Uttar Pradesh Rajarshi Tandon
Open University, Prayagraj

UGHN-109
DIET THERAPY

UTTAR PRADESH RAJARSHI TANDON OPEN UNIVERSITY
UGHN 109- DIET THERAPY

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UGHN-109
DIET THERAPY

BLOCK
1
CONCEPT OF DIET THERAPY

Block 1 Concepts of Diet Therapy

The energy and building blocks for the innumerable chemicals that are necessary for the development and survival of living beings are provided by food. The physiologic and biochemical mechanisms that control how nutrients work determine how they become part of the body and help it function.

This block includes growth and scope of dietetics, purpose and role of therapeutic diets in disease prevention, modifications of therapeutic diets, role of dietician and characteristic of dietician in society and health care process.

The type of nutrition care given to a person relies on a number of factors, including the existence or danger of a disease, the environment, the person's stage of growth and development, and socioeconomic concerns. In addition to identifying nutrition diagnoses, it will include an evaluation of the variables influencing the current nutritional status and the appropriateness of dietary intake. Depending on the etiology of the issue, various therapies may be used, including dietary manipulation, enteral or parenteral support, intervention through counselling or education, and care coordination. The majority of the time, institutions will have set standards of care or practice guidelines that outline suggested patient nutrition care procedures.

Second chapter of this block highlights hospital food services, Importance of Diet counselling, role of dietician in health care professional team, use of various software and technologies in diet planning and counselling and Indian Dietetic Association (IDA).

UNIT 1 CONCEPTS OF DIET THERAPY

STRUCTURE

1.1 Introduction

Studying nutrition requires a thorough understanding of the many food ingredients, their roles in the body, and the body's requirements for each one. One learns how to make the right food selections for meals that provide a well-balanced blend of the essential vitamins, minerals, and other nutrients. It also involves studying the processes by which food is digested and absorbed by the body. This area is used in public health, agriculture, veterinary science, and medicine.

It is impossible to exaggerate the impact of diet on people's health and wellness. One's quality of life is considerably improved by eating a healthy, balanced diet. Insufficient nutritional intake and bad eating habits are the main causes of many diseases. The fields of nutrition and dietetics are related to this aspect of life involving food and nutrition.

Objectives

After studying this unit you will be able to :

- Understand the field of nutrition and dietetics and it's relation with human physiology.
- Understand the principles of therapeutic diets.
- Types and purpose of various therapeutic diets.

1.1 Growth and scope of dietetics

The study of using nutritional principles to develop suitable diet program for both health and sickness is known as dietetics. To put it another way, dietetics lays a lot of attention on diet therapy and the potential applications it may have for patients.

Therefore, two alternative approaches to nutrition care and intervention—individual and group-focused—can be related with dietetics.

The body can only use nutrients that have been taken through food. Therefore, nutritionists and dietitians must take into account all the factors that influence or rather determine what, how, when, why, and how much a person consumes.

Dietetics requires multidisciplinary methods because nutrition and diet guidance are both science and art.

Scope of dietetics / dietitian

Concerning the moral problems and difficulties associated with providing patients with nutrition therapy, the dietitian has a specific responsibility to play. The dietician serves as a link between the patient and the medical staff or doctor when making challenging decisions concerning nutrition treatment.

The dietician must continue to be crucial in the assessment and formulation of decisions about the nutritional care of terminal patients.

Dietitians are employed in a variety of roles and workplace environments.

Dietitians work for food service for students, hotels, food and pharmaceutical enterprises, employee cafeterias (industrial canteens), as well as community and public health services. Some work independently and/or in private practice. These days, dietitians work in journalism, sales, and marketing as well.

Figure 1.1. Scope of Nutrition

The practice and functions of dietitians are continually changing as societal health requirements change and as the health care system improves to suit those needs.

Dietitians need to have communication and education skills, in addition to their technical knowledge and practical abilities, because they may be asked to plan, organize, and implement and assess the effectiveness of groups, clients, and individual nutrition education.

1.2 Purposes and Principles of Therapeutic Diets

A well-planned diet that provides the body with all of the essential nutrients aids in nutritional balance in a typical, healthy person. However, in conditions of disease, the body tissues either do not absorb the proper nutrients in appropriate proportions or are unable to use the nutrients that are present as a result of poor food element digestion, absorption, or transportation, which affects the sick person's nutritional homeostasis. As a result, the diet needs to be carefully modified.

Dietary therapy therefore focuses on modifying a person's typical diet to meet their medical requirements.

Diet therapy is the practice of using food not only to treat illness but also to prevent disease and maintain good health.

It focuses on the use of food as a tool to speed up the healing process after illness.

The broad objectives of Diet therapy are:

1. To keep up good nutritional health.

2. To remedy nutritional deficiencies that might have developed as a result of the illness.

3. To provide rest for the entire body or for the particular organ that the sickness has afflicted.

4. To modify food intake to the body's capacity to metabolize nutrients while the sickness is present.

Factors to consider in planning therapeutic diets:

1. The underlying illness that requires dietary modification.

2. The potential severity of the illness.

3. The dietary components that need to be changed in order to treat these disorders.

4. The patient's tolerance for oral nutrition.

The following are a therapeutic diet's four qualities:

- Suitability
- Reliability

- financial
- Delectability

1.3 Modifications of Normal Diets

A therapeutic diet is a qualitatively or quantitatively altered version of a typical diet that has been adapted to meet the evolving nutritional demands of the patient or individual and is used to treat a particular illness or condition.

The quality and quantity of therapeutic diets can be modified in two ways

Qualitative-

- Limiting a nutrient, such as sodium in cases of hypertension

- An excess of a nutrient, such as in the case of tuberculosis, where more protein and energy are needed.

Quantitative

- A different consistency, such as a clear liquid diet

- Rearranging meals, such as eating more frequently.

- Food omission, such as in the case of an allergy, which necessitates total omission of the allergenic food.

The following are possible justifications for altering diets:

- For necessary or life-saving therapy, such as providing a gluten-free diet for people with celiac disease.
- To replenish individuals who are undernourished as a result of illnesses like cancer and gastrointestinal disorders by giving them more protein,
- To address nutritional deficits and maintain or improve nutritional status.
- To rest or soothe an injured organ, as in the case of gastritis,
- To adapt to the body's capacity to metabolise, absorb, digest, or excrete: For instance, a low-fat diet caused fat malabsorption.
- To modify consumption of food tolerability. When patients with esophageal cancer cannot handle eating by mouth, tube feeding is indicated, for instance.
- To avoid foods because of food intolerances or allergies,

- To overcome mechanical challenges, such as modifying the texture or consistency of food as advised for senior people with denture issues because of chewing and/or swallowing issues.
- When necessary, such as in the case of obesity or underweight, to increase or decrease body weight/body composition.
- As an effective treatment, alternative to or in addition to medication, such as in the case of diabetes or hypertension.

1.4 Dietary Modifications for Therapeutic Needs: Classification

Before a diet can suit the therapeutic requirements of a certain patient, it may need to be changed and modified in a variety of ways. Among these adjustments could be a change in food consistency, such as a liquid diet, soft diet, low-fiber diet, or high-fiber diet.

An increase or decrease in the diet's energy value, such as a low-calorie diet for losing weight or a high-calorie diet for burning calories.

A change in the amount of a certain nutrient or the type of food ingested, such as a diet low in sodium, high in fibre, or high in potassium.

Removing seasonings and condiments, such as through bland diets.

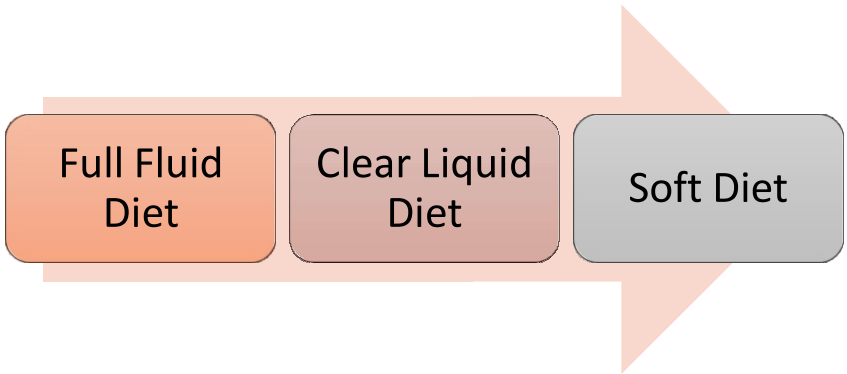
Exclusion of certain foods, such as in gluten-free diets and allergy diets

Adjustments to the balance and ratio of proteins, lipids, and carbohydrates, such as those seen in cholesterol-lowering, diabetic, and renal diets.

Test diets: These are one- or two-day diets or single meals that are provided to patients in conjunction with specific tests, such as the fat absorption test used to identify the presence of steatorrhea.

Modifying the quantity and frequency of meals, such as with a diabetic diet or a diet for peptic ulcer disease; changing eating intervals; and changing the frequency of meals.

1.Diets of Altered consistency



a) Liquid Diet consists of foods that can be served in liquid or strained form in room temperature. They are usually prescribed in febrile states, postoperatively i.e. after surgery when the patient is unable to tolerate solid foods. It is also used for individuals with acute infections or digestive problems, to replace fluids lost by vomiting, diarrhoea. The two major types of liquid diets include - Clear liquid diet and full liquid/fluid diet.

Clear, liquid meals and drinks served at room temperature make up a clear liquid diet. Hydrating patients with fluids and electrolytes is the aim of the clear liquid diet. It provides some energy but just a little amount of other nutrients. It is also deficient in fibre.

Foods and drinks that are liquid or semi-liquid at room temperature make up a full liquid diet. It functions as a food stopgap between a clear liquid diet and a regular diet. The goal of a full liquid diet is to provide an oral (by mouth) source of fluid for people who are unable to chew, swallow, or digest solid food. It provides appropriate nutrients and more calories than the clear liquid diet, with the exception of the absence of fibre. It is **Soft Diet**: A "soft diet," as the name implies, consists of soft, whole foods that are mildly seasoned and are akin to a regular diet. The term "soft" describes the fact that the foods in this kind of diet are soft in consistency, simple to chew, and easily digestible.

It does not have strong tastes and harsh fibres. It is used during acute infections, some gastrointestinal conditions, and at the post-operative stage to people who are recovering from surgery. The soft diet offers a transition from a liquid to a regular diet, that is, at the time when a patient must stop taking a full liquid diet but still cannot take a regular meal.

b) Bland Diet: A bland diet consists of soft, unexceptional foods. Spiciness and little fibre. It consists of meals that are least prone to irritate on a mechanical, chemical, and thermal level. Gastrointestinal system. This diet is recommended for people with stomach or duodenal ulcers, gastriris, or ulcerative colitis.

Foods Served: milk and dairy products with reduced or no fat content; Rice, refined cereal-based pasta, bread, prepared fruits and vegetables without skin or seeds; eggs, chicken, fish, and other lean, soft meats that are steamed, roasted, or grilled; Butter, cream, puddings and custards, and clear soups.

Modification in Quantity

Depending on their clinical condition, some persons may need to adhere to a restriction diet, such as a low residue diet (recommended and/or before stomach surgery) or a salt restricted diet (as in high blood pressure). The goal of these diets is to reduce faeces' frequency and output. A complete elimination diet may occasionally be recommended when there are food intolerances or complete insensitivity to a single food, such as a gluten-free diet, a dairy-free diet, a nut-free diet, etc. On rare occasions, a clinical condition could call for a larger consumption of a specific dietary element, such as a high potassium diet, a high-fiber diet (for constipation), or an iron-rich diet (for anemia).

