MODULE

Protein Energy Malnutrition

For the Ethiopian Health Center Team

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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 list of references given and suggested reading materials to

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 parent

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) ……

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-albunemia

b) To assess protein malabsorbtion

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 deflciency 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

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

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b) Vitamin D deficiency

c) Riboflavin deficiency

d) Iron deficiency

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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 hypocromic

c) Macrocytic normocromic

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

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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 sever 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

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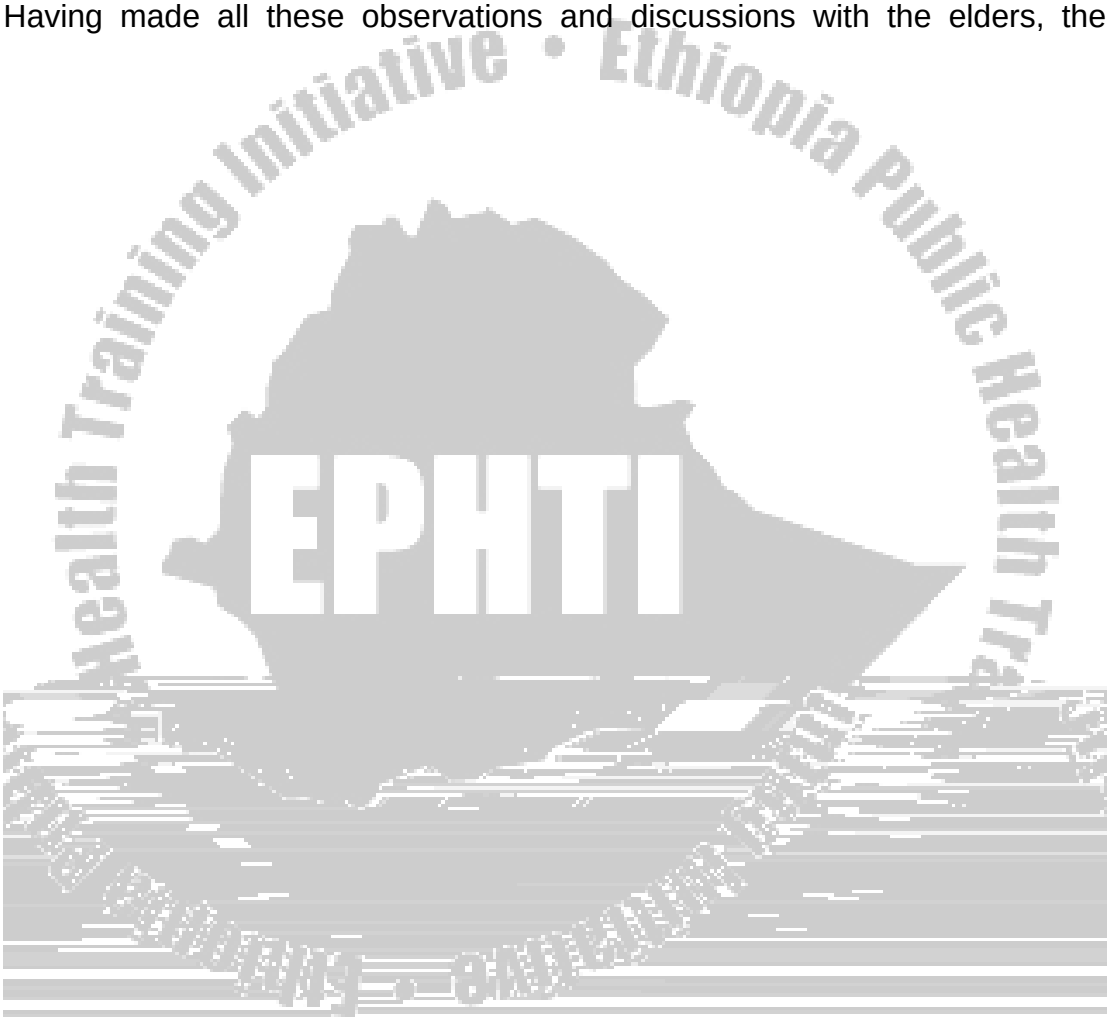
7. All the houses, except for a few scattered dwellings were thatched with asingle room.
8. Almost all dwellings were used as barn & the houses were in general crowded.
9. Children were playing in highly commentated environment.

Having made all these observations and discussions with the elders, the



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.

