Chapter 1- DIARRHOEA

(TYPES, CAUSES, CLINICAL SYMPTOMS AND DIETARY MANAGEMENT)

***Learning Objectives*:**

After reading this unit, the students will be able to:

1. define diarrhoea and review the different terminologies used in the context of diarrhoea,
2. differentiate between different types of diarrhoea,
3. explain the causes, clinical symptoms and the metabolic changes during diarrhoea, and
4. describe the diet therapy during diarrhoea.

We have looked at the basic concepts and inter-relationship between fever, infection and nutrition in our study so far. Diarrhoea, an infection, is an important public health problem among under-five children in developing countries. Recent evidence suggests that diarrhoea is the third leading cause of childhood mortality in India, and is responsible for 13% of all deaths/year in children under five years of age. Do you know what diarrhoeal diseases are? What causes it? What are the symptoms and how can we prevent and treat it? Yes, diarrhoea is both preventable and treatable. This Unit will focus on the classification/terminologies, determinants, preventive and control strategies of diarrhoea and equip you with dietary principles for management of diarrhoea at home or in a community setting.

DIARRHOEA: DEFINITION, CAUSES and SYMPTOMS

What is diarrhoea? As per the World Health Organization (WHO), diarrhoea is defined as the *passage of three or more loose or liquid stools per day* (or more frequent passage than normal for the individual).

Now consider the following cases.

Case 1: Rani is a 2 year old girl. She has a history of frequent passing of stools but they are well formed. As a baby who was breast fed, even then, Rani use to pass loose "pasty" (semi formed) stools. Her mother is worried.

Case 2: Ramu is a 2 year old boy. He has a 2 day history of watery diarrhoea. His mother informs that he has had several episodes of loose motions with 4-5 loose liquid stools passed per day.

In your opinion are the two children suffering from Diarrhoea? Before you jump to any conclusion, please read the definition of diarrhoea once again more carefully.Then comment on each case.

Yes, what does the definition state? Diarrhoea is the passage of three or more liquid or watery stools in a day. Here the *consistency and character of stools* rather than the number of stools alone is critical.

Now, considering the two cases mentioned above, Ramu is more likely to be suffering from diarrhoea as his stools are liquid, watery and off course frequent. Rani, though was passing frequent stools but the stools were well formed. Hence, she is not likely to be suffering from diarrhoea. Remember, Diarrhoea is characterized by the frequent passage of liquid stools, which is accompanied by excessive loss of fluids and electrolytes, especially sodium and potassium. Diarrhoea, is a symptom and not a disease. This must be clear to you.

While studying about diarrhoea, you may come across other terminologies/terms such as acute watery diarrhoea, dysentery, persistent diarrhoea used in context of diarrhoeal diseases. Do they mean the same as diarrhoea? Let us review.These terminologies are defined in box 1.

BOX 1: Terminologies used in context of Diarrhoea

Acute Watery Diarrhoea: Acute watery diarrhoea is the same as Diarrhoea, which is the passage of three or more liquid or watery stools in a day. It is the recent change in consistency and character of the stools rather than the number of stools that is more important. The duration of acute diarrhoea forms a continuum, most episodes terminating within 7 days and last no longer than 14 days.

Dysentery: Dysentery is referred to as *bloody diarrhoea*. The clinical syndrome of dysentery is characterized by the presence of blood and pus in the stools, abdominal cramps and fever.

Persistent Diarrhoea (PD): The most commonly used clinical definition of persistent diarrhoea is an episode which starts acutely but lasts for 14 or more days.

Having reviewed the terminologies, you may have noted that acute and persistent diarrhoea are not two separate diseases but form a continuum. Most episodes of diarrhoea last less than one week, but a small proportion of episodes last for two or more weeks. So we may consider as there are three clinical types of diarrhoea as also highlighted in Figure 1:

- Acute watery diarrhoea – last several hours or days,
- Acute bloody diarrhoea- also called dysentery, and
- Persistent diarrhoea – lasts 14 days or longer.

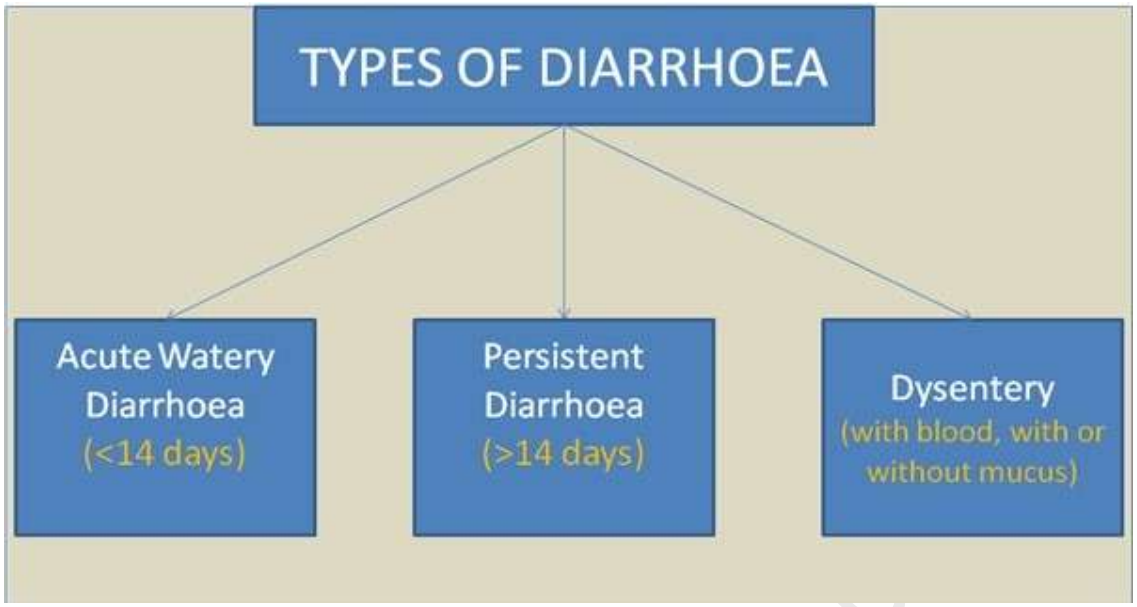


Figure 1: Types of diarrhoea

An episode of diarrhoea can be acute (recent origin) or chronic (extended duration and repeated episodes) in nature. Have you ever suffered from diarrhoea? What symptoms did you experience? Let's consider.

Symptoms of Diarrhoea

Yes you may have experienced watery stools, weakness, dizziness, dryness of mouth and anorexia. Diarrhoea is associated with symptoms depending on the cause and who is affected. Common symptom, however, include:

- Watery, thin or loose stools
- Abdominal cramps
- Sense of urgency to have a bowel movement
- Nausea and vomiting

In addition to the symptoms described above, the symptoms of severe persistent diarrhoea include:

- Dehydration
- Blood, mucus, or undigested food in the stool
- Weight loss
- Fever

Diarrhoea can be life-threatening! During diarrhoea, the stools have high water content – an indicator that water is being lost in higher than normal amounts. The stools also contain a high amount of electrolytes (sodium, potassium). This results in the deficiency of water and

electrolytes in the body which is referred to as *dehydration.* It is important that caregivers recognize the sign/symptoms of dehydration that require immediate attention. Children are at great risk than adults of life-threatening dehydration. Why? Because water constitutes a greater proportion of children's body weight, so dehydration occurs early. Child can loose 5ml to 200ml liquid in 24 hours. Also metabolic rate is high and use more water as compared to adult. So how do we recognize dehydration? A review on how to determine the dehydration status is presented under treatment and management of diarrhea in the next section.

