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# UNIT 3 NUTRITIONAL MANAGEMENT OF INFECTIONS AND FEVERS

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## 3.1 INTRODUCTION

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In this unit, we shall deal with defense mechanisms and the role of nutrition in managing fevers and infections caused due to impairment in the immune system.

Go through these two examples given below to have a brief idea of the kind of issues with which we shall deal in this unit.

Case I Shalini is a easy going college **student**, 19 years of age; extremely fond of snacking and trying out all varieties of food ranging from the “**dhabas**” to the “**branded**” ones. This summer she took ill... She had fever which she never monitored to begin with, but it kept on rising day by day. She was anorexic, felt bloated, complained of abdominal cramps and episodes of diarrhoea. She lost considerable weight. What do you think is the problem with Shalini?

Case II Ram Singh is a coolie. He stays in the adjoining **hutments** of the railway station which has bad drainage, poor lighting and ventilation. In the recent past, he has been suffering frequently from upper respiratory infection (cold, cough and mild fever). This has been continuing for the past 1 year. Now he has started feeling weak and his cough has worsened with thick sputum and sometimes blood in sputum. What do you think Ram Singh is suffering from?

- What are the **factors/conditions** which have led to this state for Shalini and Ram Singh?
- What is the basic difference between the two cases presented?
- How does the management of the two cases differ?

These are some of the questions which will be answered in this unit.

Infection, as you are already aware of, brings about many undesirable physiological changes which must be taken care of by proper nutrition care. How are these infections/ fevers classified? What metabolic changes occur during such conditions?

These are the issues which we will review in this unit. Finally, we will focus on the etiology, clinical manifestations and dietary management of different types of infections, including typhoid and HIV-AIDS.

### Objectives

After studying this unit you will be able to:

- discuss the various defense mechanisms in the body which protect us from infections,
- explain the relationship between nutrition and infection,
- differentiate between acute and chronic infections,
- identify the symptoms associated with some common acute and chronic infections and their physiological significance, and
- describe the dietary management of acute and chronic infections.

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## 3.2 DEFENSE MECHANISM IN THE BODY

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You would recall reading about defense mechanisms in the course of Applied Physiology (MFN-001) in Unit 3. What is meant by defense mechanism? What is its role? How does it function? Let us review once again.

Defense *mechanisms* relate to the body's ways to protect itself from any infection or a disease. These mechanisms can be:

- A) *Non specific*: These relate to the physical barriers like skin and mucous membrane. They form the first line of defense against entry of microorganisms or foreign substances in your body. Various body secretions, intestinal flora, iron binding proteins, certain nutrients like vitamin A, vitamin C, protein and zinc, hormonal influences and leukocytes (WBC) act against infections.
- B) *Specific*: These relate to specialized cells located throughout the body which respond to invasion of foreign materials/microorganisms such as bacteria, virus, fungi or unwanted substances produced or entering the body. Some specific cells are fixed in tissues such as thymus, lymph nodes, bone marrow, spleen, lymphoid tissue of the respiratory, gastrointestinal and genitourinary tract, Kupffer cells of the liver and Peyer's patches of the small intestine.
- C) *Others*: These include the mobile cells such as leukocytes and lymphocytes. They are released in the blood and are carried to the site where they are needed when the microorganisms invade the tissue.

The specific immune (defense mechanisms) response can be broadly classified into two types:

- a) Cell mediated *immune* response: This is achieved through large number of activated lymphocytes that are specially designed to destroy foreign agents e.g. the T lymphocytes produced by the thymus.
- b) *Humoral immune* response: The body develops circulating antibodies which are globulin molecules that are capable of attacking the invading agents. B lymphocytes are produced by lymphoid tissue.

We suggest you look up Unit 3 in the Applied Physiology Course to understand these immune responses before you read further about the relationship between nutrition and infection.

### 3.3 NUTRITION AND INFECTION

The interaction between nutrition and infection is synergistic – that is nutritional deficiency lowers resistance to infection and infection aggravates existing malnutrition. Individuals who are chronically undernourished not only succumb to infection more readily but take a longer period to recover than do the well nourished. There are series of studies to show the specific roles of nutrients like vitamin A, vitamin C, vitamin E, omega 3 fatty acids, trace minerals like iron, zinc which have a role either in terms of maturation, number and/ or activity of T cells and B cells. These have an influence on the cellular and humoral immunity. If you wish to go into the details of specific role of individual nutrients in the immune process, you could refer to some additional references listed, at the end of this course.

Malnutrition, impaired immunity and infection can form a triad or vicious cycle, as illustrated in Figure 3.1, which works synergistically and thus worsens the condition of an individual. For example, a patient suffering from typhoid if not provided with good nutritional support, would deteriorate his nutritional status and develop nutrient deficiencies which would be detrimental to the immune system. An impaired immune system would increase the susceptibility to infections.

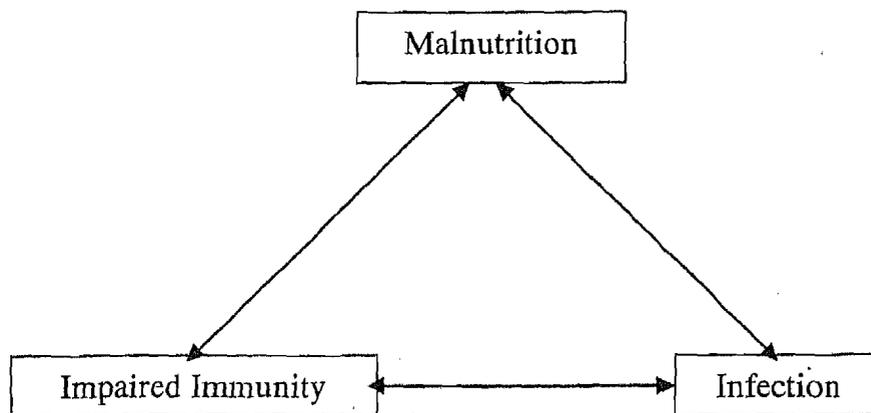


Figure 3.1: Synergism of malnutrition and Infection

So the synergism of malnutrition and infection must be clear. Next, let us see what metabolic changes occur during infection which impact on our nutritional needs.

### 3.4 METABOLIC CHANGES DURING INFECTION

With the rise in body temperature above normal (98.4°F or 37°C) due to infection several metabolic changes occur in the body that increase nutritional needs. Some important changes are discussed below:

- 1) The Basal Metabolic Rate (BMR) increases in severe infection with fever. There is a 7% increase in BMR with every 1°F increase in body temperature or 13% increase in BMR with every 1°C rise in body temperature. The energy needs are estimated to be 20% above BMR for mild infections and 70% above BMR for severe infections. Injury factors can also be taken into consideration to workout the exact calorie expenditure.
- 2) Nutrient losses may be increased due to increased perspiration, vomiting and diarrhoea. Minerals like sodium, potassium, zinc, magnesium and phosphorus are lost by the body.
- 3) Infection and fever sets in an environment of catabolism (breakdown) in the body. Infection can be related to a state of physiological stress. The body responds to this stress by altering the levels of several hormones to meet the increased requirements (*Acute Phase Response*). Increased levels of glucocorticoids,

growth hormone, catecholamines, glucagon work synergistically to increase glycogenolysis (breakdown of glycogen) and gluconeogenesis (formation of glucose from non-carbohydrate sources). In addition, increased insulin levels and insulin resistance at the cellular level decreases the ability of the body to utilize carbohydrates as substrate for energy. Thus, body favours protein breakdown (catabolism) followed by fat breakdown (lipolysis) as the major substrate for meeting the energy requirements. Branched chain amino acids (leucine, isoleucine and valine) are used as major substrate for energy by the liver through the process of transamination (transfer of amine group), deamination (removal of NH<sub>2</sub> from amino acid) followed by gluconeogenesis. The muscle breakdown favours nitrogen excretion and sets in a state of negative nitrogen balance (Excretion > Intake). The rate of protein breakdown (catabolism) increases depending upon the severity of the infection and the duration of fever. There are increased losses in long continuous fevers than in short duration fevers. Protein breakdown is especially marked in fevers such as typhoid, malaria, poliomyelitis and tuberculosis. This leads to increased nitrogen wastes and places an additional burden on the kidneys.

