14.2.1 Diarrhoea

What is diarrhoea? Diarrhoea is characterized by the ***frequent evacuation of liquid stools, usually exceeding 300 ml, accompanied by an excessive loss of fluids and electrolytes, especially sodium and potassium.*** It occurs when there is excessively rapid transit of intestinal contents through the small intestine, decreased enzymatic digestion of foods, decreased absorption of fluids and nutrients or increased secretion of fluids into the GI tract. It is important to note here that ***diarrhoea is a symptom and not a disease.***

An episode of diarrhoea can be acute (recent origin) or chronic (extended duration and repeated episodes) in nature. You may recall reading in the Food Microbiology ans Safety Course about microbial infections and toxins, which are a major cause of diarrhoea among individuals. However, there are several other causes of diarrhoea such as metal poisoning, deficiency of enzymes, side effects of drugs, structural/ functional abnormalities in the organs etc. Table 14.1 highlights the causes for acute and chronic diarrhoea.

Table **14.1:** Causes of diarrhoea

Acute Diarrhoea	Chronic Diarrhoea
Heavy metal poisoning e.g lead, mercury, arsenic.	Malabsorption, lesions of anatomic, mucosal or enzymatic origin.
Viral infection (rotavirus)	
Bacterial toxin (Salmonella, related to food poisoning), Bacterial infection (E. Coli; *Shigella*)	Metabolic disease such as diabetic neuropathy, Addison's Disease.
Drugs (Ncomycin, colichine, antibiotics, antacids, chemotherapy, digoxin, sorbitol)	Carcinoma of small intestine and colon.
Psychogenic factors	Cirrhosis of liver
Protozoa infection (giardia, lamblia, entamoeba histolytica)	Allergy and food sensitivity

It must be evident from the table above that acute diarrhoea generally occurs in association with infections, poisons and drugs. Chronic diarrhoea on the other hand are the result of long-term diseases such as malabsorption syndromes, deficiency of GI secretions, chronic deficiencies/allergies etc. Some common forms of chronic diarrhoea which you may come across while managing other disease conditions include:

- Osmotic diarrhoea: This kind of diarrhoea is caused by the presence of osmotically active substances in the intestinal tract, which in turn, favour the drawing of large volumes of water in the gut e.g. diarrhoea associated with lactose intolerance (sugar lactose is not digested due to lack of enzyme lactase in the intestine), dumping syndrome (multiple symptoms related to removal of part of stomach).
- Secretory *diarrhoea*: It is a result of active secretion of electrolytes and water by the intestinal epithelium caused by bacterial and viral infections. These, in turn, lead to the production of exotoxins and increased intestinal hormone secretion.
- Exudative diarrhoea: It is associated with the mucosal damage leading to out pouring of mucus, blood and plasma proteins with a net accumulation of water and electrolytes in the gut.
- Limited mucosal *contact diarrhoea*: It results from situations of inadequate mixing of chyme (semi-liquid mass of food passing through intestine) and inadequate exposure of chyme to intestinal epithelium because of destruction and decreased mucosa due to surgical procedure. This type of diarrhoea is usually complicated by steatorrhoea (increased amount of fat in feces).

Now, let us have a look at the consequences of diarrhoea with the help of flow chart given in Figure 14.2.

Consequences of Diarrhoea

All of us must have suffered from diarrhoea atleast once in our lifetime. How do you feel thereafter? Well most of us must have experienced weakness, dizziness, dryness of mouth and anorexia. Our skin also becomes dry and loose. During diarrhoea the stools are loose and have a high water content – an indicator that water is being lost in higher than normal amounts. The stools also contain a high amount of electrolytes due to enhanced peristaltic movements i.e. increased movements of the stomach and inteslines. This results in the deficiency of water and electrolytes in the body which is referred to as dehydration. Dehydration results in reduction in the extracellular blood

volume and hence a reduction in the total blood volume which is often referred to as hypovolemia. Low blood volume is associated with hypotension and a low cardiac output. In response to hypotension, the heart tries to compensate by increasing the number of cardiac cycles per minute which is indicated by a high pulse rate. You will often find that during diarrhoea the patients have low blood pressure but usually a higher than normal pulse rate. As the severity of dehydration increases, despite enhanced cardiac cycles, adequate amount of blood and nutrients do not reach all

changes in the nervous system. They can be as mild as dizziness due to less supply of oxygen, glucose and other nutrients to the brain cells or as severe as resulting in coma due to excessive accumulation of nitrogenous waste products and other toxic metabolites in the blood. It would thus be evident that maintenance of adequate blood volume is imperative to prevent dehydration and its consequences some of which can be life threatening. A basic outline of the consequences of diarrhoea has been indicated in the Figure 14.2.

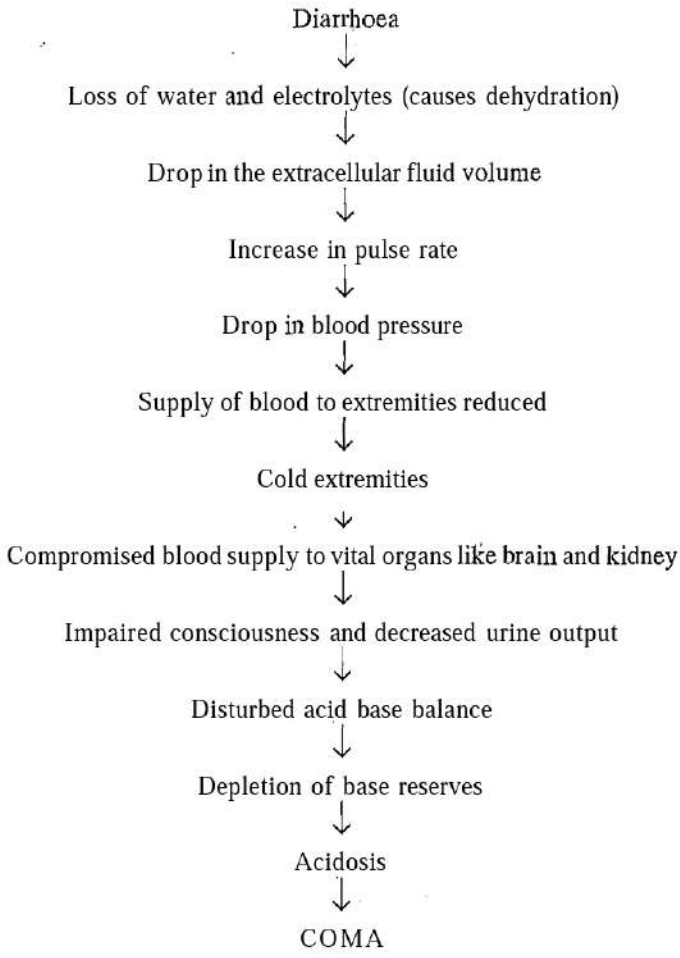

Figure 14.2: Consequences of diarrhoea

erstood the seriousness of diarrhoea and can understand illness and death especially in children.

cussion to learn about the treatment and management of

nt of diarrhoea

now that diarrhoea should not be neglected and must to minimize the frequency of morbidity and morlalities. discussed above, let us now examine what should be the t of this disease.

nanagement of diarrhoea include:

placement

cially if infection)

onic diarrhoea)

3. Nutritional management

Now, let us understand these points.