The food must be prepared fresh if possible or leftover food must be stored

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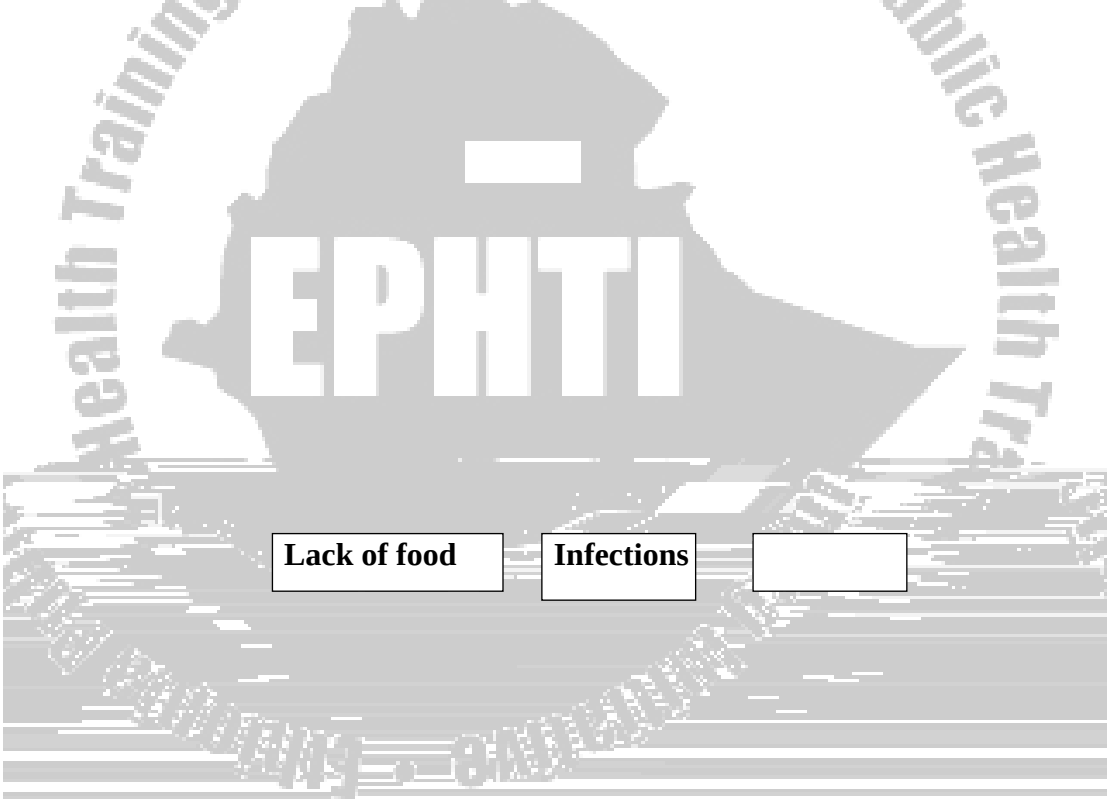
2.7 Causes, Etiology and Pathogenesis

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 calls. This theory accommodates all other theories.

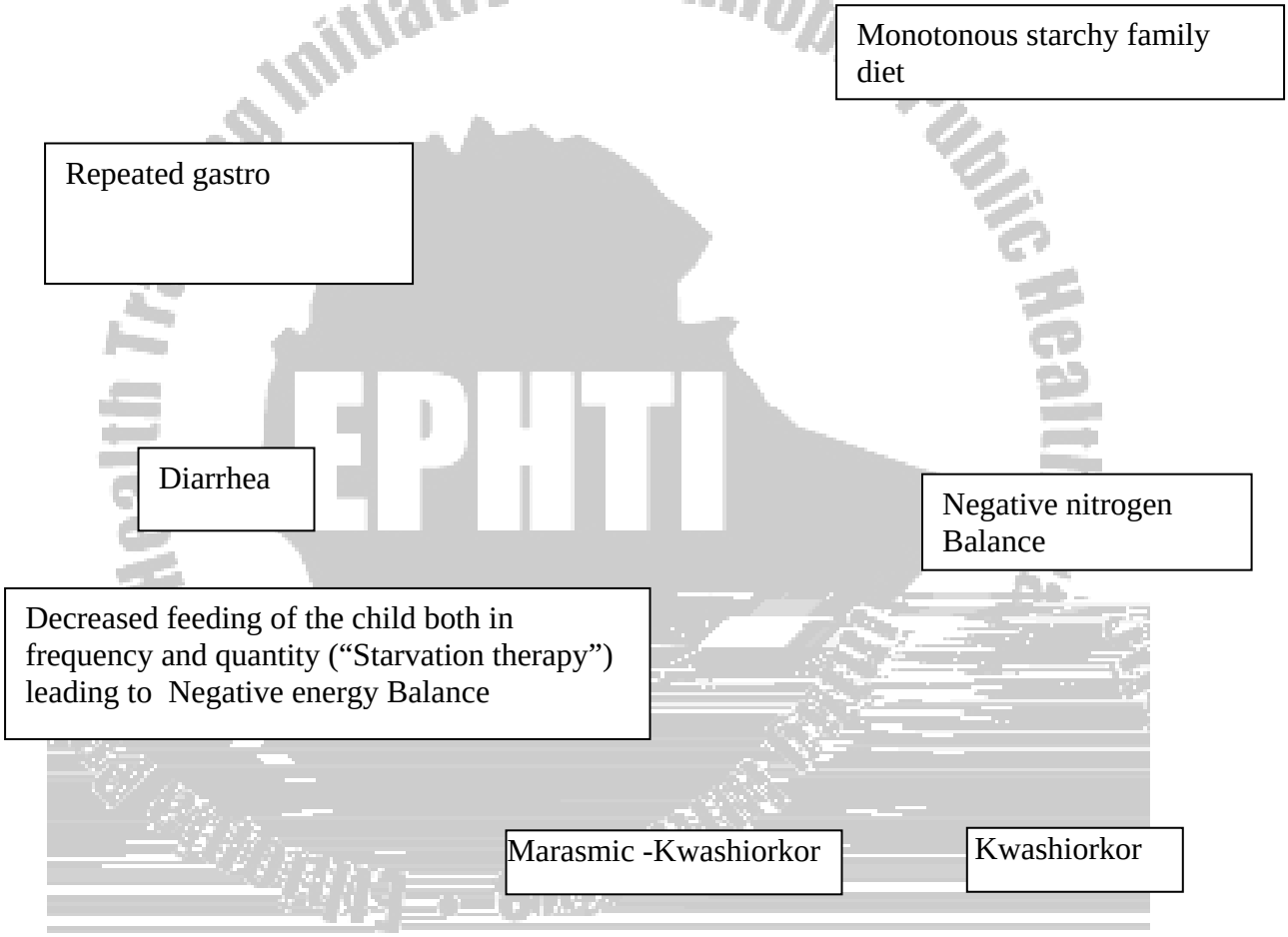
4. Aflatoxins : -

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.