Modification in Nutrient Content

To correct nutritional deficiencies, alter body weight, or manage disorders like diabetes or hypertension, the nutrient composition of the diet is changed. You may have seen patients with high blood sugar levels who were given a diabetic diet that called for alterations to the amount and kind of carbohydrates included in each meal. It is advisable to stay away from refined carbs (such sugar, honey, refined flour, semolina, etc.) and instead use complex carbohydrates (like whole wheat flour, coarse cereals, etc.). Patients with advanced liver illnesses and kidney failure should follow a low-protein diet, while those with HIV disease, cancer, or malnutrition should follow a high-protein, high-calorie diet. Patients with heart disease should follow a fat-controlled, low-cholesterol diet. Others as in the case of overweight, obesity a weight reduction diet, low in fat and calories.

Changes in Meal Frequency

Individuals suffering with gastro-esophageal reflux disease (GERD) stand to benefit by consuming small but frequent meals. 5 to 6 small meals instead of three regular meals are recommended.

Check Your Progress Exercise 1

1. What are the factors considered for planning therapeutic diets?
2. What are the various opportunities in the field of nutrition?
3. List down the types of modifications in therapeutic diets.
4. **State whether the following are true or false**:

(i) The practise and functions of dieticians are continually changing as societal health requirements change and as the health care system improves to suit those needs.

(ii) A bland diet is a liquid diet.

(iii) Therapeutic diets are the modification of normal diets.

1.5 Dietitian's Role in Nutritional Care

A dietitian is a specialist in dietetics who manages human nutritional care. A dietitian helps individuals understand the link between diet and health and helps them choose the correct foods to attain and maintain good health as well as to prevent and cure disease using the concepts and science of human nutrition. Clinical, community or public health, food service, administration, freelancing or consulting, research, or teaching are just a few of the professions that dietitians hold. However, you'll find that the majority of dietitians are clinical dietitians who work in hospitals, nursing homes, and other healthcare facilities or specialized institutes/units to offer dietary advice to patients and provide nutritional therapy to patients with a variety of medical conditions.

1.6 Characteristics of Dietitians

Clinical dietitians are more likely to engage in the following activities:

- Gathering, organising, and analysing information about the nutritional and health status of people, groups, and communities.
- Reviewing and analysing patients' nutritional requirements and objectives in order to provide suitable dietary advice
- Create and implement nutrition care programmes, and then follow up with, assess, and make any corrections to them.
- Determine the nutritional value of the planned meals or foods,
- For patients who are critically ill or near death and need specialised feeding via oral, enteral, or parenteral channels, prescribe therapeutic diets and specific nutrition support and feeding regimens, supervise the production of special foods, and special nutrition formulas.
- Plan and arrange simple menus, aid in directing the preparation of menus by food service staff.
- To ensure the efficient operation of the kitchen and other places used for food preparation or eating, schedule work assignments for the dietary unit.

1.7 Let us sum up

In order to maintain and practice a healthy lifestyle, it is crucial to learn the fundamentals of nutrition and diet. What is the field of nutrition actually, and how does it significantly impact our daily lives, as we began this unit? We discovered that inadequate nutritional intake and poor eating habits are the main causes of many diseases. The fields of nutrition and dietetics are related to this aspect of life involving food and nutrition.

Dietitians play a key role in enhancing health since they may lead you down the right route by managing lifestyle factors effectively. The idea of therapeutic nutrition and how to alter typical diets to achieve different therapeutic diets were also discussed in this course. The goal of a therapeutic diet is to address specific illness conditions by altering the consistency, nutrient content, and meal times of the diet, since we now understand that a diet plan is always customized and not generalized. It is advised to start your diet with a clear liquid diet after surgery and gradually increase the consistency to a full meal if you have ulcers, for example. Specific modification has a key role in treating specific illness problems.

We also covered the various functions of a nutrition care professional and how important their role is in nutritional management of disease. Completing this section would have given you a brief insight into the field of nutrition and dietetics.

1.8 Glossary

Celiac disease: A disease in which the small intestine is hypersensitive to gluten found in wheat as well as barley, rye, and oats.

Gastritis: Inflammation of the lining of stomach

Gastro esophageal Reflux Disease (GERD): A digestive disease in which stomach acid or bile irritates the food pipe line.

Gluten-free diet : A gluten-free diet (GFD) is a nutritional plan that strictly excludes gluten, which is a mixture of proteins found in wheat as well as barley, rye, and oats.

Esophageal cancer: Cancer of the esophagus.

1.8 Progress Exercises

1. What are the factors considered for planning therapeutic diets?

2. What are the Opportunities in the field of nutrition?

3. List down the types of modifications in therapeutic diets.

UNIT 2 DIET PLANNING AND COUNSELLING

STRUCTURE

2.1 Introduction

In the modern world, where there is so much uncertainty in life, it is challenging to manage and keep a healthy lifestyle and avoid getting any chronic diseases. We will learn more about the idea of diet planning in this unit. A balanced diet is what leads to a healthy lifestyle. A nutritious and well-balanced diet aids in addressing nutritional deficiencies and is crucial for a quick recovery from illnesses. We will discuss a number of features of hospital food services and the significance of a healthy diet over the course of disease treatment and recovery. When it comes to managing hospital food services, meal planning, and food delivery to the appropriate patient, a hospital dietitian is essential. The Dietitian ensures proper nutrition care to all the patients admitted in the hospital and post discharge.

Nutrition guidance is important when it comes to carrying out a diet plan. A proper nutrition counseling session helps the patient comprehend the value of a balanced diet and takes them through the specifics of the diet that has been given. The development of new tools and apps that let us track our fitness indicators has opened up new avenues for nutrition instruction. This subject will educate us on all facets of food planning and several strategies for efficient nutrition counseling.

Objectives :

After studying this unit you will be able to:

- Understand aspects of hospital dietary food services

- Steps of Nutrition Care Process
- Understand different types of nutrition counselling

2.2 Hospital Dietary Food Service

Diet is an important part of patient care. A healthy diet is the key to great health and vigor. Inadequate and badly prepared diets cause a variety of chronic degenerative disorders, including as cancer, diabetes, and cardiovascular disease, in addition to under nutrition.

The dietary department, which is made up of dieticians, participates in the decision-making process for patient care. In addition to ensuring that a patient's nutritional needs are met, dieticians are in charge of planning, prescribing, and counseling patients about their diets in light of their medical conditions.

Aim of Hospital Dietary services:

- To keep all patients' nutritional state in good shape.
- To inform patients of the important role nutrition plays in the management of many disorders.
- To alter patients' everyday eating habits in order to accommodate their needs while dealing with various diseases.
- To address deficiencies, particularly in patients who have spent a lot of time in the hospital, like cancer patients and patients in critical care units.
- Most of the time, diet therapy is a technique that supplements or improves the effectiveness of medical or surgical treatment rather than acting as a cure in and of itself.

Outpatient diet clinic: The assigned dietician would first review the patient's OPD card to determine the patient's diagnosis and offer diet recommendations. Only then would the dietician plan the diet and provide a chart with thorough counseling on how to follow it.

In-patient Nutritional Care: The designated dietician will make daily ward rounds to check on each patient to assess their nutritional condition, make adjustments based on their needs, and provide a brief introduction to our hospital cuisine. Each patient hospitalized is given a thorough dietary history, and their diagnosis and biochemical parameters are examined in order to change their diet in accordance with their medical condition. At the time of discharge, a diet plan and counseling are also offered.

Food service management: All in-patients must follow a strict diet. Contractual management is used to oversee the hospital kitchen. Dieticians, who keep a careful eye on the calibre of the food and the services rendered, provide daily instructions on how to make and serve the meals.

The following are the main tasks carried out in the kitchen:

- Taking delivery of raw supplies.
- Raw materials are kept in the appropriate storage locations, such as a walk-in refrigerator for perishables and a dry storage space for non-perishables.
- Production of food in which different meals are made in accordance with a recommended diet plan.
- Using standardised cups to serve food in portions that correspond to the diet plan's guidelines, and placing the diet tray next to the patient's bed.

Role of Dieticians in Food Service Management of the Hospital Kitchen

- Compilation of the diet sheets that are collected twice daily from all the wards.
- Using a meal card that details the required calories and protein, a therapeutic diet can be planned.
- A list of the foods that will be served at each meal is also included on the meal card.
- Each therapy tray will have a meal card placed on it when food is served in order to instruct the serving staff on the type of diet, serving sizes, and foods to be offered.
- Planning Ryle's Tube Feeds in accordance with the necessary protein, calories, and volume.
- Before giving the patient any prepared meal, it is evaluated.
- During mealtime, check the patient's therapeutic tray to make sure they received their meal according to the plan specified on the meal card.
- Maintaining the cleanliness of the kitchen's numerous spaces.

2.3 Nutrition Counseling

Nutrition therapy is a helpful strategy for determining priorities, establishing goals, and creating tailored action plans that value and promote self-care.

During nutrition counseling, a patient and their doctor or other healthcare professional converse. A skilled dietician instructs patients on how to understand the results of their nutritional assessment and combine a variety of nutritionally-balanced items into healthful, reasonably priced, and delicious meals and snacks. Patients can understand how their diet influences their health and change their behavior to focus on realistic lifestyle changes to meet their nutritional objectives. Setting and attaining personal goals that lead to an all-around healthy lifestyle benefits patients.

In order to provide appropriate nutrition support to the patient a step wise Nutrition Care Process needs to be followed which would be really helpful in clearly defining the problems of the patients and rule down its solution.

Check Your Progress Exercise 1

1. **List down the tasks carried out in hospital kitchen.**
2. **What are the responsibilities of a dietician in hospital food service management?**
3. **What are the steps of Nutrition Care process**
4. **Define Nutrition counselling.**

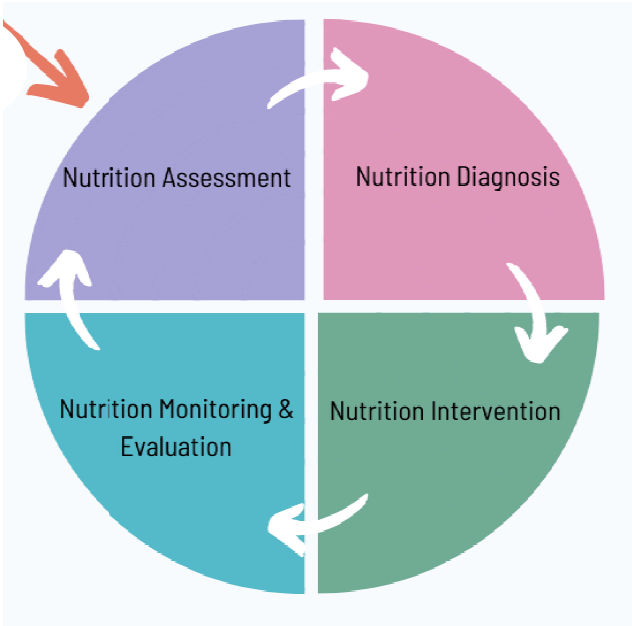


Figure 2.1 Steps of Nutrition Care Process

The four steps of Nutrition Care Process define a step by step process of Nutrition support.

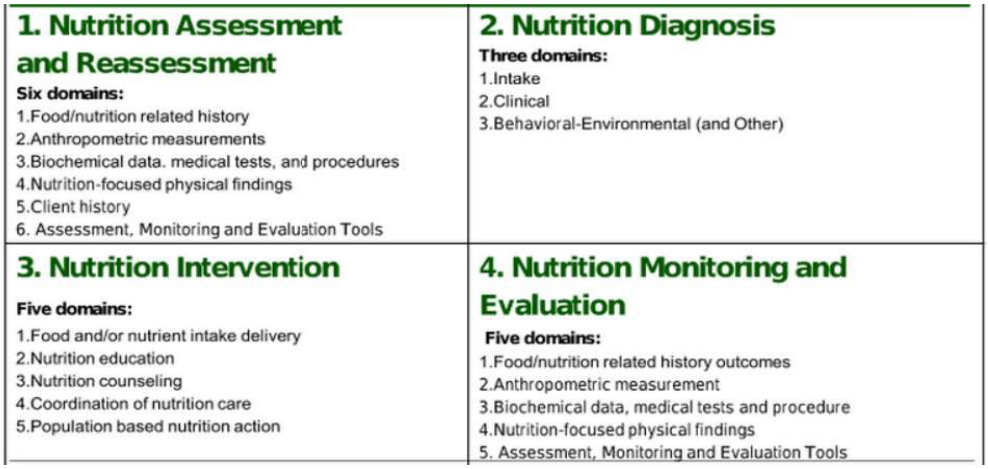


Figure 2.2 Components of Nutrition Care Process

Let Us Understand more about Nutrition counseling

Nutrition Counseling: A method by which a healthcare provider with nutrition expertise guides patients towards selecting nutritious foods and developing wholesome eating routines.