It is important for you to understand that the two main dangers of diarrhoea are malnutrition and death. Do you recall our study in Unit 2 regarding the relationship between infection and malnutrition? We studied that infection adversely affects nutritional status through reductions in dietary intake and intestinal absorption, increased catabolism and depletion of nutrients that are required for tissue synthesis and growth. So Diarrhoea, which is an infection, is strongly associated with diminished food intake. Acute, repetitive, or chronic infection then invariably causes some degree of nutrient losses due to associated anorexia, catabolism of nutrient stores, and malabsorption due to intestinal infection, thus predisposing to malnutrition. Diarrhoea impairs weight as well as height gain leading to poor nutritional status. Children are particularly more vulnerable.

By now, you must have understood the consequences of diarrhea/dehydration and can appreciate that it is the highest cause of illness and death especially in children. So an understanding on what causes diarrhoea needs urgent attention. Let's review the etiology next.

Causes of diarrhoea

Diarrhoea, as must be evident to you by now, is usually a symptom of bowel infection. The infection may be caused by a wide range of pathogens, including bacteria, viruses and protozoa. These include:

- Bacteria, such as *Campylobacter, Clostridium difficile* (C. difficile), *Vibrio cholerae* (causing cholera) (*Escherichia coli* (E. coli), *Salmonella* and *Shigella*: they all may cause food poisoning
- Virus, such as a Norovirus or Rotavirus
- Parasite , such as the *Giardia intestinalis*, that causes Giardiasis

Infection is spread through contaminated food or drinking-water or from person to person as a result of poor hygiene. Poverty, ignorance, poor sanitation is often the underlying risk factors Diarrhoea caused by contaminated food or water while travelling is often known as traveller's diarrhoea.

Recognizing the ill-effects, management of diarrhoea, particularly in the context of management of dehydration and malnutrition is crucial which is discussed next.

TREATMENT AND MANAGEMENT OF DIARRHOEA/DEHYDRATION

You must have realized by now that diarrhea/dehydration should not be neglected and must receive prompt medical care to minimize the frequency of morbidity and mortalities. In light of the complications discussed above let us now examine what should be the objectives in the management of diarrhoea and more specifically dehydration.

Objectives: The major objectives in the management of diarrhoea include:

1. Fluid and electrolyte replacement
2. Removal of cause (especially if infection)
3. Nutrition concerns

The therapy for diarrhoea thus consists of:

1. Determining the status of dehydration
2. Fluid management
    - Oral Rehydration Therapy (ORT) - home made/commercial Oral Rehydration Salts (ORS)
    - Emergency treatment and drug management
3. Nutritional management

Let us review each of these therapy individually. The first step in diarrhea management is to determine the status of dehydration. Let us consider this.

Determining the status of Dehydration

How can we identify dehydration in an individual suffering from diarrhoea? What are the sign/symptoms to look for to identify dehydration? Table 4.1 and Figure 2 present the sign/symptoms of dehydration.

Table 4.1: Recognizing dehydration

Dehydration status	Sign/Symptoms
Some dehydration	Two of the following signs: • Restless, irritable • Sunken eyes • Drinks eagerly, thirsty • Skin pinch goes back Slowly
Severe dehydration	Two of the following signs: • Lethargy or unconscious • Sunken eyes • Not able to drink or drinking poorly • Skin pinch goes back very slowly