Monotonous starchy family diet
Repeated gastro
Diarrhea
Negative nitrogen Balance
Decreased feeding of the child both in frequency and quantity (“Starvation therapy”) leading to Negative energy Balance
Marasmic -Kwashiorkor
Kwashiorkor

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), Wizened 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)

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

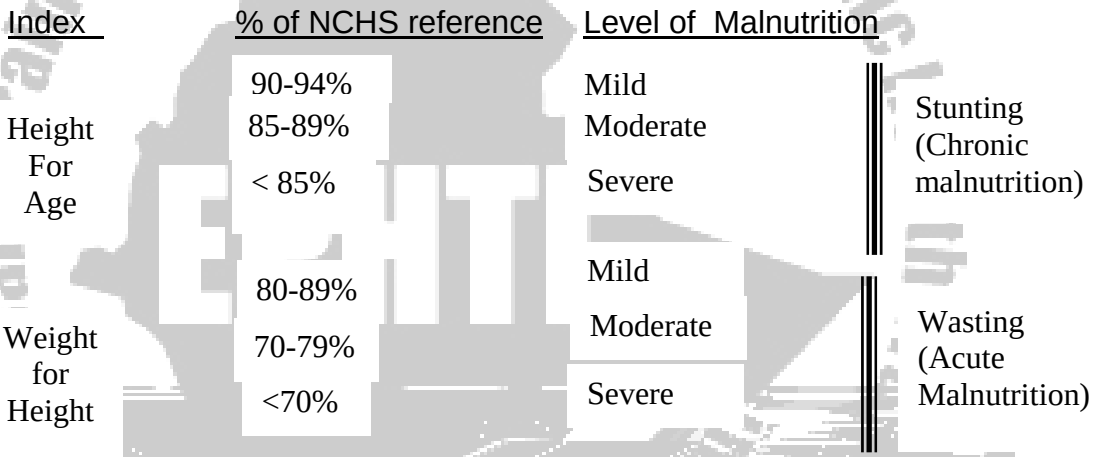
The disadvantages of this classification are: - The cut off point 90% may be too high as many well-nourished children are below this value, edema is ignored and yet it contributes to weight and age is difficult to know in developing countries (agrarian society).

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

Percentage (%) NCHS Reference	Level of malnutrition	
	Edema	No edema
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)



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

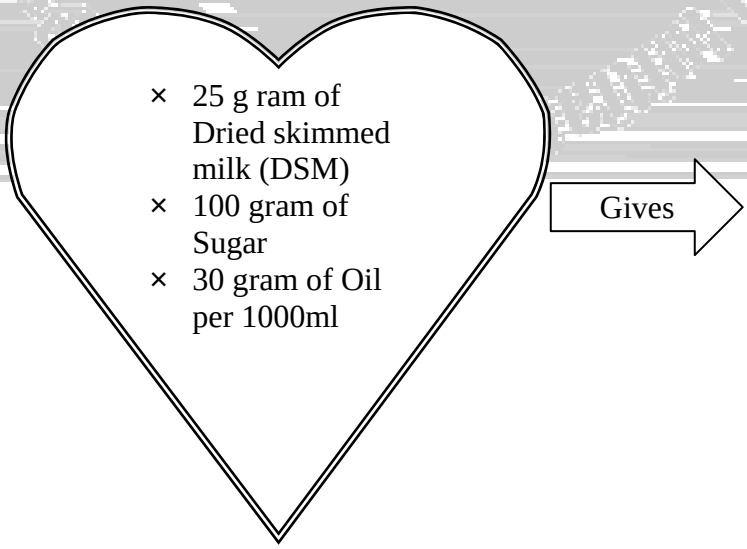
Management of a case of PEM focuses on the correction of specific nutrient deficiencies (dietary management), treatment of complications and supper imposed

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 dyeing 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:



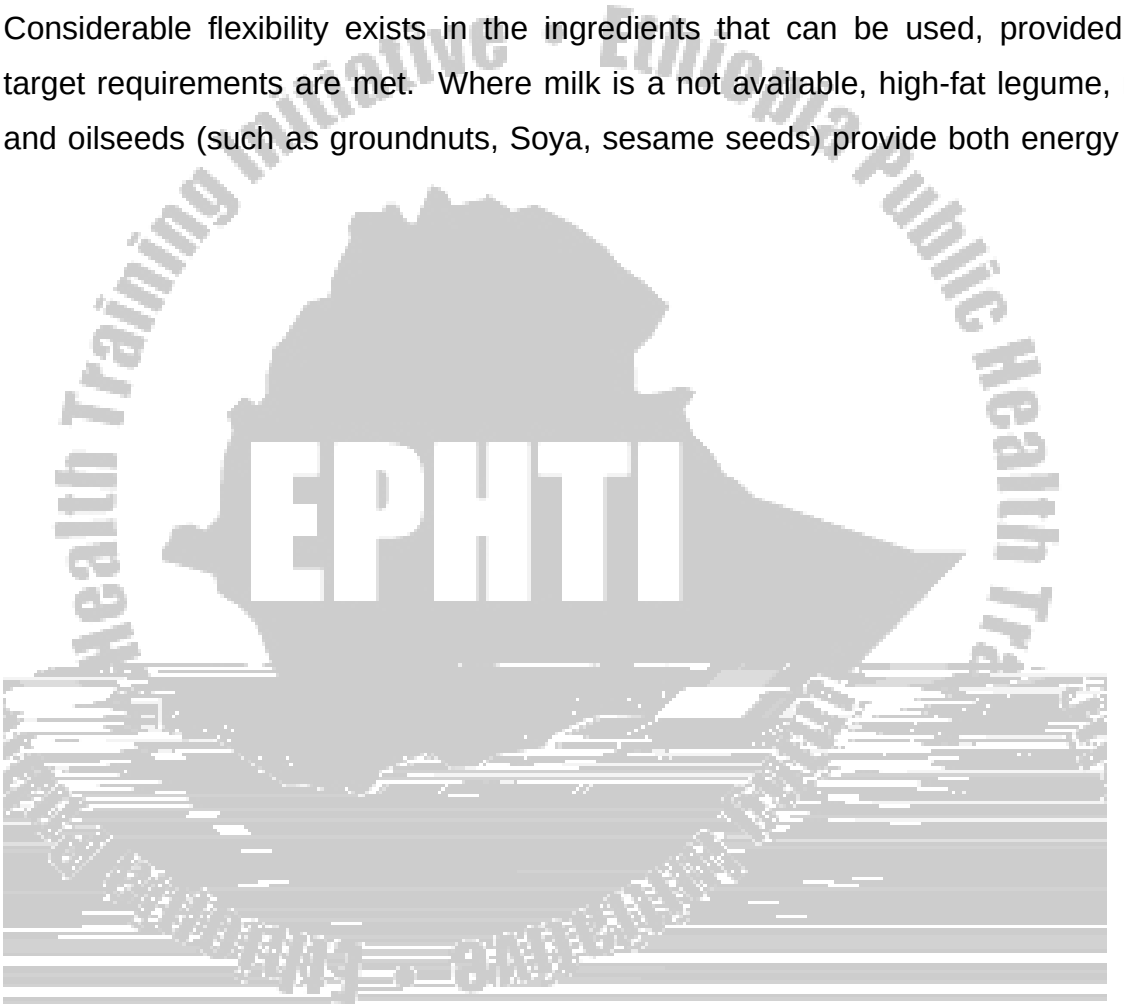
It is important to give additional Potassium 4mmol/kg/d, Magnesium 2mmol/kg/d, Zinc 2mg/kg/d), Copper 0.2mg/kg/d and a multivitamin preparation and folic acid. **Do NOT give iron** early before infection is controlled. High dose vitamin A should be given even if there are no eye signs of deficiency.