Types of counseling:

1. **Multicultural Counselling**
   - Developing a multicultural awareness is the first step to becoming an expert in nutrition counselling. Effective multicultural communication is one of the most important skills for providing healthcare, and the first and most important step is to assess one's own attitudes and beliefs and to feel at ease with potential disparities (in racial, ethnic, religious, and cultural practises) between oneself and clients. Intercultural communication is a complicated subject that involves language as well as the context in which words are used, including posture, gestures, concepts of time, spatial relationships, one's place in a group, status and hierarchy of people, and the environment.
   - Every culture has its own set of beliefs, values, presumptions, and methods for perceiving the world, as well as a system for encoding and decoding verbal and nonverbal cues. Communication between persons from different cultures can easily lead to misunderstandings.
   - Misdiagnosis, disobedience with therapy, unnecessary suffering, and even death can result from poor communication in the medical industry. Being sensitive to or aware of another person's culture entails respecting and understanding their attitudes, values, and beliefs; being willing to apply this understanding when engaging with clients; and taking their culture into account when making recommendations for therapy.

- A person's position within their cultural community can have a big impact on how well healthcare is provided. While clients from individual-oriented cultures desire confidentiality and privacy when it comes to personal health care issues, clients from group-oriented cultures want greater family and related interaction in decisions affecting health and sickness.
- Misunderstandings in intercultural communication are usually caused by gestures, facial expressions, and postures. A key sign of respect in almost every culture is having good posture. Eye contact protocol is often complex and changes depending on the gender, social class, and physical proximity of the people involved.

2. Directive Counselling

- The counsellor takes an active part in this therapy since it is thought of as a way to teach people how to learn to solve their own difficulties.
- Counselor-centered counselling is another name for this kind of therapy.
- Because the counsellor in this counselling performs all analysis, synthesis, diagnosis, prognosis, prescription, and follow-up tasks independently. characteristics of directive counselling It has these characteristics:
- During the interview, attention is given to a specific issue and potential solutions. The interviewer takes on a more active role than the client or student.
- Although the student or client makes the decision, the counsellor does everything in his power to influence them to choose a choice that is consistent with his diagnosis.
- The counsellor uses information to educate, explain, interpret, and advise the client or student to guide his or her thinking.

Role of Counselor in Directive counseling:

The counselor's role in this therapeutic process is vital. He is the process' pivot point and the situation's leader. The counselor is a frequent participant in problem-solving discussions; the client is rarely the major topic. The client does not collaborate with the counselor; rather, he works for him.

The counselor tries to change the client's or counselee's thinking by providing information, clarification, interpretation, and occasionally guidance.

The counselor compiles all pertinent information about the students or counselees and analyses it to have a thorough understanding. He organizes and summaries the information in order to understand the pupils' abilities and limitations, adjustment, and maladjustment.

He makes deductions about the nature and causes of his problems. He anticipates how his problems may change in the future. The student follows the recommendations he makes for dealing with his problems, and the prescription has the desired effects or consequences.

Directive counseling is also referred to as prescriptive counseling because the therapist prescribes the solutions or course of action for the students.

Steps in Counseling

1. **Interviewing**

The purpose of the client interview is to gather information. A series of unthreatening questions are asked in order to acquire background data that will guide the session. Before the session starts, everyone is formally introduced to one another. The client gives a justification for why they are there. The interviewer typically starts off with general, open-ended questions and ends with follow-up, closed-ended inquiries.

2. **First Session**

The therapy relationship must be established at the first session. The environment ought to encourage seclusion, and there ought to be a plan for minimising disturbances (like forbidding phone calls, staff, or other patients from pounding on the door). To demonstrate their interest in one another, the counsellor and client should, if at all feasible, sit across from one another in chairs without a desk in the middle. Additionally crucial are body language and communication abilities. The counsellor introduces the session's topic during the first meeting.

3. **Asking Open- ended questions**

In answer to open-ended questions, patients are more likely to express a wider range of viewpoints. Closed questions can help keep the discussion on point and weed out off-topic discussion. For the person who isn't ready to change, targeted discussions about difficult topics might keep the session on course.

The counsellor's questions call for more discussion and explanation than simple one-wordresponses. For someone who isn't ready to change, this is essential because it enables discussion of the problems keeping the client from being ready.

4. **Affirming**

Counsellors commonly understand the idea of supporting a client's efforts to establish a new eating pattern but find it difficult to articulate it in words. When the counsellor validates the client's issues, they get aligned and normalized. The counsellor informs the client that he or she understands and is there for

them during tough times in accordance with this. Assuring the client that their behaviour is reasonable and that feeling these emotions is perfectly normal is the aim of normalization.

5. **Summarizing**

The counsellor goes over the client's comments from time to time and underlines the key elements. Even when they reflect negative feelings, the best arguments are condensed and straight to the point. If competing opinions are expressed, the counsellor can use the strategy "on the one hand you want to change but love those old eating patterns." As a result, the client is better able to identify the internal conflict that frequently prevents habit change.

6. **Self-Motivational Phrases to Use**

The four communication strategies of open-ended questions, attentive listening, affirming, and summarizing are essential when acquiring self-motivational statements. The customer should be made aware of the situation, why it is troubling, and what future remedial action might be taken to address it. The goal is to use these findings to provide the groundwork for future programme to change people's diets. The following examples show the questions to ask in order to get the self-motivational sentiments statements.

To show that you truly understand what the client is saying, it can be useful to summarize their comments on their progress, challenges, potential causes for change, and what needs to be different moving forward.

7. **Ending the session**

When the session is complete, the counsellor will let the client know that the subjects will be brought up again once the client has had some time to think about them. When the time is right, it will be beneficial to convey optimism and confidence in the client's ability to change in the future.

Plans for future contact can be arranged at this stage. When interacting with a client who isn't ready to change, it's easy to adopt a protective and authoritarian position. At this point, refrain from advising, persuading, confronting, coaxing, or instructing the consumer what to do. Knowing that change at this level commonly occurs outside of the workplace may reassure a dietitian. The client is not anticipated to be prepared to act during the visit.

Check Your Progress Exercise 2

1. **State true or false for the following statements**

a. Nutrition counselling is not a part of Nutrition Care Process.

b. Multi-cultural counselling is a counsellor cantered counselling.

c. It is important to establish trust and relation with the patient during the first session.

2. **List down the types of counselling.**
3. **What are the steps involved in an effective nutrition counselling?**

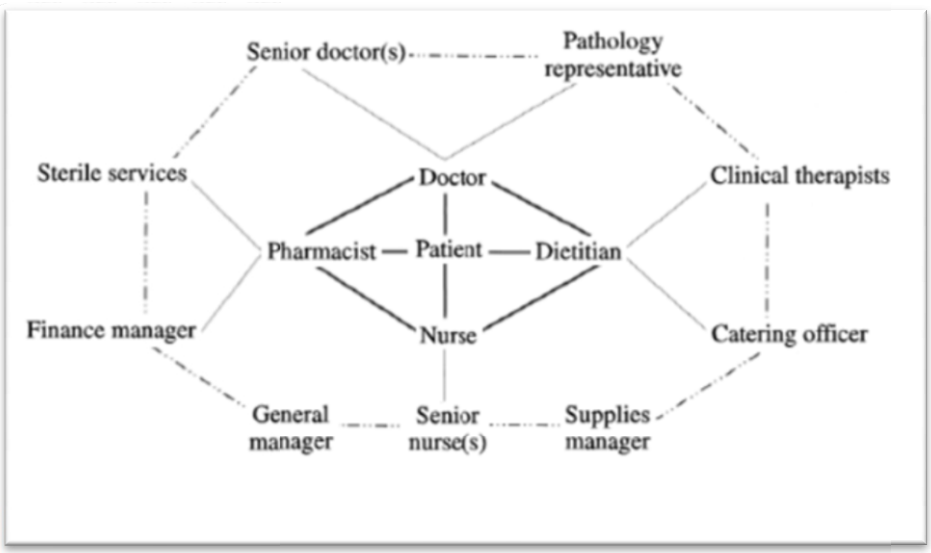
2.4 Team approach in nutritional care

In order to give nutritional support to patients in the most efficient manner possible, a multidisciplinary team with great communication skills is required. Such a team improves the quality of treatment and lowers costs by avoiding unnecessary procedures and streamlining those that are used, minimizing complications, monitoring the use of nutrients and the results of treatment, minimizing waste, standardizing nutrients, and equipping to enable bulk purchases and the negotiation of competitive prices.

Setting up and maintaining a nutrition support team may be challenging and time-consuming, so it's important to be clear about roles and responsibilities. A variety of potential hazards must be recognized and actively managed if the team is to succeed. The secret to this achievement is providing high-caliber clinical services, excellent communication, and explicitly adding value to the organization.

The main players in a nutrition support team are a (senior) doctor (such as a surgeon, intensivist, or gastroenterologist), a nutritionist, a nurse, and a chemist. The "core team" may also include a finance manager, general manager, nurse staff member, supply member, catering officer, clinicaltherapist, pathology representative, senior doctor, and additional people on a permanent or as-needed basis.

Figure 2.3 Team approach in nutrition care



2.5 Principles of Food Prescription

The kind, quantity, and frequency of meals are specified in a nutritional prescription depending on each patient's disease process and disease treatment objectives. A calorie limit or other restriction may be necessary due to the condition. Additionally, different dietary components like carbs, protein, fat, vitamins, minerals, fibre, phytonutrients, or water may be reduced or increased. Economic status, eating habits (such as vegetarian, Ovo vegetarian, or non-vegetarian), food intolerances (such as lactose intolerance, gluten sensitive enteropathy), allergies (such as milk, eggs), the patient's occupation, and meal timings are additional factors that the dietetic prescription considers.

1. **Economic Status:** When creating a diet prescription, this is one of the crucial practical factors to keep in mind. A few costly things may be acceptable during an acute sickness, but for more persistent or chronic conditions like diabetes or peptic ulcers, the recommended foods must be affordable to the patient.
2. **Food Preferences:** It is important to understand these so that the patient's food preferences can be taken into account when recommending a diet. It is necessary to know if someone is a vegetarian or not. If so, the level of vegetarianism should be evaluated. Ovo-vegetarians, for example, consume eggs but no animal flesh, while egg and fish vegetarians only consume eggs and fish. Home vegetarians, on the other hand, prefer to eat only vegetarian meals at home but will eat meat or chicken at a party or restaurant.
3. **Food Intolerances:** It is important to determine the patient's food intolerances. For instance, milk may cause constipation in some persons while causing diarrhoea in others. Whole pulses are likely to cause flatulence in those with colonic problems. Therefore, the dietician must be aware of and have clear indication of any food intolerances when prescribing a diet.
4. **Allergy:** Food allergies can cause allergic reactions, cramping in the stomach, blood asthma, and angioedema. Many people are found to be allergic to milk or eggs, and the patient may need to cut these foods out of their diet.

   Due to young children's use of milk, gluten enteropathy (celiac disease) and colitis may develop. Gluten is a protein found in cereals and millets.
5. **Timing of Meals:** It is important to take into account both the profession and the daily mealtime. A manager with set hours of work needs less specific information on a peptic ulcer diet than a factory worker who works various shifts.

