month in the second and third trimesters (or less than 10.5kg gained over full course of pregnancy)

$$\text{Body Mass index} = \text{Wt}/(\text{Ht})^2$$

**Table: 5. The BMI and recommended weight increase during pregnancy**

<b>Pre pregnancy BMI</b>	<b>Recommended total gain (kg)</b>
Low (BMI < 19.8)	12.5 – 18
Normal (BMI 19.8 – 26)	11.5 – 16
High (BMI > 26 - 29)	7 – 11.5
Obese (BMI >29)	< 7

#### Common indicators

- Edema
- Dyspigmentation of the hair
- Angular Stomatitis
- Corneal lesions
- Swelling (enlargement) of glands
- Xerosis, etc.

#### Key interventions to improve Maternal Nutrition

Improving Maternal Nutrition

- Ensure access and consumption of salt fortified with iodine in every household
- Distribute a high dose of vitamin A within six weeks after delivery
- Distribute iron supplements during the last six months of pregnancy

- Delay first pregnancy
- Increase birth intervals
- Increase food intake during pregnancy and lactation
- Access to labor saving devices

### 3.5.13. Essential Nutrition Actions Approach:

#### An action oriented approach to nutrition...

If we use ENA approach to nutrition, estimated decrease of child mortality is 25%.

#### Action areas:

##### 1. Women's nutrition:

Key messages:

During pregnancy and lactation

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

##### 2. Control of Vitamin A Deficiency:

Key messages:

- Vitamin A rich foods
- Maternal supplementation
- Food fortification

#### Vitamin A

Target Group	Dosage IU	Frequency
Post partum women	200, 000	within 45 days after delivery

##### 3. Control of Anemia:

Key messages:

- Supplementation of women and children with iron and folate.

Group	Iron-folic acid doses	Duration
Pregnant and Lactating women	Iron: 60 mg /day Folic acid; 400mg/day	six months during Pregnancy
Adolescents	Iron: 60 mg /day Folic acid; 400mg/day	

- Advise on iron rich foods
- De-worming for pregnant women and children (Twice/year)
- Take a single dose of albendazole (400mg) or a single dose of mebendazole (500mg) in the second trimester of pregnancy as a treatment of hookworm. If hookworms are highly endemic (>50 percent prevalence), take an additional dose in the third trimester of pregnancy.
- Malaria control
  - Prescribe and make accessible anti-malarial curative and/or prophylactic drugs for pregnant women (according to local recommendations)

#### **4. Control of Iodine Deficiency Disorders:**

Key messages

Access and consumption by all families of iodized salt

#### **Iodine capsule**

Dosages are:            One Capsule for pregnant women  
                                 Two Capsules for women in the reproductive age

#### **Universal Iodization**

IDD can be eliminated by daily consumption of iodized salt. Salt is used universally by all age, socio-economic, cultural, and religious groups throughout the year. Iodized salt is both a preventive and curative measure for iodine deficiency and is the most effective, low cost, long-term solution to a major health problem.

#### **Supplementation of Iodine capsules**

Iodized salt should be used on a daily basis in an iodine deficient environment and the daily requirement for adults is 150 micrograms.

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

**Critical contact points in the lifecycle**

**1. During Antenatal Care**

- Pregnancy: Tetanus toxoid
- Antenatal visit, Iron/Folic Acid
- De-worming
- Maternal diet
- Exclusive breast feeding
- Risk signs, family planning, sexually transmitted infection prevention
- Safe delivery
- Iodized salt

**2. Delivery, Safe delivery,**

- Exclusive Breast Feeding
- Vitamin A, Iron/Folic Acid
- Diet, Family Planning and Sexually Transmitted Infection, Referral

**3. Postnatal and Family Planning:**

- Exclusive Breast Feeding, Diet, Iron/Folic Acid
- Family Planning, Sexually Transmitted Infection prevention
- Child's vaccination

**4. Immunizations:**

- Vaccination, Vitamin A
- De-worming
- Assess and treat infant's anemia
- Family Planning, Sexually Transmitted Infection prevention, Referral

## UNIT FOUR

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