

MODULE

Protein Energy Malnutrition

For the Ethiopian Health Center Team



**Ethiopia Public Health
Training Initiative**

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TABLE OF CONTENTS

<u>TOPIC</u>	<u>PAGE</u>
UNIT 1.0 Introduction	
1.1 Purpose and use of the module	2
1.2 Directions for using the module	3
UNIT 2.0 Core Module	
2.1 pre and post tests	4
2.2 Significance and brief description of the protein energy malnutrition	21
2.3 Learning objectives	22
2.4 Case study: learning activities	23
2.5 Definition	27
2.6 Epidemiology	27
2.7 Etiology and pathogenesis	29
2.8 Clinical features (signs and symptoms)	34
2.9 Diagnosis	36
2.10 Case management	37
2.11 Prevention of protein energy malnutrition	43
2.12 Learning activities (case study) continued	47
UNIT 3.0 Satellite Modules	
3.1. Health Officer	50
3.2 Public Health Nurse	61
3.3 Medical Laboratory Technician	69
3.4 Sanitarian	90
3.5 Primary health worker/ Community health worker	100
3.6 Take home message for care givers	108
UNIT 4.0 Role and Task Analysis	111
UNIT 5.0 Glossary and Abbreviations	119
UNIT 6.0 Bibliography	123
UNIT 7.0 Annexes	
7.1. Answer keys	127

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UNIT ONE

INTRODUCTION

1.1 Purpose of the Module

The lack of appropriate and relevant teaching material is one of the bottlenecks that hinder training of effective, competent task oriented professionals who are well versed with the knowledge, attitude and skill that would enable them to solve the problems of the community. Preparation of such a teaching material is an important milestone in an effort towards achieving these long-term goals.

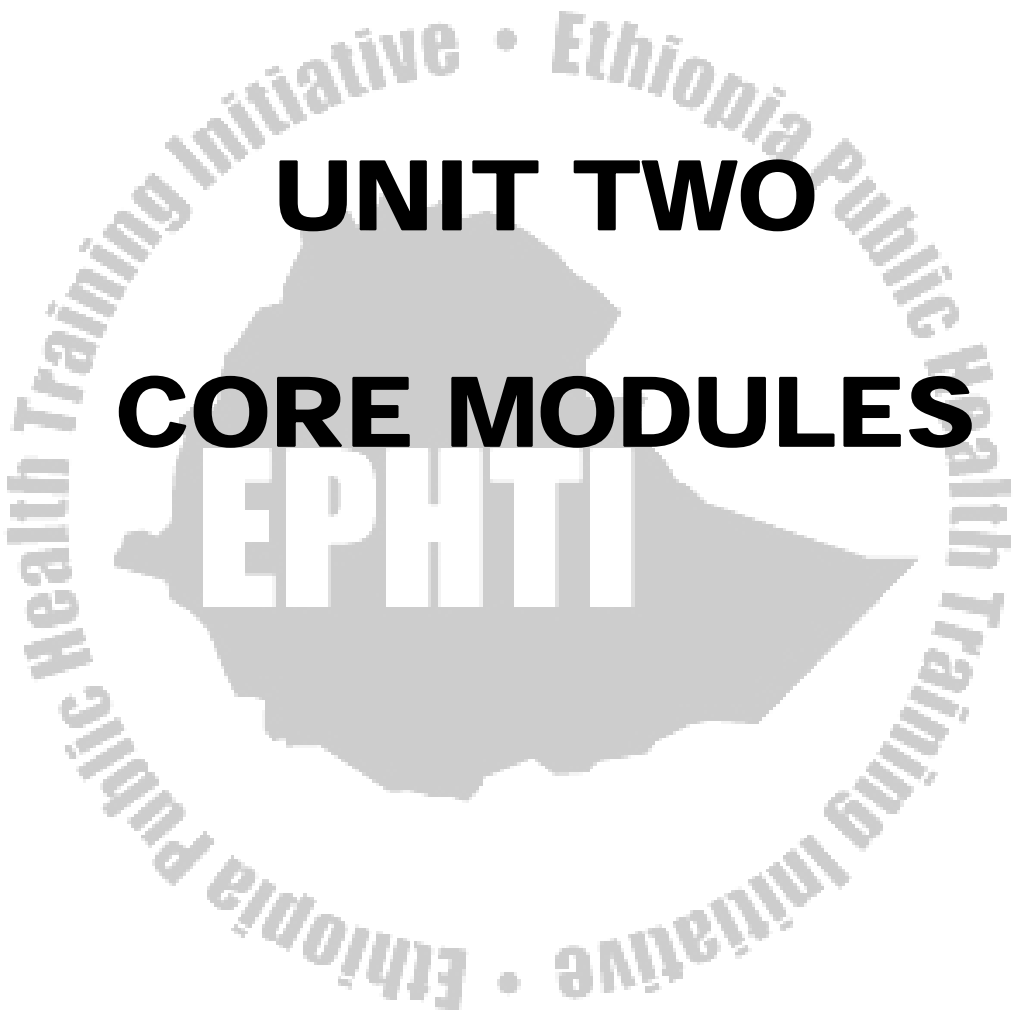
Therefore, this module is prepared to facilitate the process of equipping trainees with adequate knowledge, attitude and skill through interactive teaching mainly focused on protein-energy malnutrition.

This module can be used in the basic training of health center teams in the training institutions and training of health center teams who are already in the service sectors, community health workers and care givers. However, it was not meant to replace standard text Books or reference materials.

1.2 Direction for Using the Module

In order to make maximum use of the module the health center team should follow the following directions:-

- 1.2.1 Check prerequisite knowledge required to use the module.
- 1.2.2 Do the pretest pertaining to the core module section 2.1.1.
- 1.2.3 Read the core module thoroughly.
- 1.2.4 After going through the core module try to answer the pretest questions.
- 1.2.5 Evaluate yourself by referring to the key given in section 7.1 and 7.2.
- 1.2.6 Read the case study and try to answer questions.
- 1.2.7 Use the listed references and suggested reading materials to substantiate and supplement your understanding of the problem.
- 1.2.8 Look at the satellite module and the task analysis related to your field to understand your role in the team in managing a case of Protein Energy Malnutrition (PEM).

The background features a large, light gray watermark of the Ethiopia Public Health Training Initiative (EPHTI) logo. The logo consists of a circular border containing the text "Ethiopia Public Health Training Initiative" twice. In the center of the circle is a map of Ethiopia with the acronym "EPHTI" overlaid in white, bold, capital letters.

UNIT TWO

CORE MODULES

2.1 Pre-and Post Test

2.1.1 Pre and Post Test for the Health Center Team (From the Core Module)

Directions: Choose the letter of the choice with the right answer.

1. Which age groups of children are more predisposed to protein energy malnutrition (kwashiorkor)?
 - a) Under one year
 - b) All under five
 - c) Children 2-3 years old
 - d) Children 4-5 years
 - e) None

2. What are the different risk factors involved for the development of protein energy malnutrition?
 - a) Low socioeconomic conditions
 - b) Ignorance of parents about the importance of child nutrition
 - c) Infections like measles, Pertusis, diarrhea
 - d) Child abuse (Neglect)
 - e) All of the above

3. How common is the problem of protein energy malnutrition?
 - a) Severe forms of malnutrition are frequent in the order of 5-10% in developing countries
 - b) The prevalence of mild and moderate forms Protein energy Malnutrition range from 20-40%
 - c) Stunting is the more common form of malnutrition than wasting in most developing countries including Ethiopia
 - d) Wasting follows seasonal shortage of food
 - e) All are correct

4. What are the different types of Protein energy malnutrition (PEM)?
- a)
 - b)
 - c)
 - d)
 - e)
5. Why is weaning time usually the period for the syndrome of protein energy malnutrition to set in?
- a) Ceasing or reduction of breast-feeding
 - b) Improper weaning practices like introduction of supplementary foods abruptly
 - c) Use of bottle-feeding with diluted and dirty formula predisposing the child to infection
 - d) All
 - e) None
6. How do you differentiate kwashiorkor from Marasmus clinically? List at least four specific manifestations for each.

Kwashiorkor

- a)
- b)
- c)
- d)

Marasmus

- a)
- b)
- c)
- d)

7. What other diagnostic methods could you list?
- a)
 - b)
 - c)
8. What are the different phases of management of cases of PEM?
- a)
 - b)
9. What is the danger of administration of high protein and energy in the first phase of the management of PEM?
-
-
10. What are the basic causes of protein –energy malnutrition?
- a) Drought
 - b) Social inequality
 - c) War
 - d) All of the above
 - e) None
11. Which of the following is a false statement?
- a) Protein energy malnutrition is associated with diarrhea
 - b) Immunization can prevent malnutrition
 - c) Marasmus is one of the problems of our society
 - d) Malnutrition is non-preventable communicable disease
 - e) A and D
12. What sanitary measures should be taken to prevent PEM?
- a) Provision of safe and adequate food
 - b) Sources of water should be protected
 - c) Personal and environmental hygiene should be maintained

- d) All of the above
 - e) None of the above
13. In the clinical work up of protein energy malnutrition, what laboratory investigations can be done in a routine laboratory setup?
- a) Hemoglobin determination
 - b) Stained red blood cell morphology assessment
 - c) Serum albumin determination
 - d) Differential leukocyte count
 - e) All of the above
14. What is the importance of hemoglobin determination in the assessment of protein energy malnutrition?
- a) To diagnose anemia
 - b) To diagnose polycythemia
 - c) To assess the presence of abnormal red blood cell morphology
 - d) None of the above
15. What is the importance of studying stained red cell morphology in the assessment of protein energy malnutrition?
- a) To assess nutritional anemia
 - b) It enables the classification of anemia
 - c) To diagnose iron deficiency anemia
 - d) All of the above
16. What is the importance of serum albumin determination in the assessment of protein energy malnutrition?
- a) To diagnose hypo-albuminemia
 - b) To assess protein malabsorption
 - c) To diagnose hyper-albuminemia
 - d) A and B

17. What is the importance of differential leukocyte count (particularly lymphocyte count) in the assessment of protein energy malnutrition?
- a) To diagnose the presence of infections
 - b) To determine the relative lymphocyte count as an indicator of viral infection in protein energy malnutrition
 - c) To see the presence of atypical lymphocytes
 - d) All of the above
18. What pathogens contribute indirectly to the development of protein energy malnutrition?
- a) Viruses
 - b) Bacteria
 - c) Parasites
 - d) All of the above
19. The basic objective of managing a child with protein energy malnutrition is the following except one:
- a) Treating superimposed infections
 - b) Correction of specific nutrient deficiencies
 - c) Managing complications
 - d) Provision of immunization (measles)
20. One of the advantages of providing small frequent feeds in the acute phase of dietary management of PEM is:
- a) It increases appetite; therefore, the child could strive to gain weight at earliest time
 - b) It reduces the risk of infection
 - c) It minimizes the risk of vomiting, hypoglycemia and hypothermia
 - d) None of the above

21. The objective of the rehabilitation phase in dietary management of PEM is
- a) To decrease the risk of vomiting, diarrhea and hypothermia
 - b) To increase and promote a rapid rate of catch up growth through administration of high energy and protein
 - c) To avoid unnecessarily prolonged hospital stay so as to prevent cross infection
 - d) To promote the participation of mothers/care givers in the dietary management process.

2.1.2 Pre and Posttest for Specific Categories of the Health Center Team (from the Satellite Module)

2.1.2.1 Health Officers

Directions: Choose the letter of the choice with the right answer.

1. One of the following are nutritional problems of public health importance in developing countries.
 - a) Protein energy malnutrition
 - b) Iron deficiency anemia (IDA)
 - c) Iodine deficiency diseases (IDD)
 - d) Vitamin A deficiency
 - e) Vitamin D deficiency

2. The commonest type of malnutrition in Ethiopian Community is
 - a) Over weight
 - b) Under weight
 - c) Wasting

- d) Stunting
 - e) Kwashiorkor
3. The most important criteria for admission of a child with protein energy malnutrition coming to a hospital are:
- a) Age < 1 year plus severe PEM
 - b) Severe PEM plus dehydration
 - c) Severe PEM plus hypothermia
 - d) Severe PEM plus infection
 - e) Recurrence of the situation in the same child
4. Which of the following diseases have a very close relationship with protein energy malnutrition?
- a) Tuberculosis
 - b) Measles
 - c) Diarrhea
 - d) Pertusis (whooping cough)
 - e) Common cold

Abebech brought 3years old male child called Temam to the pediatric OPD of Jimma Hospital. She told you that the child has diarrhea on and off type, loss of appetite. Besides she stated that the child is not interested in his surrounding and sits miserably. On physical examination you found out that the child is apathetic, hypotensive, has gray easily pluckable hair, edema, weighs 9kg. While he is expected to weigh 14kg. Answer questions 5 to10 based on the above scenario.

5. What is the type of malnutrition the child is suffering from?
- a) Marasmus
 - b) Kwashiorkor
 - c) Marasmic-kwashiorkor
 - d) Underweight
 - e) Stunting
6. How would you manage this child?
- a) Admit him and correct fluid and electrolyte balances first
 - b) Start him with low protein 1 - 1.5g/kg/d and low energy 100kcal/kg/d in the stabilization phase and later increase to 5gm of protein/kg/d and 180kcal/kg/d in the rehabilitation phase
 - c) The treatment principles are different for the different types of PEM
 - d) High dose of vitamin A is required
 - e) Screen him for infection and treat accordingly
7. What will be your approach to the mother to prevent the recurrence of this situation?
- a) Nutrition education on child feeding and meal planning
 - b) Counseling her on the importance of mixing different foods (cereals with legumes) and other food stuffs like oil or sugar to enrich the protein and energy content of weaning food
 - c) Tell her the importance of gardening in her yard-garden if she has a land
 - d) Work with her how to improve the nutritional status of her child
 - e) Appoint her for follow-up (growth monitoring)

8. What other history would have been important to ask about this child?
- a) About breast feeding
 - b) About weaning process and type of weaning food
 - c) Immunization history
 - d) About who is carrying for the child at home
 - e) Income of the family, marital status, educational status and family size
9. The main objectives of treating this child in the rehabilitation phase is
- a) To promote catch up growth
 - b) To promote restoration of the wasted tissue
 - c) To prevent death because of the complications
 - d) To correct hypoglycemia
 - e) To prevent recovery syndrome
10. What will be the consequence if adequate catch up growth does not occur in this child during this rehabilitation phase?
- a) The child will remain stunted and tracks below the standard and ends up in a small (short) adult
 - b) Both his physical growth and mental development will be hampered
 - c) He will have poor physical work output as an adult later in his life
 - d) There will be difficulty in giving birth if she is a female
 - e) He will definitely grow up to be as tall as his maximum genetic potential
11. Which of the following is correct?
- a) The limiting factor for a catch-up growth of a child with protein energy malnutrition is protein

- b) Small frequent feeds are advisable for children with PEM because of the alteration of the GI-histology as due to the pathology and due to the fact that they have small stomach
 - c) Administration of other micro-nutrients like zinc, magnesium and potassium in the stabilization and rehabilitation phase is equally Important
 - d) Basically all mothers free of HIV/AIDS be advised to exclusively breast feed their young for the first 4-6 months and for a minimum of 2 years then after
 - e) Using cup and spoon is by far the most preferred method of child feeding as compared to bottle feeding
12. The types of classification of PEM so far in clinical use is
- a) Gomez classification
 - b) Waterlow classification
 - c) Welcome classification
 - d) Mid upper arm circumference
13. The type of classification that has a relative advantage for community survey of PEM is
- a) Gomez classification
 - b) Water low classification
 - c) Well comes classification
 - d) Not stated here
14. Other micronutrient deficiencies that co-exist with PEM include:
- a) Vitamin A deficiency

- b) Vitamin D deficiency
 - c) Riboflavin deficiency
 - d) Iron deficiency
15. If you find stunting and wasting in children of a given community, this condition indicates that:
- a) There is a long standing nutritional problem
 - b) Wasting indicates that there is still an acute nutritional problem
 - c) There might be other social and environmental factors hidden in community
 - d) All
16. What main dangers do you anticipate in the first phase management of PEM?
- a) Cardiac problem
 - b) Dehydration
 - c) Infection
 - d) Hypothermia
 - e) All

1.2.1.2 Pre and Posttest to Public Health Nurses

Direction: Respond to the following questions accordingly.

1. List the roles of the public health nurse in a team approach to nutrition care:
- a)
 - b)
 - c)

2. The following are the responsibilities of public health nurse in managing protein energy malnutrition except:
 - a) Maintain the child's body temperature with in normal range
 - b) Keeping the intake and output accurately
 - c) Preventing bed sore and infection by keeping the skin clean and dry.
 - d) Avoid stimulation since this disturbs sleeping pattern of a child.

3. List at least 3 points to be told to the mother of a child with protein energy malnutrition?
 - a)
 - b)
 - c)

4. Write seven rules, which can largely improve nutritional status in the community.
 - a)
 - b)
 - c)
 - d)
 - e)
 - f)
 - g)

2.1.2.3 Pre and Post Test for Medical Laboratory Technicians

Direction: Circle on any of the following choices that you think are the best answer

1. What laboratory investigations can be carried out to determine protein energy malnutrition?
 - a) Hemoglobin determination

- b) Stained red blood cell morphology assessment
 - c) Serum albumin determination
 - d) Differential leukocyte count
 - e) All of the above
2. What are the sources for blood samples for hematological tests to assess nutritional anemia?
- a) Capillaries
 - b) Venous
 - c) Arteries
 - d) A and B
3. What are the morphologic classification of anemia in stained thin blood film examination in the assessment of protein energy malnutrition
- a) Normocytic normochromic
 - b) Microcytic hypochromic
 - c) Macrocytic normochromic
 - d) All of the above
4. What is the normal differential range of lymphocytes in the age groups of 1-4 years?
- a) 38-45%
 - b) 25-35%
 - c) 44-55%
 - d) 50-60%
5. What is the approximate albumin normal range in g/l?
- a) 30-45

- b) 25-35
 - c) 20
 - d) 30
6. By what percentage is the level of albumin lowered in infants and when individuals are lying down?
- a) 10%
 - b) 20%
 - c) 30%
 - d) 40%

1.2.1.4 Pre and Post Test on PEM for the Sanitarians

Direction: Circle on any of the following choices which you think is the best answer.

1. Which of the following are risk factors for the development of protein-energy malnutrition
 - a) Poverty
 - b) Infection
 - c) Lack of knowledge on food sanitation
 - d) All could be the possible risk factors

2. How is diarrhea associated with the protein energy malnutrition?
 - a) During infection there will be increased loss of nutrients due to diarrhea
 - b) Their causative agents are the same
 - c) Both are health problems to children under five years of age
 - d) None

3. Which of the following **acute infection** has a very close relationship with PEM?
- a) Whooping cough
 - b) Leprosy
 - c) Malaria
 - d) All
4. What are the immediate causes of protein-energy malnutrition?
- a) Parasitic infection
 - b) Lack of knowledge about feeding and cleanliness
 - c) Lack of clean and unadulterated food
 - d) All of the above
5. The nutrition education to be given to the caregivers should focus on: -
- a) The importance of hygienic preparation and storage of food
 - b) Feeding balanced diet (unadulterated diet) for children
 - c) Importance of breast feeding
 - d) All of the above
6. Which of the following is the most important requirement for a child to be healthy and active?
- a) Immunization
 - b) The child should be fed non-adulterated food
 - c) Keep the personal hygiene of the child
 - d) All of the above
7. Why is PEM one of the major health problems for children of the third world countries?
- a) Poor sanitation coverage
 - b) No safe and adequate water supply
 - c) Shortage of safe and proper food
 - d) All of the above

8. What type of quick sanitary survey could be conducted to identify sanitary problem in a community.
 - a) Health walk
 - b) Computer analysis
 - c) Observational hygiene analysis
 - d) "a" and "c"

Give Short answer for the following questions:

9. Describe the major symptoms of malnourished children in the community?
10. Explain some of the major interventions that should be conducted by you to prevent acute and repeated infection?
11. Mention some points that we should focus on to make hygiene/health education more successful?

2.1.2.5 Pretest for Primary Health Workers (PHWS)/Community Health Workers (PHWS)

1. The cause of PEM is
 - a) Germs
 - b) Evil eye
 - c) Lack of adequate child feeding practice
 - d) Tooth extraction
 - e) None of the above
2. One of the following is not a method of preventing PEM: -
 - a) Keeping personal hygiene and proper waste disposal
 - b) Bottle feeding
 - c) Immunization
 - d) Food hygiene

- e) Exclusive breast-feeding up to 4-6 months and addition of supplemental food and then after.
3. Which of the following is not a signal for malnutrition?
- a) Loss of appetite
 - b) Stopping or ceasing of growth
 - c) Gray and lusterless hair
 - d) Happy smiling child
 - e) Swelling of the body
4. Which of the following is a risk factor for the occurrence of PEM?
- a) Poor feeding both in quality and quantity
 - b) Neglect of children in the household by parents or care givers
 - c) Harmful traditional practices
 - d) Economic problems
 - e) All are correct
5. What would you have done to prevent to development of PEM if you were in Jiren village?
- a)
 - b)
 - c)
 - d)
 - e)

2.2 Significance and Brief Description of the Problem

The term PEM includes a wide spectrum of malnutrition primarily affecting children in developing countries (infants, pre-school). Its severe clinical forms are: Marasmus, Kwashiorkor and Mixed feature called marasmic-kwashiorkor.