1. *Determining the status of dehydration* has been explained to you earlier. The child in a severe dehydration state must be hospitalized,

2. *Fluid management:* The key to diarrhoea management is the early replacement of fluid lost in the stools through intravenous or oral route. While severe cases need administration of dextrose and electrolyte solutions intravenously; mild to moderate cases can be managed at home. The patient can be easily managed by giving any fluid at home e.g. coconut water, buttermilk, salted *rice kanji*, lemon sugar salt beverage or weak tea. This is commonly referred to as the Oral rehydration therapy (ORT). Let us read more about ORT.

- *Oral Rehydration Therapy* (ORT) refers to providing fluids and/or oral rehydration salt solutions to the patient. An oral rehydration solution can easily be prepared at home by taking a teaspoon of salt, 3 tablespoon of sugar with or without lemon juice mixed in a liter of potable water. Oral Rehydration Salt formulations as suggested by WHO are freely available commercially in small packets.

Composition of Oral Rehydration Salt (WHO Standard Formulation)

1. Sodium Chloride (common salt) = 3.5 g
2. Glucose = 20 g
3. Trisodium Citrate = 2.9 g or sodium bicarbonate = 2.5 g
4. Potassium chloride = 1.5 g.
5. Dissolved in a litre of potable water.

This solution provides (g per litre of water):

1. Glucose (g/100 ml) = 2 (provides energy)
2. Sodium (mEq/L) = 90 (favours rehydartion)
3. Potassium (mEq/L) = 20 (prevents acidosis)
4. Chloride (mEq/L) = 80 (favours rehydration)
5. Bicarbonale (mEq/L) = 30 (builds base reserves)
6. Osmolality (mOsm/L) = 330 (maintains osmotic balance and favours early rehydration).

- Emergency treatment *and* drug *treatment*: Severe dehydration is fatal and requires intravenous fluids and hence hospitalization. You have read about causes of diarrhoea and know that several types of protozoas, viruses and bacterias cause diarrhoea. Many toxins are produced by some varieties of bacilli, which are harmful for the mucosal lining and hence drug therapy is required.

  Next, we shall discuss about the dietary management of diarrhoea.

3. *Nutritional management*

The conservative concept of treatment for diarrhoea was not in favour of feeding adequate amount of food. However, with the identificationof varied underlying causes and not so positive outcomes of the starvation therapy, it has become evident that adequate nutritional care is pertinent to ensure enhanced recovery and proper rehabilitation. Dietary management of diarrhoea has changed completely over the years and it is now advocated that the patient should be prescribed a diet most suitable for the underlying etiology of diarrhoea. Today we know that the nutrient requirements and or the quality (consistency) of diet may not necessarily be the same for all forms of diarrhoea. While the demand for fluids and electrolytes are particularly high during an acute episode; that of all macro-and micronutrients increases during chronic diarrhoeas. In our subsequent section, we shall discuss in detail the nutrient requirements during diarrhoea.

Dietary Recommendations during Diarrhoea

The diet should take into account the normal RDI and various adjustments made to the quantity and quality of the foods to be given. The following information will help you to understand these concepts.

Energy: During the acute phase of diarrhoea, the caloric intake can be increased gradually as per the tolerance of the patient. An increment of 200-300 Kcal is a feasible target. Patients suffering from diarrhoea should never be starved as even in acute diarrhoea digestive enzymes are functional and almost 60% digestion can take place. Resting the gut can be most damaging as it can bring about structural changes in the gut membrane, which can predispose an individual to associated complications.

Recent studies indicate that children who are fed with appropriate type and amounts of food through the acute phase of diarrhoea show absorption of substantial amounts of nutrients, and are therefore at lesser risk to nutritional deficiency. These children show better weight gain, have shorter duration of diarrhoeal episode and a quicker recovery. Calories can be provided through easily digestible carbohydrates. Excess sugar may be avoided to prevent fermentative effect, which may aggravate the

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Protein: Requirements are increased only in chronic diarrhoea because of associated tissue depletion. An additional 1 0 g of protein may be recommended above the normal requirements. Milk a source of good quality protein is restricted as it is a high residue food or if it is anticipated that diarrhoea may have developed due to relative deficiency of lactase in the gastrointestinal tract. 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.

Fats: Total amount of fat may be restricted as its digestion and absorption is compromised. In order to increase on the calorie density of the diet, emulisified fats or those, which are rich in medium chain triglycerides, may be added in restricted amounts. Fats like butler, ghee and cream are easily digested. Fried food must be avoided. Invisible form of fat i.e. fat present inherently in the food (egg yolk, whole milk, paneer, curd, flesh food etc.) is tolerated more as compared to visible form of fat.

Carbohydrates: Adequate amount of carbohydrates i.e 60-65% of the total energy should be given to the patient. Easily assimilated carbohydratesi.e. principally starches should be preferred. Glucose, sugar, honey, jaggery, potato, yam, colocasia, rice, sago, semolina, refined flour, pastas can be incorporated lo prepare dishes such as khichdi, vegetable/pulse puree, fruit juices, soufflé, shakes, custard and kanji. The fibre content of the diet should be kept minimum and insolublefibre should particularly be avoided. Table 14.2 and 14.3 give the low fibre and low residue foods. A low-residue/low fiber diet limits the amount of food waste that has to move through the large intestine. These diets may help control diarrhoea and abdominal cramping and make eating more enjoyable.

Information provided in Box 14.1 relates to the concept of residue read it carefully.

Box 14.1	Residue in Foods
Residue is defined medically as the solid contents that have reached the lower intestine. A low residue diet is composed of foods, which are easily digested and readily absorbed, resulting in a minimum of residue in the intestinal tract. Thus, a low-residue diet contains limited amounts of undigested or only partially digested ingredients. Foods, which are high in residue, are those, which are high in roughage, or fiber. The main source of residue is fiber in foods like whole-grain breads and cereals, seeds and nuts, dried fruits, and the stalks and skins of fruits and vegetables. Milk should be consumed in moderation.	

- Fibre: Insoluble fibre in the form of skins, seeds and structural plant materials should be strictly avoided to minimize on the irritation of the GI tract. 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.