- 4) Infection and fever is invariably accompanied by anorexia (lack of appetite) which limits the food intake causing decreased energy intake which is not sufficient to meet the increased energy requirements. Thus leading to weight loss which particularly marked in severe infections.
- 5) The absorption of nutrients also decreases if there are intestinal infections.
- 6) Excessive sweat and urination causes further loss of body fluids and electrolytes. This can be an outcome of severe infection with high fever. The sweating occurs in response to high fever while the volume of urine is increased for elimination of nitrogen wastes produced due to catabolic activities.
- 7) Glycogen and adipose tissue stores decrease significantly due to increased energy expenditure.

The above changes accompanied by loss of appetite, increase in energy needs, losses of protein due to catabolic activities, loss of fluid or electrolytes due to perspiration, vomiting and diarrhoea or poor absorption of some nutrients leads to loss of weight. Poor eating precipitates loss of weight particularly if the infection is prolonged. Thus infection may have a significant effect on nutritional status. The extent would depend on the following factors:

- a) Nature of infection
- b) Severity of the infection
- c) Duration of the infection
- d) Presence or absence of fever, and
- e) Nutritional state of the individual before the infection sets in.

Next, let us review how fevers are classified.

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### 3.5 CLASSIFICATION AND ETIOLOGY OF FEVER/INFECTION

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Infection and fevers can be classified into two broad categories.

- a) *Acute Infections/Fever:* Acute fevers are of short duration with acute symptoms, the body temperature may rise to above 104°F. Examples of such infections are chickenpox, tonsillitis, influenza, pneumonia, typhoid and malaria.
- b) *Chronic Infections/Fever:* These are generally of longer and sustained duration. The patients have a past history of repeated episodes or continued spells of infection, Such infection may be characterized with a low-grade fever, which

continues for even several months as in the case of tuberculosis. Thus chronic fever is the one, which has a slow, gradual onset and may be low grade in nature. Examples of chronic fever infections include tuberculosis, HIV infection and AIDS.

Fevers can also be intermittent or cyclic in pattern and they are associated with infections like Malaria.

**INFECTION AND FEVERS ARE COEXISTENT. FEVER IS AN OUTCOME OF THE INFECTION.**

You must have had fever sometime in your life. Do you remember? What caused it? In other words, what was the etiology of the fever? A number of internal (endogenous) and external (exogenous) factors play a role. Let us see what they are.

*Etiology*

Fevers can be caused due to

1. *Internal (endogenous) factors:* This could be caused within the body. Examples are antigen-antibody reactions, malignant cancer, graft rejections.
2. *External (exogenous) factors:* These are caused by bacteria, fungi, virus etc. which invades the body. The cause is from a source outside the body. Fevers caused by these external factors can be seen in the flow chart given in Figure 3.2.

**BACTERIA, FUNGUS, VIRUS**

Infection due to bacteria, fungi or any antigenic input

Activation of phagocytes in the bone marrow

Release of pyrogen (fever inducing hormone)

Synthesis of prostaglandins (hormone like substance)

Thermo regulatory center in the anterior hypothalamus

Increase in temperature

**Figure 3.2: Development of fever exogenous factor**

So far in this section we have discussed about the basic concepts and inter-relationship between fever, infection and their association with nutrition. In the subsequent sections we shall be discussing about some common infections such as typhoid, tuberculosis and HIV-AIDS to help you in gaining an in-depth understanding regarding the care of patients with acute or chronic infections and fever. However, let us first perform the check your progress exercise before proceeding further.

**Check Your Progress Exercise 1**

1. What is a defense mechanism? What are its two major types?  
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2. 'Malnutrition and Infection' form a vicious cycle. Explain giving an example.  
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3. Enumerate any five metabolic changes occurring in the body as a consequence of infection.  
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4. Discuss the etiology of fevers.  
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5. Fill in the blanks:
  - a) The two physical barriers which form the first line of defense against the entry of microorganisms are .....and .....
  - b) The cells involved in Cell mediated immunity are ..... and in Humoral immunity are.....
  - c) In severe infection, the BMR increases by ..... % for every 1°C rise in body temperature.
  - d) The two broad categories of fever are .....
  - e) ..... and ..... are utilized as the substrates for meeting energy requirements during fevers.

Now that you have a general idea about fevers and infections, let us get a little more specific and study in details about some acute and chronic infections/fevers.

### 3.6 TYPHOID

Typhoid is often called *enteric fever* because the infection or bacteria is found in the intestines and attaches itself to the epithelium of the intestinal wall where it multiplies or finally reaches the blood causing damage and increase in the body temperature.

Typhoid is an enteric fever, which relates to acute infection of short duration. It is caused by bacteria called *Salmonella typhosa* about which you may recall studying in the Food Microbiology and Safety Course (MFN-003) in Unit 5, sub-section 5.4.1. The mode of spread of this infection is through the fecal-oral route. The source of infection is the drinking water, milk and food contaminated by intestinal contents (through feces and urine) of the patients or "carriers" or by flies which transmit the disease. It may affect all age groups but is commonly observed in children. The incidence and magnitude of typhoid fever has greatly reduced in the present context due to improved sanitation and vaccines and effective drugs available.

It is important for you to understand that this fever has a number of adverse effects on the body as it is extremely catabolic in nature, thus in no time it causes weakness, and compromised state of nutrition causing tremendous weight loss.

Some observations seen in this fever are:

1. Massive loss of lean body mass or muscle due to tissue breakdown (250-500 g muscle tissue is lost/day) leading to excessive nitrogen losses.
2. Body stores of glycogen are quickly depleted because of increased energy requirements.
3. The gastrointestinal tract is highly inflamed and irritable as the seat of typhoid infection is the Peyer's patches of the intestine. The bacteria attaches to the epithelium of the intestinal wall, penetrates and multiplies in the mesenteric lymph nodes, eventually reaching the blood stream which in turn leads to secondary infection of the intestines.
4. Excessive diarrhoea, vomiting and perspiration can cause a lot of fluid and electrolyte losses.
5. Inflammation of GI tract can lead to intestinal ulceration and bleeding.

Clinical symptoms of typhoid are:

1. Graded fever which follows an upward ladder pattern.
2. Abdominal pain, cramps and diarrhoea.
3. Anorexia and vomiting.
4. Internal haemorrhage and melena (gastrointestinal bleeding and black tarry stools)

Management of the typhoid patient includes:

1. Bed rest
2. Antibiotic therapy
3. Modification of diet

We should leave the antibiotic/drug therapy to a physician but we can learn more about the dietary management in the following text.

### ***Dietary Management***

The golden rule in the dietary management of any fever is "feed the fever". Considering that enteric (typhoid) fever is accompanied by anorexia, vomiting and high grade temperature, the diet has to be modified as per the patients' tolerance. The patient needs to be encouraged to eat. Feeding several times a day improves tolerance. The texture of foods given would depend on the severity of infection. Bland, low fibre and soft foods are beneficial.

The dietary principles underlying the enteric diet include:

- High calorie
- High protein
- High carbohydrate
- Moderate fat
- High fluid
- Low fibre and soft diet

Now let us go further in details on the specifications of each nutrient and the basis for working the requirement of the same for the given condition.