The milder forms of it like **stunting (chronic form)** and **wasting (acute)** forms of malnutrition are highly rampant in developing countries.

In rural Ethiopia, up to 1983, wasting was between 5-10%. By late 1983, it increased to 15-20% in parts of Wollo, North Shoa and Hararge. In 1984, it further increased to 30% in Bale and Sidamo. Child malnutrition in Bale, Kaffa, Gojam region that usually produce food surpluses, was found to be higher than the national average. At present, within those regions relatively unaffected by drought, it is estimated that about one third of rural children are chronically malnourished and nearly one-half are underweight.

The 1992 rural nutrition survey in Ethiopia revealed that stunting affected most of the northern parts of Ethiopia, namely Gondar, Gojam, Wollo and Tigray and also Showa, Sidamo and Illubabor located in the southern part of the central plateau. Tigray and Gondar, in northern Ethiopia, were again most affected by wasting plus underweight and regions of the western plateau and extreme south (Sidamo, North Omo, Borena) were also more affected by wasting and underweight.

2.3 Learning Objectives:-

For effective management of a case of PEM the students at the end of the training will have the following knowledge, attitude and behavioral outcomes:-

1. Define and identify the types of PEM
2. Enumerate the causes and factors contributing to PEM
3. Describe the magnitude and contribution of PEM to the overall child health problems in the country and locally.
4. Identify and describe the clinical manifestations of PEM and its complications.
5. Demonstrate the process of assessing a child with PEM
6. Identify the degree of PEM in a child
7. List the diagnostic methods and procedures for a case with PEM.
8. Describe the principles and methods of treating PEM
9. Select the appropriate treatment for a case of PEM
10. Describe methods of preparing dietary treatment for a case of PEM
11. Identify and manage or refer timely when needed, a case of severe PEM
12. Demonstrate the appropriate management of a case of PEM
13. Weigh children regularly and monitor their growth (growth monitoring) and take action
14. Promote hygienic preparation and storage of weaning foods.
15. Identify methods and targets for health education in the prevention of PEM
16. Describe proper growth monitoring activities and their importance in the prevention of PEM
17. Promote breast feeding and proper weaning practice
18. Promote immunization of children

2.4 Case Study: Learning Activity Health Professionals in Jiren – a Rural Community

Almaz lives in a rural village of Jiren community. She has many children of which several have died, but more are still alive. Her children were always weak, unhealthy, full of parasites, and irritable. They were not playful like most kids in the neighborhood. Almaz is a believer in God and therefore accepts every thing as natural.

August 19, 2000 was the first time when a health center team (a nurse, a sanitarian, a laboratory technician and a health officer) from the Jimma health center came to their village to do a “**health walk**”. Together with the village elders, the team walked all round the village and observed the environmental sanitation conditions, housing condition, water supplies sanitation facilities, and the health of children. In their preliminary assessment they registered many things that needed to be corrected in order to improve the health condition of the villagers. Some of the health and sanitation problems observed were:

1. Feces of adults and children in many places; some of the excreta contained ascaris worms.
2. Wastes such as rubbish, and dung, etc were scattered all over the place.
3. No clean water supply in the village.
4. No single latrine in the whole village was seen.
5. The eyes of most children were unwashed, infested with flies and covered with discharge.
6. Many children seen were not playful, & happy, but weak looking, with big bellies, thin, and gray or cooper hair.

7. All the houses, except for a few scattered dwellings were thatched with asingle room.
8. Almost all dwellings were used as barn & the houses were in general crowded.
9. Children were playing in highly commentated environment.

Having made all these observations and discussions with the elders, the health center team (the health officer, the nurse, the laboratory technician and the sanitarian) reached a consensus that, although almost all people in our country are leading the same life, this village, in particular, seems even more deprived of all the necessary health promotion mechanisms. The population is not that poor, but they have been isolated, uninformed and unexposed to health care services and mostly illiterate.

The team discussed their observations and agreed to start an intervention program together with the people. They agreed that the intervention programs should start from the basics and build up later.

The most important ones were: -

- ◆ Basic hygiene education.
- ◆ Teach basic and proper child nutrition.
- ◆ Protect the water source.
- ◆ Give basic technical help for all to have access to latrines.

The next day, when the car which brought the health center staff arrived and parked under a tree, children were running around to tell their mothers about the guests arrival. Ladies were calling each other to come to the meeting. On the way, they were asking each other what the meeting would really be about. They speculated about many things.

At the meeting place, children were crying, people were moving here and there, and the team was unloading things such as kerosene stoves, some bottles containing oil, some flour and chopping board from the car.

After everyone sat down and the supplies were unloaded, the health officer clapped his hand for silence. All except some children were quiet. The nurse, the health officer and the lab technician were dressed in white gowns; the sanitarian is dressed in neat Khaki trousers and a local cap for the sun.

Once they were quite and relaxed, the health officer began to explain to them what they do in the health centers and the team will be having in the village in the future.

The sanitarian then told them how disease is transmitted from one person to another. He then pointed out the sanitation problems in the villages and explained that when children play in those areas; they contaminate themselves and their families. He also discussed how diseases are transmitted through water or flies. He told them these things in a simplified way, showing them some posters, which he brought with him.

The health officer and the public health nurse reinforced what the sanitarian hve just said by asking them simple questions such as, how many of you've children that pass ascaris worms with their stools? Almost every mother raised her hand. Again they asked; how many of you have children that have had diarrhea in the last four days including today? Again many mothers raised their hands.

Then, they stopped asking and started to tell them about children's health, cleanliness and nutrition. They added that in order for children to grow, they have to be kept clean, fed properly (nutritious food as often as five or more times a day), teach them good habit of hand washing and always monitor

their growth, mood, and illness especially from parasitic disease as much as possible. Children should eat, and drink clean water or milk

If the children are not getting the necessary nutrients, such as body builders (proteins) energy foods (carbohydrates and fats) and protective nutrients (vitamins and minerals) they: -

- Grow slowly
- Be weak, unhappy, not playful
- Look like an old person
- Have elastic skin
- Have no resistance to disease
- Have frequent attack of diarrhea
- Have slow mental development
- Eventually may die

She started showing them pictures of a child with different kinds of nutritional deficiencies. She pointed to the pictures of Marasmus, Kwashiorkor and Marasmic-kwashiorkor and asked the mothers if they have seen a child such as the one in the picture before. One mother pointed to her own child and asked whether it is the same? The nurse told her it was the same. Getting a living example the nurse started to tell them about what had happened and they can reverse the condition. She put on her apron and asked the mothers to make a circle and observe so that they see how to prepare simple foods in their house in clear and simple manner.

They told mothers how much and how frequently they need to feed their children with the above nutrients and their locally available food sources. This shows that we do not have to be necessarily very rich to have our children grow healthy and strong.

The food must be prepared fresh if possible or leftover food must be stored and covered in clean utensils and in clean place. Leftover food must also be heated adequately before giving it to a child.

2.5 Definition

Protein-energy malnutrition (PEM) is a diagnosis that includes several overlapping syndromes. The scientific basis for PEM was questioned in the early 20th century and different terms were introduced to describe it and there were different views as to its etiology. Controversies raged since 1930 and in 1935 cicely William's introduced the Ghanaian diagnosis Kwashiorkor (a disease of child disposed from breast by birth of the next one).

The term kwashiorkor -remained constant in spite of the criticisms because it doesn't describe the cause. Over the next 20 years around 50 different alternative names have been given to the same syndrome.

In 1959, Jelliffe, proposed the term protein calorie malnutrition (PCM) to include all syndromes relating to inadequate feeding. This has been largely replaced by **protein-energy malnutrition (PEM) or malnutrition.**

2.6 Epidemiology

Protein energy malnutrition is the major nutritional problems of the third world countries. Its prevalence ranges from 20-40% in Africa and Southeast Asia. In Ethiopia, according to CSA rural nutrition survey in 1992, the highest prevalence of stunting was recorded in South Gondar (74.5%) and the lowest prevalence in South Omo (49.2). Whereas the highest prevalence of wasting was recorded in Tigray (14.2%), and the lowest in Bale (4.4%). Concerning the prevalence of underweight, the highest (59.9%) was recorded in Tigray and the lowest in Bale (29.2%). Generally, the prevalence of moderate and severe forms of stunting and

underweight in Ethiopia showed an increasing trend over a decade according to the report on rural nutrition survey in 1992 (see Figure 1).

PEM is mostly common in children under five years of age. Marasmus is common in children less than 12 months of age and kwashiorkor is prevalent in children less than 5 years, commonly in the age groups of 2-3 years.

Many studies show that this problem is associated with different factors like improper weaning practice (early abrupt weaning with dilute and dirty formula), infections (diarrhea, measles, tuberculosis, pertusis, etc.), harmful traditional practices (age bias in feeding, sex bias, in feeding, food prejudices- omission from family diet), and child neglect. These factors do operate in the Ethiopian context. In Ethiopia, there is a cyclic occurrence of malnutrition in most rural agrarian communities following the turn of the seasons. The winter (rainy) season is therefore called the hunger (lean) season and that of the summer (dry) season is the harvest season. This seasonality of energy and protein intake is reflected in the variations in the prevalence of PEM in those two seasons.

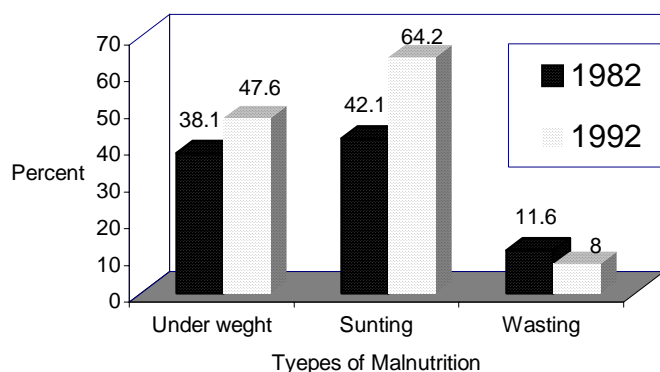


Figure 1. Trend of protein Energy malnutrition in children 5-59 months in Ethiopia over 10 years (1982-1992)

Source: CSA report on rural nutrition survey module, 1992

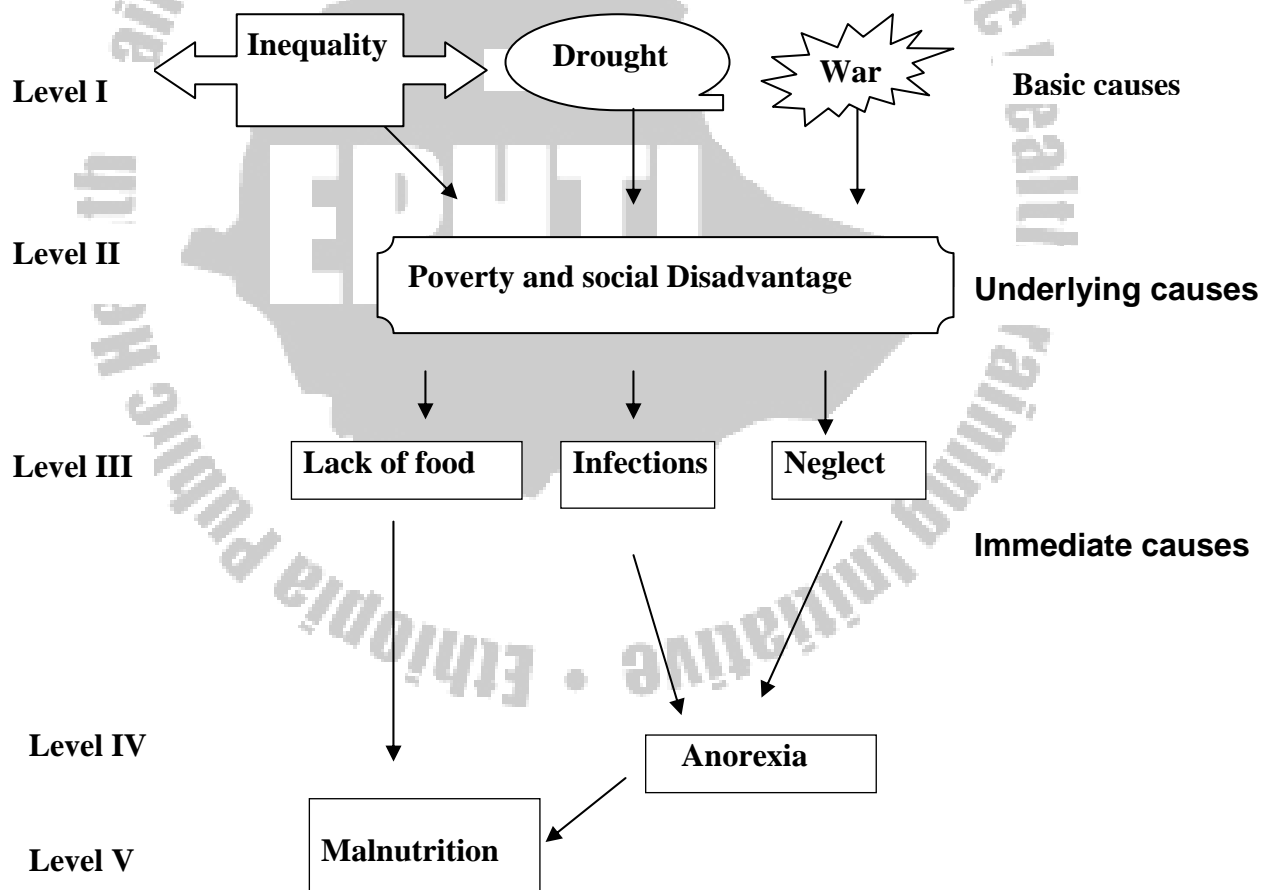
2.7 Causes, Etiology and Pathogenesis

2.7.1 Causes

Causes of protein energy malnutrition are multi-factorial having a number of interwoven factors operating simultaneously. The causes could be categorized as immediate, underlying and basic.

The following diagram depicts the causes operating at different levels.

Hierarchical Model of the Causes of PEM



At the level of the individual child one or more of the following factors may operate:-

- ❖ **Lack of knowledge** -People do not understand the nutritional nature of their Child's health problem
- ❖ **Poverty** - lack of means to obtain and provide food to their child (as in the case of war)
- ❖ **Famine and vulnerability**- destitution, being orphan (Example HIV taking away parents Lives)
- ❖ **Infections** - there is a reciprocal relationship between malnutrition and infection. During infection, the requirement for nutrients increases, there will be increased loss of nutrients due to diarrhea; genesis of fever and other acute phase reactants is at the expense of nutrients.
- ❖ **Emotional deprivation**- In orphan children and in children whose parents are negligent in giving care to their children, due to different reasons, children will lose appetite for feeding and hence end up in state of malnutrition
- ❖ **Cultural factors**- Different biases as to who should take the lion's share of the family 's food (Example, age bias—older children are given more food than the smaller ones,
- ❖ **Sex bias**—male children are more favored in getting nutritious food than female children in some families, etc.)
- ❖ **Mal-distribution of foodstuffs** - within the family, it occurs between the different ages and sexes due to biases, food prejudices and taboos. It also occurs between the different regions of a country because of inappropriate food and nutrition policy, poor marketing and distribution system due to different reasons like embargo, country under-siege, etc.

2.7.2 Etiology of Protein Energy Malnutrition

Protein-energy malnutrition: is a multi- deficiency state and not just a deficiency of protein and energy. Marasmus is a semi-starvation, which includes the deficiency of energy, protein and other nutrients. There are several theories for kwashiorkor: -

1. **Low Protein Intake: -**

Low protein intake, which leads to hypo-albuminemia, which in turn leads to edema. However, different studies have shown that children can have low albumin without edema, it was found difficult to produce edema in animals on protein deficient diet, and edema may go and come unpredictability regardless of their protein intake.

2. **Dys-adaptation**

Edema is determined not only by diet but also by **intrinsic differences** among children with regard to their protein requirement or hormonal response. Hence, kwashiorkor develops in children that poorly adapted and Marasmus develops in children that are well adapted to the states of lower nutrient intake.

3. **Free Radical Damage**

The outcome of malnutrition is determined by extrinsic factors (noxae) leading to free radical formation and intrinsic factors (micronutrient deficiencies) which may impair body's ability to **scavenge free radical species**. This results in membrane damage and leakage of fluid from the cells. This theory accommodates all other theories.

