UNIT 20 NUTRITION AND INFECTION

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20.1 INTRODUCTION

You are aware that children suffering from malnutrition like PEM almost always have infections such as diarrhoea and respiratory infections. As you may know, the infections are caused by microorganisms which can be seen only through a microscope. Just as infections are common in cases of severe malnutrition, infections like measles, diarrhoea and whooping cough can also lead to malnutrition. Therefore, an understanding of the relationship between malnutrition and infection is essential. Based on such an understanding, you will be able to plan programmes to control malnutrition. This unit presents a detailed discussion on the interaction between infection and malnutrition and the effect of infections on nutritional status. It focuses on the dietary management of two of the common infections—diarrhoea and measles.

Objectives

After studying this unit, you will be able to:

- discuss the interaction between infection and malnutrition
- describe the effects of infections on nutritional status of children
- discuss how malnutrition can lead to infection and
d- state the dietary considerations for management of infections like measles and diarrhoea

20.2 INTERACTION BETWEEN INFECTION AND MALNUTRITION

You have just learnt that children with PEM usually have either diarrhoea or respiratory infection. In fact, children suffering from either PEM or a severe form of vitamin A deficiency most often die due to infections. This is due to the fact that infections and malnutrition increase the severity of each other.

When two diseases exist in the same person concurrently, the interaction between the two diseases may alter the behaviour of the diseases. Suppose, there is a child with PEM who is also suffering from diarrhoea. In such a case, the usual result is an exaggerated clinical condition or disease. It means that because of the existence of these two conditions i.e. PEM and diarrhoea, the overall clinical status of the child worsens often resulting in increased complications or increased duration of the diseases and finally death. In other words, the coexistence of infections and malnutrition in the same child is producing an effect that is beyond the summed effect expected from the two diseases acting alone. This is described as synergism. For example, if a child with moderate PEM also has infections like measles or diarrhoea, the moderate nutritional disorder such as loss of weight often is precipitated to manifest as kwashiorkor. Similarly, the severity of the infection process can get increased. Both these put together can lead to death and complications in the disease.
The relationship between malnutrition and infection can be described as a vicious cycle (Figure 20.1).

![Vicious Cycle of Infection and Malnutrition](image)

Malnutrition can increase the risk of infections and infections can, in turn, lead to malnutrition. This interrelationship and the synergistic effect of malnutrition and infections often lead to a high rate of child deaths in poorer communities in India. The cumulative effect of malnutrition and infection produces retardation of physical growth leading to stunting or short stature in children. The effects of stunting are long lasting. As a result, the capacity to do physical work of adults may also be reduced. We can, for example, see as to what generally happens to a poor rural child starting from birth to adulthood in India. The child at birth weighs much lower than a normal child. Subsequently he/she is solely breast fed for longer periods. The delayed supplementary feeding i.e. delayed introduction of additional food usually triggers slowing in growth. In other words, malnutrition sets in. In view of the poor environment and lack of hygiene, the children are constantly exposed to infections like diarrhoea and respiratory infections. There is reduction in food intake by the child due to loss of appetite due to these infections. As a result, there is further slowing down of growth. The cycles of dietary deficit and infections ultimately may lead to kwashiorkor in a child. (Figure 20.2)

![Weight curve of an infant who developed undernutrition](image)

*Fig. 20.2 Weight curve of an infant who developed undernutrition. (Source: Gopalan and Vijayaraghavan, K. Nutrition Atlas of India, 1971, National Institute of Nutrition, Hyderabad)*
The story is same in all such children. The ill effects of malnutrition and infection on the health of the child get accumulated year by year and the effects are devastating. Ultimately the child with poor nutrition and health during his childhood enters adulthood as a malnourished adult. They are not only much shorter than their normal counterparts but also have weights lower than healthy individuals. Consequently their capacity to do physical work is significantly reduced. This, as you know, can hamper the development of the country.

So far we have studied about interaction of infection and malnutrition. Let us now look at the effect of malnutrition on infection.