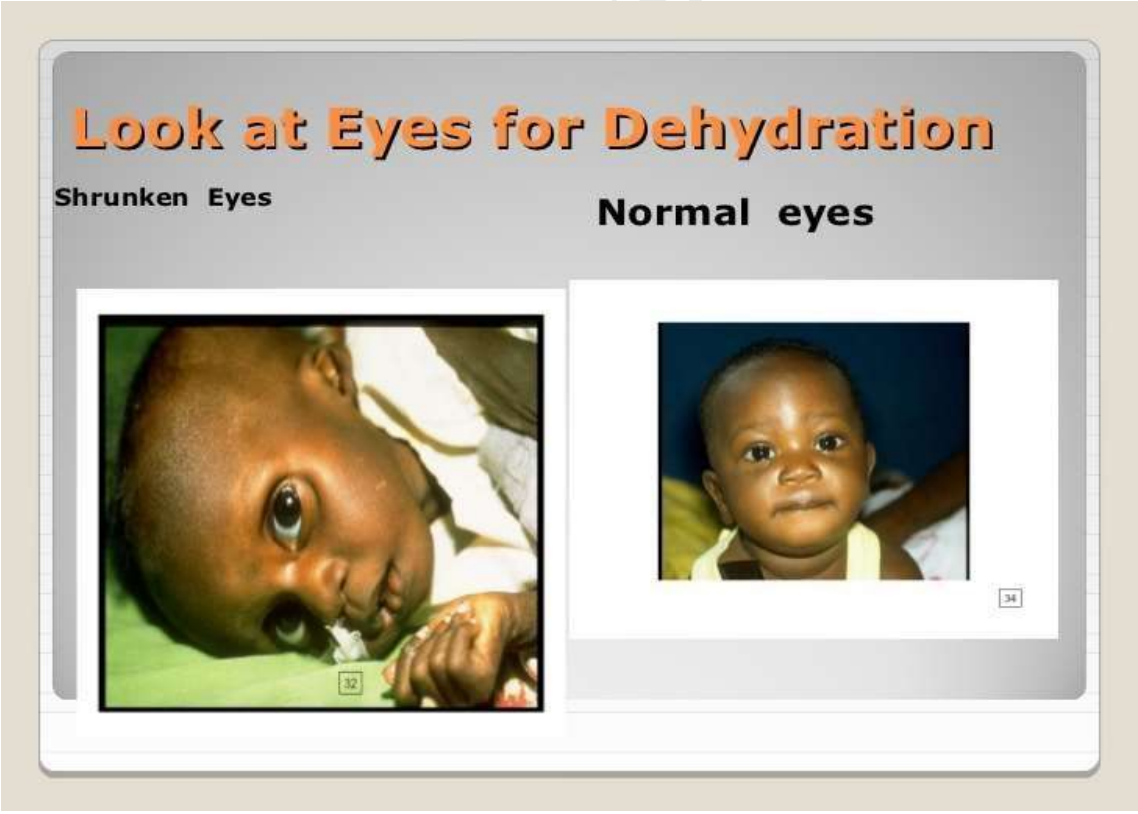


Figure 2a: Sunken eyes - a sign of dehydration

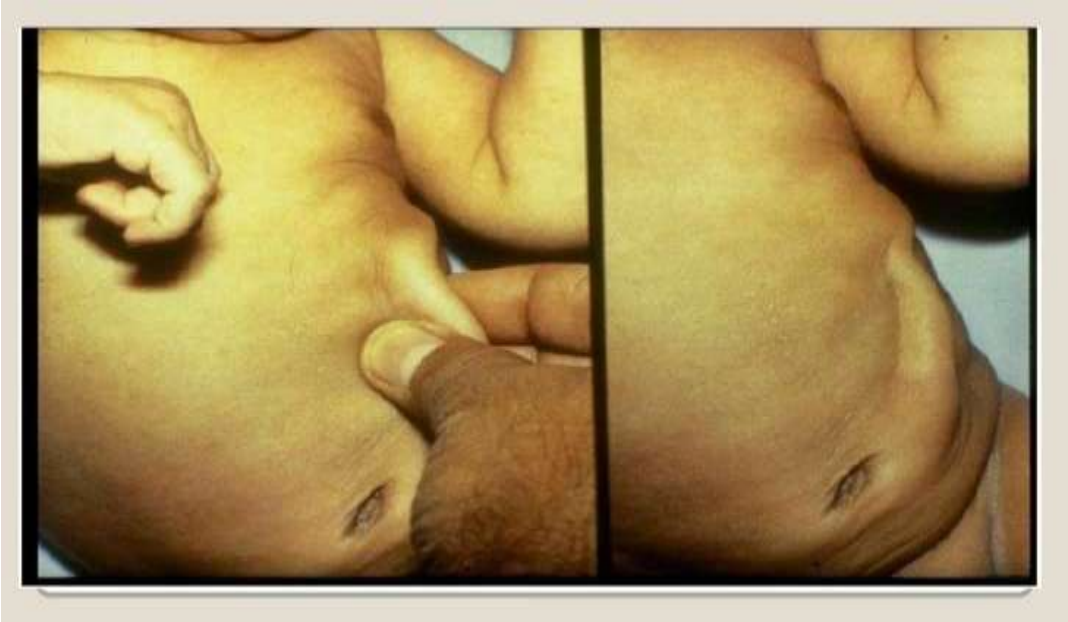


Figure 2b: Skin pinch - goes back slowly

So next time you have a bout of diarrhoea or come across an individual suffering from diarrhoea, look out for the sign and symptoms of dehydration. Look at the individual's general condition. Is he/she lethargic or unconscious, restless or irritable? Look for sunken eyes (Refer to Figure 2a). Look for skin pinch (Refer to Figure 2b). Does the skin go back promptly, slowly or very slowly? Offer the individual fluid to drink. Is he/she not able to drink or drinking properly? Drinking eagerly indicates thirsty. Based on these signs and symptoms, decide on the degree of dehydration. If an individual does not show enough signs to classify as some or severe dehydration than the person does not suffer from dehydration.

Once status of dehydration is identified, the plan of treatment is worked out. Next step deals with fluid management. Note, Oral Rehydration Therapy (ORT) is at the core of management of dehydration/diarrhoea. A review on the use of ORT and the fluid therapy in the management of dehydration is presented next.

Fluid Therapy/Oral rehydration therapy

The key to diarrhoea management is the early replacement of fluid lost in the stools through intravenous or oral route (by mouth). Oral Rehydration Therapy (ORT) is at the core of management of diarrhoea. A review on the use of ORT and the fluid therapy in the management of dehydration is presented in this section.

First let us understand *what is ORT?* Oral rehydration therapy is a simple treatment for dehydration associated with diarrhoea. The term ORT includes:

- Complete oral rehydration salts (ORS) solution,
- Solutions made from sugar and salt,
- Food based solutions, and
- Home fluids without insisting on specified amounts of glucose and salt.

Let us review each of them.

The term ORS refers to the complete *oral rehydration salt* mixture. ORS is potentially the most important medical advance of this century. It is safe, effective and cost saving. ORS can alone successfully rehydrate 95-97% individuals with diarrhoea. A single universal ORS solution containing: sodium - 75 mmol/l and glucose - 75 mmol/l, osmolarity 245 mosmol/l is recommended for all ages and all types of diarrhoea.

How much of ORS to give for replacement of ongoing stool losses to maintain hydration? Refer to Table 4.2 for easy reference.

Table 4.2: ORS guidelines for replacement of ongoing losses to maintain hydration

Age	After each liquid stool, offer
< 6 months	Quarter glass or cup * (50 ml)
7 months to less than 2 years	Quarter to half glass or cup * (50-100 ml)
2 up to 10 years	Half to one glass or cup* (100-200 ml)
Older children and adults	As much as desired

* Large tea cup

Besides ORS, other oral rehydration therapies can also be used and recommended, when ORS is not available. These other oral rehydration therapies are presented in Table 4.3.

Table 4.3: Other oral rehydration therapies*

	Composition per litre	Appropriate use
Home made fluids Sugar and salt solution (SSS)	Sugar (Sucrose) 40g Salt (NaCl) 4g	Prevention of dehydration
Food based solutions Rice water* with salt Dal or dal water with salt Butter milk (Lassi) with salt Soups with salt	Rice approximately 50g (precise measurement not required) Salt 4g	Prevention of dehydration

Home fluids Plain water, lemon water, coconut water, soups Thin rice kanji, dal water without salt	Without insisting on both a glucose precursor and salt or their presence in specified amounts	Prevention of dehydration; most useful in presence of continued feeding which provide both absorbable substrate and some salt.
WHAT IS NOT ORT?		
Glucose water without salt. Fluids without starch or sugar and salt in children/other individuals who are starved. Fluids consumed in very small quantities e.g. plain tea, herbal tea, medicinal concoctions.		

* May be used for treatment of dehydration when ORS is not available.

Source: Revised guidelines for management of diarrhoea in children for medical officers and health workers. Ministry of Health. Government of India.2007.

We hope you have got a good insight about ORT and the various options. Here we would also like to emphasize that, while ORS remains the mainstay of therapy during acute diarrhoea, *zinc administration* during and after diarrhoea, has an additional benefit in reducing duration and severity of diarrhea, especially among children. The therapeutic benefit in acute diarrhea may be attributed to the effect of zinc on the various components of the immune system and its direct gastrointestinal effects.

The recommendation for use of zinc supplementation (in diarrhoea) includes:

- All cases of diarrhoea should receive zinc in addition to ORS. A uniform dose of 20 mg of elemental zinc should be given during the period of diarrhoea and for 7 days after cessation of diarrhea to children older than 3 months.

NUTRITION MANAGEMENT OF DIARRHOEA

Diarrhoea we know worsens nutritional status, especially in case of children. The nutritional status is affected because of:

(a) decreased food intake due to anorexia and maternal food withholding, and

(b) intestinal malabsorption of macronutrients and of some micronutrients.

You may have noticed that in some household's mothers tend to fast the child during diarrhoea in the misconception that feeding will cause more diarrhoea. There is no basis for this fasting. In fact, the role of diet in the management of diarrhoea is quite crucial and beneficial. Children should continue to be fed during acute diarrhoea because feeding is very important and prevents or minimizes the deterioration of nutritional status that normally accompanies such illness. Feeding prevents malabsorption and facilitate mucosal repair. It prevents growth faltering and malnutrition.

While the demand for fluids and electrolytes are particularly high during an acute episode as already highlighted above. The demand for all macro and micronutrients increases during chronic diarrhoeas. The nutrient requirements and or the quality (consistency) of diet may not necessarily be the same for all forms of diarrhoea. Here we will focus on dietary management and nutrient intake during diarrhoea in general and then with particular focus for children.

Dietary Considerations and Nutritional Need during Diarrhoea

The diet should take into account the normal recommended dietary allowances and various adjustments made to the quantity and quality of the foods to be given. Table 4.4 highlights the dietary recommendations.

Table 4.4: Dietary considerations and nutritional needs during diarrhoea

Dietary requirements	Recommendation/Justification	Dietary Considerations
Energy (Kcal) (Carbohydrates and Fats) An increment of 200–300 Kcal in acute phase as per the tolerance of the patient.	High calorie diet: -minimizes the deterioration of nutritional status - prevents the weight loss that takes place due to illness - replenish the depleted stores of the body.	60-65% of the total energy should be provided by easily digested carbohydrates. Glucose, sugar, honey, jaggery, potato, yam, colocasia, rice, sago, semolina, refined flour, pastas can be incorporated to prepare dishes such as khichdi, vegetable/pulse puree, fruit juices, soufflé, shakes, custard and kanji. Excess sugar may be avoided. The fibre content of the diet should be minimum. Emulsified form of fats like cream, butter, ghee, egg yolk should be included as they are easily digested and well tolerated by patients. Fats help in increasing the energy density of the food without increasing the bulk of the diet. Fried food must be avoided.
Proteins (g) In chronic diarrhoea, an additional 10g of protein may be recommended above the normal requirements.	High protein diet compensates for: - massive loss of lean body mass (muscle) due to tissue (protein) breakdown.	Milk in the fermented form like curds is better tolerated, as it is easy to digest and helps in maintaining the gut health. Other cooked and diluted milk products like a light porridge; paneer etc can also be tolerated in small amounts. Apart from these, easily assimilated protein-