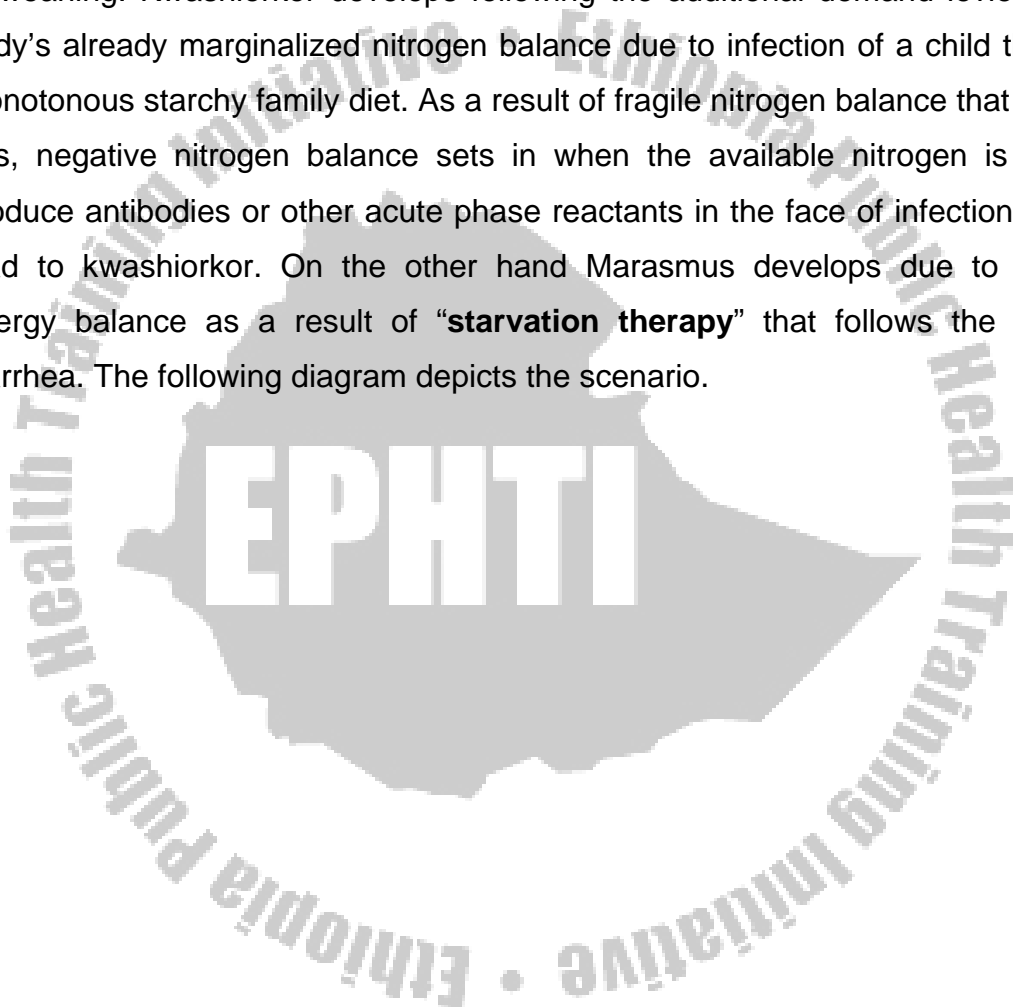
4. **Aflatoxins : -**

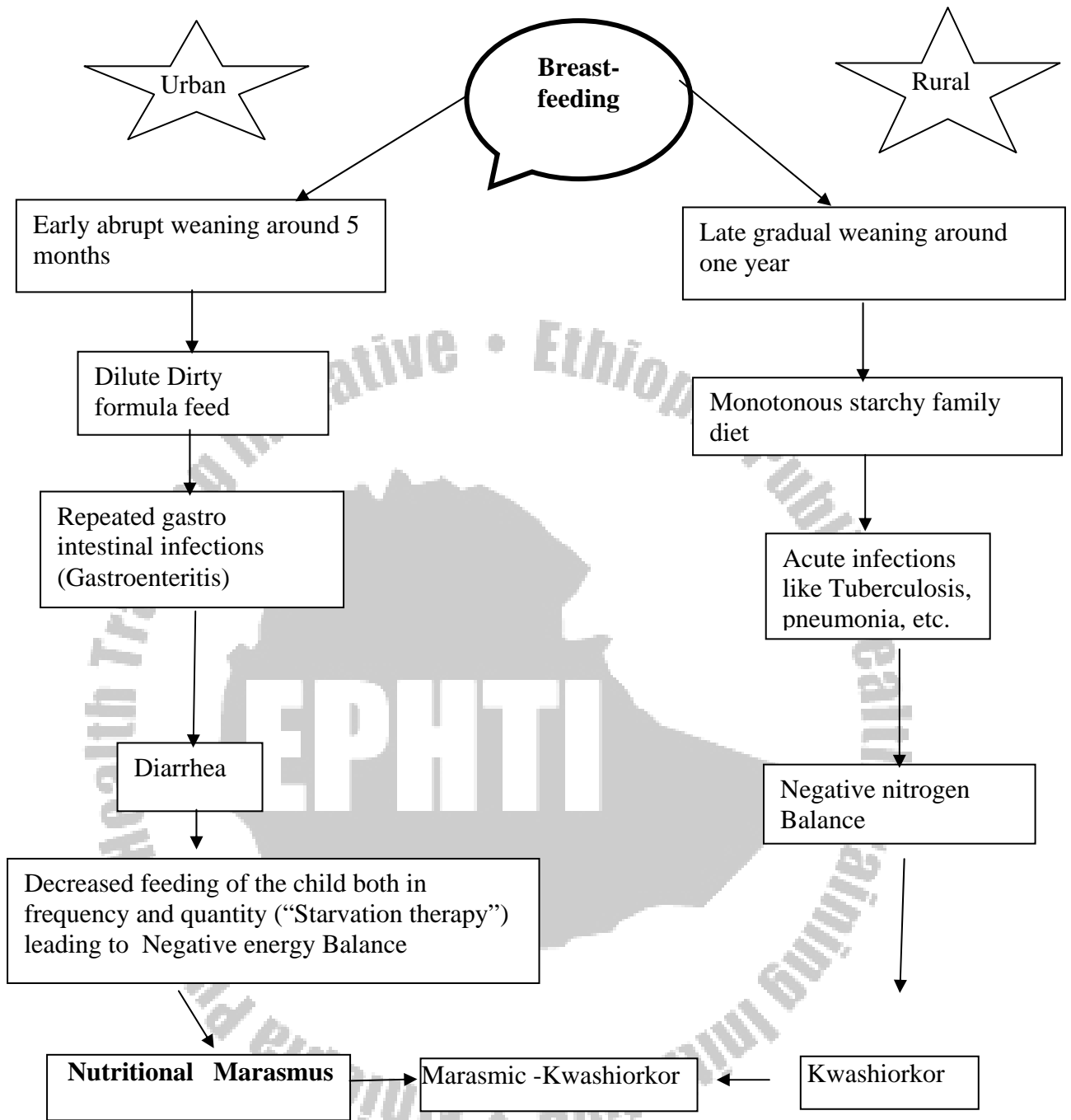
It was reported from a study in Sudan by Hendricks that children with Aflatoxins developed edema compared to those with no aflatoxin intake.

2.7.3 Pathogenesis

Marasmus and Kwashiorkor in their extreme forms have basically different pathogenesis.

The initiation of the pathogenesis of both problems can be traced back to the time of weaning. Kwashiorkor develops following the additional demand levied on the body's already marginalized nitrogen balance due to infection of a child that is on monotonous starchy family diet. As a result of fragile nitrogen balance that the child has, negative nitrogen balance sets in when the available nitrogen is used to produce antibodies or other acute phase reactants in the face of infection, this will lead to kwashiorkor. On the other hand Marasmus develops due to negative energy balance as a result of "**starvation therapy**" that follows the bouts of diarrhea. The following diagram depicts the scenario.





Adapted From Maclarane

2.8 Clinical Features

The severest clinical forms of PEM are Marasmus, kwashiorkor and features of both called Marasmic- kwashiorkor. The following symptoms and signs clinically characterize them: -

Marasmus

Marasmic children have retarded growth with specific clinical manifestations including:-Wasting of subcutaneous fat and muscles (flabby muscles), Wizenod monkey (old man face), Increased appetite, sunken eye balls, mood change (always irritable) and mild skin and hair changes.



Figure 2. A child with marasmus manifesting with old man's face and bone and skin appearance

Kwashiorkor

Children with the **kwashiorkor syndrome** may have the following clinical manifestations; -

Growth failure, wasting of muscles and preservation of subcutaneous fat, edema (pitting type), fatty liver (hepatomegaly), psychomotor retardation (difficulty of walking), moon face due to hanging cheeks as a result of edema and preserved

subcutaneous fat, loss of appetite, lack of interest in the surrounding (apathy) and miserable, skins changes (ulceration and depigmentation or hyper pigmentation), and hair changes (de-pigmentation, straightening of hair and presence of different color bands of the hair indicating periods of malnourishment and well nourishment (flag sign) Straightening of hair at the bottom and curling on the top giving an impression of a forest (Forest sign) and easily pluckable hair. Marasmic kwashiorkor can have the clinical features of both Marasmus and kwashiorkor.

In children with PEM, there are usually deficiencies of micronutrients like: - riboflavin, vitamin A, Iron and Vitamin D. Therefore, it is advisable to have high index of suspicion and look for the signs and symptoms of deficiencies of these nutrients.



Figure 3: Child with kwashiorkor manifesting with edematous swollen legs and apathy

2.9 Diagnosis

The diagnosis of PEM rests mainly on meticulous clinical examination for the symptoms and signs of the syndrome plus anthropometric assessments using different methods. Additionally one may need laboratory investigation for the assessment of complications and other health problems associated with malnutrition. Epidemiological considerations also contribute to the diagnosis of malnutrition.

The clinical symptoms and signs are presented in section 2.8. The anthropometric assessments can be done using the following methods.

1. Gomez classification (weight-for-age)

<u>Percentage (%)</u> <u>Of NCHS Reference</u>	<u>Level of malnutrition</u>
90-109	Normal
75-89	Mild (Grade I)
60-74	Moderate (Grade II)
< 60	Severe (Grade III)

The disadvantages of this classification are: - The cut off point 90% may be too high as many well-nourished children are below this value, edema is ignored and yet it contributes to weight and age is difficult to know in developing countries (agrarian society).

2. Well-come classification (weight-for-age)

<u>Percentage (%)</u>	<u>Level of malnutrition</u>	
<u>NCHS Reference</u>	<u>Edema</u>	<u>No edema</u>
60-79%	Kwashiorkor	Under-weight
< 60%	Marasmic- kwashiorkor	Marasmus

Shortcoming of this method is that it does not differentiate acute from chronic malnutrition.

3. Waterlow-classification (Height-for-age and weight-for-height)

<u>Index</u>	<u>% of NCHS reference</u>	<u>Level of Malnutrition</u>	
Height For Age	90-94%	Mild	Stunting (Chronic malnutrition)
	85-89%	Moderate	
	< 85%	Severe	
Weight for Height	80-89%	Mild	Wasting (Acute Malnutrition)
	70-79%	Moderate	
	<70%	Severe	

Laboratory Diagnosis

Laboratory investigation for protein energy malnutrition is to determine the level of serum protein, hemoglobin and co-infections due to pathologic organisms that can be viral, bacterial or parasitic origin. Besides determination of micronutrient deficiencies can also be done.

2.10 Case Management

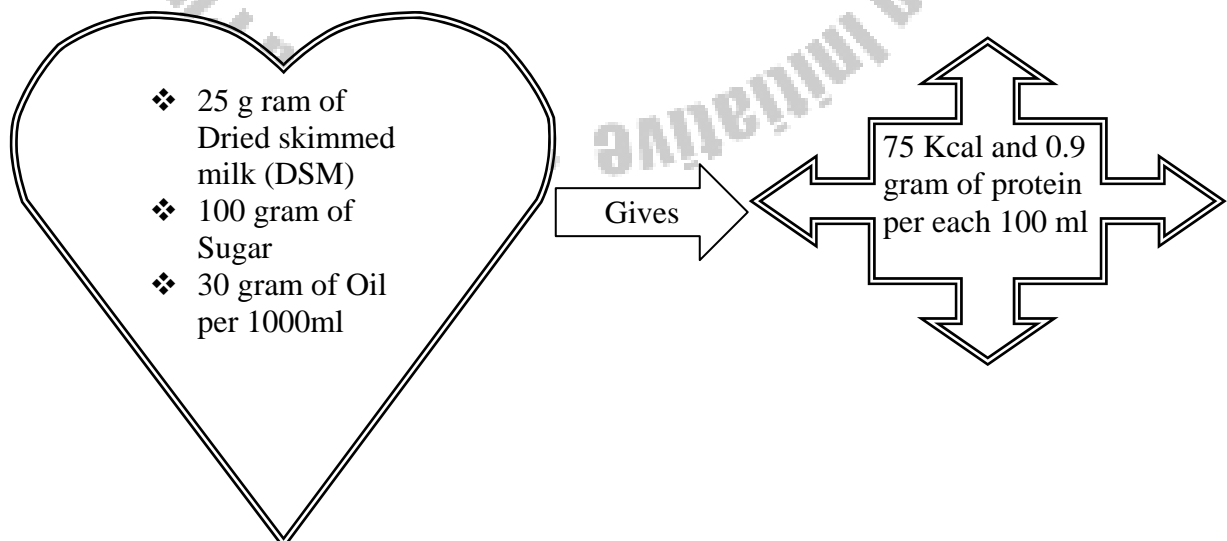
Management of a case of PEM focuses on the correction of specific nutrient deficiencies (dietary management), treatment of complications and supper imposed

infections. The treatment approach is classified into two phases—The acute stabilization phase in which the main focus is treatment of infection and other complications like dehydration, hypoglycemia, hypothermia and other electrolyte imbalances. The rehabilitation phase focuses on the restoration of the lost tissue and promotion of catch up growth.

Dietary Management

1. Acute Phase

Children are most at risk of dying during the acute phase. Dehydration, infection and severe anemia are the main dangers. In PEM, cardiac and renal functions are impaired and in particular malnourished children have a reduced capacity to excrete excess water and a marked inability to excrete Sodium. The amount of fluid given and the Sodium load must be carefully controlled to avoid cardiac failure. A cautious approach is required; aiming at administration of about 100kcal/kg/day and 1-1.15g of protein/kg/day. Small frequent feeds (as much as 12 times in 24 hours for the first two days and gradually tapering the number of feeds to be 6 in 24 hours after a week) are ideal as they reduce the risks of diarrhea, vomiting, hypoglycemia and hypothermia. The maintenance formula can be made as follows:



It is important to give additional Potassium 4mmol/kg/d, Magnesium 2mmol/kg/d, Zinc 2mg/kg/d), Copper 0.2mg/kg/d and a multivitamin preparation and folic acid.

Do NOT give iron early before infection is controlled. High dose vitamin A should be given even if there are no eye signs of deficiency.

On this regimen, edema will disappear and the general condition will improve. High energy or high protein diets should not be introduced too early or too rapidly. Such action may precipitate the **recovery syndrome** which can prove fatal. Return of a **good appetite** is a sign that a child is ready to progress to the next phase (rehabilitation phase).

2. Rehabilitation Phase

The aim of this phase is to restore wasted tissues and promote a rapid rate of catch-up growth through administration of high energy and protein. A vigorous approach is required. In this phase there is no danger of recovery syndrome.

The synthesis of new tissue requires protein and other nutrients. Synthesis also requires a considerable amount of energy. The aim is to provide all necessary nutrients so that none limits the rate of recovery. Normal rate of growth of children is such that they gain a weight of 1gram/kg/day by taking 105 kcal/kg/d and 0.78gram of protein /kg/d. To increase this rate of growth by 20 times the normal, the energy and protein intakes need to be increased to 200kcal/kg/day and 5kcal/kg/day, respectively.

What to give: The choice of ingredients will vary with local circumstances. There are many advantages in using milk as the basic ingredient, since milk can be modified very effectively and easily, by adding sugar and vegetable oil, to produce a high-energy formula.

Modification of different milks to provide 1 liter of high-energy formula

	<u>Milk (g)</u>	<u>Sugar (g)</u>	<u>Vegetable oil (g)</u>
Dried skimmed milk	80	50	60
Whole dried milk	110	50	30
Liquid cow's milk	900	50	30

Considerable flexibility exists in the ingredients that can be used, provided the target requirements are met. Where milk is not available, high-fat legume, nuts and oilseeds (such as groundnuts, Soya, sesame seeds) provide both energy and protein in a relatively compact form. The formulas above provide ~ **100kcal and 3g protein/100ml**.

How much to give:

The greater the intake of energy and protein intakes the faster the growth. Hence one should give the high-energy and protein formula of at least 180 ml/kg/day (6 feeds at 30 ml/kg/feed). This amount will provide **180 kcal/kg/day and 5-gram protein/kg/day**.

Assessing Progress:

Patients should be weighed **at least weekly, preferably daily, and the weights plotted**. Failure to maintain rapid catch-up may signal an undiagnosed infection and/or inadequate intake. Keeping a record of the child's food intake helps to elucidate the cause of poor weight gain.

Almost all malnourished children have diarrhea, but it is rarely due to **lactose intolerance**. Chronic diarrhea may result from gut parasites (e.g. Giardia) or bacterial overgrowth of the small bowel. The introduction of the high-energy formula may cause mild diarrhea initially, but this is not a cause for concern unless stool frequency exceeds 8 per 24 hours.

Role of the Family Diet:

Transfer to a family-type of diet is important in rehabilitation. Introducing a family-type diet at an early stage of treatment is unlikely to permit catch-up growth because the traditional diet usually does not provide enough energy and protein. There are two options:

1. Feed a high-energy formula until the child reaches his normal weight-for-height and then transfer to a family-type diet as experienced in Jamaica.
2. Make an early transition to a **modified** family diet having a high energy and protein concentration to support catch-up growth as evidenced in Bangladesh.

Local circumstances will influence which option is chosen. In the first option weight deficits should be corrected in 4-6 weeks even in the most severe cases. The second option provides an opportunity for catch-up growth and for demonstrating improved feeding practices. This has been successful in India and Bangladesh for the home management of PEM.

Where to Rehabilitate

1. In Hospital: -

In many hospitals, treatment of PEM is unsatisfactory due to cross infection and frequent relapses. Moreover, it is expensive and does not give a chance for parental education:

Therefore, not all children with protein energy malnutrition be admitted to hospitals merely for the purpose of feeding. Admission of children to a hospital be targeted to those children with severe protein energy malnutrition plus other admission criteria (see Satellite module for health officers section 2.10).

2. At Home: -

As experienced in Bangladesh, even severe cases have been successfully rehabilitated at home. **But, this was successful only after one week** of medical care to treat infections and other complications. This method was also proved **to be the most cost-effective**, and parents prefer the method, even though no food supplements were provided.

3. Day-care Nutrition Rehabilitation Centers (DCNRCs):-

Typically, these centers provide treatment for uncomplicated cases of PEM. According to Bengoa's original concept, children receive 3 meals for 6 days of each week, for 3-5 months, i.e. a period sufficiently long to enable parents to understand 'why' and 'how' to improve infants' feeding practices. The primary long-term objective of DCNRCs is to prevent PEM. In practice, this is often unpopular because of the time required by the mothers/ caregivers to take the child to the center. In the Ethiopian context, day-care nutritional rehabilitation centers that are attached to the health centers are organized in such a way that children with severe PEM are brought to the center every 1-2 weeks where the mothers/ care givers are provided nutrition education regarding how to prepare nutritious food from locally available food stuffs and children are given supplementary feedings.

4. Residential Nutrition Rehabilitation centers (RNRCs): -

These are usually convalescent centers for children treated initially in hospitals. Mothers may accompany their children, e.g., in Kampala, where an intensive education programme was provided. In Ethiopia, this approach is used in some areas under the NGOs. The primary objective of this approach is **preventative** rather than curative, but again they may be incompatible with the mother's other responsibilities.

2.11 Prevention of Protein Energy Malnutrition (Options for Intervention)

Many children attending outpatient clinics are malnourished. Prevalence of mild forms of malnutrition like stunting and wasting is 40-50% while those severe cases is 5-10% in most of the developing countries. If these cases of PEM can be recognized early enough by routine weight and height measurements (growth monitoring in under five clinics) and relevant action taken, then severe malnutrition can often be prevented easily.

It is not sufficient to treat only severe cases of malnutrition coming to the health institution, as those coming to the health institution are the tips of an iceberg. Therefore, further approaches at the grass root community level are required. The following are some of the nutritional intervention approaches to be considered in the community.

2.11.1 Dietary Diversification and Nutrition Education

This approach focuses on educating mothers/care givers on the importance of having a balanced diet through diversification of food. It also aims at the production foodstuffs at the backyard garden and intensification of horticultural activities. The nutrition education should focus on:

- Cultural malpractice and beliefs in child feeding and weaning process, weaning foods, exposure of children to sun light, time of weaning and food prejudices
- Intra household mal-distribution of food (age and sex bias)



Fig.4: Mother breast feeding her child

- Effects of emotional deprivation and neglect on nutritional status of children and proper child treatment practices
- Importance of breast feeding
- Hygiene (personal hygiene, food hygiene, environmental hygiene)
- Importance of immunization
- Importance of growing fruits and vegetables in the backyard garden and consumption by the household members regardless of their age and sex.

Importance taking their children to health institutions for **growth monitoring**

- Monitoring of the growth of children is very important for the following reasons:
- Steady growth is the best indicator of child's health.
- Weight gain is the most sensitive measure of growth.
- Serial measurement of weight is simple, universally applicable tool for assessing growth.
- Weight gain monitoring is the best method for early detection of health problems whether from malnutrition or infection.

2.11.2 Dietary Modification:-

This approach focuses on modifying the energy, protein and micronutrient content of the weaning foods. In order to reduce dilution of the energy and protein contents of the weaning foods and their level of contamination, we need to educate mothers and demonstrate to them the benefits of sprouting (germination) and fermentation. Fermentation renders the food less contaminated probably because of acid formation as result. Using sprouted (germinated) flour otherwise known as “power flour” or amylase rich flour (ARF) makes the weaning food more liquid but less dilute. This is an attempt to reduce the problem of bulky low -energy density weaning foods, which arise from the water holding capacity of cereals, which makes them swell and become viscous upon cooking. This means that large volume is required to satisfy their energy needs.

The upper limit of dry matter in a gruel made up of ordinary flour is 20 % (0.7-0.8 kcal/gram), because beyond this level, the gruel would be too thick to stir. When germinated flour is used or added to an already made thick gruel (up to even 30% solid concentration), the meal becomes liquefied almost instantly. A meal prepared in this way with 25 to 30% dry matter would have an energy density above 1 kcal/gram. This is an energy density recommended for the weaning food on the basis that breast milk has an energy density of 0.7 Kcal/gram.

On top of this, supplementation of micronutrient like vitamin A and iron to children below five years of age and fortification of salt with iodine could also be considered based on the local needs.

2.11.3. Economic Approach:

This approach aims at improving the incomes of the target community as a solution to their nutritional problems. It is considered usually in areas where there are many poor people and if their purchasing power is low as in the case of urban slums and

people displaced because of war and other natural calamities. There are different methods in this approach: -

- **Food for work**—This involves offering of some work for the poor people and paying them off in terms of food. It is good in that it offsets seasonality in the dietary intake, but it is donor dependent
- **Food subsidy** --- This involves subsidizing of either producers or consumers of food by the government. Structural adjustment policies interfere with the materialization of this approach
- **Income generating projects**---This method operates in some regions of Ethiopia and involves development of income generating projects in the community to make them generate fund for buying food. It includes organizing the community and using their potentials in the running of the project. The projects could be weaving, pottery, Bee keeping, etc. This approach needs a good feasibility study on how the income generated is used, the sustainability of the programme, etc.

The above approaches could be used either simultaneously where it applies or independently. This should be determined by doing a thorough Strength, weakness, opportunities and constraints (SWOC) analysis.

Surveillance

Targets for surveillance:- Infants & child growth monitoring(GM) activities need to be carried out in an integrated manner with other PHC services. Missed opportunities for GM should be fully utilized in such a way that children coming to the health institutions for other purposes are covered in the growth monitoring (GM) activities. Besides, every child should be regularly monitored for growth performance (growth take up) every month. **Triple A cycle** (assessment, analysis and action) be employed in effecting GM activities.

- ❖ Assessment includes regular measurement of weight & heights of < 5 children

- ❖ Analysis includes comparison of the growth performances of children with nutritional Status.
- ❖ Action involves nutritional intervention to curb the problems.

The action may include rehabilitation of severely malnourished children and following them up and micronutrient supplementation, Nutrition education on importance of backyard gardening & horticultural activity, dietary diversification, breast feeding and proper child feeding practices.