20.2.1 Effect of Malnutrition on Infection

The following discussion documents how malnutrition favours infection.

a) Reduction in antibody production: A normal child who is adequately fed and well nourished is at a lower risk of infection. More importantly, the child can fight the infections better. Why? This is due to the ability of the healthy and well nourished child to produce disease-fighting substances called antibodies. You may recall reading about antibodies (as proteins in the human body which help fight infections) in Block 1, Unit 3. In view of this, normal children recover from infections faster, as a result, the ill effects of the infections are negligible in the child. However, in the case of severe PEM, or vitamin A deficiency there is a reduction in antibody production. In other words, in malnutrition the disease fighting capability of an individual is considerably lowered, thereby, making the child more prone to infections.

b) Effect on the integrity of skin and mucous membrane: In normal and well fed individuals, the skin, mucous membranes and other tissues prevent the entry of infectious agents. These tissues act as barriers to infection and prevent the infectious agents from entering the human body. In PEM, such a protective mechanism will be absent. The secretion of mucous may be reduced, mucous membrane becomes readily permeable and a favourable environment for the growth of the infectious agents will be created. Consequently, a malnourished child can catch infections easily.

You may know that human intestines harbour microorganisms even when an individual is healthy and normal. In healthy normal individuals these organisms do not produce any disease. But, in PEM, the microorganisms may produce diarrhoea.

c) PEM and worm infestation: You would have learnt that during digestion food that is ingested, is pushed down the digestive tract with the help of certain type of movements. Always remember that proper mobility (movement) of the digestive tract is important for normal digestion. In individuals with malnutrition this mobility of the digestive tract may slow down, because of which, there is more time available for the worms to multiply. As a result, worm infections like round worm disease may become severe. In addition, the duration and severity of gastrointestinal infections may be more in malnourished individuals.

You have so far learnt how malnutrition can lead to or aggravate infections. We have also discussed that the relationship between malnutrition and infection is in the form of a vicious cycle. Now in the next section we will learn how infections can influence the nutritional status.

Check Your Progress Exercise 1

1) What is synergism?

2) List the factors which contribute to malnutrition in infection.
20.2.2 Effect of Infection on Nutritional Status

Nutritional status, you know, is the condition of health of an individual as influenced by the utilization of nutrients. How does infection influence the utilization of nutrients? What effect does it have on the nutrient intake? These are the aspects discussed in this subsection. We begin with the effect of infection on food intake.

a) Reduced food intake: When a child is suffering from infections like diarrhea or respiratory infection, one of the first changes noted by the mother is loss of appetite. Quite often, the child may not like or tolerate food. As a result of this, the child consumes less food or there is reduced dietary intake. Furthermore, the antibiotics used in the treatment of infection may also reduce the appetite in the child leading to reduced food intakes.

One of the common practices in our country when a child is suffering from infection or a disease is restriction or withholding of food. For example, in the case of diarrhea solid foods and milk are restricted and in their place starchy gruels are given. Such a practice is deleterious to the child particularly, when the child is already on border line of malnutrition due to dietary deficiency over a period of time. It would mean that there is further reduction in the intake of nutrients, thereby, leading to poor nutritional status.

b) Effect on absorption of nutrients: We studied about the process of digestion in Unit 2, Block 1. We learnt that during digestion various nutrients are absorbed and they enter the blood stream. Any decrease in the absorption of nutrients can lead to the deficiency of the particular nutrient. It is observed that in the case of infections like diarrhea, measles and respiratory disease there is reduction in the absorption of nutrients. Only 60-70 per cent of the nutrients consumed are available to the body. Even worm diseases like round worm disease usually reduce the absorption of nutrients, thus, leading to ill-health.

c) Loss of protein: In some of the infections and fevers, few nutrients, particularly proteins are excreted i.e. lost from the body. This naturally increases the requirement of protein during infections and fevers.

The overall effect of the infections on the dietary intake of the child is substantial. In a poor rural child, who is already on a deficient diet, the effect of the infections can, therefore, be devastating. It is not, therefore, surprising that in our country, kwashiorkor or marasmus are commonly precipitated by diarrhoeal disease, measles and whooping cough in children whose nutritional status is already poor.