**Energy:** Fever is characterized by elevation of BMR, thus caloric requirements are increased. The increase in caloric needs is dependent on severity of infection and degree of rise of temperature. During fevers there is a decrease in appetite, as well as, a decreased tolerance due to enteric infection, thus a desired increase in calories is 10-20% above the normal recommended requirements. The actual intake can be adjusted and given as per patients' tolerance.

**Protein:** The requirement of protein is increased in typhoid, as there is a massive tissue loss. Thus, the protein intake should be increased above the normal of 1g/kg/day to 1.5-2g of protein/kg/day. A high protein diet should be supported with a high carbohydrate intake to favour efficient protein utilization for anabolic or tissue building purposes. Foods providing appreciable and good quality protein (high biological value) should be incorporated in liberal amounts. Use of protein supplements is recommended to add on to the nutrient density without increasing the bulk of the diet,

**Carbohydrates:** Carbohydrate intake should be liberal. This can be attributed to:

1. Repletion of glycogen stores.
2. Protein sparing action.

Well cooked, easily digestible carbohydrates like simple starches, glucose, honey, jam should be included as they require much less digestion and are well assimilated. Glucose can be supplemented in a variety of beverages/light desserts as it is less sweet than sucrose and adds on to the total calorie intake.

**Dietary fibre:** Typhoid patient has an inflamed intestinal mucosa, which can be easily perforated and ulcerated leading to internal haemorrhage. Thus foods high in fibre such as certain green leafy vegetables, whole pulses or cereals, thick skins or fruits or vegetables must be avoided. (These are rich in insoluble fibres). Soluble fibres can be given.

**Fats:** Use of fats should be in moderation. This is because the typhoid patient has a compromised ability to digest and assimilate due to Peyer's patches (elongated thickening of the intestinal epithelium) which result in repeated episodes of diarrhoea. Fats help in increasing the energy density of the food without increasing the bulk of the diet, but the aspect which needs to be emphasized is the type of fat. Use of dairy fats like butter, cream, fats in milk products, egg yolk etc. help in easy digestion as they contain medium chain triglycerides. Excessive use of fat in cooking, eating fried foods can aggravate nausea, impair digestion and lead to severe diarrhoea. These should be avoided.

**Minerals:** Loss of electrolytes and water is observed due to diarrhoea. Thus 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. Food preparations in forms like juices, stews, soups and dal water are beneficial. The other minerals, which are of importance, include iron particularly if blood is lost due to haemorrhage in the intestines. Losses of zinc and chromium have also been observed.

**Vitamins:** Vitamins which need to be emphasized include B complex, considering the increase in the energy requirement and 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. As a result, antibiotics are prescribed. In addition, vitamins A and C are also needed to boost immunity, favour wound healing and maintenance of the integrity of epithelial membrane (gut mucosa). Vitamin supplementation may be given in the early stages of the infection when the patient is anorexic and has low food tolerance.

**Fluid:** Liberal fluid intake is desired to compensate for the fluid losses from the body. A daily fluid intake of 2.5 to 3.5 litres may be recommended. Fluid intake can be

accomplished through a variety of beverages, soups, juices, broths, dal besides plain water. Adequate fluid intake helps in eliminating wastes and maintaining water balance in the body.

So remember the foods to be included are:

- a Juices, soups, dal water, broths.
- a Refined cereals and their products (e.g. maida, rava, bread, rice, noodles, washed dals, pureed vegetables, stewed fruits). These foods contain low insoluble fibre.
- a Eggs, cottage cheese, tender steamed or baked chicken, fish. These contain high biological value proteins.
- a Fruit juices, gelatin, honey, sugar and milk products. Calorie and protein-rich desserts could be prepared.

Foods to be restricted include:

- Excessive milk and milk products and dairy fats such as cream and butter.

Foods to be avoided are:

- High fibre foods like whole grain cereals and their products (e.g. whole wheat flour, cracked wheat, whole pulses)
- Raw vegetables and fruits
- Fried fatty foods
- Chemical irritants like spices, pickles, papad, ketchups etc.

Now answer the questions given is check your progress exercise 1 and recapitulate what you have learnt so far.

### Check Your Progress Exercise 2

1. Why is typhoid called an enteric fever'?

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2. Discuss the adverse effects of typhoid fever on the body.

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3. List the salient features of the diet given to a typhoid patient?

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4. Suggest two snacks for a typhoid patient and justify your selection?

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Next, we shall review the chronic fevers and see how dietary management of these differ from the acute fevers.

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## 3.7 CHRONIC FEVER/INFECTION

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As mentioned earlier, chronic fever and infection are always supported with a long standing history of symptoms or repeated episodes of infection. One of the commonly observed chronic infections is tuberculosis. Let us understand the treatment and management of this chronic infection.

### 3.7.1 Tuberculosis

Tuberculosis is a chronic infectious disease which is caused by a bacterium - *Mycobacterium tuberculosis*. It affects the lungs most commonly 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.

The prevalence of tuberculosis earlier was restricted to lower socioeconomic strata being attributed to poor hygiene, sanitation and poor quality of food intake. The present scenario reveals an increasing incidence of tuberculosis in people from higher socioeconomic strata as well. A strong genetic history gets highlighted in most of the cases. This disease presents itself in an acute and a chronic phase.

In the acute stage, the disease is quite similar to that of acute fever and the chronic phase to that of chronic fever. The chronic phase is accompanied by low grade fever and therefore increase in metabolic rate is not so marked. The long duration of illness in turn leads to wasting of body tissues.

The symptoms, treatment and dietary management are enumerated next.

#### A. Salient Features of Pulmonary Tuberculosis:

The salient features tuberculosis include:

- o Wasting of tissues
- Exhaustion
- o Cough
- Expectoration, and
- Fever

The acute phase, resembles pneumonia with high fever. The chronic phase presents itself with low grade fever, accompanied with exhaustion, cough, expectoration and loss of weight. The progression of the disease may be slow with gradual worsening of the cough. This can lead to erosion of the blood vessel of lungs. The tubercle bacteria may thus subsequently get access to other body organs, thereby, establishing numerous secondary foci of infection.

#### B. Treatment

The disease can be very effectively treated with the help of antibiotic therapy, rest and nourishing food. The key to the treatment is early detection of the disease.

The antibiotic therapy given should be continued for the stipulated period of time (6 months to 1 year), inspite of the waning of the symptoms. A clinically recovered tuberculosis case can still be a carrier and thus a relapse of the disease is likely if the antibiotic therapy is not followed the right way.

Let us now proceed over to the nutritional care of patients suffering from tuberculosis.

### C. Dietary Management

It must be evident to you that majority of the tuberculosis patients are emaciated and malnourished. Proper dietary management during and after the infection is essential to ensure complete treatment, proper rehabilitation and prevention of relapse. Let us review the energy and nutrient requirements of the patient.

**Energy:** The criteria to establish the energy intake is the body weight status coupled with the rise in body temperature. Considering that the BMR is not highly elevated in the chronic stage of the disease the energy intake may be increased by 300-500 Kcal/day above the normal recommended intake.

**Protein:** Achronic infection is marked by a prolonged duration of fever. This leads to wasting of muscles, increased nitrogenous loss and a subsequent decrease in serum albumin levels. Thus, the chronic stage of the disease needs to be supported with a high protein intake. A level of 1.2 to 1.5 g protein/kg body weight/day should be given. Emphasis should be on energy and protein dense foods coupled with high biological value of protein rich sources to favour its effective utilization. If the disease is observed in the low socioeconomic strata, selection of cheaper options of protein dense foods like pulses, soya, nuts in combination with coarse cereals for mutual supplementation may be opted for.

**Carbohydrates:** Adequacy of carbohydrate will also favour the optimal utilization of proteins. To favour the process of anabolism a total calories to nitrogen ratio of 150:1 should be achieved in a high calorie high protein diet. Carbohydrate being the most preferred substrate of energy by the body has a protein sparing effect.