Preparation Nutritious Food from Locally Available Food Staffs

Balanced diet can be prepared by mixing different locally available foodstuffs. For Example the protein and energy requirements of children can be met by preparing the following diets: -

1. ***Quadri mix***---staple+ animal protein + plant protein + leafy vegetable
2. ***Triple Mix***---Staple +animal protein + plant protein or leafy vegetables
3. ***Double mix***--- staple + animal protein or plant protein or leafy vegetable

Parents / car givers need to be instructed how to modify the protein, energy and other nutrient contents of the locally available foodstuffs used in weaning and child feeding (See Dietary modifications, in part 2.11.2).

Nutritional Surveys

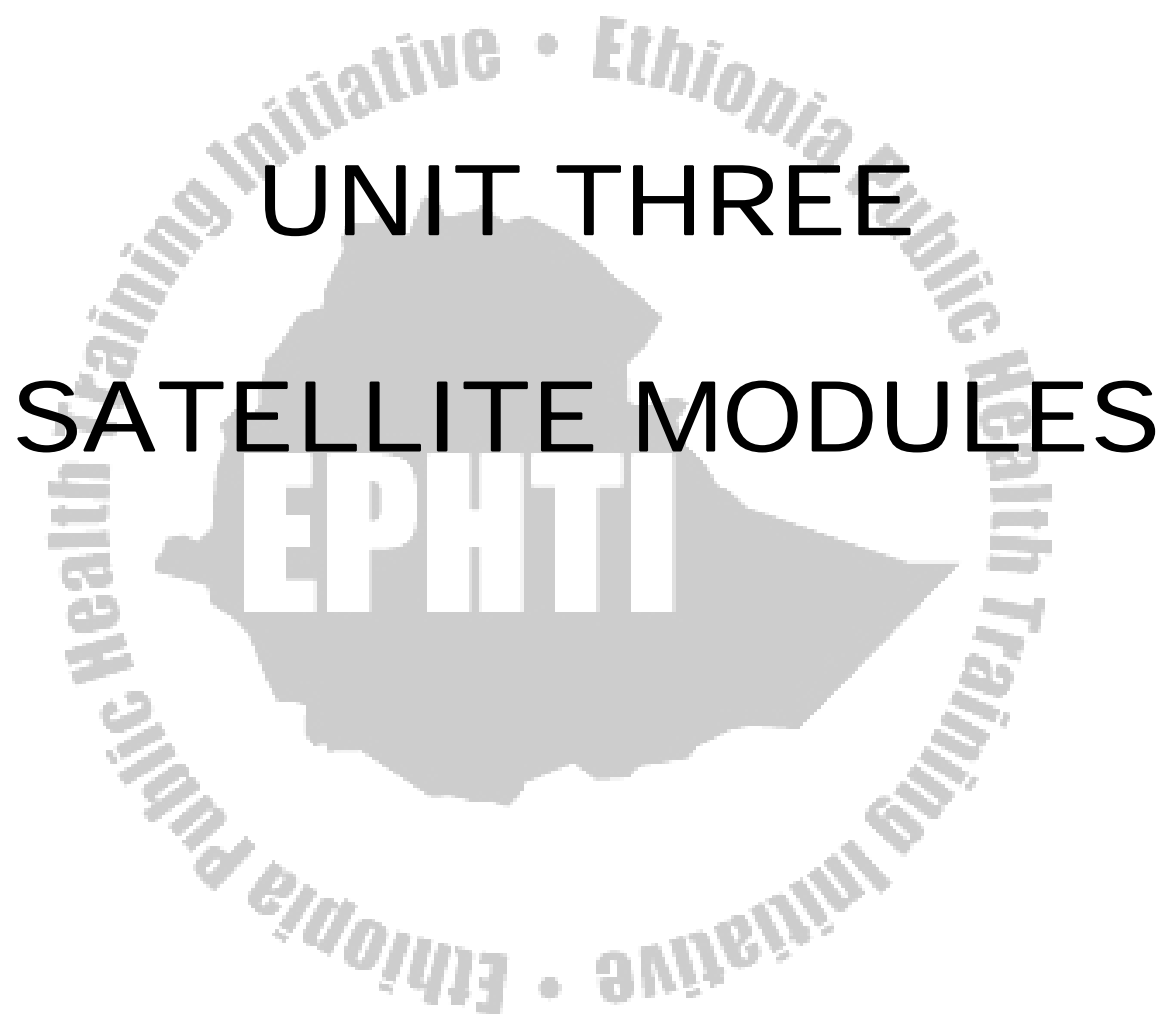
Community based nutritional surveys including anthropocentric measurements and dietary consumption surveys need to be carried out among under five children in order to early detect the occurrence of nutritional problems in the community.

2.12 Learning Activities (Case Study) Continued

Base on the story of health workers in Jiren community, different points of discussion have been incorporated in the respective satellite modules. Therefore,

the students are advised to refer to the questions in satellite modules for each professional category and discuss them in the class under the coordination of their facilitator.





UNIT THREE

SATELLITE MODULES



UNIT 3.1

SATELLITE MODULE FOR HEALTH OFFICERS

UNIT:1 INTRODUCTION

1.1 Purpose and Use of the Module

The ultimate purpose of this training module is to produce Competent Health Officers who can effectively manage and provide care for cases of PEM both in clinical and community settings.

1.2 Direction for Using the Satellite Module

This satellite module can be used in the basic training of Health Center team particularly health officers who are either already in the service or in the training programs. In order to make maximum use of the satellite module, the health officer should follow the following directions

- ❖ Evaluate your self by doing the pre-test pertinent to your category under section 2.1.2.1 before going through the satellite module and evaluate your self by referring to the answer keys given in the unit 7 section 7.1.1
- ❖ Check or read the core module very thoroughly
- ❖ Read the case study and try to answer questions pertinent to it
- ❖ Use listed references and suggested reading materials to supplement your understanding of the problem.
- ❖ For total and comprehensive understanding of the causes, etiology, pathogenesis, Epidemiology and prevention of PEM, the health officer students are advised to refer to the core module.
- ❖ After going through this module evaluate yourself by doing post-test and comparing your score with the key given in unit 7 section 7.2.1

UNIT:2 SATELLITE MODULE FOR HEALTH OFFICER

2.1 Pre and Post Test for the Satellite Module Of Health Officers

See the pre and posttests for the health officers in the core module under unit 2, section 2.1.2.1

2.2 Significance and Brief Description of the Problem

See the part under unit 2 section 2.2 in the core module

2.3 Learning Objectives

For effective case management of PEM, the health officer student will be able to do the following at the end of the training

1. Demonstrate the process of assessing a child with PEM
2. Identify and describe the clinical manifestations/complications in a child with PEM
3. List the diagnostic methods and procedures for a case with PEM
4. Describe the principles and methods of treatment of PEM
5. List the indications for admission of a case of PEM for inpatient management
6. Identify and manage or refer timely when needed, a case of PEM
7. Demonstrate the appropriate management of case of PEM
8. Describe proper follow up of a case of PEM

Case Study: Learning Activity

Read the story of health professionals in Jiren again in the core module very thoroughly so that you will be able to answer questions pertaining to it in section 2.12 of this module.

2.5 Definition

Refer to the core module unit 2 sections 2.5

2.6 Epidemiology

Refer to the core module unit 2 sections 2.6

2.7 Cause, Etiology and Pathogenesis

Refer to unit 2 section 2.7 of the core module

2.8 Clinical features (Symptoms and Signs)

The clinical features of protein-energy malnutrition vary depending on its severity. The severest clinical forms are Marasmus, kwashiorkor and features of both called marasmic- kwashiorkor. The following clinical symptoms and signs characterize them:

Kwashiorkor

- Growth failure
- Wasting of muscles and preservation of subcutaneous fat
- Edema (pitting type)
- Fatty liver (hepatomegaly)
- Psychomotor retardation (difficulty of walking)
- Moon face due to hanging cheeks as a result of edema and preserved subcutaneous fat.
- Anorexia
- Apathetic, miserable and have poor interest in the surrounding
- Skin changes
- Desquamation, De-pigmentation, Hypo-pigmentation
Flaky paint dermatosis especially on pressure areas,
Hyper pigmentation (mosaic or cracked skin)
especially on the head

Hair changes

- De-pigmentation, straightening of hair and presence of different color bands of the hair indicating periods of malnourishment and well nourishment (flag sign)
- Persistent lanugo hair, Long eye lashes,
Gray and easily pluckable hair
- Straightening of hair at the bottom and curling on the giving an impression of a forest (Forest sign)

Marasmus

- Growth retardation
- Wasting of subcutaneous fat and muscles (flabby muscles)
- Weight is more effected than Height
- Wizedened monkey (old man face)
- Sunken eye balls
- Increased appetite
- Mood change (always irritable)
- Mild skin and hair changes

In children with PEM there are usually deficiencies of: - Riboflavin, vitamin A, Iron and Vitamin D. Therefore, it is advisable to have high index of suspicion and look for the signs and symptoms of deficiencies of these nutrients.

Complications of Protein-Energy Malnutrition

Acute

- Electrolyte imbalance
- Diarrhea, dehydration and shock
- Hypoglycemia
- Hypothermia
- Sepsis

Chronic

- Insult to the brain development leading to low school performance
- Stunting and ending up in short adult with low fitness for physical activity

2.9 Diagnosis of Protein-Energy Malnutrition

The clinical work up of cases of PEM mainly focuses on four factors, which do contribute to accurate diagnosis and management. These are:-

1. **Detailed history**--pertinent to child feeding practices, weaning conditions, staple diet and other relevant history on the socio-cultural, environmental and other predisposing factors
2. **Meticulous physical examination**--of all systems of the body
3. **Anthropometric assessment**--Measurement of weight and height of children and comparing it with the standard according to Gomez and Welcome classifications)
4. **Epidemiological considerations**--information regarding the age, sex, birth weight, height, season, existence of epidemics, drought and other natural and man made calamities will have to be assessed critically.
5. **Laboratory findings**--determination of albumin level or pre-albumins like retinal binding proteins, etc. in the plasma may give some clues, but the diagnosis can be done without laboratory investigations. Laboratory investigations for the diagnosis of concurrent infections, micronutrient deficiencies like anemia are important to consider.

2.10 Case Management

Management of a case of PEM focuses on the correction of specific nutrient deficiencies (dietary management), treatment of complications and superimposed infections. The treatment approach is classified into two phases—The acute stabilization phase in which the main focus is treatment of infection and other complications like dehydration, hypoglycemia, hypothermia and other electrolyte imbalances. The stabilization phase focuses on the restoration of the lost tissue and promotion of catch up growth.

The ten steps in the treatment of a child with PEM developed by Ashworth and Feachem are depicted in the following table.

PHASE	REHABILITATION		
	INITIAL (Stabilization)		
Complications to be treated	Duration over which the interventions be started and continued		
	Day 1-2	Day 2-7+	Week 2-6
1.	Hypoglycemia	----->	
2.	Hypothermia	----->	
3.	Dehydration	----->	
4.	Electrolytes	----->	
5.	Infection	----->	
6.	Micronutrients	----- no iron-----with iron----->	
7.	Initiate feeding	----->	
8.	Catch-up growth	----->	
9.	Sensory stimulation	----->	
10.	Prepare for follow-up	----->	

The treatment procedures are the same for Marasmus and kwashiorkor.

Dietary Management

1. Acute Phase

Children are most at risk of dying during the acute phase. Dehydration, infection and severe anemia are the main dangers. In PEM, cardiac and renal functions are impaired and in particular malnourished children have a reduced capacity to excrete excess water and a marked inability to excrete Sodium. The amount of fluid given and the Sodium load must be, carefully controlled to avoid cardiac failure. A cautious approach is required, aiming at about 100kcal/kg/d and 1.15g of protein/kg/d.

Schedule for Oral Feeding in the First Week

Day	Number of Feeds/per day	Volume per feed (ml/kg)	Energy Kcal/kg/day	Protein Gram/kg/Day
1-2	12	11		
3-5	8	16	100	1.0
6-7	6	22		

Small frequent feeds are ideal as they reduce the risks of diarrhea, vomiting, hypoglycemia and hypothermia. Refer to the core module section 2.10 for the preparation of the maintenance formula.

It is important to give additional Potassium 4mmol/kg/d, Magnesium 2mmol/kg/d, and Zinc 2mg/kg/d), Copper 0.2mg/kg/d and a multivitamin preparation and folic acid.

2. Rehabilitation Phase

Refer to the core module section 2.10

Inpatient Management of PEM: -

In many hospitals and health centers, treatment of PEM as inpatient is unsatisfactory and relapses are frequent. Attention needs to be given to: -

- a) Reducing mortality through: rehydration, treatment of infection, and small frequent feeds.
- b) Reducing length of stay: through administration of high-energy feeds in the rehabilitation phase.
- c) Reducing relapses through: parental education, follow up, improvement of family resources.
- Not all children with protein energy malnutrition be admitted to hospitals merely for the purpose of feeding. Admission of children to a hospital be targeted to those children with severe protein energy malnutrition plus other conditions stipulated below. A child with severe protein energy malnutrition (weight for height < 60%) and the following conditions should be admitted to a hospital or health center for inpatient management:
 - Infection
 - Age < 1 year
 - Severe dehydration
 - Intractable vomiting
 - Severe diarrhea
 - Severe loss of appetite
 - Hypoglycemia

2.11 Prevention of Protein Energy Malnutrition (Options for Intervention)

Parental education on child feeding practice, importance of bringing their under five children to the nearby health institutions every month in the first 1 year, every 2

months in the second year 3 month then after for **growth monitoring and follow up**, the importance of immunization and personal, food and environmental hygiene are critically important in averting the occurrence and recurrence of protein energy malnutrition. For further details refer to the core module unit 2, section 2.11.

2.12 Learning Activities (Case Study) Continued

Refer to story of health professionals in the core module and discuss on the following questions in the class. The instructor can assist you.

1. What pertinent history do you ask parents of children in the Jiren community?
2. What pertinent physical signs would you look for?
3. What laboratory investigations would you order in order?
4. What other assessments do you carry out in order to determine the type of malnutrition? What is your diagnosis from the story?
5. What other causes do you consider for the differential diagnosis?
6. What complications do you expect from malnutrition of such kind?
7. What are the risk factors for the development of PEM?
8. How would you manage the problem of Almaz?
9. What are the preventive measures for PEM?

2.13 Post Test

See the pre and posttest in the core module pertaining to health officers unit 2 section 2.1.2.1

2.14 Role and Task Analysis

Refer to unit 4 of the core module for the tasks expected of you.

2.15 Glossary and Abbreviations

Refer to unit 5 of the core module

2.16 References

Refer to unit 6 of the core module

2.17 Annexes

Refer to unit 7 of the core module for answer keys and other materials





UNIT 3.2

SATELLITE MODULE FOR PUBLIC HEALTH NURSES

UNIT: 1 INTRODUCTION

1.1 Purpose and Use of the Module

The purpose of this satellite module is to equip students (trainees) with knowledge and skills required to identify and manage effectively cases of protein and energy malnutrition. The public health nurses can use this satellite module in their pre-service or in-service training programs.

1.2 Direction for Using the Satellite Module

For a better understanding of this module, the public health nurses are advised to follow the following directions.

- Do the pretest pertinent to your field in unit 2 section 2.1.2.2 of the core module
- Read or refer the core module thoroughly
- Read the story of health workers in Jiren community and try to address the question relevant to you.
- Evaluate yourself by doing posttests and comparing your score by referring to the key given unit 7 section 7.2.2.

UNIT: 2 SATALLITE MODULE FOR PUBLIC HEALTH NURSES

2.1 Pre and Posttest

See the core module unit 2, section 2.1.

2.2 Significance and Brief Description of the Problem

See the core module unit 2, section 2.2

2.3 Learning Objectives

The main objectives of this satellite module is to equip the students or trainees with the appropriate knowledge, and skills required to effectively identify and manage cases as well as prevent and control protein energy malnutrition.

2.4 Case Study: Learning Activities

Read the story of health workers in Jiren community so that you will be able discusses questions in section 2.12 of this module.

2.5 Definition

Refer to the core module unit 2, section 2.5

2.6 Epidemiology

Refer to the core module unit 2, section 2.6

2.7 Etiology and Pathogenesis

Refer to the core module unit 2, section 2.7

2.8 Clinical Features (Symptoms and Signs)

Refer to the core module unit 2, section 2.8

2.9 Diagnosis

Refer to the core module unit 2, section 2.9

2.10 Case Management

The nurse in the nutrition support team plays a central role in client care, management and client relationship. As a team member, the public health nurse also coordinates client care when discharged home on special support, teaches them how to follow their feeding programs and provide them all the supplies and equipment needed. The nurse makes arrangements for follow up care if necessary and is usually available to answer questions of clients receiving home nutrition support.

2.10.1 Role of a Nurse in Helping the Sick Child to Eat

Sick children often require special care. Therefore, those who care for children must be sensitive to their needs and feelings.

- 1) Notice the child's body posture. The body language will tell a child's feeling of pain or discomfort.
- 2) Touch the child often and lovingly. Your touch communicates more than your words.
- 3) As adults, let the child choose what to eat as much as possible
- 4) Notice whether the child eats the food. Putting a tray of food in front of a child is not enough.
- 5) Stay with the child during the meal or make sure a loved person is there. The child will eat and assimilate food better if a caring person soothes anxiety and loneliness away.
- 6) Encourage the child to eat the most nutritious foods first before they become too full to complete the meal.
- 7) Let the child eat with other children if possible. They will enjoy meal times more, accept more food and eat for longer periods.

2.10.2 Responsibilities of Public Health Nurse in Managing PEM

The nursing management of PEM consists of providing nutrition rich in the essential nutrients to correct the dietary insufficiency and to promote normal growth and development. The digestive capacity of malnourished child is initially poor. As a result oral feedings are given in small frequent amounts, limited in proteins and carbohydrates especially fats that are hard to digest.

In addition, the nurse is responsible for:

1. Maintaining the child's body temperature within a normal range.
2. Providing periods of rest and appropriate activity.
3. Providing stimulation
4. Recording intake, output and daily weight
5. Turning position in bed frequently.
6. Preventing bedsores and infection by keeping the skin clean and dry.

7. Providing appropriate treatment of bedsore and oral trash if any.
8. Administering iron and folic acid to correct the accompanying anemia.
9. Diluting liquid iron preparations and giving through a straw to prevent staining of tooth enamel

2.10.3 The PHN is Responsible for Advising the Mother to:

- Provide sufficient iron containing foods such as liver, red meat, fish and legumes.
- Prevent non-compliance with iron therapy by reminding that stools will change in color when taking iron preparations.
- Provide the child the type and amount of food recommended for his age as often as recommended even if the child does not eat much.
- Offer the child's favorite foods, if possible to encourage eating.
- Avoid bottle-feeding if used and replace by cup and spoon-feeding.
- Return for follow up visit after 30 days or earlier if there is feeding problem.

2.11 Prevention and Interventions

The public health nurses should advise the mothers/care givers of malnourished children to come for regular check up (growth monitoring) and vaccination to prevent the occurrence and recurrence of mal nutrition. They should be advised about proper child feeding practices. During the follow up visit, if the recommended changes in child's feeding are helping, encourage the mother to continue accordingly, but if the child is continuing to loss weight and no change in feeding seems likely, discuss with the other team members mainly the health officers for further management.

2.11.1 Education to Improve Nutrition

This involves teaching all sections of the community, especially fathers and mothers, to make the best use of the foods available (including breast-feeding), to make use of available primary health care services, and to grow local foods in their own gardens.

2.11.2 Practical Nursing for Improving Nutrition

There are seven rules, which, if kept, can largely improve nutritional status in the community.