On this regimen, edema will disappear and

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

	Milk (g)	Sugar (g)	Vegetable oil (g)
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 a not available, high-fat legume, nuts and oilseeds (such as groundnuts, Soya, sesame seeds) provide both energy and



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

2. At Home: -

As experienced in Bangladesh, even severe cases have been successfully rehabilitated at home. **But, this was successf**

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

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the students are advised to refer to the questions in satellite modules for each professional category and discuss them in the class under

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 Capy

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

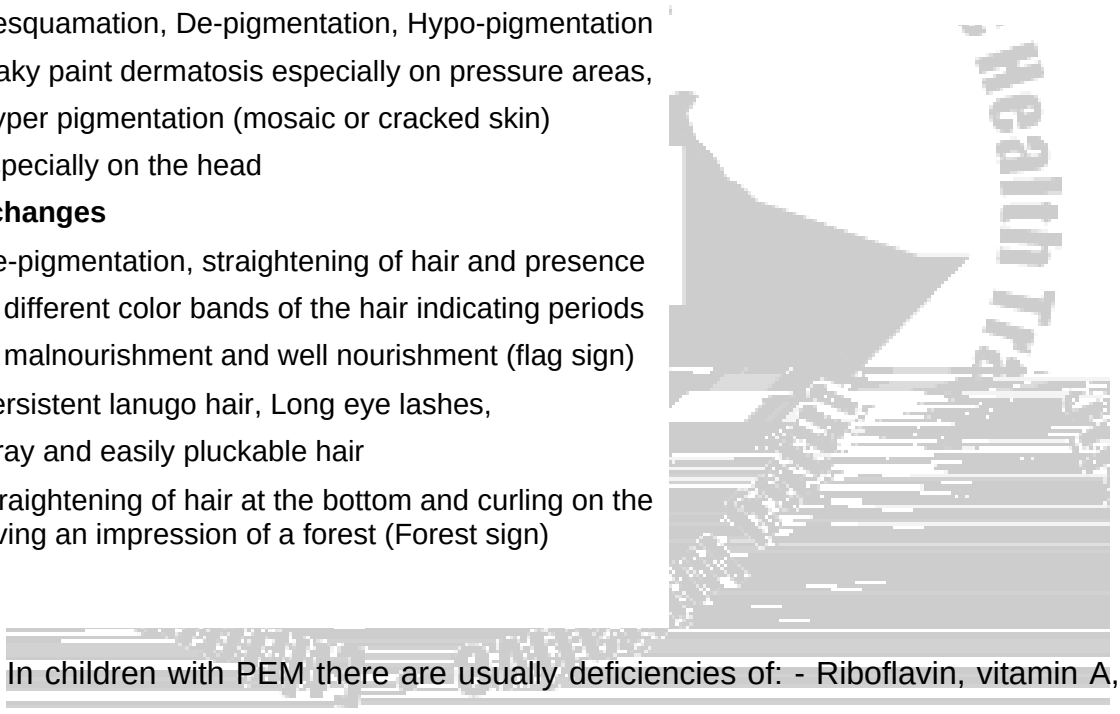
- Desquamation, De-pigmentation, Hypo-pigmentation Flaky paint dermatosis especially on pressure areas, Hyper pigmentation (mosaic or cracked skin) especially on the head

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
- Wizened 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 NITIAL (Stabilization)		REHABILITATION	
	Duration over which the interventions be started and continued		
Complications to be treated	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.