Table 14.2: Low fibre foods

Milk products	Paneer, curds, toned milk
Cereals	Refined cereals: rice, white bread, noodles, maida, suji
Pulses	Dehusked pulses

Table 14.2: Low fibre foods

Milk products	Paneer, curds, toned milk
Cereals	Refined cereals: rice, white bread, noodles, maida, suji
Pulses	Dehusked pulses
Vegetables	Potato, bottle gourd, tomato (without skin or seeds), spinach
Fruits	Papaya, banana and fruit juices

Table 14.3: Low residue foods

Cereals	Rice, refined cereals such as maida, suji, white bread sweet biscuit, cornflour
Vegetables	Tender, well-cooked, pureed low fibre vegetables
Fruits	Fruit juices or pureed fruits
Meat and its products	Chicken and fish
Pasta	plain macaroni, noodles, sphagetti etc.
Sweets	White sugar, brown sugar, honey, clear jelly

Vitamins and minerals: Loss of vitamins is related to the degree of mucosal damage in chronic diarrhoea, which in turn impair absorption and synthesis of various essential substances in the body. The vitamins of importance are B complex vitamins especially folic acid, vitamin B_{12} and vitamin C. Fat soluble vitamins (A, D, E and K) can be lost if fat is not digested and lost in stools. Minerals which are of importance include iron especially if there is an associated bleeding. Sodium and potassium may need to be replaced. Potassium supplementation may favour bowel motility and build up appetite.

Fluids: Intake should be liberal to minimize the risk of dehydration. Remember we read about fluid management in this section before. Preference must be given to diluted drinks as concentrated ones may favour osmotic diarrhoea.

Lastly, a few simple tips which should be given to the patient.

- Boiling, steaming, baking, pressure cooking should be encouraged
- Consume small and light meals frequently instead of 3 big meals a day to replenish the lost nutrients.
- Have plenty of fluids like lemon juice, fruit juices, vegetable soups, watery dals, lassi, coconut water etc. to make up for the losses of fluids.

  Have fruits like banana and apple as they are rich in potassium which helps to maintain fluid balance.
- Try to restrict the consumption of milk and dairy products, as they are difficult to digest.
- Avoid fried foods.
- Avoid raw vegetables like salads.

While the above mentioned principles are applicable for patients of all age groups and gender, we shall discuss some important aspects of management among infants and young children which are the most vulnerable segments especially with respect to

developing complications. It has also been observed that myths regarding breast feeding and food consumption are rampant due to ignorance. Efficient and aggressive counseling of the parents/carelakers is equally important for preventing dehydration and malnutrition which may affect the growth and development of the child in the long run especially in cases of chronic diarrhoea. Let us now move on to the management of diarrhoea in children – which is one of the leading causative factors of infant deaths in our country.

Dietary Management of Children with Diarrhoea

Diarrhoeas are more common in children and malnutrition often leads to the elicitation of this symptom as undernourished are more prone. Poverty, ignorance, poor sanitation are often the underlying risk factors. The magnitude of the incidence of diarrhoea in India is majorly observed in children. It has been estimated that almost 250 million episodes of diarrhoea annually are observed in children below 5 years and nearly 1.5 million children die of diarrhoea annually. Thus, managing diarrhoea in children is of great concern. The guidelines for the same are as follows:

1. The first objective is to rehydrate the child. Thus using ORS would be the ideal modality. The WHO-ORS standard preparation is useful but recent studies have suggested that the osmolarity of the solution should be reduced from 311mmol/litre to 200-250 mmol/litre by reducing the concentration of glucose. Sodium has a beneficial effect on the stool output and duration especially in non-cholera

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2. Breast feeding should be continued in young infants during diarrhoea. This helps in decreasing the number and volume of stools and the duration of diarrhoea. Starving the child during diarrhoea may deteriorate the nutritional status.
3. Children 4-6 months of age or older should receive energy rich mixture of soft weaning foods in addition to breast milk. The energy rich mixture can be a mix of cereal, pulse, roots, green leafy vegetables, and fats like ghee, butter that are easy to digest. The caloric density of the feeds can be increased by using amylase rich flour (ARF), i.e the flour obtained from germinated grain which is rich in amylase and can be prepared as a soft and thin porridge without taking away its nutritional value. Fermented foods like dhokla, bread, idli, dosa may be included in the diet.
4. Foods to be avoided include: spicy and oily foods, confectionary, mithai and chocolates, as well as, uncooked fruits and vegetables.
5. Supplementation with B-complex vitamins especially folic acid, vitamin B_{12} and minerals like zinc help in normalizing the intestine.
6. The criteria for monitoring the state of hydration and nutritional status are: good urine output, appearance of the eyes, skin, buccal mucosa and weight gain.
7. Consult the doctor, if required.

REMEMBER THE GOLDEN RULE: FEED IN DIARRHOEA, DON'T STARVE THE CHILD.

THERE ARE MORE LIVES LOST DUE TO STARVATION THAN FEEDING.

- INFANT: CONTINUE BREAST FEEDING
- OLDER CEILDREN: MAKE NECESSARY MODIFICATIONS IN THE NORMAL DAILY DIET. GIVE FREQUENT LIQUIDS OR/AND LOW RESIDUE SOFT DIGESTIVE FEEDINGS. GIVE BLAND AND LOW FIBRE DIETS.

We shall next proceed over to discuss about another common disorder of 'the gastro-intestinal tract viz., constipation.

14.2.2 Constipation

Constipation is irregular, infrequent or difficult passage of faeces. It is the most common physiological disorder of the alimentary tract. It is characterized by incomplete evacuation of hard, dried stools. It occurs commonly in children, adolescents, adults on low fibre diets, patients confined to bed, in invalids and in elderly persons. It is a condition in which:

- fewer than 3 stools per week are passed while a person is eating a high residue diet,
- more than 3 days go by without the passage of a stool, and

stools passed in one day amounting to less than 35 grams.

There are three main types of constipation. These are:

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There are three main types of constipation. These are:

1. *Atonic constipation*: This type is most common, often it is called the "lazy bowel". There is a loss of muscle tone causing weak peristalsis, the causes are:
   a) lack of fluids, rouhage and potassium
   b) vitamin B Complex deficiency
   c) irregular defeaction habit and poor personel hygiene.
   d) excessive purgation or use of enema.
   e) sedentary lifestyle or lack of exercise
1. *Spastic constipation:* It results from excessive tone of the colonic muscle.
2. *Obstructive constipation:* It occurs usually due to obstruction in the colon, cancer, or any other obstruction due to inflammation or narrowing of the lumen.

Let us see what are the causes and symptoms of constipation.

Etiology

The most common causes of constipation are poor elimination habits, a lack of fibre in the diet, insufficient fluid intake, lack of exercise and a loss of lone in the intestinal musculature. Apart from these, chronic overuse of laxatives, nervous strain and worry are also some common causes. The causes can be classified under two heads – systemic and gastrointestinal – as highlighted in Table 14.4.