2.6 Indian Dietetic Association

In order to underline the significance that dietetics and nutrition play in sustaining health as well as in the prevention and treatment of diseases, a group of like-minded nutritionists, dietitians, and members of the allied health professions resolved to establish a scientific organisation in 1962. Thus, the Indian Dietetic Association was founded, with Prof. Kalyan Bagchi serving as Secretary and Dr. C. Gopalan acting as President. The organisation joined the International Congress of Dietetics in 1975.IDA's headquarters are in Kolkata. Hyderabad hosted the IDA's Golden Jubilee celebrations in 2012.

Objectives & Aim

- To promote the cause of science by encouraging the spirit of active pursuit of knowledge and original scientific research particularly in the field of Nutrition and Dietetics.
- To facilitate social, scientific and cultural fellowship and cultivation of goodwill among its members.
- To promote close contact and interaction between persons following different branches and thus facilitate the development of a wider outlook and the integration and application of available scientific knowledge for the welfare of society.
- To safeguard the interests of scientists generally and its members in particular and work for their welfare.

IDA conducts Registered Dietitian exam every year. The RD Board is actively involved in setting standards of practice for dietitians in clinical practice. The Board has developed a competency package for training the interns. The Board conducts an annual exam and those who pass the exam are allowed to use the title 'RD' after their name.

2.7 Diet planning using Computer

ICT in the subject of nutrition encompasses a range of interventional tactics, including text messaging and online chats, interactive video sessions using ppt, computer and mobile games and apps in the play store or webstore, nutrition software and programmes, and more. These tactics have evolved into sources of information, guidance, learning, and understanding during this lockdown crisis brought on by the corona virus.

In recent years, the development of wearable technology—including smart watches and mobile phone technologies—has eased the burden on individuals and contributed to the availability of more up-to-date, accurate, and consistent data for a variety of health conditions. The public can now learn about the foods

that affect the body's immunity, DNA alterations, gene expression as a result of viruses, and nutrition as a component of nutrigenomics thanks to technological breakthroughs in study and science.

Technology aids everyone, from energy expenditure measures to automatic nutritional intake, including online personalized therapeutic and educational services. Currently, the target audience for these applications might include both at-home users and those who focus on developing their own self-monitoring, self-policy, and self-management skills to gauge their degree of learning, as well as carers and professional service providers (Drigas & Karyotaki, 2013). Because these websites have more ways to access historical data and the capacity to keep track of current events, such as taking pictures of food consumed or making notes about it in mobile notes, which relieves the physical and mental burden of carrying a notebook, it is believed that nutritional interventions through ICT offer a more individualized approach than traditional methods.

Artificial Intelligence and Nutrition

On-body sensors, primarily in the form of smart watches, have significantly contributed in determining the health and nutritional status of the body. The assessment of heart rate, calories burnt, and the proportion of solid to liquid food consumption possible with these sensors can be utilized to support autonomous dietary monitoring. Robotic hospital staffing, like that used at Bangalore's Fortis hospital, is the best example of how artificial intelligence is being used in healthcare.

Mobiles, Tabs, and Nutrition

Smartphones and tablets can be used to obtain information, learn new things, and even practice using a variety of diverse, affordable learning software packages. Popular nutrition apps like Healthifyme, Nutrition Guide for Clinicians, and others can offer services like diet plans and diet counselling in addition to guidance on healthy eating habits to strengthen immunity and prevent disease. Zoom and Skype are some applications that provide a pleasant interactive experience. Today's mobile devices also come with motion sensor technology, which converts accelerometer counts into energy consumption, simultaneously monitors temperature and heart rate, and allows users and experts to participate in constant, tailored communication.

Software analysis

Nowadays, many people utilize nutrition software since it speeds up and simplifies computations. The software will compute the daily nutrient intake for each vitamin and mineral present in the product for a particular person or group of people once the ingredients, their quantities, and serving sizes have been

entered. Even foods and recipes that can be found all throughout the country, such Dietcal, Diet soft, etc., are included in this programme.

Check Your Progress Exercise 3

1. **List down the principles of diet planning.**
2. **What is the importance of RD?**
3. **What is the role of mobile and tablets in nutrition education?**

2.8 Let us sum up

The lessons learned regarding hospital dietary services are summarised in this section along with a thorough explanation of the nutrition intervention and counselling processes. We learned about the several hospital environments, such as the outpatient department, inpatient department, and food service management, and how a dietitian significantly contributes to each of these areas. When a patient is admitted to the hospital, the dietitian is responsible for caring for their nutritional needs and ensuring proper nutrition. However, when the patient is about to be discharged, it is crucial that the dietitian clarifies the discharge diet and offers recommendations for the nutrition care post-hospital stay. This is done in an OPD setting, and a date for follow-up is set.

When it comes to implementing the diet plan, explaining it to the patient is an essential step. This lesson examined the whole Nutrition Care Process and, more specifically, Nutrition Counselling. A dietician needs specific abilities, such as excellent communication, empathy, and understanding, in order to counsel or guide a patient. We also researched several approaches to nutritional therapy, including multicultural and directive approaches. Designing a personalized nutrition plan requires some basic understanding of diverse cultures. A dietitian must plan the counselling session, as was discussed in the steps of counselling, to guarantee a successful session. Finally, we discussed the different apps and software that are being developed in the field of nutrition. These tools shorten the time required to establish a diet and facilitate follow-up by effectively and immediately monitoring a variety of health indicators.

2.9 Glossary

Lactose Intolerance : In ability to fully digest the sugar lactose present in dairy products, caused mainly by the deficiency of enzyme lactase which is responsible for digestion of lactose sugar.

Nutrigenomics : A scientific study of interaction of nutrition and genes , especially with regards to prevention and treatment of a disease.

Ovo vegetarian: Ovo vegetarianism is a type of vegetarianism which allows the consumption of eggs but not dairy products and other animal-based products.

Phytonutrients: Chemicals produces by plants generally helps in resisting infections by fungi, bacteria and plant virus infection and is beneficial to human health.

Ryle's Tube Feeds: It is a way to provide medications and nutrition in liquid form through a tube which is inserted in stomach or a part of intestines for the patients who are un able to take oral intake.

UNIT 3 MEDICAL NUTRITION THERAPY IN OBESITY, UNDERWEIGHT

STRUCTURE

3.1 Introduction

With increasing financial status, an abundance of convenient foods, and a lack of physical activity, weight management has taken on a lot of importance in the modern world. The reasons why people get overweight are not mysterious. Weight (ideal body weight) in connection to general health. Excess weight is the result of long-term, regular ingestion of considerably more calories than you are able to expend.

In this unit, you will learn the importance of maintaining an appropriate weight for preventing a number of other chronic degenerative disorders in this unit. We will also discover the many strategies that people who are overweight, obese, or morbidly obese should take into account in order to reach their ideal weight. More importantly, we will discover how to avoid gaining weight in the first place.

Underweight happens when there is a negative energy balance, just as overweight happens when there is a positive energy balance. Obsession with sliming, people especially from young group go for crash diets and fad diets to get quick results. How to cop up with such problems? This is the focus of first part of this unit.

Objectives

After studying this unit, you will be able to:

- Describe the significance of sustaining a healthy weight over the course of a lifetime.
- Address the underlying causes, methods of prevention, and remedies for various weight management-related problems (such as obesity and underweight).
- Plan basic diet for weight loss and weight gain

3.2 Weight imbalances / Malnutrition

You already know that one of the biggest global public health issues is obesity. Previously an issue for wealthy countries, it is now progressively affecting our nation. To extend life expectancy and improve quality of life for both individuals and society, it is crucial to maintain a somewhat steady body weight. It is a proven fact that excessive weight fluctuations on either side (underweight or overweight) of a healthy weight range are associated with a higher likelihood of morbidity and mortality.

The key to excellent health is maintaining a healthy body weight. Beyond a certain point, body weight deviations lead to many additional illnesses. Body weight includes the weight of the muscles, fat tissues, bones, tissues, and organs.

There are several mechanisms like hormonal, neural and chemical which helps to regulate the body weight by keeping balance between energy intake and energy expenditure. Weight fluctuations occurs due to disturbance in these mechanisms.

The definitions of overweight and obesity include abnormal or excessive fat accumulation that could harm one's health.

The most prevalent dietary disorder in prosperous countries and among higher socioeconomic groups is obesity.

When a person's weight is 20% or more over their optimal weight, they are said to be obese, according to medical terminology.

In contrast, overweight is the term for the condition of having an excess of 10% to 20% of one's optimal body weight.

Age, gender, and height all affect a person's ideal body weight.

Prevalence

Adults

Over 1.9 billion persons who were 18 years of age and older were overweight in 2016. Over 650 million of these adults were obese. 39% of adults over the age of 18 in 2016 were overweight (40 % of women and 39% of males).In 2016, 11% of men and 15% of women in the adult population worldwide were obese. Between 1975 and 2016, the prevalence of obesity nearly tripled globally (WHO Factsheet, 2021).

Children

A remarkable 38.2 million infants under the age of five were reportedly overweight or obese in 2019. Overweight and obesity, once thought to be an issue only in high-income nations, are increasingly becoming more prevalent in low- and middle-income nations, especially in metropolitan areas. Since 2000, there has been a nearly 24% increase in the proportion of under-5-year-old overweight children in Africa. In 2019, Asia was home to over half of the world's young overweight or obese children (WHO Factsheet, 2021).

More deaths than underweight are associated with being overweight or obese worldwide. In every region of the world with the exception of some areas of sub-Saharan Africa and Asia, there are more obese individuals than underweight people.

Double burden of malnutrition

The "double burden" of malnutrition is currently being felt by many low- and middle-income countries. These nations still struggle with issues like infectious diseases and undernourishment, but they are also seeing a sharp rise in non-communicable disease risk factors like obesity and overweight, especially in urban areas. In the same nation, the same neighborhood, and the same household, under nutrition and obesity are not unusual.

Children in low- and middle-income nations are more susceptible to malnutrition during pregnancy, as a newborn, and as a young child. These children are also exposed to meals that are high in fat, sugar, salt, and energy, but low in micronutrients. These foods are typically less expensive, but their nutritional value is also reduced. These eating habits, coupled with a decline in physical activity, cause a dramatic rise in childhood obesity while under nutrition problems go unresolved.

Check your progress Exercise 1

1. **Fill in the blanks for following statements:**
   a. The definitions of overweight and obesity include abnormal or excessive _____ accumulation that could harm one's health.
   b. About 38.2 million infants under the age of _____ were reportedly overweight or obese in 2019 as per WHO.
   c. Young children suffer from malnourishment due to consumption of meals which are high in fat, sugar and salt but low in _____.
2. **What is double burden of malnutrition?**
3. **What is the difference between Overweight and Obesity?**

3.3 Obesity

A condition known as obesity is brought on by an accumulation of extra body fat. Over time, people consume diets that provided far more energy than they were able to expend for their metabolism, physical activity, and growth, which results in the fat deposition. Obesity has becoming more common in developing nations. This is due to societies transitioning from a subsistence-based lifestyle to an affluent one. In India, there has been an upsurge in the movement of people from rural to urban areas. This transformation has also contributed to changes in lifestyle, such as a marked decline in physical activity that has affected weight.

3.3.1 Body composition

It's crucial to understand the body composition in relation to weight, such as how much of the overall weight comes from lean body mass (LBM) and how much comes from fat.

Risk of developing a number of chronic diseases is influenced by two key variables, including total body fat and how it is distributed, which can either be in the stomach region or on the arms and legs.

There are two types of body fat:

a) Essential fat
b) Storage fat

Essential fat

It is found in small amounts in the heart, lungs, bone marrow, muscles, and other bodily cells necessary for functioning properly.

Storage fat

It is the energy reserved stored as adipose tissues under skin and other body organs.

Total fat which is the combination of both required in following amounts among males and females both:

Adult Male: 10-25% of total body weight

Adult Female: 18-30% of total body weight

The total amount of body fat distribution is referred to as adiposity. It varies between men and women and is genetically determined.