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 sever 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:

Á Infection
Á Age < 1 year
Á Sever dehydration
Á Intractable vomiting
Á Sever diarrhea
Á Sever loss of appetite
Á 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 mal nutrition. 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

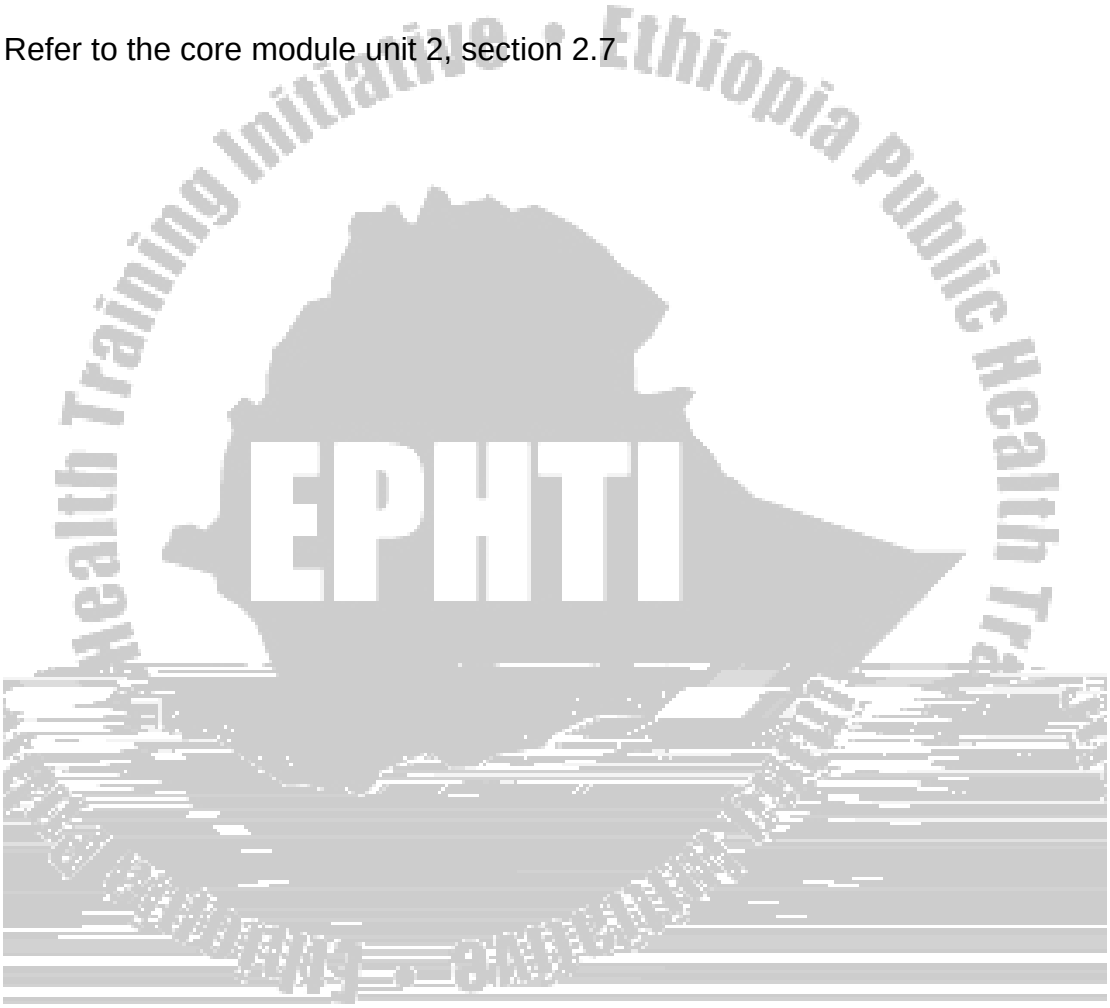
For a better understanding of this module, the public health nurses are

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



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 eats 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

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, read 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

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 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.