Table 14.4: General causes of constipation

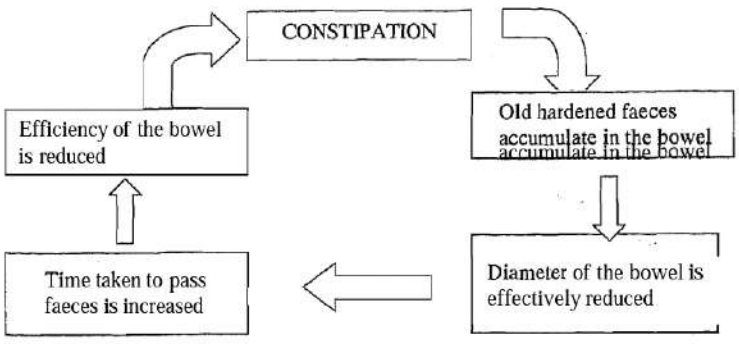
Systemic	Gastrointestinal
Side effects of medications	Celiac disease
Metabolic or endocrinal abnormalities such as hypothyroidism	Duodenal ulcer
Lack of exercise	Gastric cancer
Ignoring the urge to defecate	Cystic fibrosis
Vascular disease of the large bowel	Diseases of the large bowel
Diet low in fibre	Irritable bowel syndrome
Pregnancy	Anal fissures & haemorrhoids
	Laxative abuse

Symptoms

Have you ever suffered from constipation? Do you recall the symptoms associated with the problem? Yes, the symptoms were specific to having a bloated stomach, stomach pains/cramps, inability to evacuate, a feeling of fullness in the lower abdomen,

lethargy, irritability, a sensation of dullness or even moderate pain in the head. These are the symptoms of constipation.

Let us now move on to the major complications involved in this disorder. If constipation is suffered frequently, the problem worsens due to a vicious cycle of events, as depicted in the Figure 14.3.



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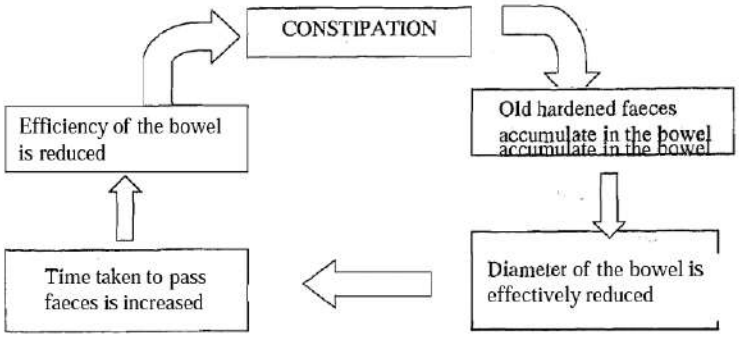

Figure 14.3: Complications in constipation

Apart from this, the list of other complications for constipation have been mentioned in Table 14.5.

Table 14.5: Complications associated with constipation

Haemorrhoids (swollen blood vessels around the anus)	Diarrhoea
Anal fissure (a tear in the anal region)	Faecal incontinence (inability to control bowel movement)
Rectal bleeding (protruding rectum through the anus)	Rectal prolapse
Rectal hernia	Faecal impaction (hard stools in the bowel)
Uterine hernia	Uterine prolapse (downward displacement)

What can be done to prevent constipation? Can dietary management help relieve the problem? Let us find out.

Management of Constipation

You must have realized by now that proper dietary and lifestyle management can help in maintaining the normal bowel movements to a great extent. Medical interventions are required only when constipation arises because of some structural functional change in the gastrointestinal tract. In our subsequent discussions, we will deal with the dietary management of conslipation. Let us first identify the objectives of the patient care process.

Dietary and Life Style management Goals

The dietary and life style management goals include:

- To develop regularity of habits in evacuation
- To follow a regular meal pattern
- Consume a high fibre diet

- Take adequate amounts of fluids
- Increase physical activity

Based on these objectives, the dietary management of constipation is highlighted next.

Dietary Management of Constipation

Management of constipation lies in developing regularity of habit through a bowel-training programme and by establishing good healthy habits such as regular meals and elimination timings, adequate fibre and fluid intake, and sufficient exercise.

The mainstay of the treatment of constipation is however dietary in nature with a lot of emphasis on *dietary fibre* and *fluid intake*. So let us get to know about dietary fibre – its sources and potential benefits.

Dietary fibre is defined as plant polysaccharide resistant to hydrolysis by the digestive enzymes in the human intestinal tract. It includes:

- Structural polysaccharides (insolublefibre) of the plant cell wall such as cellulose, hemicelluloses,non carbohydrate material, lignin etc.
- Non-structural polysaccharides (soluble fibre) such as pectins, gums and mucilages.

What are the sources of dietary fibre in our diet?

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What are the sources of dietary fibre in our diet?

The sources of dietary fibre include whole grain cereals, legumes, whole pulses, leafy vegetables, vegetables like peas, beans, ladies finger, fruits like guava, apple, citrus fruits, nuts, oilseeds like flaxseeds, methi seeds etc. Remember we read about the sources of soluble and insoluble fibre in Unit 11 earlier. You may wish to go back and recapitulate.

Do you know what the recommendations for fibre are? Well, the crude fibre intake should be 14 g/1000 Kcal. For adult woman 25 g/day and for adult man 38 g/day is desirable.

Increase in fibre intake may lead to symptoms such as flalulence and abdominal distention. This can be relieved through use of inputs like sprouting, fermentation, proper distribution of high fibre foods through out the day and adequate fluids. Bran and powdered supplements may be of help in individuals who do not eat sufficient amounts of fibrous foods.

What about the fluid and other nutrient intake during constipation?

The fluid intakeshould be at least 2 litres daily. This includes fluid as foods and beverage besides water. The intake of lemon juice, citrus fruit juices, coconut water, vegetable soups, watery dal, lassi and watermelon juice may have an added benefit of adding vital nutrients like potassium which improve the muscle toile.

As for the other nutrients i.e. calories, proteins, carbohydrates and fat the requirements would be the same as the RDA for a particular age, sex, occupation of the individual, weight status etc.

The nutritional management should aim at:

- developing regularity of habits of evacuation
- following a regular and balanced meal pattern
- consuming a high fibre and adequate fluid diet, and
- increase in physical activity and exercise

The requirements of various nutrients are not altered in constipation. It is essentially a normal balanced diet (normal RDA's) with modification in fibre and fluid intake. The

intake of fibre should be increased. High fibre foods should be given freely. Some of the foods which can be given freely/avoided have been mentioned in Table 14.6 and 14.7 respectively.

Table **14.6**: Foods to be given freely in constipation

Cereals	Whole-wheat, maize, millets.
Pulses	Whole-pulses such as rajma, chole, whole green gram etc.
Vegetables	Green leafy vegetables, knoll khol, lotus stem, peas, beans
Fruits	Guavas, pomegranate, apples with skin, chickoos, cherries, pear, peaches and plums.

Table **14.7:** Foods to be **avoided**/ restricted during constipation

Refined foods: pasta, refined cereals like maida, suji, baked products, pizza, patties, biscuits etc.
Deep fried foods
Pureed fruits and vegetables, banana, mango etc.

When changes in diet and activity patterns do not improve constipation, further evaluation is warranted and the need for drugs prescribed by the physician may be necessary.