Let us now study the effect of few specific infections namely diarrhea and measles on the nutritional status.

a) Measles and Nutritional Status

Measles is a viral disease which generally attacks children around one year of age. Measles leaves the child completely weak and emaciated. The child suffers not only from the effects of measles but is exposed to a number of complications which invariably follow an attack of measles. The common complications of measles are (a) diarrhea and (b) severe respiratory disease. These complications by themselves lead to loss of weight in children. In the case of poorly nourished children the body weight does not return to the original weight the child had before the disease, for a very long time. Measles by itself decreases the disease-fighting ability of a child thus making the child easily susceptible to infections. Furthermore, one of the common practices observed among rural mothers in India is that they withhold diet to the child during measles. To add to this is the fact that absorption of nutrients is also considerably reduced in measles. Measles also can cause blindness by increasing vitamin A deficiency in a child living on inadequate diet. In other words, the risk of
nutritional blindness in children with measles is much more than those without measles. So these factors together lead to poor nutritional status.

b) Diarrhoea and Nutritional Status

Diarrhoea is a symptom characterized by the sudden onset of frequent stools of watery consistency, abdominal pain, cramping, weakness and sometimes fever and vomiting. You know that diarrhoea is very common among children. As in the case of any other illness, diarrhoea can reduce the appetite of the child considerably. As a result, the child does not eat properly.

In addition, the mother may think that the diet of the child with diarrhoea should be restricted with the belief that the number of loose motions may increase if the child is fed. So what are the consequences? Obviously, there is reduced food intake; which ultimately leads to poor health of the child.

Further you are aware that in diarrhoea fluids are lost from the body. Along with the fluids important minerals such as sodium and potassium (usually known as electrolytes) are also lost. You would recall reading about these losses during diarrhoea in Unit 5 of Block 2. This loss of fluids and electrolytes during diarrhoea leads to dehydration. It is this dehydration which is responsible for high death rate in the children with diarrhoea. In the villages and slum areas in the cities, the children generally suffer from frequent and repeated attacks of diarrhoea. Repeated attacks of diarrhoea lead to significant weight loss in children. If we examine the nutritional status of severe cases of diarrhoea we notice that the body weight of these children is much lower than the normal children. Similarly, in the case of kwashiorkor and marasmus the incidence of diarrhoea is higher.

20.3 DIETARY CONSIDERATIONS FOR MANAGEMENT OF INFECTIONS

From our earlier discussion you would have got a clear idea of how malnutrition and infections like diarrhoea and measles affect growth and development of children. Looking at the synergism between malnutrition and infections, it is important to remember that the preventive measures must necessarily take both conditions into account. How to prevent malnutrition has already been discussed earlier in this block. The dietary considerations for the management of two of the most common childhood infections—diarrhoea and measles—are however discussed in the next subsection. We begin with dietary management of measles.

20.3.1 Dietary Management of Measles

You have just learnt about the serious and deleterious effects of measles on the nutritional status of the children. You should, in such cases, take steps to ensure that the child gets proper nutrition. Generally, it is believed by the village mothers that nothing should be given to a child with measles. This is a wrong belief and you should educate and convince the mothers that without proper diet the child may develop severe malnutrition. Few dietary considerations to be advocated are:

a) If the child is breast fed, advice the mother to continue breastfeeding the baby.

b) Give to the child liquids like milk or semi-solid preparations like Kanjee, soft khichri; nutritious porridges which have been thinned by the addition of ARF. ARF (you may recall reading in Unit 9, Block 3) is nothing but a few grams of germinated wheat powder which has the ability to instantly break down the thickness of gruels and to make them much easier for a sick child to swallow.

c) If the child also has diarrhoea, the mother should be advised to give the child oral rehydration solution to prevent dehydration. What is oral rehydration solution? Refer to sub-section 20.3.2 for the preparation of oral rehydration solution.

d) All children with measles should get a large dose of vitamin A (200,000 IU) orally by mouth.
c) Ensure proper feeding of the child suffering from measles. If the child is properly fed you would notice that the reduction in body weight will be much less.

20.3.2 Dietary Management of Diarrhoea

You are aware that, like in measles, mothers often withhold food during diarrhoea due to the fear that the disease may become more severe. This belief is wrong. You should educate the mothers, in such cases, to properly feed the children. The dietary considerations include:

1) Advice the mothers to continue breastfeeding specially if the child is breast fed or alternatively give milk feeds mixed with equal amount of boiled, clean water.

2) Serve soft, well-mashed, non-spicy foods to the child which are easy to digest. For example, soft well-cooked rice with dal preparation or khichri, soups, eggs, fish etc. can be given to the child. As stated earlier nutritious cereal-pulse—oil porridges suitably 'thinned' with ARF, can also be given.