Types of fat distribution

There are two types of fat distribution:

a) Android fat distribution
b) Gynoid fat distribution

Android fat distribution:

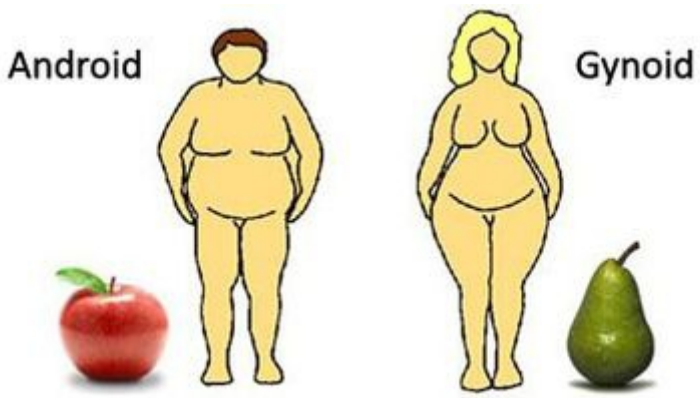
- Excess of subcutaneous fat deposited around trunk region is known as android fat distribution.
- It gives apple shape appearance to body.
- In this type of fat distribution, trunk to hip ratio is high

- It is more common among males
- It is associated with increased risk of cardio vascular diseases, hypertension, insulin resistance, hyperlipidemia, stroke and metabolic syndrome.

Gynoid fat distribution

- Excess of subcutaneous fat deposited around thigh and hip region is known as Gynoid fat distribution.
- It gives pear shape appearance to body
- In this type of fat distribution, usually hip ratio is high.
- It is most common among females. Gynoid fat distribution can take place due to pregnancy and lactation also.
- After menopause, females are more likely to develop android fat distribution and therefore they are at risk for diabetes and CVD also.

Figure 3.1. Android and Gynoid fat distribution



3.3.2 Metabolic alterations

Certain changes to the regular bodily functions that are brought on by obesity are listed here.

Disturbed Lipid profile: As you are already know, lipids are key dietary elements that comprise fats, steroids, phospholipids, and glycolipids. They are linked to a variety of vitamins and important fatty acids. Obese people typically have a distorted lipid profile. Triglyceride levels are frequently high, while HDL cholesterol levels are low. Triglycerides and HDL cholesterol are both produced as byproducts of dietary fat breakdown. Both of these levels return to normal with weight loss.

Insulin resistance: Insulin resistance is a condition in which your body cells cannot use insulin efficiently despite the pancreas secreting enough amounts.

Obesity is a factor that contributes to insulin resistance. Because enough insulin is created yet the body cells are unable to utilize it, blood insulin levels rise (hyperinsulinemia). This impairs glucose utilization, resulting in elevated fasting blood sugar levels and poor glucose tolerance. Furthermore, levels of plasma glucagon (a pancreatic hormone that has the opposite impact of insulin), free fatty acids, and uric acid are observed to be higher in obese people. As weight loss occurs, all of these changed metabolic indicators return to normal.

You've probably noticed that your overweight acquaintances and coworkers appear to have less energy, making them easy prey for weariness.

They are also less nimble and more prone to falling as a result of unbalance. They are prone to elevated blood pressure and dyspnoea (breathlessness during effort).

Many of them may be predisposed to skin disorders such as heat rash, intertrigo (superficial inflammation of two skin surfaces in close contact, such as between the thighs), candidiasis (a fungal infection), and acanthosis nigricans (dark, warty growths in skin folds such as the groyne, armpits, and mouth).

3.3.3 Etiology

What factors contribute to obesity? The answer, however easy the question may appear, is not so straightforward. We cannot deny that excess weight is caused by a positive energy balance or the consistent consumption of more calories than the body can handle expend. Obesity can thus be treated by balancing the intake and output of calories consumed and spent. Thus, it is not an easy undertaking because obesity is the consequence of a complex interplay of genetic predisposition to fat storage and a number of environmental factors that define an individual's weight status.

We cannot modify our genetic make-up, but we can exert some control over environmental circumstances by making appropriate lifestyle changes. Indians face discrimination as an ethnic group. Indians have more body fat percent and visceral fat (fat around internal organs) than other populations for a given degree of obesity or BMI, which raises the risk of chronic degenerative diseases later in life. Let's go over the various obesity etiological factors. We will also learn in depth about each of them.

Genetic Susceptibility: Some people inherit a proclivity to gain weight. Previously, it was considered that genetic inheritance varied from 66% to 80%, but it is currently thought that our odds of inheriting our parents' BMI are around 33%. Obesity or thinness is inherited, primarily from the biologicalmother. If our biological mother was overweight as an adult, we have a 75% chance of being overweight as well.

Dietary habits: You are aware that one of the key contributory factors to obesity is a positive energy balance. Some people have an unhealthy eating habit.

They may also be unaware of the caloric counts of common foods such as butter, cheese, jam, or rich baked snacks and sweets; extra helpings quickly increase the number of calories consumed. Maintaining social interactions can sometimes lead to an increase in calorie intake. As you age, your metabolic rate decreases and you require less energy to perform the same set of activities that you did 20 years ago. You will undoubtedly gain weight if you continue to follow the same diet and eating habits.

Certain eating habits, for example, those who eat at a very fast rate tend to chew food less and end up eating more food. Similarly, snacking between meals may contribute much more calories to overall intake than is typically recognised. Additionally, persons who eat whenever food of their choice is available or who just adhere to meal times even when they are not hungry tend to gain weight. Mothers generally eat their children's leftovers to reduce food waste and to add calories to their own calorie intake.

Physical activity: Obesity is caused by a sedentary lifestyle combined with a lack of exercise. As we get older, our physical activity reduces without a corresponding drop in food consumption, which leads to obesity. A debilitating ailment, such as arthritis or cardiac problems, may limit activity. Reduced activity may be from a change in occupation or simply from increased periods of calm, rest, and relaxation. Furthermore, as we become more active, the body prefers to metabolise fat as an energy source, resulting in a decrease in adipose tissue.

Urbanization: People tend to eat more as their wealth, purchasing power, and food availability increase. When consumers are offered a variety of foods, their intake is higher than when only one dish is supplied.

Eating out has become fashionable, resulting in an increase in the intake of junk food that is high in calories but low in important nutrients. Obesity is further exacerbated by the easy availability and predilection for high fat and/or quick foods.

Psychological factors: Individuals who are lonely, bored, or depressed may find refuge in food. When there is nothing else to do, eating provides a diversion, resulting in greater calorie consumption.

Hormonal imbalance: Certain disorders connected with hormone secretion, such as hypothyroidism and hypogonadism, Obesity is one of the distinguishing symptoms of Cushing's syndrome. Many people who are unable to lose weight blame it on hormonal imbalance, but the truth is that only a small percentage of the population suffers from it. There are diagnostic tests available to determine whether or not a person is suffering from hormone imbalance.

Childhood growth pattern: It has been demonstrated that sluggish foetal growth in pregnancy and during infancy is followed by increased weight gain in youth. This combination of modest birth weight and rapid childhood weight gain

Gain has been linked to an increase in adiposity as well as insulin resistance later in life. So, can we argue that modest birth weight and rapid childhood weight rise indicate subsequent obesity? We certainly can.

3.3.4 Consequences of Obesity

Let us learn more about the repercussions of obesity and address each issue briefly.

Obesity raises the risk of morbidity and mortality in the general population. Obese people are more likely to acquire morbidities or other chronic diseases, such as cardiovascular disease (including hypertension and dyslipidaemia), non-insulin-dependent diabetes mellitus, gallbladder disease, and gout. Obesity increases the likelihood of acquiring non-fatal illnesses such as arthritis, back discomfort, infertility, sleep difficulties, and other respiratory conditions, resulting in higher morbidity. Let's go over these criteria in further depth.

Cardiovascular disease and stroke: Obesity may be an independent risk factor for coronary heart disease (CHD), with the degree of obesity directly linked to the rate of development of CHD. Even mild obesity has been demonstrated to raise the risk of CHD. Weight loss leads to improvements in cardiovascular risk factors such as hypertension and abnormal cholesterol levels. The lipid profile improves and the blood pressure returns to normal.

When brain blood arteries become damaged, they may rupture or there may be insufficient blood supply to the brain, resulting in a stroke. This could be caused to hypertension or fatty deposits in the blood arteries of obese people.

Type 1 Diabetes: Type 1 Diabetes is not a major cause of death in people of normal weight, but it is a significant contributor to morbidity and mortality in obese people.

It is linked to insulin resistance and hyperinsulinemia (a high level of circulating insulin in the blood). Fortunately, reasonable blood sugar management can be obtained by lifestyle changes. A healthy diet, physical activity, and medications can help regulate blood sugar levels, allowing an obese person to live a somewhat normal life.

Metabolic syndrome: People who have intra-abdominal obesity and a high waist-to-hip ratio are more likely to develop metabolic syndrome X. This is characterised by the presence of many chronic illnesses

such as glucose intolerance, insulin resistance, hyperlipidemia, and hypertension. One of the primary public health issues related with obesity is syndrome X.

Gallbladder diseases: Obesity is one of the risk factors for gallstone formation. Obese people are more likely to develop gallstones because their bile is supersaturated with cholesterol. Excess adipose tissue is also known to possess a high concentration of cholesterol. Weight loss does not diminish the incidence of gallstone formation because the mobilisation of adipose tissue in obese people causes the bile to become even more saturated with cholesterol.

Cancer: Obese men are more prone to get cancers of the colon, rectum, and prostate, whereas obese women are more likely to acquire malignancies of the breast, ovary, endometrial, and cervix.

Back pain, arthritis, and gout: Because of the extra stress on the spinal column, abdominal obesity increases the risk of back discomfort. This, in turn, decreases physical activity, resulting in a rise in adiposity.

Obesity is also linked to the onset of osteoarthritis and gout. The increased stress on the weight-bearing joints is a factor. Obese people are more likely to develop hyperuricemia (excess uric acid in the blood), which can lead to gout.

Infertility: Obese women are more likely to suffer from menstruation disorders, infertility, and polycystic ovarian syndrome, all of which improve with weight loss.

Sleep trouble: One of the most prevalent difficulties that obese men and women face is sleep disorder, also known as sleep apnea. When a person is supine, obesity promotes narrowing of the upper airway. In severe circumstances, this might result in abrupt death.

Psychological problems; Obese people may face criticism and prejudice in areas such as work, promotions, and social relationships. This can lead to low self-esteem and despair, which can lead to overeating for comfort. This exacerbates the current condition. Although it is becoming clear that obesity is a complex combination of metabolic, physiological, and hereditary factors, obese persons are nevertheless stereotyped as weak-willed and self-indulgent.

Following a thorough examination of the numerous variables associated with obesity, we can now turn our attention to the management and prevention of this multifaceted public health issue. In the following section, we will cover ways for generating a negative energy balance, as well as the activities that must be taken to prevent obesity.

3.3.5 Assessment methods

Obesity is described as the accumulation of excess bodily fat. Do you believe that a measure of how much fat a person has in their body may be used to classify obesity? No, because measuring direct body fat is impossible, we utilise an indirect way, a ratio known as the Body Mass Index (BMI), also known as Quetelet's index. This ratio estimates frame size dependence and is the most useful means of evaluating obesity in populations. BMI can be determined using the following formula:

BMI= Weight (kg)/ Height (m^2)

It is based on Weight (kg) with minimal clothing and Height (meters) without shoes. BMI is expressed as Kg/m^2. Lower BMI cut offs have been given for Asians as they have a great risk of Non-communicable diseases.