**Fats:** Fats add to the calorie density of the diet. Digestibility of fats (medium chain triglycerides and emulsified fats should be preferred) and fat based preparations should be considered.

**Vitamins:** The vitamins of significance for a tuberculosis patient include:

- a) **Vitamin A:** The preformed vitamin A or the retinol form of vitamin A needs to be emphasized in the diet of TB patient as the metabolism of vitamin A is adversely affected. Carotene appears to be poorly converted to vitamin A. Considering that the retinol form is restricted to milk, milk products, dietary fats and animal foods, vitamin A supplement may be recommended.
- b) **Vitamin B complex:** The requirement of the B-complex vitamin increases with an increase in the energy requirement of the tuberculosis patient. The salient ones out of the B complex group are pyridoxine, folic acid and vitamin B<sub>12</sub>. Neuritis (inflammation of peripheral nerves) can be prevented by treatment with 50 to 100 mg/day dose of pyridoxine. Folic acid and vitamin B<sub>12</sub> is also supplemented.
- c) **Vitamin C:** Vitamin C helps in collagen synthesis and helps healing of the tubercle lesions. Rich vitamin C food sources like amla, guava, drumsticks, cabbage, capsicum and citrus juice should be included liberally in a tuberculosis patients' diet.

**Minerals:** The minerals to be emphasized in the diet of a tuberculosis patient include:

- 1) **Calcium:** Calcium intake needs to be increased since it is essential for healing the tuberculosis lesions. Intake of half a litre to 1 litre of milk is recommended in different forms which can be well tolerated by the patient. Calcium supplementation (500 mg/day) with active form of vitamin D may also be prescribed.
- 2) **Iron:** The need of iron may be a concern in case of blood loss associated with expectoration or haemorrhage. The patient's haemoglobin levels should be

monitored. The diet should be tailored as per the needs. Supplementation with iron is recommended in case blood haemoglobin levels are low.

- 3) The other minerals of significance are zinc and chromium. These minerals help in boosting the immune system. Losses of these are seen in the patients having tuberculosis.

*Other considerations*

- i) The diet should have good amount of fluid and electrolytes especially potassium.
- ii) Fibre need not be restricted but the food options should be easy to digest and well tolerated.
- iii) Frequent nutrient-dense feeds are recommended. Force feeding is not desired.
- iv) Anormal dietary pattern needs to be followed with a wise, balanced and nutritious selection of foods.

Let us conclude the discussion by highlighting the foods to be included or restricted in the diet of a tuberculosis patient.

*Foods to be included:*

- Cereals ( Ragi, jowar, bajra).
- Pulses (black channa, chawli, moth, rajrnah).
- Nuts and oilseeds.
- Green leafy vegetables like methi, chaulai, mint, spinach, cabbage, drumstick leaves, colocasia and cauliflower greens.
- Citrus fruits (guava, amla, capsicum).
- Milk and milk products.
- Jaggery, sugar.

*Foods to be restricted*

Excess fat, fried preparations, organ meats (liver, kidney, brain), red meat and refined sugars.

You shall learn more about the principles of dietary management and planning of diets for acute and chronic infections in the Clinical and Therapeutic Nutrition Practical Manual (MFNL-005).

**Check Your Progress Exercise 3**

- 1. Why is tuberculosis called a wasting disease?

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- 2. Why is it important to complete the treatment of tuberculosis?

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- 3. List the importance of vitamins in tuberculosis.

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4. Suggest two high calorie high protein snacks for patients suffering from tuberculosis?

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The second chronic infection covered in this unit is HIV and AIDS. Let us learn about this acute syndrome, next.

**3.7.2 HIV (Human Immuno Deficiency Virus) Infection and AIDS (Acquired Immune Deficiency Syndrome)**

HIV/AIDS is another example of chronic infections. Its existence was discovered recently in 1981. The spread of HIV infection is widespread and can progress to AIDS. It has been shown to be caused by a retrovirus since it is one of the most dreaded infections and is growing at a rapid rate. Let us gain some more knowledge about it.

*Manifestations of HIV infection*

Four stages of HIV disease have been recognized. These are:

- e Acute HIV infection
- e Asymptomatic HIV infection
- Symptomatic HIV infection

**AIDS**

A brief review on these stages follows:

● *Acute HIV Infection*

This period is 4-7 weeks after the primary infection. During this period, there is a rapid viral replication and the infected person develops an acute syndrome, characterized by fever, malaise, pharyngitis, headache, lymphadenopathy syndrome (swollen, firm and sometimes tender lymph nodes), influenza or cancer of lymph nodes; myalgia (muscle pain/weakness).

e *Asymptomatic HIV*

In asymptomatic HIV, very few symptoms may appear which are noticeable. This stage could even last for 10 years. Sub-clinical symptoms have been reported such as decrease in lean body mass without apparent change in weight. There is an increased susceptibility to food and water-borne pathogens.

● *Symptomatic HIV*

In this, the AIDS defining symptoms appear. A decline in nutritional status and body composition may occur. Fevers, sweating, skin problems and fatigue may be seen.

● **AIDS**

The term AIDS encompasses life threatening clinical conditions linked to HIV induced immune suppression. A small portion of persons infected with HIV may develop AIDS within months following primary infection. AIDS is the terminal stage of HIV. Infections with bacteria, virus, fungi and protozoa are common. They are often the cause of diarrhoea, malabsorption, fever and weight loss. Malignant disease such as Kaposi's Sarcoma, neurological disorders (HIV encephalopathy) myelopathy

and peripheral neuropathy and myopathy lypodystrophy or lymphadenopathy may be seen. Many other organs can be affected such as the gastrointestinal tract, liver, kidney and pancreas. *Mycobacterium avium* complex can be seen in the lymph nodes, liver, bone marrow, blood and urine of patients. Most cases are affected by tuberculosis of the lungs. Acute renal failure is seen in many subjects. Chronic diarrhoea may persist in the absence of identifiable enteric pathogens as a result of AIDS enteropathy.

Malnutrition is an important complication of AIDS. Protein energy malnutrition is seen as weight loss, body cell mass depletion, decreased skinfold thickness, decreased midarm circumference, decreased iron binding capacity and hypoalbuminemia. AIDS wasting syndrome is commonly reported.

So you could see for yourself the myriads of complications and disease conditions which an AIDS patient suffers from. We would like you to understand a little more about some of the symptoms/complications that have been mentioned above.

*Kaposi's sarcoma:* This is a malignant disease of the peripheral blood mononuclear cells which manifests itself as purple nodules on the skin, mucous membranes, lymph nodes and throughout the gastrointestinal tract. These purple nodules in the oral cavity or oesophagus lead to pain and difficulty in chewing or swallowing. If in the intestinal tract, they can cause diarrhoea and even intestinal obstruction. Lymphomas, including non-Hodgkin's lymphoma can involve the small intestines and cause malabsorption, diarrhoea and intestinal obstruction. If the lymphoma is in the brain, it can cause alterations in personality (psychosis, depression and withdrawal) and motor and cognitive abilities, carcinomas of colour and tongue are also seen.

#### *Neurologic Diseases*

If the HIV enters the brain, it may result in AIDS dementia. Myelopathy (disease of the spinal cord) can result in paralysis of the lower extremities. Myelopathy affects the motor and sensory functions leading to spasticity, weakness in legs.

Peripheral neuropathy is characterized by sensory loss, pain, weakness and wasting of muscles in the hands, legs and feet. The first signs are tingling, burning, numbness in toes and fingers.

*AIDS wasting disease.* It is a diagnose for AIDS in the HIV positive individuals for whom no other cause of the symptoms can be identified. It is characterized by persistent fever, chronic fatigue, malaise and diarrhoea of unknown etiology. Weight loss of 10%-15% is common.