14.2.7 Diverticular Disease

A common disorder of the large bowel, *diverticulosis,* is an early stage of the disease. It can be identified in 15% of the people over the age of 50 years. It is *a condition of abnormal pouches in portions of the colon* (small mucosal sacs called diverticula protrude through the intestinal wall). It has a history of *constipation*, which results in an increased intracolonic pressure, straining to pass hard faeces and rupturing of the bowel wall at weak points to form small pockets, which are called *diverticuli.* Inflammation and bacterial overgrowth in diverticuli may result in diarrhoea. When the pouches become inflamed (often as a result of bacterial infection), symptoms such as cramping pains, fever, and nausea can result. Such an infection, called as *diverticulitis,* is potentially life threatening and requires immediate medical intervention due to complications like ulceration or perforation or profuse bleeding.

Let us now discuss about the symptoms of diverticulosis.

Symptoms

Depending on the site of diverticula the symptoms may appear. It occurs most often in sigmoid colon and frequency increases with age. It is more common in the western world where the fibre intake is significantly lower. Often diverticula (pouches) cause no symptoms, except the person may experience some irregularities in bowel habits. When there is an active infection, there may also be fever, chills, nausea, and vomiting, changes in bowel habits, rectal bleeding and constipation.

We will now understand the causes of this disease.

Etiology

The causes of diverticular disease are not certain, but several factors may contribute to changes in the wall of the colon. These include:

- aging,
- the movement of waste through the colon,
- changes in intestinal pressure,
- a low-fiber diet, and
- anatomic defects.

The many complications of the disease include the following conditions:

- A perforation (hole) in the intestine leading to peritonitis, sepsis, and even shock
- An abscess (pocket of pus)
- Fistulas, which may also lead to sepsis
- Blacked intestine
- Rectal bleeding

It must be clear to you that diverticulosis occurs to a great extent due to faulty dietary habits and that several complications listed above may necessitate a surgical procedure. It is thus important to provide good nutritional care to the patient. We will now highlight some important aspects of the dietary management.

Dietary Management

Most of the diseases which we have discussed so far do not require any major changes in the nutrient intake. The patients generally benefit from a high fibre diet. Hence, a greater amount of bulk or fiber in the diet will promote soft, bulky stools that pass more swiftly and are defecated more easily. Also, the intra luminal pressure generated in the lower colon would be less and the fewer diverticuli will be formed. An increased intake of fluid must be emphasized. A decreased intake of fat in the diet may be suggested.

For mild symptoms, a clear liquid diet is recommended. More serious cases may require hospitalization, intravenous feeding to rest the bowel, and intravenous antibiotics. Eating a high-fiber diet and taking psyllium supplement are beneficial. Maintain overall nutrition. Some important aspects, which need to be taken care of, include:

1. **High-fiber** *Diet:* Population based studies suggest that eating a high-fiber diet helps prevent diverticular disease and other gastrointestinal disorders. A review of such studies reports that vegetarians are less likely to have diverticular disease, most likely because they tend to eat more fiber. Lower intake of protein such as red meat and milk products can reduce the risk of diverticulosis. Fibre supplements could improve constipation. One can give 1-2 tablespoons of wheat bran daily or isabgol. Also, remember that an amount of 15-20 g/day of crude fibre and 30-60 g/day of dietary fibre should be given.

2. *Glutamine:* While specific nutrients that may have an impact on diverticular disease have not been studied as thoroughly as the high-fiber diet, glutamine supplements are beneficial as they strengthen and protect the colon wall.

3. *Omega-3 Essential* Fatty *Acids:* Omega-3 essential fatty acids found in flax and cold-water fish help fight inflammation. For a condition such as diverticulitis, it may

- aging,
- the movement of waste through the colon,
- changes in intestinal pressure,
- a low-fiber diet, and
- anatomic defects.

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3. *Omega-3 Essential* Fatty *Acids:* Omega-3 essential fatty acids found in flax and cold-water fish help fight inflammation. For a condition such as diverticulitis, it may be wise to eat a diet rich in omega-3 fatty acids. This type of diet may also help prevent colon cancer.

4. Lifestyle *modifications*: Obesity may be associated with increased severity of diverticular disease. Hence, maintaining ideal weight for age is beneficial from all health aspects. Physical activity like jogging and running are beneficial. Exercise also reduces the symptoms of this disorder.

The prevention strategy for the disease involves the following:

- Eat a high-fiber diet (more than 15 g/day of crude fiber). This helps the stools to move smoothly through the intestines maintaining proper pressure in the colon. Fibre should be included when the inflammation subsides.
- If diverticula are present, avoid foods such as seeds that may block the opening of a diverticulum and lead to inflammation and infection.
- Exercise regularly to decrease the occurrence of symptoms.

The management goals discussed above are basic to prevention of diverticulitis. However, diet therapy during diverticulitis may be limited to clear liquids progressing to full liquids to normal diet. Increase the fibre only when the inflammation subsides. So please note during a bout of diverticulitis the patient should be given a low fibre soft bland diet. Severe diverticulitis is treated by surgical methods. In such situations patient should be prepared for an elective surgery. You may recapitulate about dietary management pre and post operatively by reading the section on surgery in Unit 5 of this manual.

We now need to attempt the check your progress exercise **3** given herewith to recapitulate what we have learnt so far.

Check Your Progress Exercise 3

1. Differentiate between the following:

14.2.9 Malabsorption Syndrome

Did you know that a major part of the absorption of nutrients takes place in the small intestine and the set of enzymes involved in this process are called *disaccharidases*. In some conditions either genetically, or due to some intestinal damage there appears to be a deficiency of some of these enzymes, which in turn, leads to the malabsorption of some of the nutrients precipitating symptoms of diarrhoea, distention and abdominal discomfort and steatorrhoea (fat in stools).

These conditions are together referred to as *Malabsorption Syndromes*. The term 'malabsorption syndrome', as you have learnt earlier also, is used to describe deficient absorption to a variable degree of a number of substances such as fats, proteins, carbohydrates, vitamins, minerals and water.

Before we understand about this syndrome, let us look at the following case study. Anuradha, a teenager, presents to the physician's office with a two-year history of intermittent diarrhoea. Her reports reveal a past history of anaemia, anorexia and minor abdominal pain. Her weight has been the same for *2* years now. Her mother has attributed this to her having a "rough time in school". Her mother also questions whether the symptoms could be related to a recent move from their home. She has not yet reached menarche. A diet history suggests a normal diet with adequate iron intake. Can you guess what she suffers from and what could be the causative factors leading to such a condition?

Well, you have guessed it right. She suffers from 'Malabsorption syndrome'. Let us proceed further and get to know more about it. We shall begin with the etiology.

Etiology

The causes cited for malabsorption can be associated with a number of diseases. Many of these diseases you may not know presently but they will unfold as you read further. These are tabulated in Table 14.11.