		rich foods like minced meat, egg, skimmed milk and its preparations can be given.
Vitamins (B Complex vitamins, especially folic acid, vitamin B_{12} and vitamin C. Fat soluble vitamins (A, D, E and K)	Vitamins need to be emphasized considering: - the increase in the energy requirements, - a decreased ability of the intestine to assimilate and synthesize some of the vitamin due to compromised digestive processes and altered microbial flora, - to boost immunity and favour wound healing, particularly vitamin C, and -for maintenance of epithelial mucosa (gut lining).	Vitamin supplementation may be given in the early stages of the infection when the patient is anorexic and has low food tolerance. Subsequently well cooked soft and pureed yellow and orange coloured fruits and vegetables such as pumpkin, carrots, mango, papaya, bottle gourd etc. may be included Food preparations in forms like stews, soups and dal water are beneficial.
Minerals (Sodium, Potassium, chloride and iron)	-To compensate for loss of electrolytes observed due to diarrhea, vomiting To compensate for iron (blood) loss associated with bleeding.	Liberalizing on sodium intake through salty soups, beverages are desired. Potassium intake can be increased by emphasizing cooked fruits, low fibre vegetables, washed and dehusked pulses. Potassium supplementation may favour bowel motility and build up appetite. Iron rich foods including tender meat and meat products, dehusked pulses may help meet iron needs.
Dietary Fibre (fibre content of the diet should be kept minimum and insoluble fibre should particularly be avoided)	Avoid high fibre foods: - to minimize the irritation of GI tract	Insoluble fibre in the form of skins, seeds and structural plant materials should be strictly avoided. Soluble fibre in the form of stewed fruits and vegetables like apple juice, stew, guava nectar and pomegranate juice help in binding the stool and favour good environment in the gut. Fruits like papaya and banana have an astringent property and are beneficial. Avoid foods with high fibre content such as whole grain cereals and their products like oatmeal, whole wheat bread, whole pulses and pulses with husk, green leafy vegetables and raw vegetables, fruits with hard skin in the form of salads.
Fluids	Liberal fluids intake is desired to:	Fluid intake can be accomplished

(Liberal intake to minimize risk of dehydration)	-compensate for the fluid losses in the body -ensure adequate volume of urine to eliminate wastes, and -prevent dehydration and maintaining water balance	through a variety of beverages, soups, juices, broths, dal, coconut water besides plain water. Preference must be given to diluted drinks as concentrated ones may favour diarrhoea.
Consistency of diet	Progressive diet needs to be followed:	-In the beginning a *full fluid diet* may be provided. -As the appetite improves bland, low fibre, soft diet, which is easily digested and absorbed, should be given. Well cooked, well mashed, sieved, bland, semisolid foods like khichdi, rice with curd, suji kheer, custard etc. may be given. Note: Small quantities of food at 2-3 hours interval will provide adequate nutrition without overtaxing the digestives system at any one time.

Besides the recommendations provided in Table 4.3, nutritional considerations for young children with diarrhoea need emphasis. WHO recommends a child with diarrhoea should continue to be fed. Continued feeding speeds the recovery of normal intestinal function. In contrast, children whose food is restricted have diarrhoea of longer duration and recovery of intestinal function is slow. Some handy points and guidelines are presented next.

Recommendations for dietary management of acute diarrhea in infants and children

1. In acute diarrhoea, breastfeeding should be continued uninterrupted even during rehydration with ORS.
2. Encourage the child to drink and eat. Be patient while feeding. Give foods that the child likes. Give a variety of nutrient–rich foods/ energy dense foods with the least bulk (fibre) and available in the household in small quantities but frequently, at least once every 2-3 hours.
3. Staple foods do not provide optimal calories per unit weight and these should be enriched with fats and oils or sugar e.g. khichri with oil, rice with milk or curd and sugar, mashed banana with milk or curd, mashed potatoes with oil and lentil.
4. Foods with high fibre content e.g. coarse fruits and vegetables should be avoided.

5. Do not dilute milk. In non-breast fed infants, cow or buffalo milk can be given undiluted after correction of dehydration together with semisolid foods. Alternatively, milk cereal mixtures e.g. dalia, sago, milk-rice mixture, can be used.
6. Routine Lactose-free feeding is not required. It may be required in very few infants in whom diarrhoea persists beyond 8-10 days with progressive weight loss.
7. Do not give sugary drinks.
8. During recovery, an intake of at least 125% of normal should be attempted with energy/nutrient dense foods (enrich food with fat and sugar). Feed an extra meal for at least 2weeks after diarrhea stops. Continue until the child reaches pre-illness weight and ideally until the child achieves normal nutritional status (as measured by expected weight for height or weight for age). This might take several weeks or longer, depending on the degree of deficit.

We end our study on treatment and Management of diarrhoea here. Note, proper treatment and management of diarrhoea is highly effective in preventing death, but has limited impact on occurrence of diarrhoea. So prevention is always better than cure. Simple preventive measures for diarrhoea are highlighted next.

PREVENTION OF DIARRHOEA

Now that you are an aware citizen, you should ensure that the mothers and all other individuals know about the basic diarrhoea prevention strategies. These include:

1. The babies under 6 months of age should be exclusively breastfed. This means that the healthy baby should receive breast milk and no other foods or fluids, such as water, tea, juice, cereal drinks, animal milk or formula. Breastfeeding should continue until at least 2 years of age.
2. Weaning practices for infants should be appropriate and age specific.
3. To prevent the spread of infections that cause diarrhoea, always maintain high standards of hygiene. For example:

- Clean water for drinking and washing should be used.
- Hand washing should be encouraged. Wash hands thoroughly before eating or preparing food and after going to the toilet.
- Latrines should be used. There should be quick and sanitary disposal of babies stools.

- Avoid sharing towels, cutlery or utensils with other household members.
- Avoid returning to work or school until at least 48 hours after the last episode of diarrhoea

4. Food safety practices should be emphasized including:

- Raw food should not be eaten except undamaged fruits and vegetables that are peeled and eaten immediately;
- Food should be cooked until it is hot throughout;
- Food should be eaten while it is still hot, or reheated thoroughly before eating;
- All cooking and serving utensils should be washed and thoroughly dried after use;
- Cooked food and clean utensils should be kept separately from uncooked food and potentially contaminated utensils; and
- Food should be protected from flies by means of fly screens.

5. Children should be given measles immunization.

Based on the guidelines presented in this Unit, we hope now you are in a position to manage a case of diarrhoea. You would realize when there is no sign/symptom of dehydration it is easy to treat diarrhoea at home. In case of children, home treatment can be crucial and here are four rules of home treatment.

TREAT DIARRHOEA AT HOME

The four rules of home treatment of diarrhoea among children include:

1. **Give Extra fluid**

   Advice the caretaker/mother to breast feed the infant frequently and for longer at each feed. If exclusively breastfed, give ORS for replacement of stool losses. If not exclusively breastfed give one or more of the following: ORS, food based fluid (soup, rice water, coconut water and yogurt drinks) and clean water.

2. **Continue feeding**

   Continue usual feeding, which the child was taking before becoming sick. Feed 5-6 times in a day.

3. **Advice to care taker/mother when to seek medical advice**

   Advice mother/caretaker to seek help immediately if the child has any of these signs: not able to drink, breastfeed or drinks poorly; becomes sick or has fever .

4. **Give oral zinc for 14 days.**

We end our study on Diarrhoea here. Some Do's and Don'ts, and a list of what foods to give and what foods to avoid are highlighted in Table 4.5. You may consult the list while planning the diet.