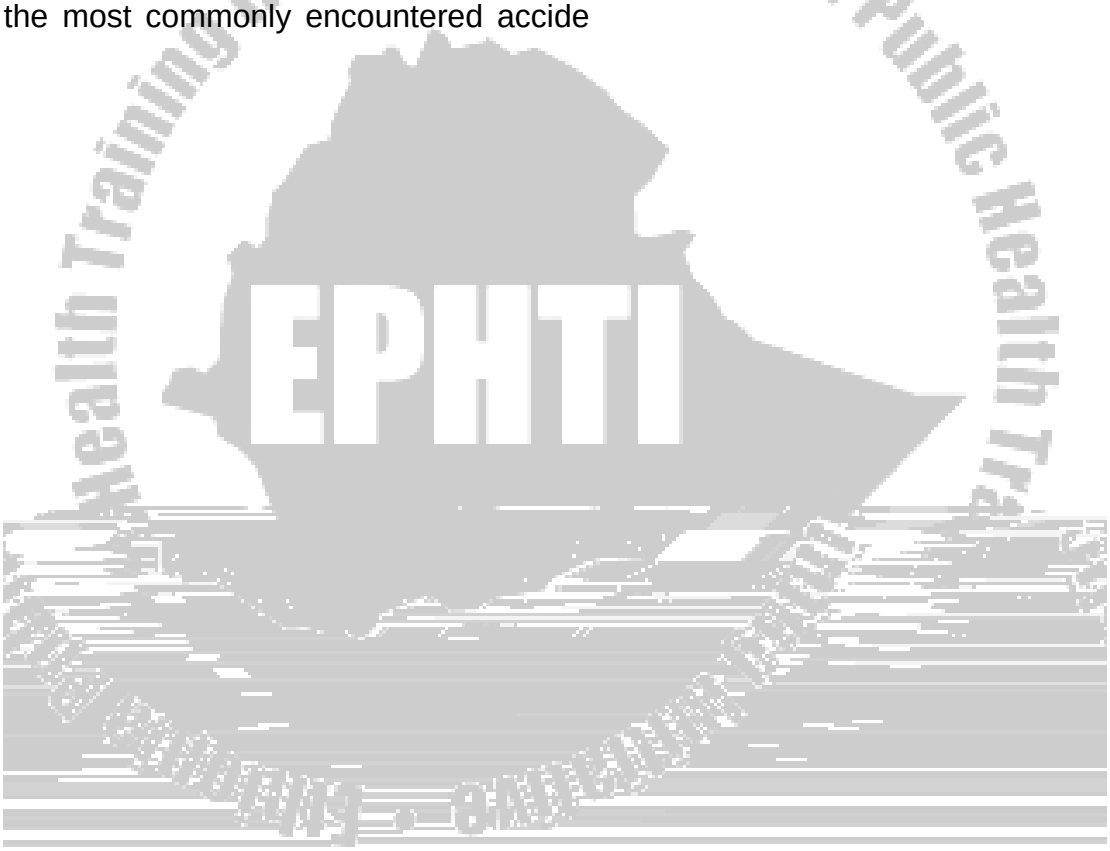
2.9 Diagnosis

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 accide



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 squeeze 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

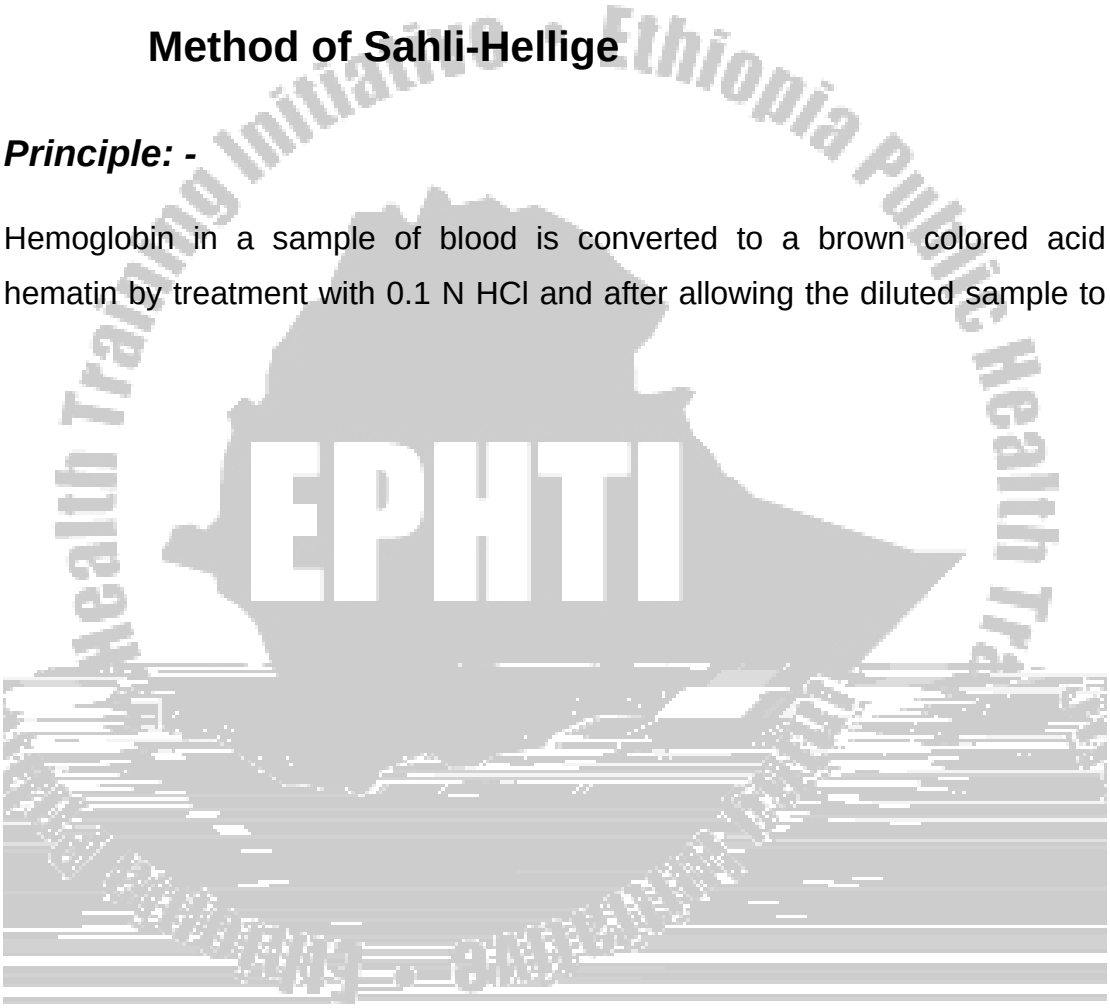
with patient's name, hospital number and other information required by the hospital.

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



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 0.1NHCl 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