Table 14.11: Principal causes of malabsorption

Anatomical or Surgical	: Surgical resection, Fistula, Gastric surgery, Blind loop and stricture and Diverticulosis
Enzyme deficiencies	: Pancreatic disease, Biliary obstruction and Disaccharidase deficiency
Mucosal defects	: Celiac disease, Tropical Sprue, Crohn's disease and Radiation
Systemic causes	: Scleroderma, Diabetes, Lymphoma, Thyroid disease and Severe skin disorders
Drugs	: Cholestyrainine, Antibiotics, excess laxatives
Infections	: Giardia and parasitic infestation, tuberculosis and bacterial overgrowth.

Malabsorption can thus occur due to a host of reasons. However, what are the symptoms that would have an impact on the nutrition and health status of the patient and hence his dietary intake. Let us read and find out next.

Symptoms

The most common symptoms are weakness, lassitude and marked weight loss. Steatorrhoea (excess fat in stools), anaemia and chronic ill health. Diarrhoea is the most common GI tract disturbance along with flatulence, mild abdominal pain, anorexia, nausea and vomiting. Nutritional deficiency commonly occurs and may manifest itself as glossitis, tetany, bone pain and paraesthesia and convulsions. The objective evidence of these are scenas smooth tongue, oedema, dry skin, bleeding, pigmentation, dermatitis, peripheral neuropathy and proximal muscle atrophy.

Let us now discuss a few important conditions grouped collectively under the term of malabsorption syndrome. These are:

- Celiac disease
- Tropical sprue
- Steatorrhoea
- Lactose intolerance
- Inflammatory bowel syndrome,
- Ulcerative colitis
- Short bowel syndrome

We shall brief ourselves on some of these disorders. Let us begin with celiac disease.

14.2.9.1 Celiac Disease

Gluten-sensitive enteropathy or, as it is more commonly called, celiac *disease*, is an *autoimmune* inflammatory disease of *the* small intestine. It is precipitated by the ingestion of gluten, a component of wheat protein-gliadin, in genetically susceptible persons. A defect in the enzyme system that splits this protein fraction along with atrophy of jejunal mucosa may be the specific cause for celiac disease. It usually develops within the first three years of life.

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Symptoms

Child with celiac's disease fails to thrive, losses appetite and has a potbelly. Stools are large, pale and offensive due to the presence of fat in the form of fatty acids. Anaemia is present with symptoms of paleness, fatigue, tachycardia (fast pulse). The microscopic section of the villi show flattening of the villi. When gluten-free foods are given there is a dramatic recovery in the symptoms and the reversal of villi to normal growth. Celiac disease has also been noted to be associated with numerous neurologic disorders, including epilepsy, cerebral calcifications, and peripheral neuropathy. The list of symptoms as mentioned in various sources for celiac disease includes:

- *Digestive symptoms* – diarrhoea, abdominal pain, abdominal bloating, pale stool, foul-smelling stool, loose stool, flatulence.
- *Behavioural symptoms* — there are also several other symptoms such as irritability – especially in children, depression and behaviour changes in adults.
- *Inadequate nutrition symptoms* — because celiac causes malabsorption, the body does not get enough nutrients, leading to symptoms such as weight loss, delayed growth, failure to thrive (infants), missed menstrual periods, anaemia and fatigue. Anaemia is the most common laboratory manifestation of celiac disease. Iron is absorbed in the proximal small intestine, where celiac manifestations are most prominent; hence, iron malabsorption is common. Less commonly, vitamin B_{12} deficiency, folate deficiency, or both may be present.
- Gas formation, bone pain, joint pain, seizures and muscle cramps.
- *Non-specific symptoms* — some people get mild but unclear symptoms such as, tingling sensation, numbness (due to damage of nerves in the legs), painful skin rash, tooth discolouration and enamel loss.

Some important complications are enumerated herewith:

Complications

Patients with severe form of celiac's disease for long period are at risk for several complications mainly due to nutrient absorption problems leading to malnutrition. These complications are highlighted in Table 14.12:

Table 14.12: Complications due to Celiac's disease

Congenital defects – in babies born to celiac mothers	Miscarriage
Osteoporosis (weak and brittle bones)	
Lymphoma (can develop in the intestine)	Stunted growth in children
Seizures or convulsions	Anaemia

Dietary management of celiac disease is of crucial significance as it is related not only to the frequency and severity of morbidities but also mortality of the patient, usually a child. We will brief ourselves on the dietary management next. Based on the cause, symptoms and complications the major objectives of dietary management include the following:

- Providing a nutritionally adequate diet
- Strict restriction of gluten foods
- Vitamin and mineral supplementation

In the subsequent text we will learn about the dietary management of celiac disease.

Dietary ***Recommendations***

The only dietary treatment for celiac disease is to follow a gluten-free diet. For most such a diet improves symptoms, heals intestinal damage, and prevents further damage.

Improvements begin within days of starting the diet, intestines are healed within 3-6 months for children but in adults it could take upto 2 years. The gluten-free diet is a lifetime requirement. Eating any gluten, no matter how small an amount, can damage the intestine. A small percentage of people with celiac disease do not improve on the gluten-free diet because the intestines are severely damaged. Such patients must be evaluated for any complications. In such cases there is need for intravenous nutrition supplements.

What is a gluten-free diet? Let us read and find out. The Gluten-Free Diet, as we have learnt earlier also, is *a diet that contains no gluten. Foods like wheat, rye, barley, and possibly oats must be avoided.* The gluten-free diet is complicated. It requires a completely new approach to eating that affects a person's entire life. Products like bread biscuits, breakfast cereals, poories, paranthas, chapathis, macaroni, noodles

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Table 1.4.13gives an idea of the gluten sources to be avoided by the subject, the food that can be taken are from the non-gluten sources.

Table **14.13:** Gluten **and** Non-gluten sources

Gluten Sources	Non-gluten Sources
Beverages: cereal beverages, ovaltine, beer and ale	Coffee, tea, chocolate drinks (pure cocoa) wine
Milk beverages that contain malt	Whole, toned, skim milk and buttermilk
Meat and meat products: Breaded meats commercially available	Pure meats, fish, poultry, eggs, cottage cheese, peanut butter
Fats and oils: Commercial gravies, white sauce and cream sauces	Butter fats and oils
Cereal and *cereal products:* Bread, wheat, oals, rye, malt, pastry flour (maida), bran, barley, wafers, pasta.	Rice, potato flour and soya flour, pure corn, popcorn.
Vegetables: Breaded vegetables with any of the sauces, white sauces etc.	All fresh vegetables, canned and pured.
Fruits: Any fillings e.g. pies etc.	All fresh fruits
Snacks: Pastries, patties, pizzas, samosas, mathris etc.	Milk base sweets (pure) without addition of any cereal products.

Let us have a look at few of the tips whicli patients can follow and enjoy their meals and at the same time, avoid any possible nutritional deficiency.