*Lypodystrophy:* This is a disturbance of fat metabolism that involves the loss of the thin layer of fat making veins visible and protruding. Wasting of the face and limbs and accumulation of fat in the abdomen and between the shoulders is an important feature.

*Lymphadenopathy syndrome :* The lymph nodes are swollen, firm and sometimes tender causing a range of infections such as HIV, influenza or even lymphoma (cancer of lymph nodes).

Today several retroviral drugs are available to destroy HIV or suppress its replication. Management after a viral load test which measures the quantity of free virus circulating in the blood stream as CD-4 and T-cells can make the treatment comprehensive and focussed on likelihood of developing AIDS. CD-4 cells, also known as T-cells are essential components of the defense mechanism against infectious diseases. Table 3.1 gives some idea of the CD-4 cell count, the conditions, common problems and symptoms associated with it.

Result of CD-4 tests are used to plan appropriate treatment measures and medical intervention.

**Table 3.1: Condition associated with CD4 + cell count in HIV infection**

CD-4 Cell Count	Conditions and Symptoms	Common Physical Problems
200-500/mm <sup>3</sup>	Oral thrush, Kaposi's sarcoma, tuberculosis reactivation, Herpes zoster, Bacterial sinusitis or pneumonia.	Loss of appetite, white plaques, taste changes, mouth discomfort. Raised purplish lesions on the skin, mucous membranes, or lymph nodes (usually painless). Cough, blood-stained sputum, fever, night sweats, weight loss, chest pain and fatigue. Herpes causes painful vascular lesions on skin, inflammation of the nasal cavity and congestion due to fever,
100-200/mm <sup>3</sup>	Herpes simplex or pneumonia	Weeping skin lesions (oral and perirectal), bleeding, rectal discharge, pain, fever, chills, night sweats, cough, shortness of breath, antibiotic side effects, weight loss and weakness.
50-100/mm <sup>3</sup>	Systemic fungal infections, meningitis, tuberculosis, infection (protozoal) of small and large bowels. Progressive multifocal leukoencephalopathy, peripheral neuropathy and cervical carcinoma	Headache, fever, malaise, nausea, fatigue and loss of appetite. Weight loss, skin lesions, difficulty in breathing, anaemia, pneumonia, cough, blood in sputum, night sweats, weight loss, chest pain, fatigue and anorexia, Severe chronic watery diarrhoea (up to 15-20 times a day), severe weight loss, electrolyte imbalance, abdominal cramping, fever, nausea, vomiting and enlarged lymph nodes. Progressive weakness and dementia, speech problems, forgetfulness, visual problems, incontinence. Painful burning feet, numbness in feet and/or hands and vaginal discharge.
0-50/mm <sup>3</sup>	Cytomegalovirus disease bacterial (mycobacteria), Non-Hodgkin's lymphoma, AIDS, dementia	Blindness or visual loss, fever, fatigue, malaise, weight loss, racial oedema, enteritis or colitis, fever, severe weight loss, cachexia, diarrhoea and malabsorption. Mumps, fatigue and pain. Loss of coordination, mood swings, loss of inhibitions, cognitive dysfunction.

(Adapted from Martin J, Hughes A, Franks P, *AIDS Home Care and Hospice Manual*. 2nd ed. San Francisco Nurses and Hospice of San Francisco. 1990. and Phair JP, Murphy R. *Contemporary Diagnosis and Management of HIV/AIDS infections*. Health Care Co., 1997).

Now that we are clear about HIV/AIDS and the complications linked with it, let us move further and learn about the etiology, prevalence, diagnosis and medical nutrition therapy for this chronic infection.

### A. Prevalence, Etiology and Pathophysiology

More than 21 million people throughout the world suffer from HIV. The conservative forecast of WHO (World Health Organization) is that a minimum of 30-40 million people worldwide will be infected with AIDS by the end of the decade. Currently the infected umbrella spreads in a descending order to sub saharan Africa, South -Latin America (Caribbean) North America, Middle East, Western Europe, Eastern central Asia, China, Japan etc. The overall incidence in the country is about 0.1 percent (Delhi AIDS control Society 10<sup>th</sup> September, 2003).

Primary infection with HIV is the underlying cause of AIDS, This invades the genetic code of CD-4 cells or T helper lymphocyte cells. Infection occurs from an infected person through body fluids such as blood, semen, vaginal secretions and lymph system

and the central nervous system. The virus (HIV) causes progressive depletion of CD-4 cells. This leads to immune deficiency and other complications finally leading to AIDS. Even breast milk, saliva, tears and urine contain enough virus to infect human beings. Unprotected sex, sharing of contaminated needles, across the placenta to the baby are common ways of getting in touch with infected body fluids. Workers must take precautions for themselves or others when working with **body fluids**. The virus is not transmitted by causal contact, touching, hugging, kissing or **sharing utensils, glasses** etc.

It is uncertain whether all HIV infected persons develop AIDS. Reports indicate about 5% of HIV infected individuals exhibit no signs of progression to AIDS.

### **B. Diagnosis of HIV Infection**

The first step is ELISA (Enzyme Linked Immunosorbent Assay) **Screening**. The second step involves western **Blot Testing** for confirmation of suspected positive samples. Both the tests are highly sensitive and specific. This is associated with the clinical symptoms that may vary with the stages of disease.

### **C. HIV Medical Management**

The goals of medical management of HIV are to:

- prolong life and improve the quality of life,
- suppress the virus to as low a level as possible,
- optimize and extend the usefulness of currently available therapies, and
- minimize drug toxicity and manage side effects.

Disease progression differs from an individual to individual therefore treatment decisions must be individualized keeping in mind the stages.

AIDS IS THE FINAL STAGE OF HIV. IT OFTEN CAUSES SEVERE PROTEIN ENERGY MALNUTRITION AND IS OFTEN KNOWN AS AIDS WASTING SYNDROME.

### **D. Malnutrition and AIDS**

Malnutrition is an important and complicated consequence of HIV infection. It normally manifests as:

1. **Protein Energy Malnutrition:** associated with weight loss, body cell mass depletion, decreased skinfold thickness and mid-arm circumference, decreased iron binding capacity and hypoalbuminemia.
2. **AIDS wasting syndrome:** associated with the involuntary weight loss of 10% baseline body weight plus either chronic diarrhoea (2 loose stools /day for more than 20 days) or chronic weakness and documented fever (for 30 days or more, intermittent or constant) in the absence of an associated illness or condition that would explain the findings. It may be associated with the following:
  - a) **Inadequate food intake:** Associated with disorders of mouth and oesophagus such as candidiasis, herpes simplex, severe anorexia, secondary to medication, depression, infections. In addition, other contributory factors would be nausea, vomiting, dyspnoea, fatigue or neurologic disease.
  - b) **Malabsorption of nutrients:** The malabsorptive symptoms have been related to both drug diet interactions and the progressive effects of HIV infection. An AIDS enteropathy in the early stages of infection is characterized by blunting of the intestinal villi, abnormal intestinal enzymes that cause clinical malabsorption. HIV infection infiltrates lymphocytes, as well as, enterocytes which make the gut more prone to infections, leading to severe diarrhoea and malabsorption.

- c) **Disordered metabolism**: Relates to hypermetabolism or "Altered" energy metabolism - usually associated with end stage effects of the HIV infections, as well as, increased spread of several infections. There is a progressive depletion of lean body mass, as well as, increase in REE (Resting Energy Expenditure). Energy metabolism is altered as cycling of fatty acids is associated with increased serum triglycerides levels, the catabolism of skeletal muscle as an endogenous sources of energy and elevated levels of the cytokine alpha interferon produced by the cells of the immune system. The metabolic picture is unlike simple starvation in which body fat is oxidized for energy.