Table 4.5: Foods to include and foods to avoid during diarrhoea

Foods to include	Foods to avoid
1. Plenty of fluids like soups, coconut water, salt, sugar solution (electrolyte), barley water, lemon water, rice water, dal water, butter milk (lassi), plain water, 2. Bland, well cooked, well mashed, sieved, soft, semisolid foods like khichdi, rice with curd, suji kheer, custard etc. 3. Low fibre foods such as refined cereals and their products (e.g. maida, rava, bread, rice, noodles etc.) dehusked pulses (washed dals), well cooked/stewed fruits, vegetables in soft and puree form and potatoes. 4. Foods providing proteins of high biologic value e.g. eggs, soft cheeses, tender meats, fish, poultry etc.	1. High fibre foods like whole grain cereals and their products e.g. whole wheat flour, whole wheat bread, oats and cracked wheat, whole pulses and pulses with husk. 2. All raw vegetables and fruits with hard skin or fibre such as green leafy vegetables. 3. Simple sugar solutions 4. Fresh juices – Fresh or tinned. 5. Carbonated soft drinks 6. Tea, coffee 7. Gelatin desserts 8. Thick creamy soups 9. Fried fatty foods .

In addition to the list provided in Table 4.5, some do's and don'ts are summarized in Table 4.6. Make a note of them.

Table 4.6: Do's and Don'ts

Do's	Don'ts
1. Always wash vegetables and fruits with clean water before eating. 2. Wash hands frequently, particularly before eating or preparing food and after using the toilet. 3. Drink water that has been boiled, filtered and treated. 4. Eat small frequent meals. 5. Make sure the food (meat, fish or vegetables) whatever it is that you are eating has been thoroughly cooked and served steaming hot.	1. Avoid places that do not maintain hygiene. Avoid foods from street vendors 2. Do not buy open and cut fruits and vegetables from street vendors. 3. Do not eat unwashed or unpeeled fruits and vegetables. 4. Avoid excessive use of fat in cooking 5. Avoid eating foods served at room temperature. 6. Avoid using ice made from tap or well water or flavoured ice. 7. Avoid close contact or sharing eating utensils, cups with people who are infected.

Chapter -2: FEVERS

(TYPES, CAUSES, CLINICAL SYMPTOMS AND DIETARY MANAGEMENT)

***Learning Objectives*:**

After reading this unit, the students will be able to:

1. define the term fever and present the classification of fevers
2. differentiate between acute and chronic fevers
3. explain the causes, clinical symptoms and the metabolic changes during infection and fevers, and
4. describe diet therapy during fevers.

In the previous Unit we looked at the interrelationship between nutrition and infections. You would realize that infection and fevers are coexistent. Fever is an outcome of infection. In this section we will also look at the basic concepts and inter-relationship between fever, infection and nutrition. A detail review on dietary management of fevers will be presented.

FEVER: DEFINITION, CAUSES and SYMPTOMS

Fever is classically defined as the abnormal condition of the body, characterized by undue rise in temperature, quickening of the pulse, and disturbance of various body functions. Surely, you must be aware of the normal body temperature. Yes, the normal human body temperature may range from 36^{o}C to 37^{o}C (98.6F). So, technically any body temperature above the normal temperature may be considered fever. What do you think? Well, in practice an individual is usually not considered to have a significant fever until the temperature is above 100.4 (38 C).

It is important to understand that fever is not an illness but it is a symptom or an adaptive response of our body to a variety of conditions, such as infection, inflammation or unknown causes. Fever may be caused by a bacterial infection or by a virus or certain inflammatory conditions such as rheumatoid arthritis (inflammation of the lining of the joints) or a malignant tumor etc.

As a child you may recall suffering from cold/cough and/or chest infection or diarrhoea, and very often these infections were accompanied by fever. The clinical and behavioral manifestations of fever besides elevated temperature you might have experienced included headache, muscle ache, chills and shivering, sweating, loss of appetite, irritability, general weakness, dehydration etc.

Fever is, therefore, a sign that something out of the ordinary is going on in the body. Fever, in fact, is part of the body's own disease-fighting mechanism. A rise in body temperature is one of the ways our immune system attempts to combat an infection Fever helps defend against microbial (bacterial/viral) invasions and apparently is capable of killing or inhibiting the growth of some bacteria/viruses that can tolerate only a narrow temperature range.

From our review so far we may then conclude that usually a rise in temperature helps the individual resolve an infection. So a mild fever i.e. above the normal body temperature but below 100.4F (38 C) is probably helping to neutralize the bacteria or virus that is causing the infection. There is no need to worry. But sometimes fever may rise too high and can be severe and serious and lead to complications. Therefore it is important to learn about the classification, type and pattern of fever for appropriate management.

FEVER: LASSIFICATION AND TYPES

Fevers are primarily classified into three categories: Acute, Sub-acute and Chronic fevers based on duration as highlighted in Figure 3.1.

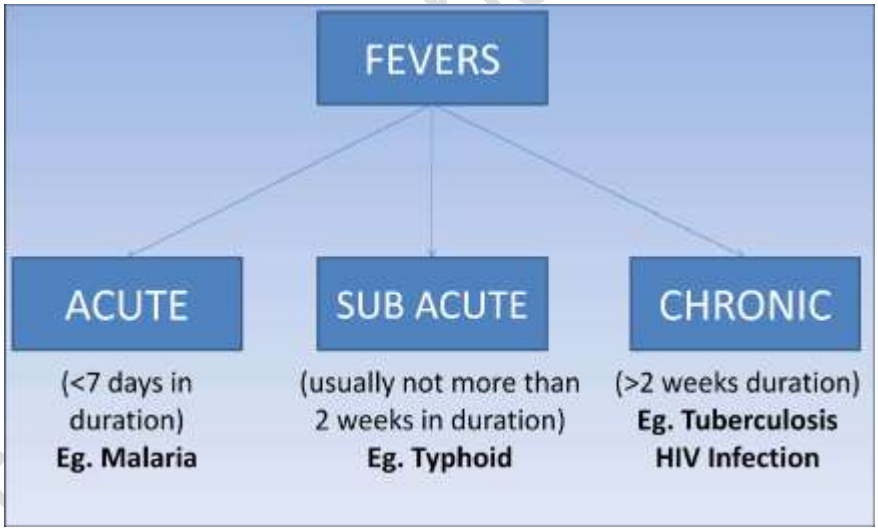


Figure 3.1: Classification of fevers

Acute fevers are those which are for less than 7 days in duration and are characteristics of infectious diseases such as malaria and viral-related upper respiratory tract infections. *Sub-acute fevers* are usually not more than 2 weeks in duration as can be seen in cases of typhoid fever. *Chronic fever* on the other hand are persistent, usually more than 2 we k in duration

and are typical of chronic bacterial infections such as tuberculosis, viral infections like HIV, cancers etc.

Further, based on the height of the body temperature, fevers can also be classified as *low grade, moderate grade or high grade* fever. You would notice that a low grade fever does not exceed 37.8^0C and is present daily especially in the evening. Tuberculosis causes low grade fever. Similarly you may come across fever types described as *continuous or sustained* fever, *intermittent* fever and *remittent* fever. Continuous/sustained fever is defined as a fever that does not fluctuate more than about 1^oc (1.5F) during 24h, but at no time touched normal. Continuous fevers are seen in pneumonia, typhoid, and urinary tract infection among others. Such fevers are characterized by slow step-wise temperature rise. *Intermittent* fever is defined as fever present only for several hours during the day. This pattern you may notice in malaria, tuberculosis or pyrogenic infections. *Remittent* fever, on the other hand, is defined as fever with daily fluctuations exceeding 2^oC but at no time touched normal. This kind of fever is always associated with infectious diseases such as infective endocarditis, rickettsiae Infection.

Having looked at the different types and classification of fever, we shall focus next on management of fevers, with special reference to dietary management. Diet, you would notice plays an important role in the management of fevers. With the rise in body temperature, (above normal), several metabolic changes occur in the body that increases the nutritional needs. A brief review on these changes is presented next.