- Iron deficiency should be treated with supplemental iron.
- Osteoporosis should be treated with calcium and vitamin D supplements.
- Depending on individual factors, patients with gluten-sensitive enteropathy may need to take a multivitamin supplement along with iron, calcium, magnesium, zinc, selenium, vitamin D, or other nutrients,

- Check for commercial gluten-free products, including breads, cookies, chips, and breakfast cereals that may be available in India.
- Meats, vegetables, fruit, and most dairy products are free of gluten.

Another common malabsorption syndrome listed in the section 14.8 seatorrhoea which is discussed below.

14.2.9.2 Steatorrhoea

Steatorrhoea is a symptom of the disorders of fat metabolism and malabsorption syndrome and can be defined as *a condition of foul-smelling bulky faces.* It is suspected when the patient passes large, "greasy", and foul-smelling stools. Both digestive and absorptive disorders can cause steatorrhoea. Digestive disorders affect the production and release of the enzyme lipase from the pancreas, or bile from the liver, which are substances that aid digestion of fats. Absorptive disorders disturb the absorptive and enzyme functions of the intestine. Any condition that causes malabsorption or maldigestion is also associated, with increased faecal fat (steatorrhoea). **As** an example, children with cystic fibrosis (hereditary disease) have mucous plugs that block the pancreatic ducts. The absence or significant decrease of the pancreatic enzymes; amylase, lipase, trypsin, and chymotrypsin limits fat, protein and carbohydrate digestion, resulting in steatorrhoea due to fat malabsorption.

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A predominant feature is delayed and defective absorption of fat, which results in bulky stools containing large quantities of fat (known as steatorrhoea). The severity of steatorrhoea depends on the quantity of fat in the diet. Besides the absorption of water, electrolytes, vitamins and minerals is also impaired. These defects are due to flattening of the villi in the jejunum (a part of the small intestine). Remission and relapses are common if proper medical and dietary care is not provided. The major reasons attributable to steatorrhoea have been enumerated below.

Etiology

The list of possible underlying causes of steatorrhoea includes:

- Malabsorption
- Malabsorption of fats in small intestine
- Pancreatitis
- Celiac disease
- Sprue

Symptoms

The list of symptoms includes:

- Bulky, pale, loose, greasy and foul smelling stools.
- Anorexia, feeling of fullness, pain in abdomen.

The major points that we must remember while planning diets for patients suffering from steatorrhoea are highlighted below for a quick reference.

Nutritional Management

The nutritional management of steatorrhoea should focus on the following:

- Plenty of rest and relaxation and avoid stress
- Correction of water balance

- Correction of electrolyte problems (Na, K, Ca)
- Vitamin supplementation (A, D, E and K)
- Inclusion of low fat, carbohydrates and fibre diet
- High to moderate protein intake
- Give digestive enzyme supplements (if required)

The nutrient requirements do not change considerably and other principles of dietary management remain more or less the same as for chronic diarrhoea.

Next, we will discuss about lactose intolerance – a form of food allergy which has a widespread prevalence.

14.2.9.3 Lactose Intolerance

We commonly hear from people of all age groups, particularly children and elderly to be complaining of abdominal discomfort after consuming milk. Some individuals are able to tolerate a small quantity while others are unable to tolerate even a small amount. Well, this could be due to lactose intolerance. But what is lactose intolerance?

Lactose intolerance relates to insufficiency of the disaccharidase enzyme '*lactase*' which is found in the greatest quantity in the outer membrane of the mucosal cell of the jejunum. The degree of lactase deficiency may vary in individuals. Lack of lactase does not break down the disaccharide sugar – lactose present in milk, to glucose and galactose, it passes unchanged into the large intestines where it gets converted to lactic acid by the bacteria, which subsequently cause diarrhoea and other symptoms of discomfort, distension and abdominal pain. The problem is gene related and often seen in infants and young children commonly, but may also be present in adults. Major causative factors are being discussed below.

Etiology

14.2.9.4 Inflammatory Bowel Disease (IBD)

Inflammatory bowel disease is a general term used to refer to chronic inflammatory condition of the intestine. It is applied to three conditions having similar symptoms but different underlying clinical problem. It includes:

1. Ulcerative colitis
2. Crohn's disease
3. Short bowel syndrome

When the inflammation is in rectum with extension into the colon without affecting the right colon or small intestine, the disease is called *ulcerative colitis*. When an inflammatory process involves one or more lengthy segments of the small or large intestine with inflammation from the mucosa to serosa, the disease is called ***Crohn's* disease.**

What is the difference between ulcerative colitis and Crohn's disease? The differences between the two include:

1) Anatomic distribution of the inflammatory process: Crohn's disease can occur in any part of the GI tract – the small intestines the colon and even the colorectal region. However, in ulcerative colitis, the inflamination is confined to left colon and rectum.

2) In Crohn's disease, inflammatory process affects the entire thickness of the wall of the small intestine leading to strictures that can cause obstructions or formation of fistulas. In ulcerative colitis the inflammatory process is in mucosa and sub mucosal tissues of the intestine and lasts for a few weeks.

Having looked at the difference between ulcerative colitis and Crohn's disease, let us next review the etiology of these diseases.

Etiology

These diseases are referred to as idiopathic (cause unknown) and though the possible mechanism suggested includes genetic factors, immune mechanism, bacterial or viral agents, sugar (excess) and low fibre intake has also been implicated especially in Crohn's disease.

The symptoms, complications of inflammatory bowel disease are summarized next.

Symptoms

Inflammatory bowel diseases are associated with:

- Abdominal cramping, diarrhoea
- Steatorrhoea
- Obstruction caused due to bulky foods, and
- Malnutrition

What are the causes for malnutrition in these disease conditions? Let us find out.

Causes of Malnutrition in Inflammatory Bowel Disease

The causes of malnutrition include:

- Decreased oral intake, which can be disease induced due to abdominal pain, diarrhoea, nausea, anorexia.
- Malabsorption due to decreased absorptive surface (destruction of villi), bile salt deficiency, bacterial overgrowth and use of drugs.
- Increased secretion and nutrient losses due to GI blood losses, electrolyte, trace mineral losses.
- Increased requirements due to inflammation, fever, increased intestinal cell turnover, haemolysis.
- a Drugs interference related to corticosteroids, (interferes in calcium absorption and protein metabolism), sulfasalazine (interferes in folate absorption), Cholestyramine (interferes in fat soluble vitamin absorption).

- Deficiency of folate, vitamins A, C, D, low serum levels of zinc, copper and iron are observed in patients.

So then, what can be done to manage these conditions? The next section focuses on the nutritional management of inflammatory bowel diseases.

Nutritional Management: Inflammatory Bowel Disease

Adequacy of nutritional needs and minimizing stress on the inflamed or narrowed segment of the bowel are the main principles of nutrition management.