3) Give the child foods rich in potassium such as fruit juices, mashed bananas, potatoes, carrots, well-cooked whole grain cereals.

4) Give the child food as much as he wants and atleast 5-7 times a day.

5) As soon as diarrhoea starts, give the child more fluids than usual for example, rice water(kanjee),fruit juice, coconut water, butter milk (lassi), dal soup, diluted milk, tea, nimbu pani (fresh lime in water),barley water or any other fluid available at home and acceptable to the child.

6) Give oral rehydration solution (ORS) to the child. What is ORS? ORS is a solution made from sugar and salt dissolved in water. This solution helps replace the fluids and electrolytes lost in the stools during diarrhoea. You may be aware that in the market several electrolyte mixtures are available. This mixture should be added to one litre of clean water (preferably boiled and cooled) and the child should be fed this solution as frequently as possible and after every loose stool. We can prepare this solution at home as well in the following manner:

Take one litre of clean water, add three finger pinch of common salt and four finger scoop of sugar and mix well (Fig. 20.3). This mixture is as good as the electrolyte mixtures available in the market. It is now known that salt (as stated above) added to one litre of thin rice kanjee or barley water will also serve as well. Low income mothers prefer this as they very often may not have sugar or jaggery at home, but all homes will have some cereal or the other to make a kanjee solution. The child should be given this solution as frequently as possible.

The education of the mothers is the sheet anchor in the management of diarrhoea. Tell the mother she can prevent diarrhoea, if:

- she gives her child fresh, clean and well-cooked food and clean drinking water and
- she practices good hygiene.

Check Your Progress Exercise 2

1) Explain in four or five lines the relationship between infections and nutritional status.

2) How will you prepare oral rehydration mixture at home? Discuss.
Three finger pinch of common salt

Four finger scoop of sugar

Salt and sugar should be added in one litre of water

Fig. 20.3 Preparation of Oral Rehydration Mixture
3) What dietary advice will you give to a mother for the management of measles?

4) Fill in the blanks:
   a) The relationship between malnutrition and infection can be described as a.................cycle.
   b) In malnutrition the disease fighting capability of an individual is..................
   c) In poorly nourished children after measles the body weight does.................return to the pre-disease weight.
   d) In dehydration there is loss of fluids and..................

20.4 LET US SUM UP

Malnutrition and infections often coexist in Indian children. The combined effect of both these conditions on the health of the children is devastating. Malnutrition can lead to infections by reducing the disease-fighting capacity of the child. Infections on the other hand can lead to malnutrition because of reduced nutrient intake due to loss of appetite, dietary restriction, reduced absorption etc. Thus malnutrition and infection form a vicious cycle. Measles and diarrhoea contribute significantly to the high rate of malnutrition. Measles immunization, oral rehydration and proper dietary advice can help reduce the effect of infections on the child’s nutritional status.

20.5 GLOSSARY

Antibiotics : Medicines used to treat infections.
Antibiotics : Chemical substances which help in fighting infections in the body.
Dehydration : Loss of fluids and electrolytes in the body often leading to death.
Diarrhoea : Frequent passing of loose stools.
Measles : An acute viral infection characterized by fever and skin rash.

20.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) The interaction between two diseases or condition producing a summed effect of the diseases resulting in increased complication or increased duration of the disease is called synergism.

2) Loss of appetite, restriction of diet by mother, reduced absorption of nutrients, intolerance to food.

Check Your Progress Exercise 2

1) Infections have a significant effect on nutritional status. During infection there is reduced food intake. The absorption of nutrients is also considerably reduced. Further there is loss of nutrients from the body. All these factors together lead to poor nutritional status.
2) Take one litre of clean water. Add three finger pinch of common salt and four finger scoop of sugar and stir well. ORS is ready. This should be given to the child as frequently as possible.

3) a) Continue breastfeeding the child if breastfed.
   b) Serve liquids like milk or semi-solid preparations like kanjee, soft khichri, nutritious porridges to the child.
   c) Give oral rehydration solution to the child suffering from diarrhoea.

4) a) vicious
   b) reduced
   c) not
   d) minerals (electrolytes)