Studies indicate that as the wasting of lean body mass nears 55% normal for age, sex and height in persons with AIDS death is imminent regardless of the cause of malnutrition. Body fat is not a predictable marker of wasting in individuals with AIDS, especially men tend to lose body cell mass with little loss of fat in contrast to uncomplicated starvation in which fat stores are depleted.

Malnutrition may contribute to the frequency and severity of infection seen in AIDS by compromising immune function. Deficiencies of protein, calories, copper, zinc, selenium, iron, essential fatty acids, pyridoxine, folate, vitamin A, vitamin C and vitamin E all interfere with immune function. Severe weight loss can also result in organ damage which may increase the risk for a fatal outcome from infections.

Now let us understand the medical nutrition therapy for AIDS.

### E. Medical Nutrition Therapy

The general goals of nutrition intervention are to:

- preserve optimal protein status,
- prevent nutrient deficiencies or excesses known to compromise immune function,
- minimize nutrition related complications that interfere with either intake or absorption of nutrients,
- support optimal therapeutic drug levels,
- enhance the quality of life, and
- educate patients on importance of balanced diet or how to improve nutritional status.

Table 3.2, presents the screening criteria for medical nutrition therapy in HIV-infected adults and adolescents older than 18 years of age.

**Table 3.2: Screening for medical nutrition therapy in HIV-infected adults and adolescents older than 18 years of age.**

<i>Referral is automatic when any one of the following conditions exist :</i>	
1.	Newly diagnosed HIV infection or never been seen by a registered dietitian
2.	If asymptomatic: not seen by a registered dietitian in the past 6 months to 1 year
3.	Newly diagnosed HIV with symptoms or AIDS
4.	If HIV with symptoms or AIDS: not seen by a dietitian in the past 6 months or more
5.	>5% unintentional weight loss from usual body weight within the last 6 months, or since the last visit (% weight loss formula: $\frac{\text{usual body weight} - \text{current body weight}}{\text{usual body weight}} \times 100$ )
6.	Poor oral intake of food or fluid
7.	Change in stools (colour, consistency, frequency, smell)
8.	Persistent gas, bloating, heartburn

9.	Persistent diarrhoea or constipation
10.	Persistent nausea or vomiting
11.	Difficulty chewing, swallowing. Mouth sores, thrush or herpes simplex type 1
12.	Severe dental caries
13.	Changes in perception of taste or smell
14.	Food allergies/food intolerance (fat, lactose, wheat, etc.)
15.	Economically unable to meet caloric and nutrient needs
16.	Concomitant diabetes mellitus, hypertension, hepatic or renal insufficiency, heart disease, cancer, pregnancy, or other nutrition-related condition.
17.	Visible wasting <90% ideal body weight
18.	Albumin 0.2 mg/dL
19.	Cholesterol < 120 mg/dL or >200 mg/dL
20.	Triglycerides > 450 mg/dL
21.	Scheduled chemotherapy or radiation therapy
22.	Medication regimen that involves food or meal modification
23.	Need for enteral or parenteral nutrition
24.	Patient- or MD-initiated weight management, obesity, vitamin-mineral supplementation, vegetarianism or complementary/alternative diet therapies.

(Adapted from Fenton M. Nutrition referral screening for adults (18 + years) with HIV/AIDS. AIDS Project Los Angeles, 1997.61: Guidelines and Protocol of Care for Providing Medical Nutrition Therapy to HIV-infected Persons. Standards of Care Committee, Los Angeles County Commission on HIV Health Services. 1997).

Once the patients have been screened for medical nutrition therapy, the dietary guidelines include:

**Energy:** Energy needs vary depending on the health status of the individual at the time of HIV infection, the progression of the disease and the development of complications that impair nutrient intake and utilization. Activity can also effect energy requirements. Depending on the activity, the energy is increased. In case of fever, the energy intake should be further increased so that there is no loss of weight.

**Protein:** High protein diets might safely promote positive nitrogen balance and lean body mass repletion. Studies are still needed to clarify the ability of high protein diets to reverse HIV associated malnutrition and body composition changes. Considering that the requirements of protein are increased, an intake of 1.0 to 1.4 g/kg for maintainance and 1.5 to 2.0 g/kg for repletion has been recommended. Protein restriction is recommended only in persons with severe hepatic or renal diseases.

**Fats:** A moderate fat intake is recommended for an HIV patient to add on to the caloric density and palatability of the food given. Tolerance to fat varies from person to person. Studies suggest that the use of medium chain triglyceride (MCT) oil is better than long chain triglycerides based supplements for decreasing stool fat and stool nitrogen content and in reducing the number of bowel movements and abdominal symptoms. MCTs are more readily absorbed than long chain triglycerides. Fish oil (omega 3 fatty acids) when given with MCT oil may improve immune function because this combination is less inflammation promoting than the usual omega 6 fatty acids.

**Fluids and Electrolytes:** Fluids needs in HIV infected individuals are similar to those of well individuals and are calculated to be 30-35 mL/kg (8-12 cups for adults) with additional amounts to compensate for losses from diarrhoea, nausea and vomiting, night sweats and prolonged fever. Replacement of electrolyte loss (Na, K and Chloride) in the presence of vomiting and diarrhoea is also recommended.

**Vitamin and Minerals:** The exact requirements for vitamins and minerals are still unknown, increased intake of the following micronutrients:  $\beta$ -carotene, vitamin E,

ascorbic acid, vitamin B<sub>12</sub>, vitamin B<sub>6</sub> and folic acid is recommended. Use of vitamin mineral supplement providing 100% RDA is also recommended.

*Water Safety*: HIV/AIDS subjects are vulnerable because of the immune suppression. Hence water borne pathogens are a concern. Water safety is important. Boil water, filter tap water, use boiled water as far as possible.

HIV and AIDS infected patients are known to have symptoms associated with medications, malnutrition, malabsorption. Some of the practical eating suggestions for symptom management are given in Table 3.3.

Table 3.3: Practical **eating** suggestions for symptom management

Symptom/problem	Management
Nausea	Small, frequent meals, Avoidance of high-fat, greasy foods, Cool or room-temperature foods, Avoidance of lying down flat after eating.
Sore mouth/throat	Soft, moist foods, Avoidance of spicy or acidic foods, Experimentation with temperature of foods (avoidance of very hot or very cold foods; cool or room-temperature foods are best). Use of nutrient- and energy-dense foods to maximize oral intake.
Xerostomia (dry mouth)	Use of foods that are moist or served with a sauce or gravy. Consumption of liquids at mealtimes and extra fluids between meals. Emphasis on good oral hygiene: flossing, brushing, and rinsing, regular dental care. Use of fluoride gels or mouthwashes. Consideration of prophylactic antifungal therapy. Chewing of sugarless gum or sucking of mints.
Difficulty with breathing.	Use of easy to eat foods, Use of nutrient- and energy-dense foods.
Diarrhoea	Fluid and electrolyte replacement, Low-insoluble, high-soluble fibre diet. Possible benefits from low-lactose diet, Low-fat diet (may be indicated). Avoidance of gas-causing foods, beverages and caffeine.
Constipation	Increased fluid and dietary fiber intake. Use of nutrient- and energy-dense foods, including nutritional supplements. Use of small, frequent meals and snacks. Consideration of alternative nutrition support.
Fatigue	Adequate sleep, relaxation, exercise, adequate diet, especially foods rich in vitamins, B <sub>12</sub> , A, C, folate, and carotene or zinc, as inadequate levels may cause fatigue. Avoidance of caffeine, alcohol, cigarette smoking, and recreational drug use. Avoidance of stress and treatment of anxiety or depression. Identification and management of possible causes for anaemia. Medications: AZT, bactrim, interferon, pyrimethamine Other causes: alcohol abuse, bleeding, <i>Mycobacterium avium</i> complex, tuberculosis, fungal infections, cytomegalovirus
Body cell mass loss	Adequate diet, Resistance exercise, Correct for testosterone deficiency, Consider anabolic agents (Rx from MD)