METABOLIC CHANGES DURING FEVER

Fever is usually characterized by certain metabolic changes. Higher the temperature, longer the duration of the fever, more is the ill effect. The common effects include:

- Increase in the *basal metabolic rate* (BMR). Note, there is a 13% increase in BMR with every 1^oC rise in body temperature. (or 7% increase with every 1^oF increase in temperature).
- Decreased glycogen stores and decreased stores of adipose (fat) tissue.
- Increased catabolism (breakdown) of proteins, especially in case of typhoid, malaria, tuberculosis fevers. This results in production of excess amount of nitrogenous wastes, which places an additional burden on the kidneys.
- Increased excretion of sodium, potassium, chloride etc. thought sweat, urine, vomiting leading to electrolyte imbalance.
- Accelerated loss of body fluid in the form of excessive sweat and urine formation.
- Loss of appetite which limits the food intake thus leading to weight loss.
- Decrease in the absorption of nutrients like proteins, vitamins, minerals.

Basal Metabolic Rate is defined as the rate at which our body uses energy when we are resting in order to keep the vital body functions (such as breathing, heart beating etc.) going.

The above changes accompanied by headache, muscle ache, chills and shivering, sweating, loss of appetite, irritability, general weakness, dehydration experienced during fever may have a significant effect on the nutritional status of the individual. Thus management of fever becomes critical. In the next section we shall look at the diet therapy for management of Fevers. We shall first consider the dietary management of Typhoid which you learnt earlier is sub-acute fever, followed by dietary therapy for chronic fever such as tuberculosis.

DIETARY MANAGEMENT OF TYPHOID

Typhoid is a serious health threat in the developing world such as India, especially for children. We have already learnt that typhoid is a sub-acute continuous fever which can last for about two week's duration. What is the cause of typhoid? Typhoid is caused by the *Salmonella Typhi* bacteria, and is also called *enteric fever* because the bacteria or infection is found in the intestines.

Typhoid fever spreads through contaminated food and water or occasionally through direct contact with someone who is infected. The mode of spread of this infection is, through *fecal-oral route*. Let us understand the concept of fecal-oral route here. Note, Salmonella typhi is passed in the feces and sometimes in the urine of infected people. The source of infection can be the drinking water or milk or any other food contaminated by intestinal contents (through faeces, urine) of the patient or by flies which transmit the disease. We can also contact the infection if we eat food handled by someone with typhoid fever who has not washed their hands carefully after using the toilet.

A patient with typhoid will usually present with:

- high fever, headache, loss of appetite, nausea and vomiting
- gastrointestinal problems like abdominal pain and either diarrhoea or constipation.
- increased BMR
- massive loss of lean body mass (muscle) due to tissue (protein) breakdown leading to excessive nitrogen loss.
- significant decrease in glycogen and adipose tissue stores because of increased energy expenditure.
- excessive diarrhoea, vomiting leading to fluid and electrolyte losses.

It is to be noted that typhoid fever is catabolic in nature, thus in no time it causes weakness and weight loss thus adversely impacting on nutritional status of individual's. Thus diet during typhoid fever needs particular attention. Let's consider the dietary management for typhoid.

Dietary management of Typhoid

The main objective of dietary management during typhoid is to:

i) provide a nutritious diet to prevent malnutrition.

ii) restore positive *nitrogen balance* and reduce the burden on kidneys

iii) provide relief to symptoms as and when present.

iv) correct and maintain water and electrolyte balance, and

v) avoid irritation of intestinal tract as may occur in typhoid.

Thus the dietary management will focus on providing a diet that contains high calories, proteins, carbohydrates and moderate fat. But very often the typhoid fever is accompanied by anorexia, vomiting, nausea. You would notice the patient has poor appetite moreover is unable to tolerate food. So, the diet has to be modified as per the patients' tolerance. The texture of foods given would depend on the patient's tolerance. Initially a *liquid or full fluid diet* may be provided for few days. As the person's appetite improves a *bland diet, low fibre soft diet* may be given which is soothing and easy to digest. Slowly the person may be put on a normal diet. The idea is to encourage the patient to eat so as to meet the increased nutrient requirements. Feedings several times a day need to be encouraged. The nutrient needs during typhoid and how to meet them is the focus of discussion next. The information is summarized in Table 1.

Table 1: Dietary considerations and nutritional needs during typhoid

Dietary requirements	Recommendation/Justification	Dietary Considerations
Energy (Kcal) (Carbohydrates and Fats) A high calorie diet. Approx. 10-20% increase above the normal requirements.	High calorie diet prevents: -the weight loss that takes place due to typhoid fever - compensates for increased BMR, and - replenish the depleted glycogen, adipose stores of the body.	Include *high carbohydrate and moderate fat i*n the diet. Well cooked, easily digestible carbohydrates like glucose, honey, cane sugar, simple starches (unrefined cereals and their products like boiled rice, khichri, pasta, white bread, semolina kheer (suji), custard etc.) boiled potatoes, banana etc. should be included as they require much less digestion and are well assimilated. Emulsified form of fats like cream, butter, fat in milk, egg yolk should be included, as they are easily digested and well tolerated by patients. Fats help in increasing the

		energy density of the food without increasing the bulk of the diet.
Proteins (g) A high protein diet: 1.5 to 2g of protein/kg body weight/day.	High protein diet compensates for: -massive loss of lean body mass (muscle) due to tissue (protein) breakdown leading to excessive nitrogen loss.	Good quantity and good quality protein (of high biological value) in the form of yogurt, eggs, tender meats, fish, and poultry should be incorporated in liberal amounts. Vegetarians can eat dehusked pulses, legumes and cottage cheese that are high in protein content. Use of protein supplements is recommended to add on to the nutrient density without increasing the bulk of the diet.
Vitamins (B Complex vitamins, Vitamin A and Vitamin C)	Vitamins need to be emphasized considering: - the increase in the energy requirements, - a decreased ability of the intestine to assimilate and synthesize some of the B complex vitamin due to compromised digestive processes and altered microbial flora, - to boost immunity and favour wound healing, particularly vitamin C, and -for maintenance of epithelial mucosa (gut lining) vitamin A is required.	Vitamin supplementation may be given in the early stages of the infection when the patient is anorexic and has low food tolerance. Subsequently well cooked soft and pureed yellow and orange coloured fruits and vegetables such as pumpkin, carrots, mango, papaya, bottle gourd etc. may be included Food preparations in forms like juices, stews, soups and dal water are beneficial.
Minerals (Sodium, Potassium, chloride and iron)	-To compensate for loss of electrolytes observed due to diarrhea, vomiting To compensate for iron (blood) loss due to hemorrhage in the intestines	Liberalizing on sodium intake through salty soups, beverages are desired. Potassium intake can be increased by emphasizing cooked fruits, low fibre vegetables, washed and dehusked pulses. Iron rich foods including tender meat and meat products, dehusked pulses may help meet iron needs.
Dietary Fibre	Avoid high fibre foods: -as these foods distress the digestive system and are mechanical irritants	Avoid Intake of whole grain cereals and their products like oatmeal, whole wheat bread, whole pulses and pulses with husk, green leafy vegetables and raw vegetables, fruits with hard skin in the form of salads

		as they are rich in fiber. Include low fibre foods such as refined cereals and their products, dehusked pulses, well cooked fruits, vegetables in soft and puree form and potatoes.
Fluids (Daily fluid intake of 2.5-5 litres)	Liberal fluids intake is desired to: -compensate for the fluid losses in the body through skin and sweat -ensure adequate volume of urine to eliminate wastes, and -prevent dehydration and maintaining water balance	Fluid intake can be accomplished through a variety of beverages, soups, juices, broths, dal, coconut water besides plain water.
Consistency of diet	Progressive diet needs to be followed:	-In the beginning a *full fluid diet* (rich in calories and proteins) may be provided. -As the appetite improves bland readily digested food needs to be given. -As soon as the fever comes down, a low fibre, soft diet, which is easily digested and absorbed should be givent. Well cooked, well mashed, sieved, bland, semisolid foods like khichdi, rice with curd, suji kheer, custard etc. may be given. Note: Small quantities of food at 2-3 hours interval will provide adequate nutrition without overtaxing the digestives system at any one time.