Table 3.1. Classification of Body Mass Index (BMI)

Nutritional Status	WHO criteria BMI cut-off	"Asian criteria" BMI cut-off
Underweight	<18.5	<18.5
Normal	18.5 – 24.9	18.5 – 22.9
Overweight	25 – 29.9	23 – 24.9
Pre-Obese	-	25 – 29.9
Obese	≥30	≥30
Obese Type 1 (obese)	30 – 40	30 – 40
Obese Type 2 (morbid obese)	40.1 – 50	40.1 – 50
Obese Type 3 (super obese)	>50	>50

Waist circumference

- Internationally acceptable method.
- 102 cm in men and 88cm in women are indicative risk associated with obesity. For Asians, levels are ≥90cm for men and ≥80cm for women.

Figure 3.2. Steps to measure Waist circumference

Skin fold thickness

- A common approach for estimating fat and its distribution in the body.
- Biceps, triceps, subscapular, and suprailiac measurements are all common.
- The percentage of fat deposited beneath the skin increases with body weight.
- Skin thickness can be assessed using standardised skin callipers.
- Age and gender have an impact on subcutaneous fat in the body. It accounts for 11% of total body weight in men and 18% in women.
- One disadvantage of this technology is that it does not reflect the body's true fat composition.

Waist hip ratio (WHR)

- It is the ratio of waist circumference to hip circumference.
- It is computed by dividing the waist measurement by the hip measurement (W/H).
- A person with a 76cm waist and 97cm hips, for example, has a waist-hip ratio of 0.78.
- It is a fast test of fat distribution that may suggest a person's overall health. It determines the amount of fat stored around your waist, hips, and buttocks.
- People with a higher ratio are more likely to experience a variety of health problems.
- A healthy WHR for males is 0.9 or less, and 0.85 or less for females, according to WHO.
- WHR greater than 1 raises the risk of heart disease.

Waist to shoulder ratio

- It is calculated by dividing the waist diameter by the shoulder circumference.
- This is also known as the Adonis Index and is very significant for the overall appearance of the body.

- To appear more appealing, you should make your shoulders wider than your waist.

Check your progress Exercise 2

1. **State true or false for the following statements:**
   a. Storage fat is found in heart, lungs, bone marrow, muscles, and other bodily cells.
   b. Obesity is mother of all non-communicable diseases.
   c. Android fat distribution is common among males.
   d. Obesity is not dependent on sedentary lifestyle.
   e. WHR stands for Waist Hip Rate.
2. How obesity results into various psychological problems?
3. Explain skin fold thickness method for nutrition assessment?
4. Urbanization is one of the responsible factor for occurrence of obesity. Justify sentence.

3.4 Management of Obesity

Reversing the process in which weight was accumulated is the solution to the question of how to lose weight.

When a patient is on a calorie-restricted diet, the body adjusts by lowering BMR. Thus, it gets harder and harder to reduce weight alone through food. When a lowering diet is abandoned, weight growth is made simpler if BMR is decreased.

Therefore, combining a behavioral and nutritional approach is the key to effective weight loss.

Understanding the harsh facts of the issue and its consequences is essential to managing obesity. Due to the numerous failures experienced during the process, it could be a difficult experience for the doctor and nutritionist.

Each weight reduction strategy must have a unique set of objectives that take into account the person's overall health. Obese people can significantly improve their health and reduce the severity of comorbidities or risk factors connected with obesity by losing as little as 5–10% of their initial body weight. According to studies, obese people have better glycemic control, lower blood pressure, and lower serum cholesterol levels even with a 5–10% weight loss. Therefore, it might not be realistic for obese people to continually focus solely on losing weight. Obsession with ideal weight may not always be suitable depending on the situation.

The management of obesity is having three pronged approaches:

1. Nutritional management
2. Physical activity
3. Behavior and lifestyle modifications

3.4.1 Nutritional management

The dietary changes help obese people choose healthful foods by acting as a guide. It is important to carefully review the obese person's food history before recommending a plan to help them lose weight. You must be aware of the person's regular eating schedule, diet, food availability, and likes and dislikes.

In general, the daily diet plan should contain an energy deficit of 500–1000 Kcal. It is crucial that we understand whether the client has previously attempted to lose weight, what guidance was given then, and why the results were disappointing. When preparing diets to lose weight, it is important to keep the following dietary concepts in mind. Of course, your practical will teach you more about this area as well. So let's study more about the recommended diet.

Dietary modifications should not only aim to lose weight, but also to maintain it as best as they can in the context of general health. Obesity risk is lowered by maintaining a healthy weight and losing only moderate amounts of weight. The goals of treatment are:

- To bring about a gradual weight loss
- To maintain good nutritional status
- To bring about lifestyle modifications to maintain ideal body weight.

To achieve this, dietary modifications are most important.

Energy

- The amount of energy consumed is changed to suit each person's needs for weight loss.
- To lose approximately 1 kg of body weight in a week, a reduction of 1000 kcal per day is needed, and a reduction of 500 kcal per day is needed for a loss of 1/2 kg in a week.
- A significant reduction is not advised because it might result in fatigue, weakness, nervous tiredness, and other vitamin deficiencies.
- For weight loss, a woman should consume an average of 1000–1200 calories per day, while a man should consume 1500–1800 calories per day.
- There are several ways to figure out how many calories you need, but these two are the most popular ones:

1. Reducing approximately 500-1000 kcals in a day depending on the extent of overweight and obesity.
2. Calculating energy requirements of individuals based on level of physical activity.
   This is done according kilocalories prescribed per kg of ideal body weight for obese, normal and underweight individual at different activity levels.

Table 3.2. Energy requirements per kg body weight

Activity level	Energy requirement (Kcal/kg ideal body weight/day)		
	Obese	Normal	Underweight
Sedentary	20-25	30	35
Moderate	30	35	40
Heavy	35	40	45-50

Protein

- It is advised to provide sufficient protein intake to maintain nutritional status and to promote satiety.
- In comparison to diets heavy in carbohydrates (other than non-starch polysaccharides), those high in protein promote a greater feeling of satiety. Additionally, proteins have a high specific dynamic activity, which means that consuming them increases metabolism more than consuming carbohydrates or fats, which is crucial while attempting to lose weight.
- Protein should make up 20% of total calories.
- These should consist of whole pulses, lean meats, low-fat milk, and good quality protein.

Fats

- Additionally, 20% or less of total energy should come from fats.
- To lower the risk of cardiac illnesses, unsaturated fats should receive more attention. Adipose tissues, which are weight gain caused by an excess of fat in the diet, are unhealthy.
- Include fat in the diet in the form of vegetable oils that are high in MUFAs and PUFAs to ensure that the body receives enough essential fatty acids while also lowering the risk of coronary artery disease.
- A certain quantity of fat is necessary to carry out bodily processes and make food appetizing.

- Foods that are fried should be limited and avoided.
- High fat is bad but being fat free is too bad.

Carbohydrates

- 60% of energy in diet should coming from carbohydrates.
- The majority of these should to come from complex carbohydrates, like starches and dietary fibre.
- Sugar, fruit juices, and other simple sources of CHO should be avoided.
- To produce bulk and fullness, dietary fibre or indigestible carbohydrates are essential.
- They are also important for regular bowel movements.
- 10% of total calories may come from simple carbohydrates and 50–55% of total calories from complex carbohydrates.
- Include a lot of fresh, high-fiber fruits and vegetables in your diet, especially raw and with their edible peels.

Vitamins and minerals

- Mineral and vitamin intake during weight loss should be sufficient to maintain a healthy nutritional status.
- The body's reserves of water soluble vitamins are typically not exhausted if an adequate amount of fresh fruits and vegetables are consumed.
- However, if we restrict fats for an extended length of time, our diet may lack the fat-soluble vitamins A,D,E and K. They can require supplementation in the chronic situation.
- A diet rich in salt may encourage the body to retain fluid. When following a diet plan to lose weight, moderate salt restriction may be beneficial, especially if the patient also has hypertension.
- At least 4-5 servings of fruits and vegetables, in a variety of dishes including sabji, salads, soups, vegetable juices, fruit platters, and you may even utilize veggies in breakfast foods, should be included in each day's diet.
- Vegetables are generally low in calories and good source of fibre, vitamins and minerals.
- Roughage contributes to bulk and relieves constipation.

  Alcohol
- Alcohol may be allowed under some circumstances, but adjustments must be made.
- Alcohol gives 7 kcals per ml, acting like fat and preventing fat from being oxidized.

Diet and feeding pattern

- Diets should have satiety benefits since they promote feelings of satisfaction and wellbeing, especially while following restrictive diets.
- Adequate protein consumption, fibre fruits and vegetables, whole grains, and pulses all contribute to satiety and help people eat less.
- Restrictions on fluid and salt are not necessary unless the obesity is accompanied by hypertension, edoema, congestive heart failure, and kidney issues.
- The diet might include wholesome drinks like buttermilk, lemon water, barely water, coconut water, homemade fruit and vegetable juices, and homemade fruit smoothies.

Characteristics of weight reducing diet

- ✓ Low in calories
- ✓ Adequate in other nutrients
- ✓ Should provide satiety
- ✓ Easily adapted from family meals
- ✓ Easy to follow
- ✓ Cost effective
- ✓ Must modify dietary behavior

3.4.2 Role of Physical activity

You probably know that combined with dietary and lifestyle changes, exercise is crucial for starting and maintaining weight loss. Exercise improves cardiovascular health, bone density, and a person's overall sense of well-being. It aids in boosting lean body mass relative to fat mass. Exercise releases stored glycogen, allowing for the usage of fat as fuel.

Role of exercise in reducing weight

- Exercise that is classified as aerobic involves sustained motions that use the body's fat stores as fuel.
- In the presence of oxygen, fat is more easily burned.
- By restricting appetite, it aids in weight loss and, as a result, lowers food intake by raising BMR.
- Additionally, it maintains lean body mass while reducing body fat.

- Most importantly, exercise reduces risk of diabetes and cardiovascular disease beyond what is achieved by weight loss alone.

Benefits of physical activity

- Maintains weight.
- Reduces high blood pressure.
- Reduces risk for type 2 diabetes, heart attack, stroke, and several forms of cancer.
- Reduces arthritis pain and associated disability.
- Reduces risk for osteoporosis and falls.
- Reduces symptoms of depression and anxiety.

How much physical activity do I need?

People varies greatly in how much physical exercise they require when it comes to weight management.

For maintenance of weight

Work your way up to 150 minutes of aerobic activity each week at a moderate to strenuous intensity, or an equivalent combination of the two. Physical activity can help you maintain your weight over time, according to a large body of scientific research.

To maintain your weight, you might need to engage in more than the equivalent of 150 minutes of moderate-intensity activity per week.

To reduce weight

If you don't additionally change your diet and cut back on the number of calories you consume through food and drink, you'll need to engage in a lot of physical activity. Regular physical exercise and a good food regimen are necessary for achieving and maintaining a healthy weight.

Examples of moderate activities

If you can still talk while exercising yet your breathing and heart rate are clearly increased, the exercise is generally only moderately hard. Examples are,

- Walking briskly (a 15-minute mile/1.6km).
- Light yard work (raking/bagging leaves or using a lawn mower).

- Light snow shoveling.
- Actively playing with children.
- Biking at a casual pace.

Examples of vigorous activities

It's probably fiercely intense because your breathing is too rapid and your heart rate has elevated noticeably. Examples are,

- Jogging/running.
- Swimming laps.
- Rollerblading/inline skating at a brisk pace.
- Cross-country skiing.
- Most competitive sports (football, basketball, or soccer).
- Jumping rope.

3.4.3 Life style modifications for weight loss

Modifying one's lifestyle is crucial for both weight loss and maintaining one's quality of life. It necessitates changing habits related to eating. To maintain control and change behaviors, self-maintenance and self-discipline are necessary.

Changes in behaviour and way of life are essential components of the weight loss plan. They are based on an analysis of behaviour linked to both healthy and unhealthy eating and thinking patterns. Obese people frequently overeat, which, if managed, may contribute to maintaining a healthy weight. Keeping a food diary has been linked to weight loss in and of itself. This implies that people prefer to eat less if they are conscious of when and what they eat. It should not be assumed from this that behaviour therapy eliminates the requirement for calorie restriction.