Nutritional considerations for children suffering from HIV are presented next. But just let us review the screening criteria for paediatric patients for medical nutrition therapy. Table 3.4 presents the screening criteria

**Table 3.4: Screening for Paediatric patients (< 18 years of age) with HIV/AIDS for medical nutrition therapy**

<i>In addition to the conditions listed in Table 3.3 referral to a dietitian should be automatic when any one of the following conditions exist:</i>	
1.	Weight for age <10 percentile (National Center for Health Statistics [NCHS])
2.	Height for age <10th percentile if weight for age is also <10th percentile for age (NCHS)
3.	Downward crossing of one major weight-for-age percentile
4.	Poor appetite; food or fluid refusals
5.	Prolonged bottle-feeding and/or severe dental caries
6.	Change in stools (colour, consistency, frequency, smell)
7.	Children 0-12 months having low birth weight
8.	Children 0-12 months old: no weight gain for 1 month
9.	Children 0-12 months old: diarrhoea or vomiting for >2 days
10.	Children 0-12 months old unable to suck properly
11.	Children 1-3 years old: no weight gain for 2 consecutive months
12.	Children 1-3 years old: diarrhoea or vomiting for >3 days
13.	Children 4-16 years old: no weight gain for 2 consecutive months
14.	Children 4-16 years old: diarrhoea or vomiting for >4 days
15.	Albumin <3.5 mg/dl
16.	Cholesterol < 65 mg/dl or > 175 mg/dl
17.	Triglycerides < 40 mg/dl or > 160 mg/dl

*(Adapted from Fenton M, Heller L. Nutrition referral screening for pediatrics (<18 years with HIV/AIDS. Project Los Angeles, 1997 In: Guidelines and Protocol of Care the providing Medical Nutrition Therapy to HIV-infected Persons. Standards of Care Content tee, Los Angeles, Country Commission on HIV Services. 1997).*

So far we have discussed about the details of dietary management for patients irrespective of age or physiological status. However, it is known that management of pediatric patients is difficult and a challenging task. We shall now throw some light on this aspect also.

**Nutritional Considerations for Children Suffering from HIV**

Young children are among the most vulnerable segment to HIV infection. This is particularly important as nearly one-fifth of the world's population is between 10 to 19 years of age and also because HIV can get transmitted from the mother to the foetus. According to the Centers for Disease Control, USA the symptoms of paediatric HIV infection can be classified as given in Table 3.5.

**Table 3.5: Symptoms of Paediatric HIV Infection**

Clinical Category	Symptom Severity
N	No symptom
A	Mildly symptomatic - ≤ 2 symptoms (Lymphadenopathy, hepatosplenomegaly, dermatitis, parotitis, respiratory tract infection etc.)
B	Moderately symptomatic (anaemia, neutropenia, cardiomyopathy, diarrhoea, herpes stomatitis, nephropathy, fever >1 month etc.)
C	Severely symptomatic (opportunistic infections, severe failure to thrive, wasting syndrome, HIV encephalopathy, malignancy etc.)

You will find it difficult to understand some of the technical terms. Read the glossary in this unit which defines these terms.

Nutritional problems among infants and children infected with HIV are related to:

- Poor growth/weight gain
- Impaired immune function and recurrent infections
- Depressed gastrointestinal tract function (malabsorption of fat, protein and carbohydrates even without diarrhoea).
- Malnutrition with multiple nutritional deficiencies
- Dysregulation of lipid metabolism and the fat redistribution syndrome
- Poor appetite, limited food preferences and taking a long time to eat.

Nutrition assessment is very important before developing a diet plan for HIV infected children. Since developmental delays may occur, therefore the infant/child's developmental age rather than the actual age should be used to assess the most appropriate textures, feeding position and utensils. As a dietician, you must make an attempt to identify the type/timing of meals which can be managed by the child/caregiver, in particular the time (duration) the child takes to eat a particular meal.

The nutrient requirement for paediatric patients can be much higher than for adults. The major changes in macro and micro nutrients being:

- The requirements for energy increase by 100% in view of their mobility, fever and catch-up growth. The height for age data may be used as a guidance to estimate energy requirements among children with impaired growth.
- The protein requirements increase by 150% to 200% above the recommended dietary allowance to counteract nutritional demands imposed by HIV infection and also to promote adequate growth/development of the infant/child.
- The *vitamin and mineral* requirements are not known for paediatric patients. However, it is recommended to increase the intake by 100% through the incorporation of natural foods as micronutrients supplements are generally not recommended.

### **Other Special Considerations**

- Alternative modes of feeding such as gastrostomy may be required. The patient's diet may be supplemented or substituted with semi-elemental or elemental formulas or age-appropriate sip-feed supplements may be given.
- Paediatric patients may have a poor appetite wherein the child should be served small frequent meals with palatable snacks in-between. Prevent children from consuming too much of water/beverages before meals.
- At times HIV infected children may take a long time to eat meals. In such situations, limit meal timings to not more than 30 minutes. Encourage praise on completion and offer extra food if desired,
- In case of infants, care must be taken while introducing new foods. Monitor the child closely for any signs of allergic reactions.

Proper nutritional care of HIV infected paediatric patients can help them in achieving timely milestones and delay the onset of AIDS and its complications,

We end our discussions on HIV infection here. Every symptom and complication of AIDS requires careful dietary care. We have highlighted the key aspects in this section. However, it would be a good idea to look in detail from other knowledge sources.

Questions given in check your progress exercise 4 will help you to clarify your concepts further.

**Check Your Progress Exercise 4**

1. Explain the following terms:
  - a) AIDS wasting Syndrome : .....
  - b) Persistent General Lymphadenopathy .....
  - c) Kaposi's Sarcoma .....
  - d) Peripheral neuropathy .....
2. What are the causes of malnutrition in AIDS patient?  
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.....  
.....
3. Why is it important to screen the patients for HIV positive early?  
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.....
4. What are the reasons to increase the energy and protein requirements for an AIDS patient?  
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### 3.8 LET US SUM UP

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In this unit, we studied about the defense mechanism of our body. The defense mechanism, as you would recall, comprises of the first line of defense which are generalized and specific ones, comprising of **cell** mediated and **humoral** response. Then, we moved on to the infections and fevers. Here we learnt that infection and fevers are coexistent. Fevers, as you had seen, vary depending on the nature of an **infection**. An infection can be either acute or chronic.

Acute infections/fevers include typhoid, malaria etc. while chronic infections include tuberculosis, HIV/AIDS. We learnt the etiology, medical and nutritional therapy for each of these. Finally, we focussed on the metabolic aberrations, the associated symptoms, dietary modifications (due to drug and nutrient interaction) and a brief list of foods to be included and excluded among other considerations.