To decrease eating associated symptoms and decreased bowel activity during healing,

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Nutritional Management: Inflammatory Bowel Disease

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To decrease eating associated symptoms and decreased bowel activity during healing, patients hospitalized for IBD (Inflammatory Bowel Disease) are placed on a "bowel rest" programme, which involves reduction in oral intake, clear liquids and low residue foods. This is normally done to achieve the following:

1. Decrease the absorptive work of the bowel and provide rest.
2. Minimize mechanical trauma caused by the passage of food.
3. Decreased diet associated secretions (acid, enzymes) that may aggravate inflammation.

The diet should be liberal in protein and calories and should be sufficient to maintain or restore weight/support growth of children and adolescents. Supplementation with multivitamin preparations (1-5 times above RDA) in necessary as this condition precipitates deficiency of many nutrients, decreases absorption and increases requirements.

Overemphasis on fibre may be avoided in patients with strictures as it may lead to blockage.

Streatorrhoea is more common in Crohn's disease due to ileal resection. This may favour calcium-fatty acid complex formation and increased excretion. It may be accompanied by magnesium (Mg) and zinc (Zn) losses. Steatorrhoea also favours increased absorption of oxalates. In addition, this state is marked with an increased binding of fatty acid to calcium and thus more oxalate is free in solution for colonic absorption. Fatty acid also increases the permeability of oxalate through colonic mucosa. Thus, a reduction in fat intake coupled with calcium, magnesium and zinc supplementation is suggested.

To help you understand the inflammatory bowel diseases better, we have a detail discussion on two of these diseases namely ulcerative colitis and small bowel syndrome. We begin with ulcerative colitis.

A. Ulcerative Colitis

Let us understand clearly about ulcerative colitis by reading the following case.

Varun, a 48-year-old male, had a very successful career in a computer company. His company was his life. He put in long hours when he was working on an important contract and seldom even took a Sunday off. He was delighted when a deal came together, and he celebrated his success at his favourite Chinese restaurant. When he worked 10-12 hours at a stretch, he just ordered his favorite Chinese food, which frequently gave him bouts of diarrhoea. But the latest episode was really bad. He felt nauseated and had cramps for 2 nights and developed a fever. On the second night, he noticed blood in the stools and he resolved to call the doctor. What do you think he might be suffering from? Well, this is the case of Ulcerative Colitis. What is it? Let us find out.

Ulcerative Colitis is a diffuse inflammatory and ulcerative disease of unknown etiology involving the mucosa and sub-mucosa of the large intestine. It occurs at any age but predominates in young adults. Onset is insidious in the majority of cases.

Next, we will understand the etiology of ulcerative colitis.

Etiology

No single etiologic factor has been identified although genetic auto-immune factors are thought to be involved. Although exacerbations are more likely during the conditions of mental conflict and emotional stress. Allergy to certain foods especially milk may be a factor in precipitating the disease.

What are the disease symptoms? Let us find out.

Symptoms

As discussed in the case study above, the common symptoms are:

1. Mild abdominal discomfort, an urgent need to defecate several times a day.
2. Diarrhoea accompanied by rectal bleeding.
3. Weight loss, dehydration, fever, anaemia and general debility.
4. Edematous and hyperemic mucosa seen in early stages.
5. In more severe disease, necrosis and frank ulceration of the mucosa occurs.

So how to manage this chronic condition? The dietary management is described next.

Dietary Management

important aspects of dietary management.

The dietary management and nutrient recommendations need individual attention depending on the extent of disease and problems of malnutrition exhibited, There is a wide range of tolerance for various foods observed from one patient to another. Let us first identify the calorie needs of the patient.

Energy: The calorie requirements must be increased to:

1) restore weight status and maintain ideal weight.
2) compensate for the elevated BMR.
3) support growth especially if the age group is adolescents. A caloric intake of 40-50 Kcal/kg IBW/day is recommended.

Proteins: Patients with ulcerative colitis lose about 4-8 g fecal N_2 as compared to the normal excretion of 2 g. In severe ulcerative colitis, 20 g N_2 (equivalent to 125 g of protein) may be lost daily. The serum albumin is low. Proteins are necessary for tissue synthesis, tissue healing and to compensate for the increased losses in stools. Thus, liberal amounts of high quality protein i.e. 1.5 g / IBW are needed to make up for the losses. Emphasis should be on tender meats, fish, poultry and eggs for those patients who are allergic to milk.

Fats: Usual foods, which contain fats (invisible or inherent fat), are permitted but not fried foods, as they are not easily digested due to liver dysfunction. Thus fats rich in medium chain triglycerides should be consumed as steatorrhoea is predominant in ulcerative colitis. Total fat intake can be kept close to 55-60 g with visible fat intake less than 25-30 g/day.

Carbohydrates: They form the easily absorbable source of energy. Bulk-producing vegetables are restricted so as to allow better intake of nourishing foods. Sugars and starches can make the increased caloric intake.

Fibre : Eliminating roughage seems to have a better effect on preventing relapses of the disease. A low residue diet may be given during an acute attack to prevent severe

bleeding during diarrhoea. Thereafter some degree of fibre restriction is generally needed as many ulcerative colitis patients do not tolerate raw vegetables. It may cause further damage to the alieady inflamed mucosa. The forms, in which vegetables are given, can be changed. All kinds of irritant and spicy foods should be strictly avoided. Raw vegetables, spicy and irritant foods may be avoided.

Vitamins: Commercial multivitamin preparation should be administered orally especially the ones needed for the healing process and the utilization of calories and proteins.

Minerals: Mineral losses may be marked and unless replaced may contribute to a fatal outcome. A patient with moderately advanced ulcerative colitis passes a large volume over 400 ml of faeces per day and thus may lose considerable amount of sodium (6 g NaCl/litre of stool). Thus oral sodium intake is increased by added salt, sprinkling additional salt in foods. Potassium loss can be estimated as 30 mEq / 2.2 g of potassium chloride / litre. Usually high excretion of potassium even 167 mEq / day may sometimes be encountered. Manifestations of potassium deficiency such as weakness, hypotonia; abdominal distension and even electrocardiographic changes may occur. Oral administration of potassium salts as potassium citrate may be helpful.

Elimination of milk from the diet may call upon calcium supplementation to the extent of 400-800 mg/day. Protein to Calcium ratio is to be maintained for optimum utilization. Iron by the oral route is usually not well tolerated. Daily about 30 mg of elemental iron is given. If anaemia is marked, then blood transfusions may be given.

Fluids: A liberal intake of fluid should be given to prevent dehydration. The passage of at least 1200 ml of urine indicates that a patient is well hydrated.

We will now discuss about another inflammatory bowel disease i.e short bowel syndrome.

B. Short Bowel Syndrome (SBS)

Short bowel syndrome is a *group of problems affecting people who have had half or more of their small intestine removed*. The massive resection of the intestine decreases the transit time of the faeces. Besides any damage to the small intestine, especially that of the jejunum affects the nutrient uptake and absorption.

Etiology

The etiological factors involved in this disease are:

- Anaemia
- Osteoporosis
- Stone formation
- Decreased susceptibility to infection
- Dehydration