Following the dietary considerations highlighted in Table 1, we hope you should be in a position to plan a diet for a typhoid patient. Here is a small activity for you. Look at Activity 1. Apply the knowledge you have gained so far and complete the exercise. Do's and Don'ts, and a list of what foods to give and what foods to avoid are also highlighted herewith. You may consult the list while planning the diet. For your reference a case study in also presented in Box 1.

Activity 1: Meeta is a 12 year old girl suffering from Typhoid. Calculate her nutrient requirements and plan a diet for her keeping the dietary considerations in mind. Write your activity in a separate sheet and submit for assessment.

Table 2: Foods to include and foods to avoid in the diet of the typhoid patient

Foods to include	Foods to avoid
1. Plenty of fluids like juices, soups, coconut water, electrolyte, barley water, soups. 2. Milk and milk based beverages. 3. Bland, well cooked, well mashed, sieved, soft, semisolid foods like khichdi, rice with curd, suji kheer, custard etc. 4. Low fibre foods such as refined cereals and their products (e.g. maida, rava, bread, rice, noodles etc.) dehusked pulses (washed dals), well cooked/stewed fruits, vegetables in soft and puree form and potatoes. 5. Foods providing proteins of high biologic value e.g. eggs, soft cheeses, tender meats, fish, poultry etc. 6. Plain gelatin based desserts, sugars, honey,candy and jam.	1. High fibre foods like whole grain cereals and their products e.g. whole wheat flour, whole wheat bread, oats and cracked wheat, whole pulses and pulses with husk. 2. All raw vegetables and fruits with hard skin or fibre such as green leafy vegetables. 3. Strongly flavoured vegetables like cabbage, capsicum, turnip, raddish, onion and garlic as they cause gas, bloating. 4. Thick creamy soups 5. Fried fatty foods such as samosas, pakoras, puri, paratha etc. 6. Sweet concentrated foods using excessive whole milk and dairy fat including halwas, ladoos, pasteries, desserts etc. 7. Acidic and spicy food such as pickles, relishes, chutneys, sauces, vinegar as they may irritate the intestine. 8. Spices, condiments and seasonings like pepper, cayenne and chilli powder to ensure that the digestive tract does not inflame all the more

In addition to the list provided in Table 2, some do's and don'ts basic tips are presented in Table 3. Make a note of them.

Table 3: Do's and Don'ts

Do's	Don'ts
1. Always wash vegetables and fruits with clean water before eating. 2. Wash hands frequently, particularly before eating or preparing food and after using the toilet. 3. Drink water that has been boiled, filtered and treated. 4. Consume 3 – 5 liters of fluids in a day in the form of water, fruit juices, tender coconut water and soup. 5. Eat small frequent meals. 6. Make sure the food (meat, fish or vegetables) whatever it is that you are	1. Avoid places that do not maintain hygiene. Avoid foods from street vendors 2. Do not buy open and cut fruits and vegetables from street vendors. 3. Do not eat unwashed or unpeeled fruits and vegetables. 4. Avoid eating large meals to prevent discomfort 5. Avoid excessive use of fat in cooking 6. Avoid eating foods served at room temperature.

eating has been thoroughly cooked and served steaming hot. 7. Make sure to wash	7. Avoid unpasteurized dairy products 8. Avoid using ice made from tap or well water or flavoured ice. 9. Avoid close contact or sharing eating utensils, cups with people who are infected.

We end our study of diet therapy for typhoid here. Next we move on to chronic fevers and their dietary management. Tuberculosis is an example of chronic fever. We will focus on dietary management of tuberculosis.

DIETARY MANAGEMENT OF TUBERCULOSIS

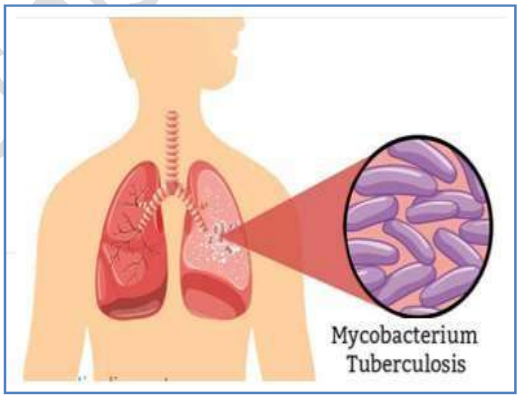
Consider the case of Ramu.

Ramu, a 40 year old factory worker, presented with persistent fever (up to 38^0C) and intermittent cough, sputum, unexplained weight loss and anorexia for 1 month. He visits the doctor who diagnosed his condition as suffering from Tuberculosis. What is tuberculosis?

Tuberculosis (TB), you may be aware, is an chronic infectious disease caused by bacteria - *Mycobacterium tuberculosis*.

The disease spreads from person to person through microscopic droplets released into the air by cough or spit or sneeze from a person with tuberculosis.

Tuberculosis mainly affects the lungs (Figure 1) but can get localized in other organs also, like lymph nodes, kidney, bone etc.



The most commonly observed form of tuberculosis in India is pulmonary tuberculosis. It is worthy to note that tuberculosis remains a major global health problem and is one of the top 10 causes of death and the leading cause from a single infectious agent. It is linked to poverty, undernutrition and poor immune function.

When a person is infected with pulmonary tuberculosis, in a normal healthy individual, the immune system help fights the infection and the bacteria in the body are in an *inactive state* and the person shows no symptom. This is called *latent tuberculosis*. However, if the body's immune system is unable to fight the bacteria the disease becomes *active* and is contagious and can spread in the body and to other people.

The association between TB and undernutrition has long been known. TB makes undernutrition worse and undernutrition weakens immunity, thereby increasing the likelihood that latent TB will develop into active disease.

The common symptom with active TB in individuals is that they:

- are in a catabolic (breakdown of protein/body tissue) state leading to muscle wasting,
- experience weight loss,
- have fever, fatigue, exhaustion and persistent coughing,
- show signs of vitamin and mineral deficiencies, and
- have low body mass index (BMI) (lower than 18.5 kg/m2).

Why do you think weight loss occurs among those with TB? Weight loss can be caused by several factors, including:

- reduced food intake due to loss of appetite, nausea and abdominal pain;
- loss of protein and other nutritional reserves due to fever ,
- malabsorption due to diarrhoea,
- loss of fluids, electrolytes
- metabolic alterations caused by the disease, and
- an increase in the energy expenditure of the patient in an attempt to fight infection

The progression of the disease may be slow gradual but can lead to serious consequences. The key to treatment, therefore, is early detection, followed by antibiotic therapy, adequate rest and diet management. Children with TB, in particular, need special attention since the child has increased requirements as a result of both growth and TB. Let us study the dietary management next.

Dietary Management of tuberculosis

As undernutrition is highly prevalent among people with TB, the dietary recommendations for TB patients are based on the nutrient and energy requirements for hyper catabolic and undernourished patients. The main objective of diet therapy is to prevent weight loss, strengthen the immune system and accelerate recovery. An adequate diet containing all essential nutrients namely carbohydrates, fats, proteins, minerals and vitamins is necessary

for the well being and health of the TB patient. The dietary recommendations and nutritional care and support for TB patients are highlighted in Table 4.