Emoglobin 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

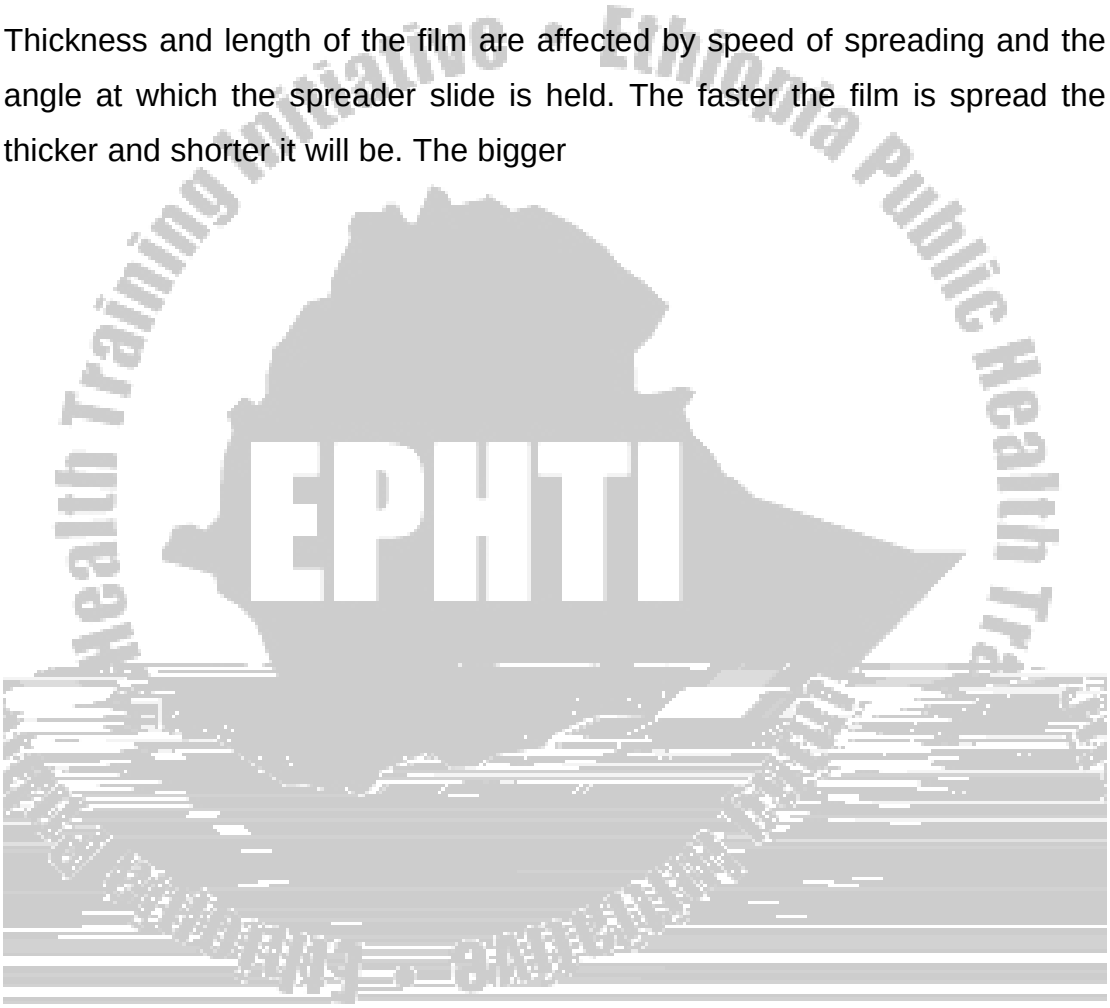
2.9.5.1 Preparation of Thin Blood Film

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.

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



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 B_{12} 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:

2.9.6.4 Interpretation: -

The relative lymphocyte count is increased above 8.0 x 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

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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: -

Albumin g/l = = x 30

Where: - AT = Absorbance of test(s)

As = Absorbance of 30 g/l standard

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

Approximate

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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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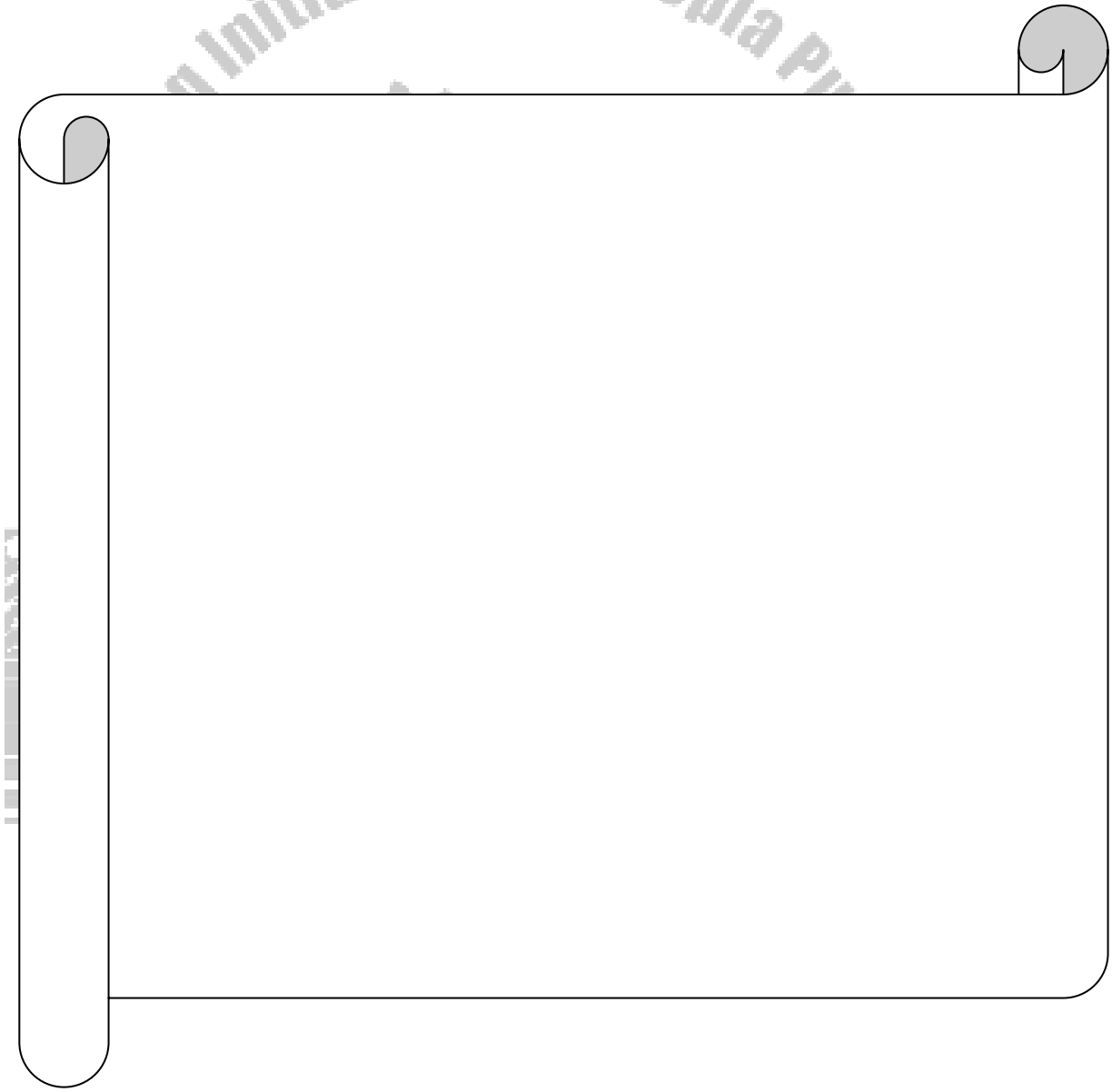
UNIT:1 INTRODUCTION