- 1) Identify the local sources of foodstuffs
- 2) Recognize the causes of improper feeding in the community
- 3) Explain the effects of improper feeding on different age groups.
- 4) Teach nutritional values of local foodstuffs.
- 5) Demonstrate how to cook balanced meals using locally available foodstuffs
- 6) Teach food hygiene in the home
- 7) Evaluate what the community members have learnt about improved nutrition

2.11.3 Practical Nursing for Infant Feeding

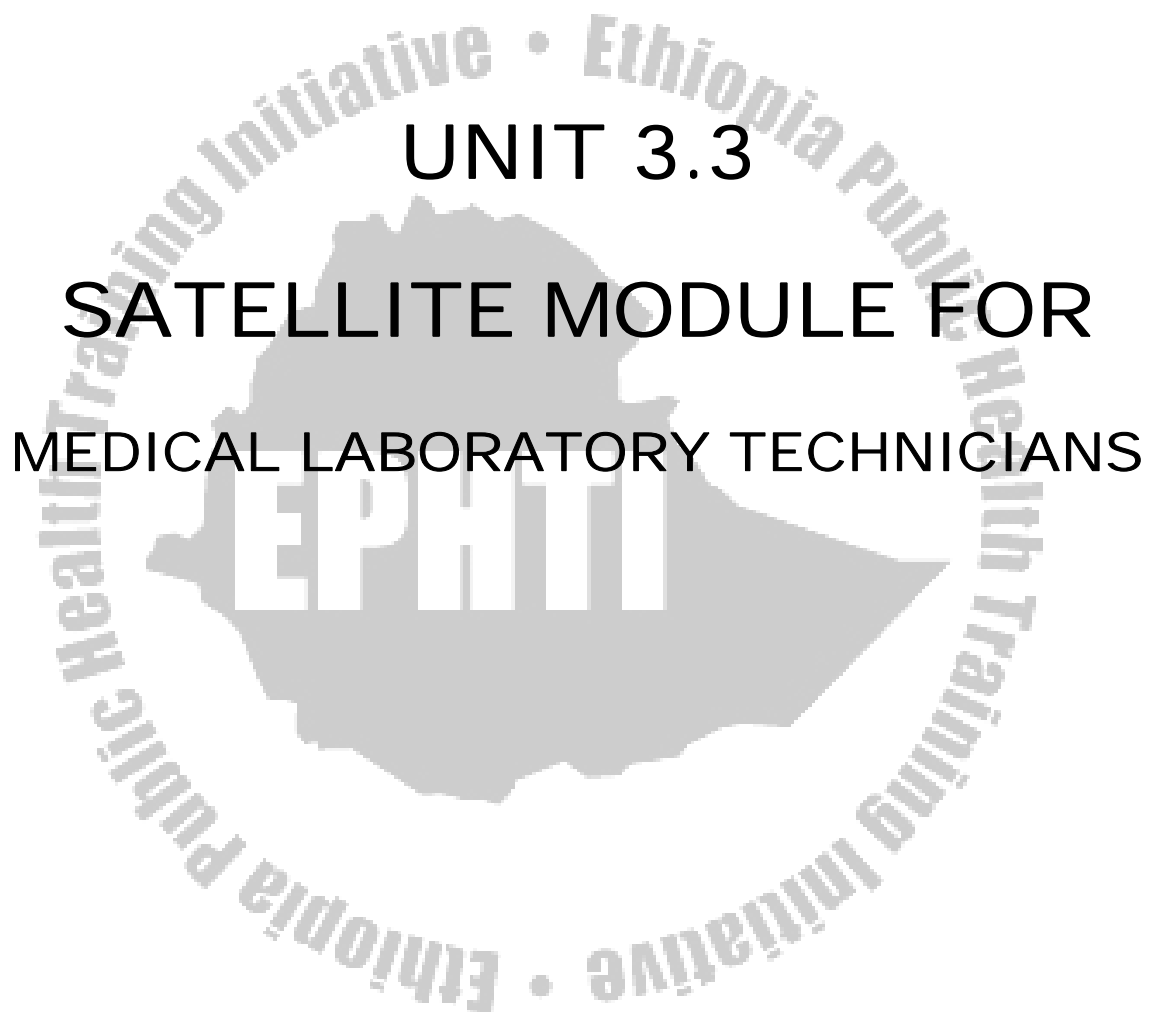
There are five rules that can largely prevent protein-energy malnutrition in educating mothers or other caregivers in-group or individually

1. Breast-feed at least until 1-2 years
2. Start thick porridge, paste or gruel at 4 months and continued breast-feeding
3. Use all available animal food sources
4. Use vegetable (cereals & legumes) mixture.
5. Give children four good meals a day

2.12 Learning Activities (Case Study) Continued

Refer to the story of health workers in Jiren community in the core module and discuss on the following questions in the classroom. The instructor will help you.

- 1) What types of major health problems did the health center team identify in that particular community?
- 2) What fundamental intervention programmes need to be planned by the health workers in general?
- 3) Who should be involved in identifying and prioritizing the health problems for better intervention and good outcome?
- 4) What is expected from the health workers to do in similar circumstances?
- 5) What hygienic behaviors and practices would bring changes and improve the health of the community?
- 6) What type of worm is common to all children in the community?
- 7) What basic things were thought by the nurse in-order to help children to grow healthier and to prevent parasitic diseases as much as possible?
- 8) What will happen to children if they do not get the necessary nutrients?
- 9) What could be the role of public health nurse in promotion of health and prevention of diseases in the community?



UNIT 3.3

SATELLITE MODULE FOR MEDICAL LABORATORY TECHNICIANS

UNIT: 1 INTRODUCTION

1.1 Purpose of the Module

This module helps laboratory technicians to participate in the team management of protein energy malnutrition, with a particular emphasis on the laboratory investigations of protein energy malnutrition, associated infections and other complications.

1.2 Direction for Using the Satellite Module

Therefore, for a better understanding of this module the laboratory technicians are advised to follow the following directions.

- Do the pretest in your profession in unit 2, section 2.1.2.3 of the core module
- Read the core module thoroughly
- Use listed references and suggested reading materials to substantiate your understanding of the problem
- Evaluate yourself by doing the post test and referring to the keys given in unit 7 section 7.1.2.3

2.1 Pretest

Refer to the pre and post test in the core module unit 2 section 2.1.2.3

2.2 Significance and Brief Description of the Problem

See the core module unit 2 section 2.2.

2.3 Learning Objectives

After completion of this module students will be able to:

- Describe how to collect, handle and label blood specimens
- Describe routine concept of laboratory diagnosis of protein energy malnutrition
- Describe and demonstrate the laboratory procedures for hemoglobin determination using Sahli-Hellige method
- Describe and demonstrate how to prepare and stain thin blood film for red blood cell morphology
- Demonstrate how to assess stained thin blood films including elements of the blood films other than red cell morphology (e.g. haemoparasites)
- Classify anemia based on red blood cell morphology and measured hemoglobin

2.4 Learning Activities: Case Study

Read the story of health professionals in Jiren the core module very thoroughly so that you will be able to answer questions pertaining to it in section 2.12 of this module.

2.5 Definition

Refer to the core module unit 2 sections 2.5.

2.6 Epidemiology

Refer to the core module unit 2 sections 2.6.

2.7 Cause, Etiology and Pathogenesis

Refer to the core module unit 2 sections 2.7.

2.8 Clinical Features

Refer to the core module unit 2 sections 2.8.

2.9 Diagnosis

2.9.1 Blood Collection

The proper collection and reliable processing of blood specimens is a vital part of the laboratory diagnostic process in hemoglobin determination. This helps to assess the morphology of red blood cells in thin blood film and to know the level and type of anemia in relation to protein energy malnutrition. Unless an appropriately designed procedure is observed and strictly followed, reliability cannot be ensured on subsequent laboratory results even if the test itself is performed carefully.

2.9.2 Biohazard Safety

All material of human origin should be regarded as capable of transmitting infection. Specimens from patients suffering from, or at risk of, hepatitis or human immunodeficiency virus (HIV) infection require particular care. When collecting blood sample, the operator should wear disposable rubber gloves. The operator is also strongly advised to cover any cuts, abrasions or skin breaks on the hand with adhesive tape and wear gloves. Care must be taken when handling especially, syringes and needles as needle-stick injuries are the most commonly encountered accidents. Do not recap used needles by hand. Should a needle-stick injury occur, immediately remove gloves and vigorously squeeze the wound while flushing the bleeding with running tap water and then thoroughly scrub the wound with cotton balls soaked in 0.1% hypochlorite solution.

Used disposable syringes and needles and other sharp items such as lancets must be placed in puncture-resistant container for subsequent decontamination or disposal.

Blood sources for hematological tests are:

- Capillary/peripheral blood
- Venous blood

2.9.3 Blood Collection

2.9.3.1 *Capillary/Peripheral Blood or Micro Blood Samples*

This is frequently used when only small quantities of blood are inquired, e.g., for Hemoglobin quantitation, and for blood smear preparation. It can be collected from palmar surface of the tip of the ring or middle finger or free margin of the ear lobe in adults and plantar surface of the big toe or the heel in infants and small children.

Notes: -

- Edematous, congested and cyanotic sites should not be punctured.
- Cold sites should not be punctured as samples collected from cold sites give falsely high results of hemoglobin and cell counts. Site should be massaged until it is warm and pink.

Materials:

- Gauze pads or cotton,
- 70% alcohol,
- Sterile disposable lancet

Technique:

Rub the site vigorously with a gauze pad or cotton moistened with 70% alcohol to remove dirt and epithelial debris and to increase blood circulation in the area. If the heel is to be punctured, it should first be warmed by immersion in warm water or applying a hot towel compress. Otherwise values significantly higher than those in venous blood may be obtained.

After the skin has dried, make a puncture 2-3mm deep with a sterile lancet. A rapid and firm puncture should be made with control of the depth. A deep puncture is no more painful than a superficial one and makes repeated punctures unnecessary. The first drop of blood, which contains tissue juices, should be wiped away. The site should not be squeezed or pressed to get blood since this dilutes it with fluid from the tissues. Rather, a freely flowing blood should be taken or a moderate pressure some distance above the puncture site is allowable.

Stop the blood flow by applying slight pressure with a gauze pad or cotton at the site.

2.9.3.2 Venous Blood Collection

It is used when larger quantity of blood is required. E.g. serum albumin. It can be collected from forearm, wrist or ankle. In infants and children, venipuncture presents special problems because of the small size of the veins and difficulty controlling the patient. Puncture of the external jugular vein in the neck region and the femoral vein in the inguinal area is the procedure of choice for obtaining blood.

Materials:

- Sterile syringe and needle,
- Tourniquet,
- Gauze pads or cotton,
- 70% alcohol,
- Test tubes without anticoagulant.

Technique:

1. Assemble the necessary materials and equipment. Remove the syringe from its protective wrapper and the needle from the cap and assemble them allowing the cap to remain covering the needle until use. Attach the needle so that the bevel faces in the direction as the graduation mark on the syringe. Check to make sure the needle is sharp, the syringe moves smoothly and there is no air left in the barrel. The gauge and the length of the needle used depend on the size and depth of the vein to be punctured. The gauge number varies inversely with the diameter of the needle. A 20 or 21 gauge needle should be used in children and infants whose veins are not well developed.
2. Identify the patient and allow him/her to sit comfortably preferably in an armchair stretching his/her arm.

3. Prepare the arm by swabbing the antecubital fossa with a gauze pad or cotton moistened with 70% alcohol. Allow it to dry in the air or use a dry pad or cotton. The area should not be touched once cleaned.
4. Apply a tourniquet at a point about 6-8cm above the bend of the elbow making a loop in such a way that a gentle tug on the protruding end will release it. It should be just tight enough to reduce venous blood flow in the area and enlarge the veins and make them prominent and palpable. The patient should also be instructed to grasp and open his/her fist to aid in the build up of pressure in the area of the puncture. Alternatively, gently tapping the antecubital fossa or applying a warm towel compress can visualize the veins.
5. Grasp the back of the patient's arm at the elbow and anchor the selected vein by drawing the skin slightly taut over the vein.
6. Using the assembled syringe and needle, enter the skin first and then the vein. To insert the needle properly into the vein, the index finger is placed along side the hub of the needle with the bevel facing up. The needle should be pointing in the same direction as the vein. The point of the needle is then advanced 0.5-1.0cm into the subcutaneous tissue (at an angle of 45⁰) and is pushed forward at a lesser angle to pierce the vein wall. If the needle is properly in the vein, blood will begin to enter the syringe spontaneously. If not, the piston is gently withdrawn at a rate equal to the flow of blood. The tourniquet should be released the moment blood starts entering the syringe/vacuum tube since some hemoconcentration will develop after one minute of venous stasis.
7. Apply a ball of cotton to the puncture site and gently withdraw the needle. Instruct the patient to press on the cotton.
8. With the syringe and needle system, first cover the needle with its cap, remove it from the nozzle of the syringe and gently expel the blood into a tube without anticoagulant and Stopper the tube. Label the tubes

with patient's name, hospital number and other information required by the hospital.

9. Reinspect the venipuncture site to ascertain that the bleeding has stopped. Do not let the patient go until the bleeding stops

2.9.4 Estimation of hemoglobin by the Acid Hematin Method of Sahli-Hellige

Principle: -

Hemoglobin in a sample of blood is converted to a brown colored acid hematin by treatment with 0.1 N HCl and after allowing the diluted sample to stand for 5 minute to ensure complete conversion to acid hematin it is diluted with distilled water until its color match as with the color of an artificial standard (tinted glass).

Materials:-

Sahli Hemoglobinometer

10. Sahli pipettes that measures 20 μ l (0.02ml)
11. Stirring glass rod
12. Absorbent cotton
13. 0.1N HCl
14. Dropping pipette

Technique:

Fill the graduated Sahli tube to the 20 mark of the red graduation/or 39% mark of the yellow grad with 0.1 N HCl using the dropper provided. Take a well-mixed venous blood or capillary blood from a freely flowing skin puncture to the "20" mark of the Sahli pipette. Wipe the outside of the pipette with a piece of cotton.

Check that the blood is still on the mark. Blow the blood from the pipette into the tube of acid sol. Rinse the pipette by drawing in and blowing out the acid sol. 3 times. Avoid the formation of bubbles. The mixture of blood and acid gives a brownish, color. Allow standing for 5 minutes. Place the graduated tube in the hemoglobinometer. Stand facing a window. Compare the color of the tube containing diluted blood with the color of the standard glasses. If the color of the sample is darker than that of the standard glasses, continue to dilute by adding 0.1N HCl or distilled water drop by drop. Stir with the glass rod with adding each drop. Remove the rod and compare the colors of the sample and standard stop when the colors match. Note the mark reached. Depending on the type of hemoglobinometer, this gives the hemoglobin consternation either in g/dl or as a percentage of normal. To convert the percentage to g/l, multiply by 1.46.

Normal Range of Hemoglobin at Different age Groups

Hemoglobin in Mg/DL

Children at birth	13.6-19.6
Children at 1 year	11.3-13.0
Children, 10-12 years	11.5-14.8
Women	11.5-16.5
Men	13.0-18.0

2.9.5 Preparation, Staining and Examination of Peripheral Blood Film

2.9.5.1 Preparation of Thin Blood Film

Examination of the blood film is an important part of the hematological evaluation and the validity or reliability of the information obtained from blood film evaluation, the differential leukocyte count in particular depends heavily on well-made and well-stained films.

If not made from skin puncture, films should be prepared within 1 hour of blood collection into EDTA. Adequate mixing is necessary prior to film preparation if the blood has been standing for any appreciable period of time.

A thin blood films can be prepared on glass slides or cover glasses. The latter has the single most important advantage of more even distribution of leucocytes.

Preparation of blood films on glass slides has the following advantages:

- Slides are not easily broken
- Slides are easier to label
- When large numbers of films are to be dealt with, slides will be found much easier to handle.

Technique: The Two-Slide or Wedge Method

A small drop of blood is placed in the centerline of a slide about 1-2cm from one end. Another slide, the spreading slide placed in front of the drop of blood at an angle of 30° to the slide and then is moved back to make contact with the drop. The drop will spread out quickly along the line of contact of the spreader with the slide. Once the blood has spread completely, the spreader is moved forward smoothly and with a moderate speed. The drop should be of such size that the film is 3-4cm in length (approx. $\frac{3}{4}$ th of the length of the slide). It is essential that the slide used as a spreader have a smooth edge and should be narrower in breadth than the slide on which the film is prepared so that the edges of the film can be readily examined. It can be prepared in the laboratory by breaking off 2mm from both corners so that its breadth is 4mm less than the total slide breadth.

If the edges of the spreader are rough, films with ragged tails will result and gross qualitative irregularity in the distribution of cells will be the rule. The

bigger leucocytes (neutrophils and monocytes) will accumulate in the margins and tail while lymphocytes will predominate in the body of the film.

The ideal thickness of the film is such that there is some overlap of the red cells through out much of the film's length and separation and lack of distortion towards the tail of the film.

Thickness and length of the film are affected by speed of spreading and the angle at which the spreader slide is held. The faster the film is spread the thicker and shorter it will be. The bigger the angle of spreading the thicker will be the film.

Once the slide is dry, the name of the patient and date or a reference number is written on the head of the film using a lead pencil or graphite. If these are not available, writing can be done by scratching with the edge of a slide. A paper label should be affixed to the slide after staining.

2.9.5.2 Staining of Thin Blood film with Romanowsky Dyes

Modern Romanowsky stains is common (e.g., Wright's) containing an acidic component (eosin B) and a basic component (methylene blue).

Wright's Stain

It is purchased as a solution ready to use or as a powder 1gm of which is carefully dissolved in 600ml of methyl alcohol and then filtered before use.

Staining Method

1. Place the air-dried smear film side up on a staining rack (two parallel glasses rods kept 5cm apart).
2. Cover the smear with undiluted stain and leave for 1 minute. The methyl alcohol fixes the smear. When it is planned to use an aqueous or diluted stain, the air dried smear must first be fixed by flooding for 3-

5 minutes with absolute methanol. If films are left unfixed for a day or more, it will be found that the background of dried plasma stains pale blue and this is impossible to remove. Without spoiling the staining of the blood cells.

3. Dilute with distilled water (approximately equal volume) until a metallic scum appears. Mix by blowing. Allow this diluted stain to act for 3-5 minutes.
4. Without disturbing the slide, flood with distilled water and wash until the thinner parts of the film are pinkish red.
5. Place the slide on end to dry.

Appearance of cells and cell components in Romanowsky-stained blood films

Films stained with Wright's stain are pinkish in color when viewed with the naked eye. Microscopically,

- Red cells - pink with a central pale area
- Nuclei of leukocytes - blue to purple
- Cytoplasmic neutrophilic granules - tan
- Eosinophilic granules - red orange each distinctly discernible
- Basophilic granules - dark blue
- Cytoplasm of monocytes - faint blue gray
- Platelets - violet granules
- Malaria parasites - sky blue cytoplasm and red purple chromatin

2.9.5.3 Examination of Stained Thin Blood Films

Examination of stained thin blood film helps for Morphologic classification of anemia and is considered to be the most appropriate and practical way for the correct appraisal of red cell morphology.

1. Normocytic Normochromic Anemia

There is normal sized RBC with normal hemoglobinization. Mean cell volume (MCV), Mean cell hemoglobin (MCH) and Mean cell hemoglobin concentration (MCHC) are normal. This is caused by increased red cell loss, blood loss, blood loss anemia, and hemolytic anemia

2. Microcytic Hypochromic Anemia

These are small, incompletely hemoglobinized red cells. MCV, MCH and MCHC are decreased. It is caused by iron deficiency anemia

3. Macrocytic Normochromic Anemia

There are large red cells with MCV, MCH increased. It is caused by folic acid and/or vitamin B₁₂ deficiency.

2.9.6. The Differential Leukocyte Count

It is the enumeration of the relative proportions (percentages) of the various types of white cells as seen on stained films of peripheral blood. The count is usually performed by visual examination of blood films, which are prepared on slides by the wedge technique. For a reliable differential count the film must not be too thin and the tail of the film should be smooth. To achieve this the film should be made using a smooth glass spreader. This should result in a film in which there is some overlap of the red cells diminishing to separation near the tail and in which the white cells on the body of the film are not too

badly shrunken. If the film is too thin or if a rough-edged spreader is used, 50% of the white cells accumulate at the edges and in the tail and gross qualitative irregularity in distribution will be the rule. The polymorphonuclear leucocytes and monocytes predominate at the edges while much of smaller lymphocytes are found in the middle.

2.9.6.1 Methods of Counting

Various systems of performing the differential count have been advocated. The problem is to overcome the differences in distribution of the various classes of white cells, which are probably always present to a small extent even in well-made films.

The lateral strip ("crenellation") pattern of differential counting is the most routinely used pattern and in this method the field of view is moved from side to side across the width of the slide in the counting area just behind the featheredge where the cells are separated from one another and are free from artifacts. Multiple manual registers or electronic counters are used for the count.

N.B: The following elements of the blood film must be observed while performing the differential count.

- Erythrocytes: size, shape, degree of hemoglobinization presence of inclusion bodies
- The presence of atypical lymphocytes
- Haemoparasites: malaria, borrelia, babesia, microfilariae, trypanosoma, etc.

2.9.6.2 Reporting the Differential Leukocyte Count

The differential leukocyte count could be expressed as the percentage of each type of cell or it could be related to the total leukocyte count and the results reported in absolute numbers.

2.9.6.3 Normal Differential Ranges:

	1-4 years	10 years	Adults
Neutrophils	36-48%	45-55%	55-65%
Eosinophils	2-5%	2-5%	2-4%
Basophils	0-1%	0-1%	0-1%
Lymphocytes	44-54%	38-45%	25-35%
Monocytes	3-6%	3-6%	3-6%

2.9.6.4 Interpretation: -

The relative lymphocyte count is increased above $8.0 \times 10^9/l$ in children in viral causes of infections in protein energy malnutrition (e.g., measles), in chronic infections (e.g., Tuberculosis, malaria).