3.4.4 Role of sleep in weight management

People frequently give a proper diet and workout all the attention they need and even more, neglecting the fact that getting the recommended amount of sleep is equally crucial for weight reduction and good health. Studies have revealed a connection between people's sleep patterns and their body weight.

It disrupts the balance of key hormones that control appetite

Two hormones that influence our appetite and hunger signals are ghrelin and leptin. Leptin signals when you should stop eating, while ghrelin is the "go" hormone that signals when to eat.

Because your body does not need to produce as much energy while you sleep as it does when you are awake, ghrelin levels fall at night. Your brain receives a signal from rising leptin levels that there is no need to cause hunger pangs.

But those who don't get enough sleep or are sleep deprived have too much ghrelin in their bodies.

The body gets "tricked" into believing it needs more calories and is hungry. Leptin levels are also falling at the same time, which can make you feel hungry all the time. One puts on weight as a result of having higher ghrelin levels and lower leptin levels.

Insulin resistance is a common side effect

According to a Cedars-Sinai Medical Centre study, one night without sleep can result in the same amount of insulin resistance as six months of eating a high-fat diet.

Your levels of the stress hormone cortisol, which causes water retention and stimulates your hunger, will be higher the more sleep deprived you are. When you are stressed, your body desires to produce serotonin to help you relax, and the easiest way to do so is by eating high-fat, high-carb foods, so you are more prone to make poor food decisions at this time.

Metabolism slows down

Being sleep deprived makes you too exhausted to workout. Your body therefore burns fewer calories as energy as a result.

Tips to ensure good sleep at night

- Avoid caffeine or caffeinated drinks after 3 pm
- Drink a glass of milk before sleeping. Milk contains an amino acid called tryptophan which relaxes you when you go to sleep.
- Turn off your electronic gadgets after 9.30-10 pm
- Have an early dinner
- Drink more water throughout the day
- Avoid exercising late at night.

3.4.5 Extreme approaches for weight loss

Obese people may turn to certain harmful extreme measures in their desperation to lose weight.

Fasting

- This method is extreme, ranging from complete fasting to extremely low-calorie diets.
- Due to the loss of cardiac muscle, it can cause acidosis, hypertension, a reduced BMR, and even mortality.
- Obese people use it, but they must be under close medical supervision.

Special clothing and body wraps

- These aid in weight loss in a particular body area to lower body size.
- Due to water loss caused by vibration or application of heat, there is a slight initial weight loss.

Drugs

- Amphetamines are frequently used to reduce appetite, however they have a number of negative side effects.
- Similar medication Phenyl Propanolamine (PPP) can cause psychotic behaviour, hallucinations, increased blood pressure, and stroke.

3.4.6 Surgical management

For people who are extremely obese, surgical procedures including jaw wiring and fat suctioning are employed. These have a number of negative side effects.

Bariatric surgery

- It consists of gastric bypass and gastroplasty, which can lower the stomach's capacity to as little as 30ml and allow for smaller meals. Additionally, it causes early satiety.
- A small gastric pouch with a tiny entrance into the distal stomach is created during a gastroplasty by placing rows of stainless steel staples to divide the stomach.
- Following surgery, a clear fluid diet is gradually progressed to a full fluid diet and then to a soft diet.
- To avoid issues with bloating, sweating, nausea, and vomiting, the patient must refrain from overeating.
- Malnutrition must be avoided by monitoring nutritional status and administering supplements.

Liposuction

It involves the suction of fat through a tiny incision into adipose tissue using a tube.

Small amounts of fat can be removed cosmetically more often on younger patients because of the skin's elasticity, which allows for tightening after aspiration.

Common complications of bariatric surgery

The risk of problems and nutritional deficits increases with how comprehensive the bypass operation is. Patients who have had extensive digestive bypasses need to be closely watched as well as take special foods and medications for the rest of their lives.

Dumping

- It is also known as rapid gastric emptying.
- It happens when food, especially sugar, enters the small intestine too quickly from the stomach.
- It frequently occurs following bariatric treatments like gastric bypass surgery, which bypass a significant amount of the small intestine.
- There are two types of dumping: Early dumping and late dumping
- It includes signs including weakness, anxiety, fainting, and symptoms of nausea, diarrhoea, and bloating.
- This typically happens after consuming foods heavy in fat, refined sugar, or CHO (table sugar or sugar that may be present in fruits).

Early dumping syndrome

- Within 30 minutes of eating a meal, it happens.
- It can also happen as a result of ingesting foods that are either excessively cold or too hot, in addition to eating foods high in CHO, fats, and sugar.

Late dumping syndrome

- It is a form of hypoglycemia
- When someone consumes too much sugar, their tiny stomach cannot adequately digest it, which causes their intestine to absorb too much of it.
- More insulin is produced by the body, which lowers blood sugar levels.

3.4.7 Fad diets

A fad diet is one that gains popularity for a brief period of time, much like fads in fashion, is not generally recommended as a healthy diet, and frequently makes exaggerated claims about rapid weight loss or improved health.

The word "fad diet" refers to a wide range of eating plans with various methods, evidence bases, and consequently varying results, benefits, and drawbacks.

In general, fad diets appeal to customers who are misinformed about the whole-diet, whole-lifestyle adjustments required for sustained health benefits by promising a variety of short-term changes needing little to no effort.

Ads for fad diets frequently make inflated promises, such as that they would cause quick weight loss of more than one kilogram per week or that they will improve health by "detoxification," or even dangerous ones, such as that they will cause malnutrition because they are so restricted and provide an unbalanced diet in terms of nutrients.

The ketogenic diet for epilepsy and the Mediterranean diet for obesity and diabetes are two examples of fad diets with scientific backing and therapeutic applications despite what some health professionals may think of them.

3.4.8 Problems in Weight management

Plateau Effect

- It occurs when weight loss eventually comes to an end and the weight stays at the same level throughout the process of losing weight.
- It is likely a weight loss stage that calls for metabolic adjustment.
- Losing excess muscle as a result of weight reduction might lower metabolic rate, which in turn slows down the weight loss process. All of this leads to a situation in which energy intake and energy use are equal.
- At this point, additional energy intake restriction or an increase in physical activity are required to cause weight loss.
- Plateaus in weight reduction can be discouraging and frustrating.
- They are a typical component of the weight loss process, though. In reality, almost everyone stalls out at some time during their weight loss process.

- Fortunately, there are a number of methods you can use to start losing weight once more and securely reach your target weight.

Weight cycling/yoyo effect

- In this, weight fluctuates several times between loss and gain.
- To lose the same amount of weight, it takes longer, and to gain it back, it takes less time.
- The causes of this are primarily behavioral in nature.

Check your progress Exercise 3

1. How obesity can be managed? Discuss guidelines in brief.
2. What is yoyo effect in weight loss journey?
3. Sleep disrupts hormonal balancing for appetite control and results into weight gain. Justify sentence.

3.5 Underweight

Just as overweight is the result of a positive energy balance irrespective of the etiology, underweight results when the energy balance is negative. For whatever reason, failure to consume enough calories to meet the body's energy needs is to blame for failure to maintain a healthy weight. You know that straying too far from the ideal body weight raises your risk of developing health issues.

3.5.1 Metabolic Alterations

Energy metabolism-related hormones are involved in the body's normal physiologic response when energy intake falls below the minimum requirements. In order to produce energy, this induces the mobilization of free fatty acids from adipose tissues and amino acids from muscle. Because proteins are burned to produce energy for the body, protein synthesis is reduced. Lean body mass and adipose tissue compress, the body's metabolic rate is lowered, and the outcome is weight loss.

Changes in body composition

The degree of changes in the body tissue compartments depends on how severely one is malnourished. Visceral proteins and muscle cell mass are the first to suffer in moderate under nutrition, with little change in body fat as a result. Significant decreases in body fat and muscle cell mass take place in cases of severe under nutrition. The degree of alterations in the bodily tissue compartments can be predicted using anthropometric measurements and a laboratory assessment of protein status.

Because they consume less food, people who are underweight may suffer from a variety of micronutrient deficiencies. A patient who is famished will have inelastic skin, a slow heartbeat, low blood pressure, obvious emaciation, and a steady weight loss.

Being underweight may make you feel exhausted, lethargic, and out of breath. Because the diet is inevitably iron-deficient at low food intake, iron-deficiency anaemia is typically observed. If the associated protein shortage is severe, oedema could be a symptom. Due to their lowered immunity, underweight people are more likely to have recurring infections. Loss of weight is frequently present before hip fracture. Starvation can result in metabolic anomalies, which can lead to mortality by bradycardia (slow heartbeat), hypotension (low blood pressure), constipation, dry skin and hair, abnormalities of the neurological system, and depression.

3.5.2 Etiology

There are various reasons for being underweight. Few of them are discussed below,

Maternal nutritional status

A Low Birth Weight baby is born as a result of the girl's poor nutritional condition and inadequate nutrition throughout pregnancy. These newborns start out at a disadvantage and may not reach their ideal weight as adults.

Poor dietary habits

Insufficient food intake, and hence insufficient calorie intake, may be the result of poor dietary choices and irregular eating patterns. It can be because the family lacks knowledge or financial resources to make purchases.

Physical activity

People who are tense, anxious, very active, and who do not get enough sleep often use up more energy than they can consume. This might result in malnutrition.

Genetic composition

An individual primarily inherits his weight from his biological mother. There is a 75% chance that the child will also be slim if the biological mother is thin.

Pathological conditions

There are many ways that illness might impact weight status.

For instance, fevers and infections raise the body's need for energy, which, if unmet due to a weak appetite, results in weight loss. In cases of gastrointestinal disorders, nausea, vomiting, or diarrhoea may drastically restrict how much food is consumed. Underweight can come from hyperthyroidism's dramatically elevated metabolic rate. In addition to affecting taste and appetite, drug therapy can cause weight loss.

3.5.3 Dietary management

For weight gain, a diet heavy in calories, proteins, fat, and carbohydrates should be followed. The addition of foods over the typical consumption must be slow and gradual since undernutrition significantly reduces the capacity of the intestines to digest and absorb food. We'll now go over some of the key components of a weight-gain diet for people who do not have any chronic illnesses that call for nutritional consumption limitations.

Energy

To acquire half to one kilogram in a week, the total caloric intake should be 500 to 1000 Kcal more than the daily requirements. As a result, if you need 2000 Kcal for daily activities, weight increase requires 2500–3000 Kcal. The energy needs can also be calculated using the optimal body weight.30-35 Kcal per Kg of optimum body weight may be administered to the patient each day. To prevent digestive issues, the calories should be raised gradually over a period of one or two weeks.

Protein

Proteins are needed to repair daily wear and tear as well as produce new tissue. People who are underweight typically have low reserves of blood proteins and amino acids, as well as diminished lean body mass. As a result, the patient might benefit from daily protein intake of about 1.2 g per kg of body weight. Animal and plant proteins should be combined, however emphasis should be placed on including easily digestible protein sources, such as half-cooked eggs, steamed, boiled, or sautéed flesh items, etc.

Fats

As a concentrated source of energy (1 g = 9 Kcals), fats are well known. Without significantly adding to the diet's bulk, fats have the ability to raise its energy content. A fast increase in fatty foods like butter, cream, and oil may cause diarrhoea; instead, add additional fat gradually. Unsaturated fats should make up about 30% of total calories.

Carbohydrates

The diet should contain generous amounts of carbohydrates that are simple to digest. To produce meals that are nutrient-dense and compact, dietary fibre intake should be kept to a minimum. Include more high-calorie vegetables like potatoes, colocasia, and yam in place of leafy, low-carb vegetables like radish, cucumber, and colocasia. All cereals offer lots of calories for a low cost. About 60–65% of the total number of calories should come from carbohydrates.