Table 4: Dietary considerations for tuberculosis

Dietary requirements	Recommendation/Justification	Dietary Considerations
Energy (Kcal) (Carbohydrates and Fats) Calorie intake increased by 300 - 500Kcal/day above the normal requirements.	High calorie diet helps: - to minimize weight loss - compensates for increased BMR, and - replenish the depleted nutrient reserves of the body.	Include *high carbohydrate and moderate fat i*n the diet. Diet should provide approximately 25–35% of energy as fat and 45–65% as carbohydrate Include energy-rich foods such as: - Whole grain cereals (wheat, rice, maize etc.), millets. - Vegetable oils (coconut, soyabean, mustard oil) and dairy fat like ghee, butter - Nuts (groundnuts, almond, cashewnuts etc.) and oil seeds - Sugar, jaggery Oils and fats help in increasing the energy density of the food without increasing the bulk of the diet.
Proteins (g) A high protein diet: 1.5g of protein/kg body weight/day from the usual 1g protein/kg body weight.	High protein diet compensates for: -massive loss of lean body mass (muscle) due to tissue (protein) breakdown leading to excessive nitrogen loss.	Good quantity and good quality protein (of high biological value) should be incorporated in liberal amounts in the form of: - milk and milk products (yogurt, soft cheese etc.) - eggs, tender meats, fish, and poultry. - Pulses, soya, nuts and some oilseeds Use of protein supplements is recommended to add on to the nutrient density without increasing the bulk of the diet. For vegetarians, combinations of cereal with pulses for improving the protein quality may be opted for. All meals should have cereal pulse combination with some animal protein, e.g., khichadi with curd, daliya with milk, missi roti with curd, egg with roti/rice etc.

Vitamins (B Complex vitamins, Vitamin A and Vitamin C)	Vitamins need to be emphasized considering: - the increase in the energy requirements, - a decreased ability of the intestine to assimilate and synthesize some of the B complex vitamin due to compromised digestive processes and altered microbial flora, - to boost immunity and favour wound healing, particularly vitamin C, and -for maintenance of epithelial mucosa (gut lining) vitamin A is required.	Vitamin supplementation may be given in the early stages of the infection when the patient is anorexic and has low food tolerance. Green leafy vegetables, yellow and orange coloured fruits and vegetables such as pumpkin, carrots, mango, papaya etc may be included Vitamin C rich food sources like amla, guava, drumsticks, cabbage, capsicum and citrus juice should be included liberally.
Minerals (Calcium, iron, zinc)	- To help heal the tuberculosis lesions - To compensate for iron (blood) loss due to hemorrhage or expectoration - To boost the immune system	Foods rich in calcium such as milk and milk products, pulses, beans, green leafy vegetables, nuts and oilseeds should be included. Intake of 500ml to 1 litre of milk is recommended (in different forms which can be well tolerated by the patient) to meet calcium needs. Calcium supplements with active form of Vitamin D may be needed. Iron rich foods including eggs, meat, poultry, fish, pulses, green leafy vegetables may help meet iron needs. Supplementation with iron is recommended in case blood haemoglobin levels are low.
Dietary Fibre	Restrict high fibre foods: -as these foods distress the digestive system and are mechanical irritants	Food options should be easy to digest and well tolerated.
Fluids (Daily fluid intake 10-12 glasses per day)	Liberal fluids intake is desired to: -compensate for the fluid losses in the body through skin and sweat -ensure adequate volume of urine to eliminate wastes, and -prevent dehydration and maintaining water balance .	Fluid intake can be accomplished through a variety of beverages, soups, juices, broths, dal, coconut water besides plain water.

Consistency of diet	Progressive diet needs to be followed:	-In the beginning, during acute phase, a *full fluid diet* (high calorie, high protein) is to be provided. - During chronic phase, as the patient improves, the diet is progressed to *semi-solid and then solid diet*. Note: Small frequent meals should be given throughout the day so as to provide adequate nutrition without overtaxing the digestives system at any one time.

Here are some recommendations on how to monitor weight gain in TB patients, particularly in children:

- Encourage the individual to eat healthy, nourishing balanced diet.
- TB often adversely affects nutritional intake due to poor appetite, making patients at risk for malnutrition. Encourage patients to consume six smaller meals per day instead of three.
- Make the meals appetizing in appearance and taste and provide enough energy and protein.
- Commercially-available high energy and protein drinks (balanced in terms of micro- and macronutrients) may be used effectively to meet the increased requirements.
- Household ingredients such as sugar, vegetable oil, peanut butter, eggs and non-fat dry milk powder can be used in porridge, soups, gravies, milk based-drinks to increase the protein and energy content without adding to the bulk of the meal.
- At least 500ml to 1litre milk (or milk product like yoghurt t, soft cheese) should be consumed daily to ensure adequate intakes of vitamin D and calcium.
- Ensure consumption of at least five to six portions of fruit and vegetables per day. Pure fruit juice can be used to decrease the bulk of the diet.
- Provide adequate fluid intake (at least 10 to 12 glasses per day) to compensate for increased losses
- Provide a good multivitamin and mineral supplement.
- Ensure safe food handling and personal hygiene.

Now, can you now summarize the dietary recommendation for a TB patient? Prepare a list of foods you may included liberally or restrict/avoid in the diet of a TB patient. Done? So now match your answer with the list of foods included in Table 7.

Table 2: Foods to include and to be restricted/ avoided in the diet of tuberculosis patient

Foods to include	Foods to avoid
➢ Cereals and millets (wheat, rice, Ragi, jowar etc.) ➢ Pulses (black channa, rajmah, soyabean etc.). ➢ High energy, protein drinks and beverages ➢ Foods providing proteins of high biologic value e.g. eggs, soft cheeses, tender meats, fish, poultry etc. ➢ Cereal pulse combination with some animal protein, e.g., khichadi with curd, daliya with milk, missi roti with curd, egg with roti/rice etc ➢ Nuts and oilseeds like peanuts. ➢ Seasonal fruits and vegetables ➢ Green leafy vegetables like methi, chaulai, shepu, mayalu, mint, spinach, cabbage, drumstick leaves, colocasia and cauliflower greens ➢ Citrus fruits (guava, amla, capsicum). ➢ Milk and milk products ➢ Vegetable oils (coconut, soyabean, mustard oil) and dairy fat like ghee, butter ➢ Jaggery, sugar.	➢ Red meat and organ meats (liver, kidney, brain) ➢ Limit refined foods like refined flour as they provide empty calorie and are devoid of nutrients ➢ Strongly flavoured vegetables like cabbage, capsicum, turnip, raddish, onion and garlic as they cause gas, bloating. ➢ Excess fat ➢ Fried fatty foods/preparations such as samosas, pakoras, puri, paratha etc. ➢ Sweet concentrated foods using excessive whole milk and fat including halwas, ladoos, pasteries, desserts etc. ➢ Acidic and spicy food such as pickles, relishes, chutneys, sauces, vinegar as they may irritate the intestine. ➢ Spices, condiments and seasonings like pepper, cayenne and chilli powder to ensure that the digestive tract does not inflame all the more

We end the dietary management of TB patients with some Do\s and Don’ts.

Table 3: Do’s and Don’ts

Do’s	Don’ts
1. Always wash vegetables and fruits with clean water before serving. 2. Wash hands frequently, particularly before eating or preparing food 3. Give plenty of fluids (10-12 glass/day) and electrolytes to	1. Do not serve large meals to prevent discomfort 2. Do not use excessive fat in cooking 3. Consumption of tobacco in any form avoided 4. Consumption of alcohol to be avoided.

compensate for losses. 4. Provide six frequent meals per day instead of usual three 5. Include 5-6 portion of fruits and vegetables in the diet each day 6. Include meals which are appetizing in appearance and taste 7. Include food options which are easy to digest and well tolerated 8. Provide a good multivitamin and mineral supplement	5. Caffeine, tea consumption avoided as they inhibit absorption of iron 6. Avoid close contact or sharing eating utensils, cups with people who are infected.

Prof. Deeksha Kapur, Discipline of Nutritional Sciences, SOCE, IGNOU, New Delhi