2.9.7 Measurement of Serum or Plasma Albumin

Serum or plasma albumin levels are mainly measured to investigate liver diseases, protein energy malnutrition, and disorders of water balance, nephrotic syndrome, and protein-losing gastrointestinal diseases.

Method

The bromocresol (BCG) binding method is recommended as a manual colorimetric technique for measuring serum or plasma albumin.

Principle of the BCG Albumin Method

Bromocresol green is an indicator, which is yellow between pH 3.5-4.2. When it binds to albumin the color of the indicator changes from yellow to blue-green. The absorbance of the color produced is measured in a colorimeter using an orange filter or in a spectrophotometer at 632 nm wavelengths. Turbidity in the solutions is avoided by the addition of Brij-35.

Albumin + BCG PH4.2 --→ Albumin-BCG complex Reagent

1. Bromocresol green (BCG), when stored at 2-8⁰ C the BCG reagent is stable for several months. It should be allowed to warm to room temperature (20-28⁰C) before use.
2. Albumin standard, 30 g/l

Technique:

Specimen: The method requires 20 μ l (0.02 ml) of patient's serum or plasma. The blood must be collected with the minimum of venous stasis and haemolysis should be avoided.

1. Take four or more tubes (depending on the number of tests) and label as follows.
B - Reagent blank
S - Standard, 30 g/l
1,2 etc. - Patients' Tests
2. Pipette 4 ml of BCG reagent (Warmed to room temperature) into each tube.
3. Add to each tube as follows;
Tube
B..... 20 μ l (0.02 ml) distilled water
S..... 20 μ l standard, 30 g/l
1,2, etc..... 20 μ l patient's serum or plasma

Note: If a patient's sample appears turbid, prepare a serum blank by mixing 20 of patient's Serum or plasma in 4 ml of succinate buffer

4. Mix well but avoid frothing of the solutions. If air bubbles are present the absorbance readings will be incorrect.
5. Read immediately the absorbance of the solution in a colorimeter using an orange filter (e.g. Ilford No. 607) or in a spectrophotometer set at 632 nm. Zero the instrument with the reagent blank solution in tube B.

Note: - If using a serum blank, read its absorbance after zeroing the instrument with distilled water. Subtract this reading from the reading of the patient's BCG sample (Read against the reagent blank solution).

6. Calculate the concentration of albumin in the patient's samples by:

-Using the following formula: -

$$\text{Albumin g/l} = \frac{AT}{AS} \times 30$$

Where: - AT = Absorbance of test(s)

As = Absorbance of 30 g/l standard

7. Report the patient's results in g/l

Approximate albumin Normal range is 30-45 g/l

To convert from g/l to g%, divide by 10.

To convert from g% to g/l, multiply by 10.

Note:- Albumin levels are lower in infants and when individuals are lying down (by 10%)

Interpretation of Serum or Plasma Albumin Results Increase

Increases:

Serum or plasma albumin levels are rarely raised, except artefactually by prolonged venous stasis.

Decreases:

Many of the causes of low total protein levels are the result of hypoalbuminaemia, especially the nephrotic syndrome. The pathogenesis and management of nephrotic syndrome have been described in the paper of Chosen. Several parasitic infections cause a reduction in the synthesis of albumin.

Summary of Albumin Method

1. Pipette into tubes as follows:

	Blank	Standard	Test 1,2, etc
Bromocresol green (BCG) reagent	4ml	4ml	4ml
Distilled water	20 μ l	-	-
Standard, 30g/l	-	20 μ l	-
Patient's serum or plasma	-	-	20 μ l

1. Mix well but avoid frothing
2. Read absorbance immediately

Colorimeter: Orange filter. E.g. Ilford No.607

Spectrophotometer: 632

Zero instrument with blank solution in tube B

3. Calculate the results as follows:

$$\text{Albumin g/l} = \frac{\text{Absorbance of test}}{\text{Absorbance of 30g/l standard}} \times 30$$

4. Report patient's result in g/l

2.10 Case Management

Refer to the core module unit 2 sections 2.10.

2.11 Prevention and Intervention

Refer to the core module unit 2 sections 2.11.

2.12 Learning Activities (Case Study) Continued

Refer to story of health professionals in the core module and discuss on the following questions in the class. The instructor can assist you.

- How is blood specimen collected, stained and examined for blood morphology examination?
- What could be the etiology of protein energy malnutrition?
- What laboratory investigations could be done at the health station or health center level?
- What materials are required to carry out the investigations?
- What should be reported in the laboratory request form in the determination of hematological tests for the assessment of protein energy malnutrition?

2.13 Roles and Task Analysis

Refer to the core module unit 4.

2.14 Glossary and abbreviations

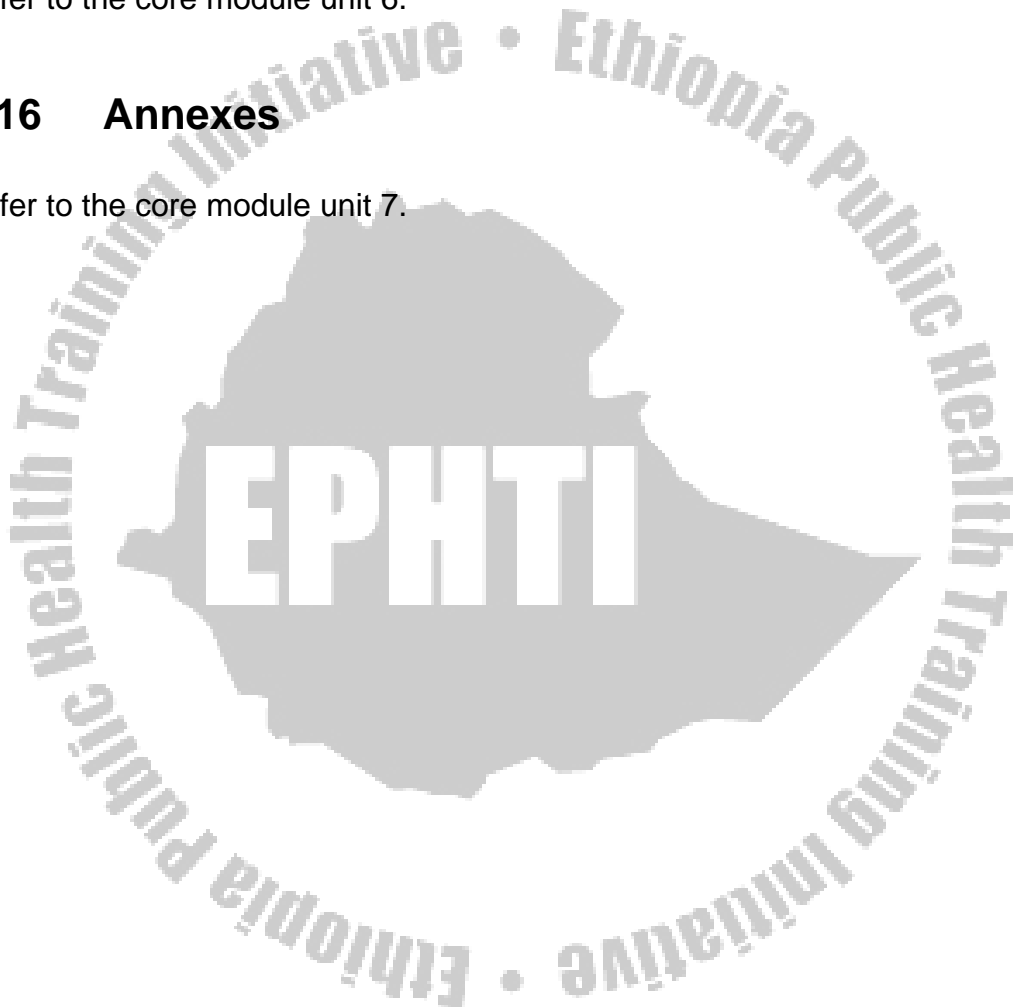
Refer to the core module unit 5.

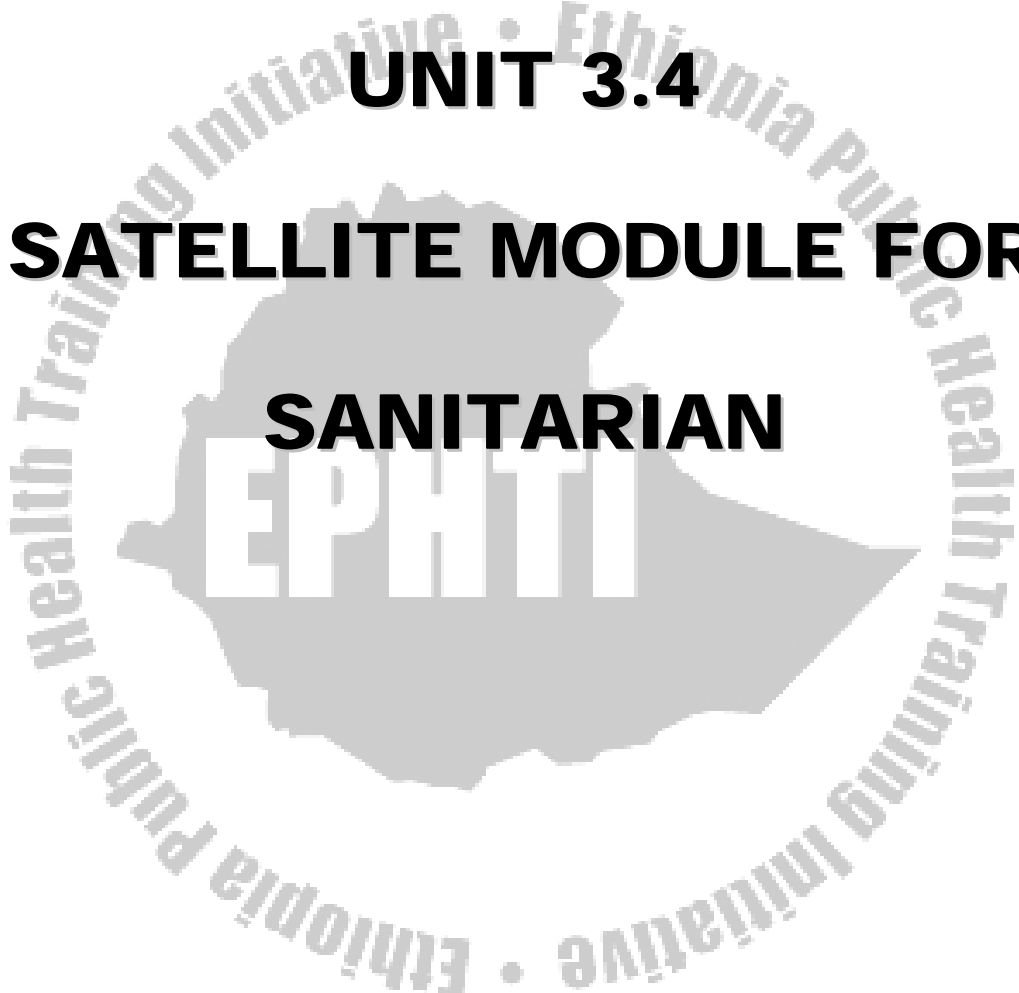
2.15 Bibliography

Refer to the core module unit 6.

2.16 Annexes

Refer to the core module unit 7.



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UNIT 3.4

SATELLITE MODULE FOR

SANITARIAN

UNIT:1 INTRODUCTION

The role of the sanitarian in the prevention of PEM is mostly on awareness creation, environmental sanitation improvement and behavior change in nutritional improvement and hygiene practices.

1.1 Purpose and use of the Module

The main purpose of this module is equip sanitarians with adequate knowledge and skill for the prevention and management of cases of protein energy malnutrition together with the other team members.

1.2 Directions for using the Module

For a better understanding of this module, the sanitarians are advised to follow the following directions.

- Do the pretest pertinent to your field in unit 2 section 2.1.2.4 of the core module. The sanitarians should also read the core module thoroughly at first and when referred in this module.
- The sanitarians could be successful in using this module if he works with other team members and inter-sectorally with other development workers (agriculture extension agents, development workers, home economists etc.)
- Since PEM and diarrhea are directly associated the sanitarians should use the module on diarrhea (core, satellite) in conjunction with this module.
- Read the story of health workers in Jiren community and try to address the question relevant to you.
- Evaluate yourself by doing posttests and comparing your score by referring to the key given unit 7 section 7.1.2.4.

2.1 Pretest and Post Test:

Please refer to section 2.1.2.1 in the core module

2.2 Significance and Brief Description of the Problem:

Please refer to section 2.2 in the core module

2.3. Learning Objectives

The objective of this module is to equip the sanitarian with the appropriate knowledge, attitude and skills required to effectively prevent PEM and conduct health and nutrition education to targets for sustainable behavioral change. Therefore, at the end of this module, the sanitarians will be able to: -

- 1) Describe the prevention methods protein energy malnutrition
- 2) Identify appropriate methods and the primary targets for nutrition and health education program in the prevention of PEM
- 3) Describe why personal hygiene, nutrition education and environmental sanitation practice prevents those risk factors which are associated with PEM
- 4) Describe the whole mechanism of different factors that are associated with the problem of PEM

2.4 Learning Activities: Case Study

Read the story of health workers in Jiren community so that you will be able to discuss question in section 2.12 of this module.

2.5 Definition

Please refer to the core module unit 2 sections 2.5

2.6 Epidemiology:

Please refer to the core module unit 2 sections 2.6

2.7 Etiology and pathogenesis

Please refer to the core module unit 2 sections 2.7

2.8 Prevention and Intervention

There are five important areas for the sanitarian to concentrate on in order to prevent PEM. These are:

1. ***Prevent Infection (Acute and Repeated)***

Many studies have shown that PEM is associated with acute infection (Tuberculosis, Pneumonia, measles, pertusis etc) as well as repeated infection (diarrhea, helmenthiasis). Almost all malnourished children have diarrhea. Therefore, to prevent this problem the following are major interventions that has to be conducted by the sanitarian together with other team members and the community.

- **Proper disposal of human feces.** Please refer to the module on diarrhoeal diseases for the sanitarian, section 2.8. No 1.

- **Water protection** at the source and use at home, please refer to the module on diarrhoeal disease for the sanitarian, section 2.8 no.2
- **Food hygiene**, please refer to the module on diarrhoeal disease section 2.8
- **Domestic and environmental sanitation**, please refer to the module on diarrhoeal disease for the sanitarian section 2.8 No. 5

2. **Nutrition Education**

Nutrition education should be given to the target group (mothers and caregivers) on the importance of:

- 1) Feeding balanced diet through the use of locally available food resources
- 2) Proper and hygienic preparation and storage of food.
- 3) Proper preparing and feeding of unadulterated and uncontaminated fresh food

3. **Health and Hygiene Education**

It has to be understood that one of the problems for the spread of malnutrition in children is lack of knowledge or information on simple preventive measures such as proper food preparation, storage and cleanliness.

Hygiene or health education program should therefore be planned to help community members understand the importance of hygienic practices in weaning food preparation, in the prevention of diarrhoeal and helminthic infections and general health promotion. To be successful in hygiene /health education program we should focus on the following facts.

- Health/Hygiene education should be targeted
- Health/Hygiene education should be simple (short and to the point facts has to be given to the targets)
- Health/ hygiene education program should be Convincing (target should be able to get the point and demonstrate it)

- Health/ Hygiene education program should be programmed to be given at appropriate time, place, and condition.

In addition, preparation for health/hygiene education should start from the behavior analysis. Behavior is culture bound and hence each culture will have to be analyzed critically so that proper strategy could be formulated to change or modify existing behavior.

3.1. Behavioral Analysis: -

This means understanding what the current or existing behaviors of people in the communities are with regard to:

- Type of food prepared for children
- The care or practices of food hygiene during preparation and storage
- Having latrine or latrine use
- Water hygiene

3.2. Select Target Behavior

There are many ideal or feasible behaviors that health professionals wants to see people practicing, but, it may not be practical to achieve all. It is therefore necessary to select target behaviors from among many ideal ones to act upon.

- What target behavior do you want to change?
For example in the case of protein energy malnutrition prevention the ideal behaviors among many which the sanitarian may have to concentrate will be focused on the prevention of diarrhea and helminthic infection.

3.3 Are their Approximation that you want to build on?

Building on local knowledge and practices is much better and short cut than to introduce new behaviors or practices. For example,

- i. People wash hands with soap after eating but not before eating
- ii. Other people wash hands before eating but not after latrine use

3.4. Types of Communication

In the arts of communication, messages are transmitted in many different ways. Examples are:

- Interpersonal Communication
- Person To Person Or What Is Called Interpersonal - Communication
- Group Communication
- Mass Communicatio

3.5. Channels of Communication

Channels are tools and means by which message is communicated to the intended audience. The hygiene educator should prepare not only the messages but also the channels so that messages will be effectively delivered and understood by the target audiences. Channels are different for each method of communication. For example for mass communication we may have to use radio, TV or newspaper, but for person-to-person communication we should use posters, or flip charts. Some of the channels used for hygiene education are:

- Posters
- Tape recorders
- Flip charts
- TV
- Radio
- Newspaper
- Drama
- Songs
- Folk tales etc

3.6 Selecting Targets for Hygiene Education

Selecting targets for health/hygiene education is the other important thing that has to be considered when organizing health/hygiene education. Targets are selected by asking the following questions.

- To who is this message appropriate?
- When and where should it be given?

Past effort in disease prevention taught us that PEM problems associated factors such as diarrhea and helminthic are transmitted because of sanitary defects and practices in the living environment. Unsanitary conditions and practices are performed in the house by those who are actively engaged in cleaning work, food preparation, water vending, child feeding etc. These members of the household (Mothers, caretakers) are the primary targets?

Usually the right time and place for addressing is to conduct hygiene using a person-to-person approach and at times when the primary targets are actively engaged in child feeding or any households chores. This way, examples could be used from the actual performance of the primary audiences or the targets.

The right person for this task is a person that could speak the language, share the culture and is trained in hygiene education methods and principles.

1. Importance of Immunization

Since immunized children will have better immunity to disease or infection the sanitarian should work together with the rest of the team in the promotion of immunization.

2. Promote Backyard Farming

The sanitarians should promote Backyard farming for two important purposes.

- Waste matters such as garbage and refuse which are health hazards if left in the open could be used for compost that can be used to condition the soil of the household garden. Motivated households that are using compost will therefore eliminate the waste and boost his harvest.
- Secondly, because of the backyard farming practice the household will get enough green vegetables, carrots and other carbohydrate sources.
- The fact that the backyard is used for vegetable garden the chance is that it will be kept clean.

3. Learning Activities (Case Study) Continued

Read the story of health workers in Jiren community and answer the following questions.

1. Why is malnutrition more prevalent in Jiren village?
(Check your response with the following key answers)
 - a) Because there is no clean water
 - b) No sanitary latrine
 - c) Children and adults are infested with parasites
 - d) Because the communities are not aware of the problem
2. What are some of the methods where quick sanitary survey could be conducted to identify sanitary defects in a community (Check your response with the following key answers)
 - a) Do health walk with elders in the community
 - b) Observation of people or children's' hygiene condition
 - c) Observation of hygiene practices at home level
 - d) Observation of children playing habits and environment

3. What are the necessary things required for a child to grow healthy and strong?

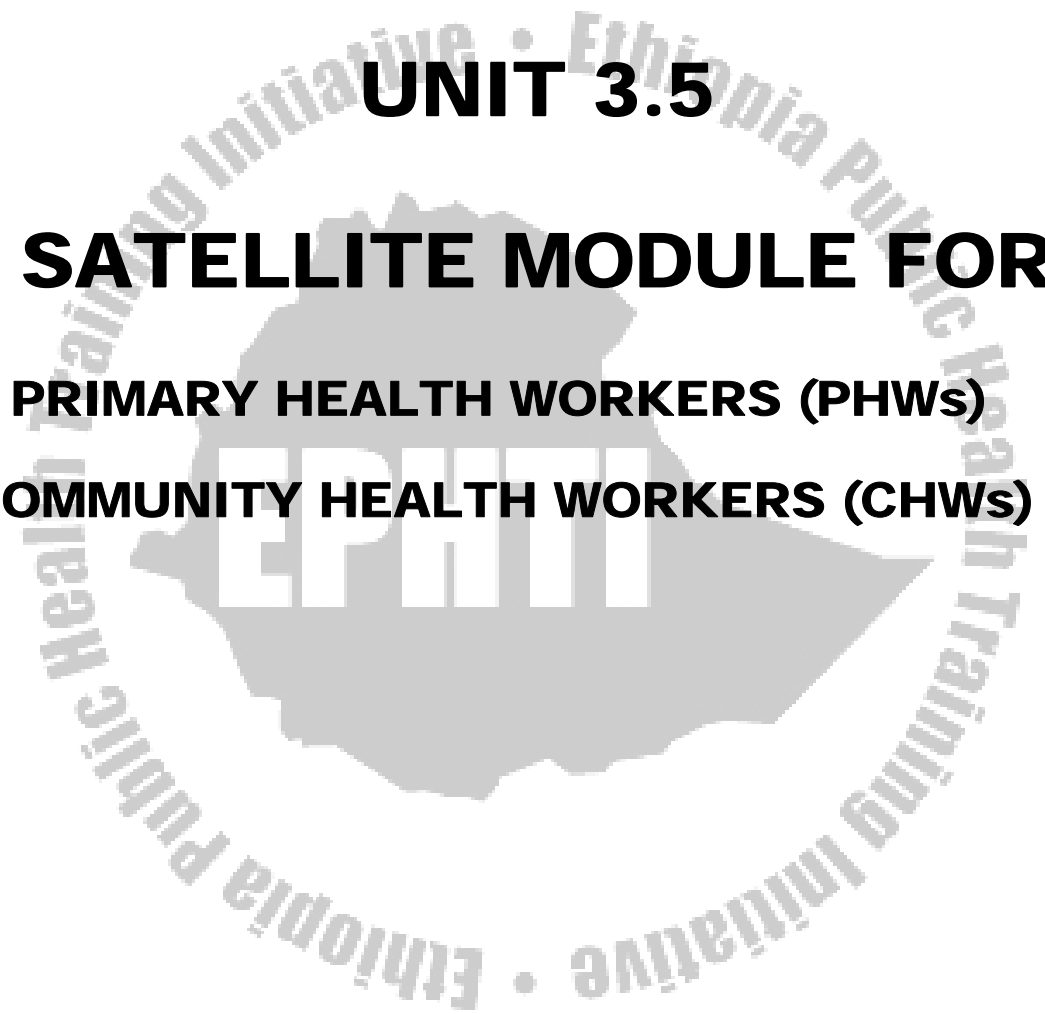
(Check your response with the following key answers)

- a) The child should be kept clean
- b) The child should be fed at least five times a day
- c) The child should be taught about cleanliness of especially the hand as early as possible.
- d) Monitoring the child on his mood, illness, growth etc.
- e) Immunization

4. What are some of the symptoms you can see on a malnourished child?

(Check your response with the following key answers.)