The role of the sanitarian in the pr

2.1 Pretest and Post Test:

Please refer to section 2.1.2.1 in the core module



2.4 Learning Activities: Case Study

- **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

- 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.

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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)/WOMRI TY HEALTHWORKERS (HW(2.1

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 that their healthy counterparts of the same age and sex. Children with kwashiorkor

- 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

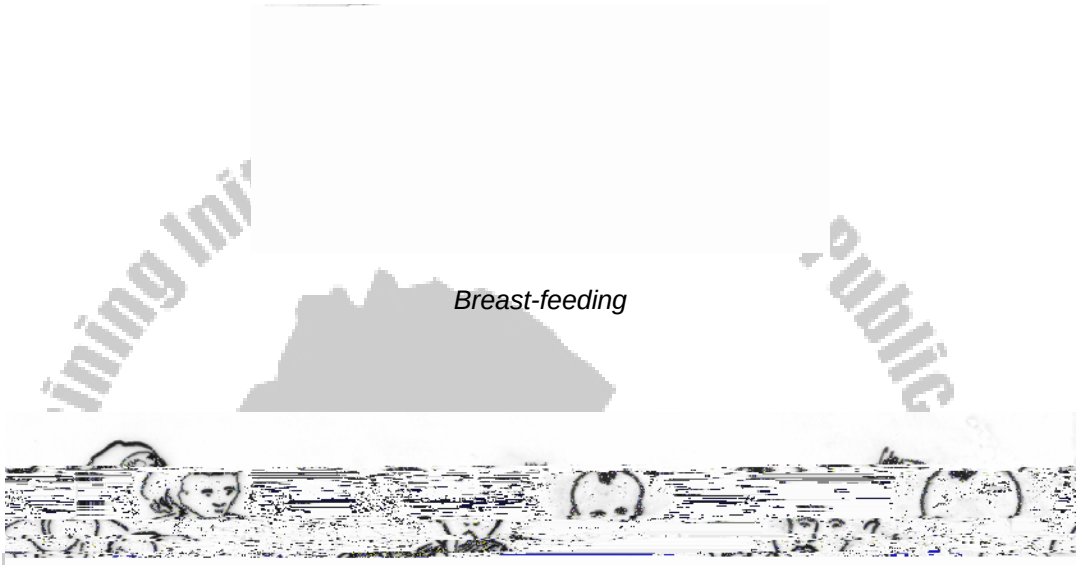
TAKE HOME MESSAGE FOR THE MOTHER / CAREGIVER

) TAKE HOME MESSAGE FOR THE MOTHER/ CAREGIVER

Protein Energy Malnutrion 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 month**s**
- 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 expeced.

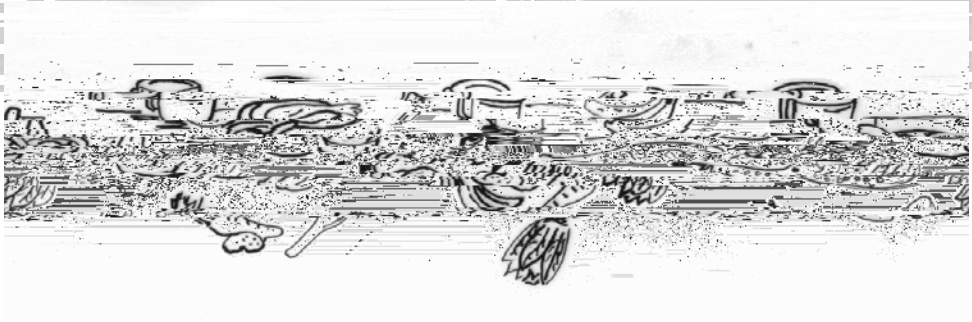
Figure 9. Proper child feeding practices (breast-feeding and using spoon than bottles



Breast-feeding

Spoon feeding

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**
	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

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

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**
	-Believe in the importance of breast feeding and weaning practices in reducing mortality due to protein energy malnutrition. -Believe in promoting	-Instruct CHW (community health workers) mothers and care gives 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.

Table. 4.4 Practice Objective And Essential Tasks of the Health C

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**
	-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 - Explain what type of food to give and how much to give in the treatment of case with protein energy malnutrition
	-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 anar 4tn01 Tw8(nutr)6.6(43(v)12.5(e)-1. 1(m)-(8(nu636 Tc-0.0014 Tw[educ)13.6(at1)5.8(o)-(n e)9.7(6(g)9.7(y)(ei)5	

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
	-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

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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 35^0C 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

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

UNIT SIX

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UNIT SEVEN

ANNEXES

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

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**

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