## 3.9 GLOSSARY

<b>Acute HIV infection</b>	: patients with transient signs and symptoms of HIV infection.
<b>AIDS (Acquired Immune Deficiency Syndrome)</b>	: a state of HIV infection along with a CD-4 cell count of 200 or less (or < than 14%) or dementia, wasting syndrome or malignant disease or one of 26 opportunistic infections.
<b>AIDS Wasting Syndrome (AWS)</b>	: involuntary weight loss of 10% of baseline body weight plus either chronic diarrhoea (2 loose stools/day for more than 30 days) or chronic weakness and documented fever (for 30 days or more, intermittent, or constant) in the absence of concurrent illness or other condition.
<b>Asymptomatic HIV infection</b>	: patients without previous signs or symptoms leading to classification in group III or IV.
<b>Basal Metabolic Rate</b>	: a measurement of energy required to keep the body functioning at rest.
<b>Cachexia</b>	: general weight loss, wasting and reduction in vitality of body and mind.
<b>Candidiasis</b>	: a disease caused by a species of the yeast-like fungus; affects the skin, nails.
<b>Carriers</b>	: a typhoid patient who is asymptomatic but continues to excrete the bacteria for weeks.
<b>CMV</b>	: cytomegalovirus or Lymphoma.
<b>Expectoration</b>	: the act of spitting out saliva or mucus from the air passages via the mouth.
<b>Graft Rejection</b>	: a rejection of a donated bone marrow by the patient's body.
<b>HIV Infection</b>	: an acute syndrome characterized by fever, malaise, lymphadenopathy, pharyngitis, headache, myalgia and sometimes rash.
<b>Kaposi's sarcoma</b>	: malignant disease of the peripheral blood mononuclear cells which manifests itself as purple nodules on the skin, mucous membranes, lymph nodes and throughout the GI tract,
<b>Lymphadenopathy</b>	: swollen, firm and some times tender lymph nodes secondary to any number of causes ranging from infections to cancer.
<b>Peripheral neuropathy</b>	: Neurological disorder causing sensory loss in toes and fingers leading to numbness and weakness felt in hands, feet and legs,
<b>Persistent Generalized Lymphadenopathy (PGL)</b>	: patients with lymph nodes >1cm in diameter that persisted for 23 months at two or more extrainguinal sites.

<b>MAI</b>	: <i>Mycobacterium avium</i> intra cellulare.
<b>Malignant Cancer</b>	: a tumor that has a tendency to spread to other parts of the body.
<b>Myalgia</b>	: diffuse muscle pain usually accompanied by malaise, vague feeling of discomfort or weakness.
<b>Opportunistic Infection</b>	: infection by an organism that does not ordinarily cause disease but which becomes pathogenic under certain circumstances such as impaired immune response.
<b>Peyer's Patches</b>	: flat patches of lymphatic tissue situated in the small intestine mainly in the ileum and are the seat of infection in typhoid fever.
<b>Pharyngitis</b>	: an inflammation of the pharynx resulting from a debilitating chronic disease.
<b>Retrovirus</b>	: species of a family of single strand RNA virus having an envelope and containing a reverse coding enzyme that allows for a reversal of genetic transcription from RNA to DNA rather than the usual DNA to RNA, the newly transcribed viral DNA then being incorporated into the host cells DNA strand for the production of a new RNA retroviruses.

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### 3.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

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#### Check Your Progress Exercise 1

1. Defense mechanism is the body's ability to fight infection and suppress multiplication of abnormal cells such as cancer cells. The two major forms of defense mechanism include non-specific and specific.
2. **Malnutrition** and infection have a synergistic effect with impaired immunity. Several nutrients strengthen the physical barriers of human body such as skin, mucous membrane, epithelial tissues whereas others help in directly inactivating an infection (T/B cells). When nutritional reserves are low; these defense mechanisms become weak/impaired and this increases the susceptibility to infections. Most of the infections as we all know result in diarrhoea/vomiting, fever or/and anorexia thereby depleting the nutrition reserves still further. Thus, malnutrition and infection are inter-related.
3. Several metabolic changes develop during infection; the most important one's are enumerated in Section 3.4. Read it carefully and answers accordingly.
4. Fever may develop due to:
  - Endogenous factors: allergic reactions, malignancy, graft rejections,
  - Exogenous factors: Infection, inflammation or other metabolic changes caused by virus, bacteria, molds etc.
5. i) skin, mucus membrane  
ii) T lymphocytes, B lymphocytes  
iii) 13  
iv) acute, chronic  
v) Proteins, fats

### Check Your Progress Exercise 2

1. Typhoid is called enteric fever because this infection or bacteria is found in the intestine.
2. During the prodromal stage, there is increasing malaise, headache, cough and sore throat, often with **abdominal** pain and constipation, while the fever begins to reduce. After 7-10 days there is **marked weakness** along with diarrhoea/constipation and abdominal distention.
3. The patients are generally **given** a high energy high protein soft diet with liberal amount of fluids. The characteristic features of **enteric** fever diet is given in section **3.6**. Read it carefully and answer on your own.
4. **Snack 1: Vegetable Dhokla**

Justification: Vegetable dhokla can be prepared by using carrots, spinach, besan, curd and some amount of semolina. This **snack** is easy to digest (fermented – soft) and provides good amount of protein, carbohydrate, vitamins and minerals.

**Snack 2: Egg Drop soup with boiled potatoes**

Justification: Mixed vegetable stock, whole egg, light cream, boiled potatoes. Potatoes will provide carbohydrates whereas, egg would provide good amount of high biological value protein. Vitamins and minerals would be present in good amounts in vegetable stock and egg. (fat-soluble vitamins), Egg and cream would provide emulsified fat.

### Check Your Progress Exercise 3

1. Tuberculosis is a **chronic** fever resulting in gradual **weight** loss due to depletion of the **energy** reserves (adipose tissue, muscles and glycogen reserves) hence, it is called the wasting disease. The patients are generally malnourished with depleted reserves of all nutrients due to reduced food intake, enhanced **requirements** and impaired **digestion/absorption** in some cases.
2. **Non-adherence** to antituberculous **treatment** is a major cause of **treatment failure**, continued **transmission** of tuberculosis and the development of drug resistant strains.
3. Vitamins of clinical significance during tuberculosis **include**: carotene, vitamin **A** ascorbic acid, vitamin **B<sub>6</sub>** and folate for the following reasons:

Enhanced conversion of  $\beta$  carotene to **retinol**, increased urinary loss of ascorbic acid, Enhanced need for calcium necessitates increased requirements of vitamin D, and Drugs may impair the absorption and utilization of certain B-group vitamins particularly vitamin **B<sub>6</sub>** and folate

4. **Snack 1: Potato and sprouted moong dal stuffed cheela**

**Snack 2: Peanut suji coconut laddoo.**

### Check Your Progress Exercise 4

1. a) AIDS wasting is the involuntary loss of more **than 10%** body weight, plus **more than 30** days of either diarrhoea or weakness and fever. Wasting is linked to disease progression and death. It results in loss of **both** muscle mass, as well as, body fat which leads to changes in body fat.
- b) It is also known as lymph follicular hypertrophy and is characterized by increased size of lymph follicles. Lymph nodes act as filters keeping **organisms** especially bacteria **from** entering the blood stream.

- c) Kaposi's sarcoma is a malignant tumor of the connective tissue often associated with AIDS. In AIDS patients, it develops aggressively and involves the skin, lungs, gastrointestinal tract and other organs. The tumors consist of bluish red or purple nodules made up of vascular tissue.
  - d) Peripheral Neuropathy is a type of neurological disorder characterized by numbness of toes and fingers due to sensory loss. The patient experiences weakness in the peripheral body parts i.e. hands, feet and legs.
2. Majority of the patients suffering from AIDS are malnourished. The etiological factors being reduced food intake associated with anorexia, nausea, vomiting, neurological problems; altered metabolic requirements and malabsorption i.e. the intestinal absorptive capacity for several micro, and macronutrients may reduce.
  3. Early screening of HIV positive individuals is imperative in order to prevent transmission of the virus from blood, infected medical devices, sexual intercourse and from mother to the child; prevent progression of the infection from being asymptomatic/ latent to the development of AIDS; reduce load on the existing medical infrastructure; and reduce early/ severe morbidity and mortality due to HIV/AIDS.
  4. Energy and protein requirements increase markedly during AIDS. The energy intake should be increased if the patient is reducing weight, is suffering from fever, chronic diarrhoea and/ or tumors.

AIDS being a wasting disease is frequently associated with loss of muscle tissues resulting in weakness, impaired resistance to infections, anaemia, hypoalbuminemia. Adequate protein intake can help in delaying or reducing the breakdown of lean body mass, maintain nitrogen equilibrium and hence normal blood and body composition, as well as, delay the risk of developing opportunistic infections.