- a) Weak looking, unhappy and not playful
- b) Look like an old person
- c) Have elastic skin
- d) Have no quick mental response



UNIT 3.5

SATELLITE MODULE FOR

PRIMARY HEALTH WORKERS (PHWs)

COMMUNITY HEALTH WORKERS (CHWs)

1.1 Purpose and Use of the Module

Materialization of the Community based management of PEM is made possible through training of PHWs/CHWs that are well equipped with the basic knowledge attitude and skill of diagnosing, treating, timely referring, preventing and controlling PEM. Therefore, this satellite module will be utilized in the training or refreshment of PHWs/CHWs by the health center team, NGOS and other like organizations.

1.2 Direction

- Administer the pretest before starting the actual training
- Read the core module thoroughly before using this satellite module for the training of PHWs/CHWS
- Read the story of health workers in Jiren community to pose practical questions to the PHWs/CHWs
- If possible interpret it into the main local loanguage
- Use more participatory and simple methods of training for this group.
- Administer the post-test at the end of the training and compare their results by referring to the keys given n unit 7, section 7.5.

UNIT: 2 SATELLITE MODULE FOR PRIMARY HEALTH WORKERS (PHW) COMMUNITY HEALTH WORKERS (CHW)

2.1 Pre and Post-test

See the pre and post test for primary health workers PHWs)/Community health workers (CHWs) in the core module section 2.1.2.5

2.2 Significance and Brief Descriptions of the Problem

The user of this module for training PHWs/CHWs is highly advised to refer to the core module sections 2.2.

2.3. Learning Objectives

At the end of completing these modules the PHWs/ CHWS will be able to:

- Define and identify types of protein energy malnutrition.
- Identify symptoms and signs of protein energy malnutrition.
- Demonstrate preparation of high energy and protein foods to the mothers and care givers.
- Refer children with severe malnutrition (weight for age < 60% of the standard) to the to the next health institution.
- Give health education on the preventive methods of protein energy malnutrition and importance of child nutrition for proper growth and development.
- Advice mothers/care givers on the importance of exclusive feeding during the first 4-6 months and supplementary feeding with breast milk there after.
- Educate mothers/care givers/or other members of the family about the importance of horticulture and backyard gardening, immunization, importance of continued feeding during diarrhea.

2.4 Learning Activities (Case Study)

Read the story of health workers in Jiren community for the class or make them read it thoroughly so that they will be able discuss the questions related to the story in unit 2, section 2.12

2.5 Definition

Protein energy malnutrition is the manifestation of deficient intake of dietary energy, protein and other nutrients mainly in children under five years of age.

2.6 Epidemiology

It affects toddlers and infants in developing countries. The severe forms of PEM affect 5-10% and mild to moderate forms account affects 20-40 % of children in Africa and Southeast Asia. In Ethiopia, the chronic forms of PEM (stunting) is a common problem, it affects about 64% of children under five years of age. Acute form of protein energy malnutrition (wasting) affects about 8% of Ethiopian children < years.

2.7 Causes

Different factors contribute to the occurrence of PEM. These include: Lack of knowledge about child feeding and child handling, infection, cultural malpractices, poverty, manmade and natural calamities, social unrest (war), poor food production, uncontrolled population growth and poor marketing, storage and distribution systems.

2.8 Clinical Features

Children with protein energy malnutrition are shorter and lighter than their healthy counterparts of the same age and sex. Children with kwashiorkor have swelling of the body and graying of hair regardless of the nutritional deficiency they are suffering. They are not interested in their surroundings and have poor appetite. Whereas, marasmic children are so skinny and have “old man” appearance. They are always irritable, cry frequently, have good appetite and no marked change on their hair. (see figures 2 & 3 on pages 35 & 36)

Refer to core module, unit 2, and section 2.8

2.9 Diagnosis

In diagnosing the protein energy malnutrition and identifying the clinical forms, proper history, physical examination and Anthropometric assessments are essential.

History- the following information needs to be asked by the CHW/PHW in order to identify malnutrition in children and specific risk factors pertaining to the index child.

- Dietary history- Weaning practices
- Food taboos
- History of diarrhea or other infection
- History of immunization
- Birth interval in the family
- Child care practices

Physical Examination

- Vital signs –Pulse rate, Respiratory rate, Weight and height

- Irritability
- Graying of hair and easy pluckability
- Skin changes
- Edema (swelling of the body)
- Emaciation and old man's appearance, loss of muscle and subcutaneous fat

2.10 Case Management

Upon regular **growth monitoring** care givers of those children with lower nutritional status should be educated to improve their child feeding practices by preparing high energy and high protein diet from locally available foodstuffs. Children in the state of severe malnutrition and those who fail to improve in their nutritional status in the subsequent measurements (follow up) be referred to the next health institution for better management. For further details refer to the core module unit 2, section 2.10

2.11 Prevention & Intervention

Give nutrition education to mothers or care givers on:-

Proper child feeding practices like:

- Exclusive breast feeding during the first 4-6 months
- Avoidance of bottle feeding and use of cup and spoon instead
- Giving supplementary foods after 6 months and continue breast feeding up to 2 years
- Importance of continued feeding during diarrhoeal attack
- Weaning of children gradually and step by step with liquid through semi-solid diet to solid diet

Avoidance of unhygienic practices that contribute to the development of PEM (Food and water hygiene, personal hygiene, environment hygiene & proper waste and excreta disposal)

- Importance of immunization on prevention of PEM
- Report to next level health facility (health center team) in the face of unusually increased number of cases of PEM in your village.
- Measure the weights and heights of under five children in your village regularly every month in the first 1years, and every two months in the second year and 3 months afterwards (**Growth monitoring**) and refer those who have weight for height < 60% to the next health institution.

2.12 Learning Activities (Case Study)

Continued:

Read story of health workers in Jiren community to the class (make them read) and discuss the following questions.

- 1) What should parents of children in the Jiren community do to prevent malnutrition?
- 2) If parents of these children come to see you first what do you do to address their problem?
- 3) What other factors contribute to development of PEM?
- 4) What do you think are the preventive measures of PEM?

UNIT:4 ROLE AND TASK ANALYSIS

See unit four of the core module for the expected role and tasks of PHW/CHW

UNIT: 5 GLOSSARY AND ABBREVIATIONS

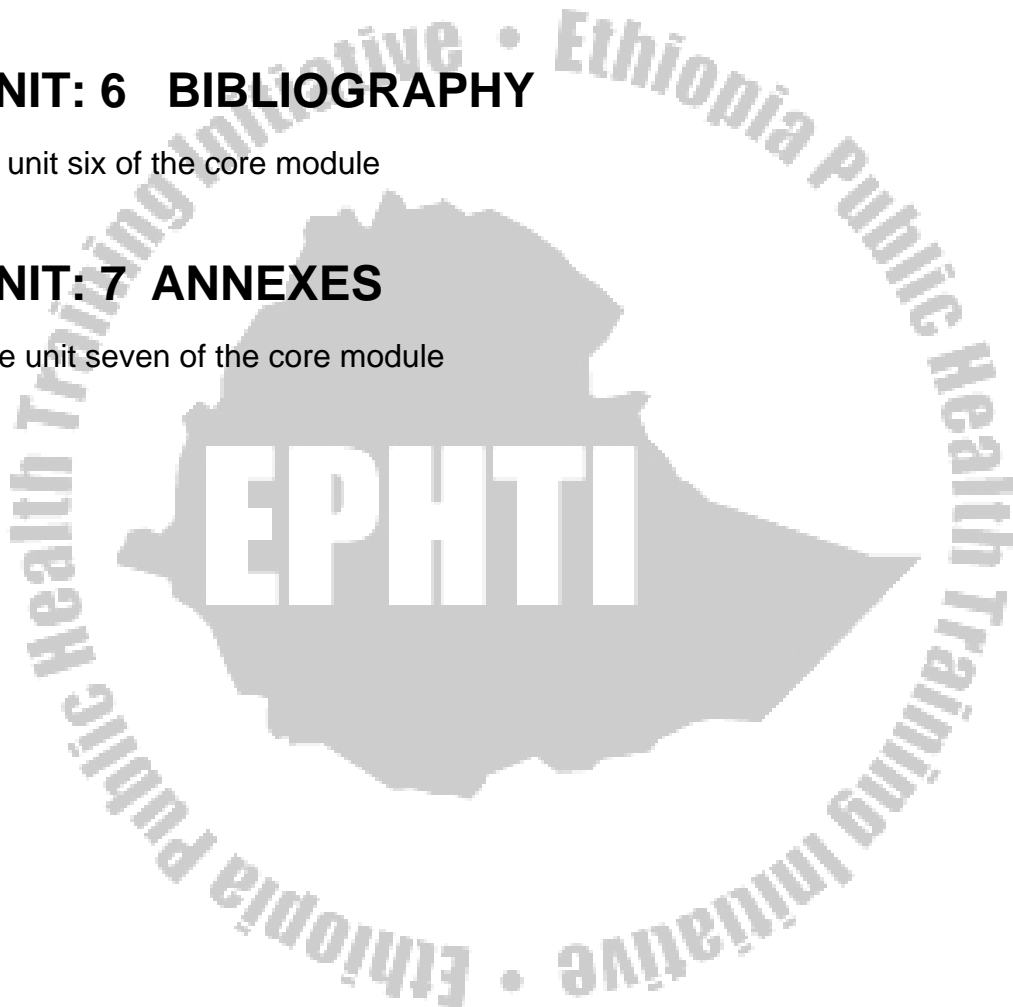
See unit five of the core module

UNIT: 6 BIBLIOGRAPHY

Se unit six of the core module

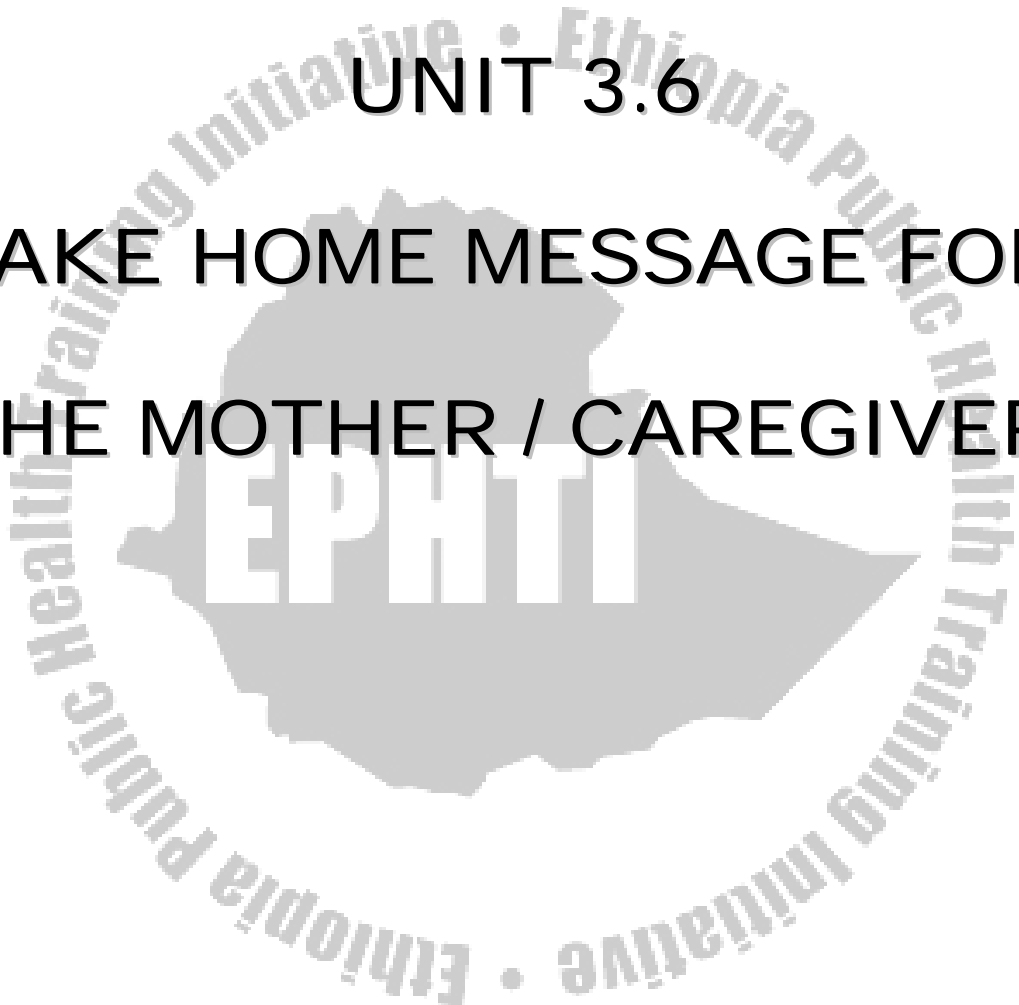
UNIT: 7 ANNEXES

See unit seven of the core module



UNIT 3.6

TAKE HOME MESSAGE FOR THE MOTHER / CAREGIVER



) TAKE HOME MESSAGE FOR THE MOTHER/ CAREGIVER

Protein Energy Malnutrition is a general poor state of health of children that arises from poor (improper) child feeding practices such as early abrupt weaning, bottle feeding, poor food hygiene, avoidance of breast feeding and poor nutritional quality of the weaning foods. The mothers or caregivers should be instructed to do the following for prevention of malnutrition: -

- , Exclusive breast-feeding during the first 4-6 months
- , Avoidance of bottle feeding and use of cup and spoon instead
- , Giving supplementary food after 6 months and continue breast feeding up to 2 years
- , Weaning of children gradually and step by step with liquid diet through semi-solid diet to solid diet.
- , Understand the importance of continued feeding during diarrhoeal attack
- , Get your child weighed in the nearby health institution/health post (PHCU) at least every month in the first one years, every two months in the second year and every 3 months thereafter for proper growth monitoring
- , Understand the importance of small frequent feeds for young children
- , Avoid unhygienic practices contributing to development of PEM (food and water Hygiene, personal hygiene, environment hygiene & proper waste and excreta disposal)
- , Understand the importance of immunization on prevention of PEM
- , Visit the primary health care unit (PHCU) when your child gets sick or fails to grow as expected.

Figure 9. Proper child feeding practices (breast-feeding and using spoon than bottles)

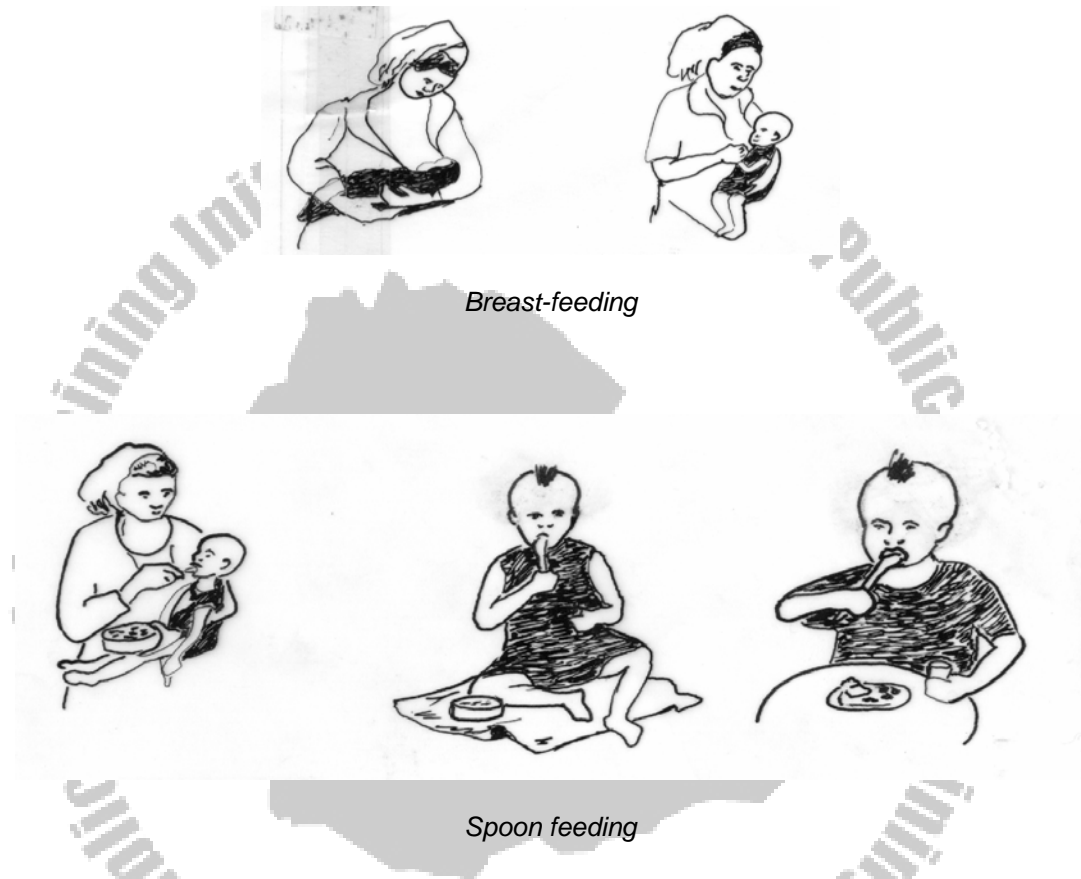


Figure 10. Sources of vitamins and minerals for good health





UNIT FOUR

TASK AND ROLE ANALYSIS

Table 4.1 Knowledge Objective And Essential Tasks Of The Health Center Team (Health Officer, Public Health Nurse, Medical Laboratory Technician and Sanitarians)

	Learning objective (expected out Come)	HO	PHN	EH	MLT	Activity
Knowledge	Define and describe types of protein energy malnutrition.	Define and describe types of protein energy malnutrition.	Define and describe types of protein energy malnutrition	Define and describe types of protein energy malnutrition.	Define & describe types of proteinenergy malnutrition	Define & Characterize types of protein energy malnutrition
	List causes and risk factor of protein energy malnutrition	List different causes of protein energy malnutrition and their association with the different risk factors.	List different causes of protein energy malnutrition & their association with the different risk factors	List different causes of protein energy malnutr their association with the different risk factors.	List different causes of protein energy malnutrition	List the different causes of protein energy malnutrition & associated risk factors.
	Describe the Magnitude and contribution of protein energy malnutrition to over all childhood health problems locally & ationally	Pin point the prevalence of malnutrition and its contribution to mortality & morbidity in children locally and nationally	Pin point prevalence of malnutrition on & its contribution to morta & Morbidity in children locally and nationally.	Pin point prevalence of malnutrition and its contribution to mortality and Morbidity in children locally & nationally.	Pinpoint the prevalence of PEM and its condition to morbidity and mortality in children locally and nationally	* Explain the burden of malnutrition morbidity & mortality in children * Describe the commonest Causes of PEM

Table 4.2. Knowledge Objective and Essential Tasks of The Health Center Team (Health Officer, Public Health Nurse, Medical Laboratory Technician and Sanitarians)

	Learning Objective (Expected Outcome)	HO	PHN	EH	MLT	Activities
Knowledge	Describe the assessment of protein energy malnutrition and its investigation	Enumerate the clinical Manifestations and complications of malnutrition	Describe the complication & their manifes of malnutrition.		Describe the different methods of laboratory investigation for malnutrition	. Perform SOAP (subjective objective, Assessment plan) of patients and . Investigate causes of malnutrition; record and report the result.
	Describe the principle & treatment methods of malnutrition.	Explain how to treat malnutrition and their principle under laying it	Describe how to administer the treatment and advising the mother or care givers.			List the different methods of protein energy malnutrition treatment Describe what advice should be given to the caregiver.
	Describe the pathogenesis of protein energy malnutrition.	-Elaborate the mechanism or development of different types of protein energy malnutrition				Indicate the different steps existing in the development of different types of protein energy malnutrition
	Elaborate methods of preparing dietary treatment for the case of protein energy malnutrition	Elaborate methods of preparing dietary treatment for the case of protein energy malnutrition	Elaborate methods of preparing dietary treatment of energy malnutrition.			Describe the different ingredients in the preparation of dietary therapy

Table 4.3. Attitude Objective and Essential Tasks of The Health Center Team (Health Officer, Public Health Nurse, Medical Laboratory Technician and Sanitarians)

	Learning Objective (Expected out come)	HO	PHN	EH	MLY	Activities
Attitude	-Believe in the importance of breast feeding and weaning practices in reducing mortality due to protein energy malnutrition.	-Instruct CHW (community health workers) mothers and care givers in reducing mortality due to protein energy malnutrition	-Instruct CHW (Community health workers) mothers, & care gives in reducing mortality due to protein energy malnutrition	-Instruct CHW (community health workers) mothers and care givers in reducing mortality due to protein energy malnutrition	-Instruct CHW (community health workers) mothers & care givers. In reducing mortality due to protein energy malnutrition	Advise CHW, mothers and care givers for the utility of feeding high energy and protein diet in facilitating recovery from protein energy malnutrition.
	-Believe in promoting proper Feeding of infants (children) with case of protein energy malnutrition	-Advocate continued feeding of a child required less malnutrition.	-Advocate continued feeding of a child regardless of malnutrition.	Advocate continued feeding of a child regardless of malnutrition.	-Advocate continued feeding of a child regardless of malnutrition	-Educate mothers care giver and community health agent, about the importance of proper feeding of a child with protein energy malnutrition
	-Believe in utilization of health service to acilitate the treatment of protein energy malnutrition in children.	-Advice mothers care giver, and CHW to promote utilization of health services for cases of protein energy malnutrition	-Advice mothers care givers and CHW to promote utilization of health services for cases of protein energy malnutrition	-Advice mothers, care gives and CHW to promote utilization of health services for protein energy malnutrition in children	-Advice mothers and care givers and CHW to promote utilization of health services for protein energy malnutrition in children	-Teach about the importance of taking children to health service setting for management of malnutrition
	-Up hold the idea that protein energy malnutrition is caused by deficiency of nutrients	-Educate mothers, care givers and CHW that protein energy malnutrition is caused by deficiency of nutrients	-Educate mothers or care givers and CHW that protein energy malnutrition is caused by deficiency of nutrient	-Educate care givers and CHW that protein energy malnutrition is caused by deficiency of nutrients	-Educate care gives and CHW that protein energy malnutrition is caused by deficiency of nutrients	-Educate the mothers, care givers and CHWs that protein energy malnutrition is caused by is caused by deficiency of nutrients

Table. 4.4 Practice Objective And Essential Tasks of the Health Center Team (Health Officer, Public Health Nurse, Medical Laboratory Technician and Sanitarians)

	Learning Objective (Expected out come)	HO	PHN	EH	MLY	Activities
Practice	-Demonstrate the process of assessing a child with protein energy malnutrition and identify its complications.	-Take appropriate history and perform proper physical examination.	-Assess vital signs and determine existence or note of malnutrition and complications like infection, etc	----	----	-Ask relevant symptoms - Look, at relevant signs and decide the degree of protein energy malnutrition - Determine if lab Investigation is needed.
	-Demonstrate how to do laboratory tests protein energy malnutrition	-Carry out laboratory investigation protein energy malnutrition	----	-----	-Carry out laboratory investigation protein energy malnutrition	- Make a laboratory investigation on protein energy malnutrition
	-Demonstrate the preparation of dietary formula for the treatment of protein energy malnutrition to the caregivers.	-Demonstrate and explain the preparation of high energy and protein foods and their administration in the treatment of protein energy malnutrition	-Demonstrate and explain the preparation of their proper use in the treatment of protein energy malnutrition	-Demonstrate the importance of clean water and utensils in the preparation of food in feeding a child with protein energy malnutrition	---	-Show materials and ingredients to be used in the preparation and utilization of feeding formula in the treatment of protein energy malnutrition.
	-Identify a case of protein energy malnutrition demonstrate its appropriate management.	-Demonstrate the management principle, identify the complication and manage accordingly	-Demonstrate appropriate feeding and rehydration and drug administration and also provide proper nursing care to the clients.	-----	-----	-Identify the case and its complication Manage the case by selecting appropriate treatment plan Refer PRN
	Demonstrate proper communication to the mother or care givers for health education pertinent to protein energy malnutrition	Display Effective communication skills with mothers care givers and CHW in treatment prevention and control of protein energy malnutrition	Display effective communication skills with mothers care givers and community health workers on treatment prevention and management of protein energy malnutrition	Display effective communication skills with mothers, care givers and community health workers on prevention and control of protein energy malnutrition	-----	Identify practical ways of educating mothers care givers or CHW on treatment prevention and control of protein energy malnutrition

Table 4.5. Knowledge Objective and Essential Tasks of Community Health Worker/ Primary Health Worker and Car Givers

	Learning Objective (Expected out come)	Community Health Workers	Care Giver Workers	Activity
Knowledge	-Describe the principle and treatment methods of protein energy malnutrition	- Describe how to prepare dietary feeding formula and its administration in treatment of protein energy malnutrition	- Describe how to prepare food for treating the child with protein energy malnutrition based on family diet	- Explain methods of preparation of feeding formula in the treatment of protein energy malnutrition to the care workers CHW
	-List the major information, methods & targets for health education in protein energy malnutrition	-Describe methods of giving health education on protein energy malnutrition and identify target groups & areas of focus (mothers /care givers patients.)	- Explain major points the care giver/ mother need to tell to the family members regarding treatment and prevention of protein energy malnutrition	- List main methods used to communicate information on energy malnutrition for the different targets (CHW)
	-List causes and risk factors for protein energy malnutrition	-List the different causes of protein energy malnutrition and their association with risk factors.	- Explain the cause of protein energy malnutrition in general and what risk behaviors are associated to it.	- Enumerate main points that the care giver needs to instruct the family and the parent/care giver - Explain the relationship between the risk factors and development of protein energy malnutrition (CHW) - Describe that protein energy malnutrition is caused by feeding, infection, diarrhea etc .

Table 4.6 Attitude Objectives and Essential Tasks of Community Health Worker/ Primary Health Worker and Car Givers

	Learning Objective (Expected out come)	CHW	Care giver	Activity
Attitude	-Promote utilization of health service facilities for the treatment of protein energy malnutrition	-Advice care givers to bring a child with protein energy malnutrition to the health service units to consult health worker	- Advice friends and families to visit health worker the health service units in case of protein energy malnutrition	- Educate care givers the importance of taking children with protein energy malnutrition to health service institution - Encourage visits health service unit the case of protein energy malnutrition
	-Advocate the importance of exclusive breast feeding in the first 4-6 months and continued feeding then after in reducing mortality and morbidity due to protein energy malnutrition	- Instruct mothers or care givers the importance of breast feeding in reducing morbidity and mortality from protein energy malnutrition.	- Advise family friends and neighbors to continue breast feeding in a child with protein energy malnutrition	-Advocate / Promote breast feeding practices in prevention of protein energy malnutrition (CHW) Encourage breast feeding practices of , family, in the prevention of protein energy malnutrition
	-Promote continued feeding of children with diarrhea	-Advocate and encourage proper feeding of children with diarrhea by mothers or caregivers.	- Feed the child with diarrhea properly encourage friends peers to do so.	- Emphasize on importance of feeding of a child with diarrhea (CHW) -Feed the child with diarrhea and advise friends or relatives to do so.

Table 4.7 Practice Objective and Essential Tasks of Community Health Worker/ Primary Health Worker and Care Givers

	Learning Objective (Expected out come)	CHW	Care giver	Activities
	Demonstrate preparation of feeding formula for the treatment of protein energy malnutrition and its proper use.	Demonstrate preparation of feeding formulas their administration to the case of protein energy malnutrition for caretakers.	Demonstrate properly how and what to prepare and administer to a child with protein energy malnutrition.	Show materials and ingredients to be used in the preparation of feeding formulas
	Identify a case of protein energy malnutrition and demonstrate its appropriate management	Identify complications of Protein energy malnutrition and its degrees and advise the caregiver to feed the patient properly.	Identify signs of symptoms of protein energy malnutrition and its complications and decide whether there is a need for admission or referral	Identify sings and symptoms of protein energy malnutrition and administer proper feeding practices (see the core module).
Practice	Demonstrate proper communication to mothers or care givers pertaining to protein energy malnutrition.	Display Effective communication skill with mothers or care givers on treatment and prevention of protein-energy malnutrition	-----	Identify ways of educating mothers/ care gives about protein energy malnutrition

UNIT FIVE

GLOSSARY & ABBREVIATIONS



Antioxidant:- Micronutrients like vitamins A, C, E, & minerals, selenium which detoxify (scavenge) free radical species formed in the body and protect body cells from oxidative damage.

Anthropometric Assessment:- Measurement of different body dimensions and proportions at different nutritional states and interpretation of the result by comparing to the standard to determine whether a person is malnourished or well nourished.

Catch Up Growth:- Rapid increase in weight and height of children after a period of nutritional deprivation in response to corrective dietary intervention.

Day Care Nutrition Rehabilitation Centers (DCNRC): Feeding and nutrition demonstration centers attached to health units where mothers/care givers bring their malnourished children and get them fed and see how to prepare balanced diet from locally available foodstuffs.

Dehydration: - Excessive loss of fluid and electrolyte from the body that impairs cellular function if not corrected timely.

Emotional Deprivation: - State of mood change in a child that occurs following neglect of child (poor care given to the child by the mother or care giver).

Exclusive Breast-feeding: - Breast-feeding of infants with no additional (supplementary) food administration.

Flag Sign: -Different color bands (gray versus black) on a long curly hair of malnourished child as a mark of seasonal variation in the nutritional status (Black = period of good nutrition, Gray = period of nutritional deprivation).

Forest Sign: - Appearance of body hair of a malnourished child in which the hair is straight and lusterless at the bottom and curled at the top giving an impression of a forest.

Free Radicals: - Highly-active reduced species produced in the body as a result of normal body chemical reactions and these result in oxidative death of cells of the body.
E.g. Super oxide, Hydroxyl radical

Gomez Classification: - A classification of malnourished children by comparing their weight with the weight of reference child of the same age.

Hypoglycemia: - Reduction of fasting blood glucose level below 50 gm/dl in older infants and children.

Hypothermia: - Reduction of the Core body temperature less than 35°C as measured rectally.

Kwashiorkor: - A form of severe protein energy malnutrition characterized by wasting of muscles, edema, gray easily pluckable hair, apathy and dermatotic skin changes and weight for age between 60-79% of the NCHS reference pursuant of nutritional deprivation.

Marasmus: - A form of severe protein energy malnutrition in which there is severe loss of weight due to wasting of both muscles & subcutaneous (weight for age < 60% of the NCHS reference), irritability, growth retardation, increased appetite and minimal hair changes following restriction energy intake.

Negative Energy Balance: - A situation in which energy intake is less than energy expenditure resulting in mobilization of body fat & muscle protein for energy production.

Negative Nitrogen Balance: - A state of affairs in which nitrogen intake is less than nitrogen excretion secondary to a diet poor in protein content.

PEM: - Protein Energy Malnutrition

Recovery Syndrome: - Fluid over load, congestive heart failure and death due administration of high protein and high calorie to a malnourished child during the acute (stabilization) phase of the management of protein energy malnutrition.

Residential Nutrition Rehabilitation Centers (RNRCS): - These are usually convalescent centers for children treated initially in hospitals where mothers may accompany their children. Nutrition education and demonstrations of food preparation and child feeding will be done to prevent the recurrence of the situation in the family.

Sensory Stimulation: - Stimulation of malnourished children using different toys, stories etc... in order to reverse the mood changes that followed the state of malnutrition in order to revive their appetite and facilitate the process of cure.

Starvation Therapy: - A harmful traditional practice in which mothers/ care givers deprive their child with diarrhea of food & fluid intake due to the wrong belief that giving food and fluid may increase the volume & attack of diarrhea.

Stunting: - A state of chronic malnutrition characterized by normal weight for height (>80%) & low height for age (<80%) according to Waterlow's classification

Wasting: - Is a state of acute malnutrition characterized by normal height for age (>80%) & low (< 80%) weight for height according to water low classification.

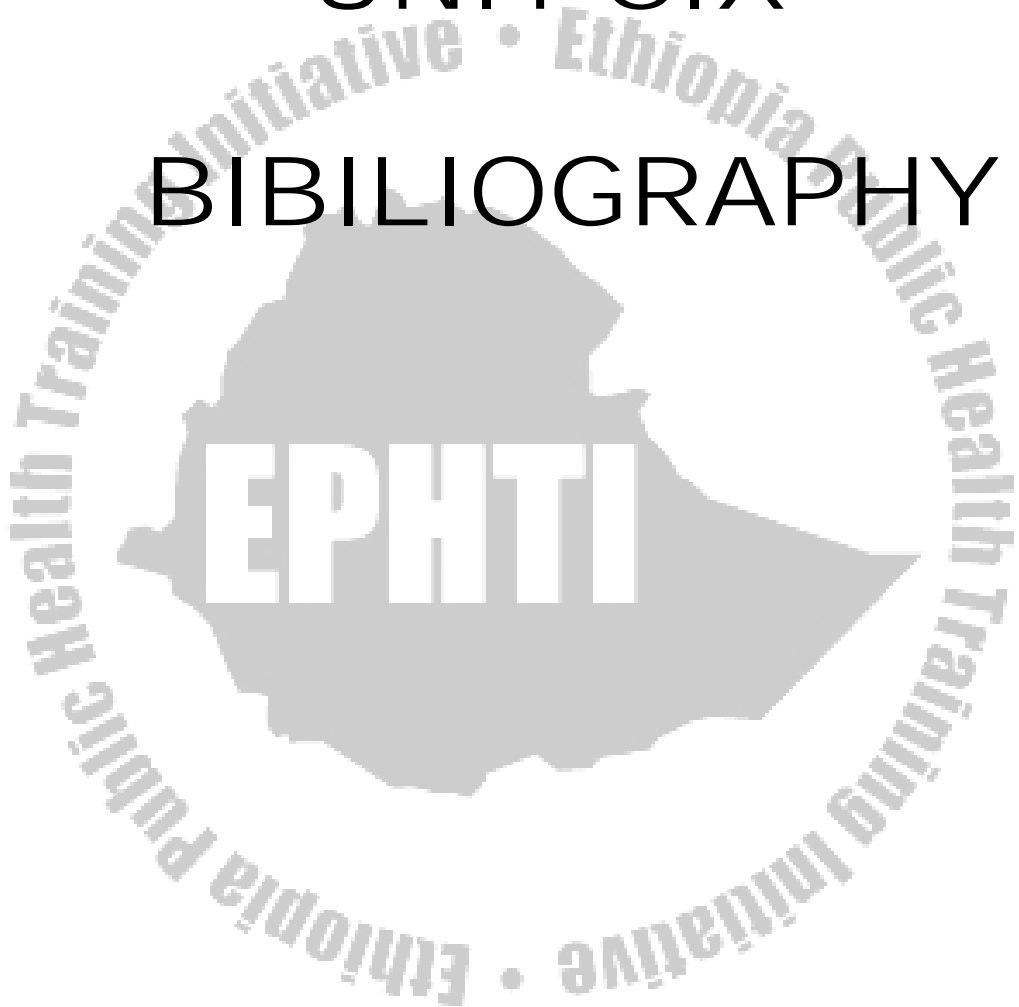
Water Low Classification: - Classification of malnourished children that uses two indices: weight for height and height for age for detection of acute and chronic states of malnutrition in the community.

Weaning: - Administration of food (solid or liquid including formula or cows milk) in addition to breast milk or without breast milk.

Welcome Classification: - Classification of malnourished children based on their weight, age & presence of edema. This classification is used to distinguish the clinical form of PEM.

UNIT SIX

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UNIT SEVEN

ANNEXES

EPHTI

7.1 Answer Keys

7.1.1 Keys for the Core Module (all categories)

Q.No.1. C

Q.No.2. E

Q.No.3. E

Q.No.4.

A Marasmus

- a. Kwashiorkor
- b. Marasmic –kwashiorkor
- c. Underweight
- d. Stunting and wasting

Q.No.5. D

Q.No.6.

Kwashiorkor

- a. Pitting edema
- b. Gray and easily pluckable hair
- c. Miserable and apathetic
- d. Loss of muscle & preservation of subcutaneous fat

Marasmus

- A. Loss of both subcutaneous fat and muscle (skin and bone appearance)
- B. Irritability and moodiness
- C. Wizened monkey faces (old man appearance)
- D. Absence of edema

Q.No.7.

- a. Anthropometric assessment
- b. Biochemical or laboratory, assessment
- c. Epidemiological (dietary assessment)

Q.No.8.

- a. Acute (stabilization) phase
- b. Rehabilitation phase

Q.No.9. **Because it causes fluid overload and death from heart failure (a condition called recovery syndrome)**

Q.No.10. **D**

Q.No.11. **D**

Q.No.12. **D**

Q.No.13. **E**

Q.No.14. **A**

Q.No.15. **D**

Q.No.16. **D**

Q.No.17. **D**

Q.No.18. **D**

Q.No.19. **D**

Q.No.20. **C**

Q.No.21. **B**

Q.No.22. **D**

Q.No.23. **D**

Q.No.24. **D**

Q.No.25. **E**

7.1.2. KEYS FOR SATELLITE MODULES (SPECIFIC PROFESSIONAL CATEGORIES)

7.1.2.1. HEALTH OFFICERS

Q.No. 1. A to E

Q.No. 2. B to E

Q.No. 3. A to D

Q.No. 4. A to D

Q.No. 5. C

Q.No. 6. A, B, D and E

Q.No. 7. A to E

Q.No. 8. A to E

Q.No. 9. A and B

Q.No. 10. A, B, C and D

- Q.No. 11. B, C, D and E
Q.No. 12. A and B
Q.No. 13. B
Q.No. 14. A to D
Q.No. 15. D
Q.No. 16. D

7.1.2.2. PUBLIC HEALTH NURSE

- Q.NO. 1 **A. Coordinate client care when discharged home
B. Teach them how to follow the feeding program.
C. Provide the necessary supplies and equipment**
- Q.NO. 2. **D**
- Q.NO. 3 **A. Provide iron rich foods, after the first 7days
B. Prevent non compliance by giving appropriate and adequate information
C. Offer the child favorite food.
D. Avoid bottle feeding
E. Return to clinic after a month or so.**
- Q. NO. 4. **A. Identify the local sources of foods stuffs.
B. Recognize the cause of improper feeding in a given community.
C. Provide information regarding the effect of improper feeding.
D. Teach nutritional values of local foodstuffs.
E. Support the information with appropriate demonstrations.
F. Teach the food hygiene at home.
G. Evaluate the feeding programme.**

7.1.2.3. MEDICAL LABORATORY TECHNOLOGY

- Q.No. 1. E
Q.No. 2. D
Q.No. 3. D
Q.No. 4. C
Q.No. 5. A
Q.No. 6. A

7.1.2.4. SANITARIANS

- Q.No. 1. A
Q.No. 2. A
Q.No. 3. B
Q.No. 4. D
Q.No. 5. D
Q.No. 6. D
Q.No. 7. D
Q.No. 8. D

7.1.2.4. PRIMARY HEALTH WORKER (PHW)/COMMUNITY HEALTH WORKER (CHW)

- Q.No.1. C
Q.No.2. A, B, C, D
Q.No.3. A, B, C, D, E
Q.No.4. E
Q.No.5. Education of parents of children on:-
A. Proper child feeding practices like exclusive breast feeding for the first 4-6 months, gradual weaning, using cup and spoon than bottle, continue feeding during diarrhea,
B. Personal, environmental and food hygiene
C. Importance of taking their children to the health institutions for Growth monitoring
D. Importance of getting their children immunized
E. Stimulation and proper treatment of children

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