Vitamins and minerals

The majority of the time, vitamin and mineral supplements are not necessary if the diet contains sufficient amounts of fresh fruits and vegetables. However, it might be necessary to use supplements or take other important medical precautions if the patient displays clinical signs of a severe nutritional deficiency.

Fluids

Drinking liquids with or before meals should only be done after meals to avoid reducing the amount of food consumed. Cold drinks, barley water, basic soda, and other low-nutrient liquids should not be chosen over high-calorie, nourishing beverages like milkshakes and egg nog.

Check your progress Exercise 4

1. What are the various changes in body composition being an underweight?
2. What is the role of protein and fat in weight gain?
3. Enlist causes of underweight.

3.6 Let us sum up

It must have been a fascinating unit to study because we are all interested in keeping a healthy body weight and because this topic has a wide range of applications. We learned about weight imbalance and the distinction between several grades of under/overweight body weight in this subject.

The clinical and metabolic symptoms of Underweight and overweight individuals were also discussed (poor glucose tolerance, hyperinsulinemia, insulin resistance, hyperlipidemia, and so on). You should have learned about nutritional and lifestyle management for overweight/underweight people. Read this carefully because the fundamentals of these are used for effective and accurate diet(s) planning for such folks with or without disease (diabetes, coronary artery disease(s), cancer, gout, fever, and so on).This lesson also covered the physiological repercussions of greater physical activity. Nutritional supplements and non-dietary (surgical, pharmacological) weight-management techniques are gaining popularity in the

treatment of secure obesity, and the assistance of a dietician is frequently required to ensure the patient's optimum nutritional care. Reading this section should have given you a better grasp of the various facets of weight management.

3.7 Glossary

Arthritis: It is a condition that causes inflammation of one or more joints.

Bariatric surgery: It refers to surgical techniques used to treat obesity.

Bariatrics: Obesity and related problems are studied scientifically in bariatrics.

Binge eating: It is defined as a period of excessive eating that is accompanied by a sensation of lack of control over the eating process.

Comorbidity: It is defined as any condition that worsens as the degree of obesity increases and improves as the degree of obesity is successfully treated.

Cushing's syndrome: It is a glandular disorder caused by an excess of steroid hormone, resulting in greater than normal adrenal gland function; it is characterised by obesity.

Hirsutism: It is the abnormal development of coarse hair, particularly in women.

Hypercholesterolaemia: It is defined as high blood cholesterol levels.

Hyperplasia: A rise in tissue size caused by an increase in the number of cells.

Hypertriglyceridaemia: A high level of triglycerides in the blood.

Hypertrophy: An increase in tissue size caused by an increase in cell size.

Hyperuricemia: It is defined as an increase in serum uric acid levels.

Liposuction: It is the suction-based removal of excess body fat using specialised surgical equipment.

Osteopaenia: It is a decrease in bone mass caused by a slower rate of osteoid (organic matrix bone) formation.

Osteoporosis: It is characterised by bone tissue loss, resulting in brittle, fracture-prone bones.

Quality of life: The amount of well-being associated with a person's lifestyle and the physical conditions in which they live.

Resting Metabolic Rate: The bare minimum of calories required by the organism to perform its basic physiologic activities.

Syndrome X: It is a syndrome characterised by glucose intolerance, insulin resistance, hyperlipidemia, and hypertension, and is closely linked to intra-abdominal fat buildup.

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UGHN-109
DIET THERAPY

BLOCK
2

MEDICAL NUTRITION THERAPY IN DIABETES MELLITUS, GASTROINTESTINAL DISORDERS, AND LIVER

Block 2 Medical Nutrition Therapy in Diabetes Mellitus, Gastrointestinal Disorders and Liver

This section's chapters trace the development of nutritional science, from the definition of nutrient needs and their practical application to theories linking nutrition to the prevention of chronic and degenerative diseases and the improvement of health and performance.

Third chapter focuses on role of nutrition in weight management including weight loss and weight gain, various nutrition assessment methods, metabolic alterations and clinical outcomes of underweight and overweight. It also highlights the role of each nutrient, requirements, food sources, role of physical activity and sleep in weight management. It also includes extreme approaches for weight loss and complications.

Fourth chapter includes Types of Diabetes, symptoms, pathophysiology, metabolic changes and complications of diabetes. It also includes topics like role of nutrients in management of diabetes, concepts of Glycemic index and Glycemic load, exchange list, lifestyle changes, dietary guidelines, etc.

UNIT 4 MEDICAL NUTRITION THERAPY IN DIABETES MELLITUS

STRUCTURE

4.1 Introduction

You've already learned about nutrition care for weight loss. This course will teach us about the nutritional management of diabetes mellitus, a major metabolic condition with public health implications.

Metabolism is an important concept to grasp. It refers to the sum of physical and chemical changes that occur in living cells. It encompasses all of the processes through which the body receives and expends energy from meals. So, when we talk about metabolic diseases, we mean disorders in which the numerous

reactions in the cells are disrupted (energy production or utilisation) due to aberrant hormone synthesis or an enzyme shortage.

Objectives

After completing this unit, you will be able to:

- Classify and categorize the various types of diabetes mellitus,
- Discuss the etiological factors and symptoms of this disorder,
- Elaborate on the metabolic changes in disease condition and complications associated with diabetes mellitus,
- Describe the nutritional management of the disease, and
- Provide diet counselling regarding diabetesmellitus prevention and control.

4.2 Diabetes mellitus

Diabetes mellitus is a metabolic condition characterised by the tissues' diminished ability or absolute inability to utilise carbohydrates (glucose). This causes changes and disruptions in fat and protein metabolism, as well as water and electrolyte balance.

The condition is caused by the lack, deficiency, or ineffectiveness of insulin, which is produced by the beta cells of the islet of Langerhans in the pancreas. It is associated with persistent and irreversible functional and structural alterations in the vascular system of the body in moderate and severe instances of lengthy duration, affecting organs such as the heart, brain, kidneys, eyes, and even the nervous system.

4.2.1 Prevalence of Diabetes mellitus

Diabetes is a chronic condition that arises when the pancreas does not create enough insulin or when the body does not use the insulin that is produced adequately. Insulin is a hormone that controls blood sugar levels. Hyperglycemia, or high blood sugar, is a typical side effect of untreated diabetes, and it can cause catastrophic harm to many of the body's systems, particularly the neurons and blood vessels, over time.

In India, an estimated 77 million people over the age of 18 have type 2 diabetes, and almost 25 million are prediabetics (with a higher risk of developing diabetes in the near future). More than half of all diabetics are ignorant of their condition, which can lead to serious health issues if not diagnosed and treated early. Diabetes increases the risk of heart attack and stroke by two to three times in adults. Neuropathy (nerve damage) in the feet, when combined with restricted blood flow, raises the risk of foot ulcers, infection, and the eventual necessity for limb amputation. Diabetic retinopathy is a leading cause

of blindness that results from long-term damage to the retina's tiny blood vessels. Diabetes is one of the most common causes of renal failure.

Diabetes mellitus, also known as 'madhumeham' in India, has been recognized for millennia. This is a condition characterized by an excess of sugar in the blood and urine. Normally, insulin uses sugar from the blood to produce energy. This prevents high blood sugar levels. Diabetes can be caused by one of two factors. One, the pancreas does not create enough insulin to remove sugar from the blood, and two, the insulin produced is ineffective, resulting in insufficient blood sugar utilization. As a result, blood sugar levels rise. If the blood sugar level climbs above 180mg/100ml, the sugar is eliminated in the urine as well. Diabetes cannot be cured, but modifications in lifestyle, nutrition, and medications can help a person live a normal life.

4.2.2 Types of Diabetes mellitus

As a consequence of global research and surveys, several types of diabetes have been identified. Diabetes types include:

- Type 1 - Insulin Dependent Diabetes Mellitus (IDDM)
- Type 2 - Diabetes Mellitus - Non Insulin Dependent Diabetes Mellitus (NIDDM)
- Type 3 - Malnutrition Related Diabetes Mellitus (MRDM)
- IGT (Impaired Glucose Tolerance)
- Gestational Diabetes

Type 1 - Insulin Dependent Diabetes Mellitus (IDDM)

This kind of diabetes primarily affects children and adolescents, but it can also affect adults and the elderly. In this case, - cells of the pancreas produce little or no insulin. As a result, the young people require insulin injections on a daily basis. If the daily injection is not administered, there may be life-threatening metabolic problems and severe symptoms. Because different forms of insulin are accessible (short and long term), the carbohydrate level of the diet must be adjusted correspondingly. In this kind of diabetes, more persons are underweight.

Type 2 - Non Insulin Dependent Diabetes Mellitus (NIDDM)

This kind of diabetes is commonly found in overweight and obese persons. The pancreas produces normal or even high levels of insulin. The disease's symptoms appear gradually. Insulin resistance is the root of the problem. Obesity is the most common cause of insulin resistance. Weight loss, nutrition, and exercise can all assist to reduce insulin resistance. Anti-diabetic medications can also be beneficial.

Type 3 - Malnutrition Related Diabetes Mellitus (MRDM*)*

This kind of diabetes has been classified as a distinct entity. It is often encountered in poor countries, including India. It typically affects young people between the ages of 15 and 30. People appear skinny, lean, and undernourished.

The cause of this type of diabetes is that the pancreas does not create enough insulin (pancreatic necrosis), hence these people require insulin.

Hormonal imbalances are very common. It has also been shown that when insulin is stopped, the complications are less severe than in type 1 diabetes.

Impaired Glucose Tolerance (IGT)

The fasting blood sugar level is used to determine glucose tolerance. An oral glucose load of 75 grammes is given, and blood sugar levels are measured again after 11/2 - 2 hours. The obtained sugar value is compared to the normal or fasting value. If the levels are higher than normal, the condition is called impaired glucose tolerance. Individuals in this category are free of diabetic symptoms, but they may acquire diabetes later if they are unable to maintain their diet and avoid obesity. Regular exercise also aids in the maintenance of blood sugar levels.

Gestational Diabetes

Gestational diabetes occurs when a pregnant woman acquires diabetes. It affects only 1% of pregnant women. Pregnant women who are at risk of diabetes due to a family history or a poor obstetric history should be screened. Diabetes issues develop in pregnant women, and the diabetic diseases may persist after delivery.

Aside from the diabetes categories listed above, another kind of diabetes, maturity onset diabetes of the young (MODY), is being identified. Maturity-onset diabetes of the young (MODY) is any of several uncommon hereditary forms of diabetes mellitus caused by dominantly inherited insulin secretion abnormalities. Six varieties have been identified thus far, but more are likely to be added. The most frequent types are MODY2 and MODY 3. The severity of the various forms varies greatly, but MODY often behaves like a very weak form of type 1 diabetes, with sustained partial insulin production and normal insulin sensitivity. MODY normally appears around the age of 25, however it can appear younger.

4.2.3 Etiology

Diabetes has an unknown aetiology, however several variables contribute to the illness. These are discussed further below.

Type I Diabetes: The condition is caused by both hereditary and environmental factors. These are listed in Table 4.1.

Type II Diabetes: Aside from the genetic and environmental causes mentioned above, an imbalance of hormones can induce this kind of diabetes, and many of these hormones may be insulin antagonists. Among these hormones are:

- Growth Hormone: Excess growth hormone has been found in around one-third of diabetics.

Table 4.1. Causes of Type 1 Diabetes

Genetic	There is a family predisposition to Type I diabetes. On chromosome 6, the frequency of specific (HLA) human lymphocyte antigens (typically a protein, foreign substance that creates antibodies) is altered, resulting in aberrant immune responses, autoimmunity, and islet cell antibodies.
Age	It can occur at any age
Gender	Young males are at more risk
Dietary factors	Diabetes is linked to a low fibre intake in the diet. Excess food (particularly processed food) leads to an energy imbalance. Obesity, a risk factor for diabetes, may result. Nutritional excess and deficiency are major etiological variables.
Infection	Viral infections such as measles and mumps can trigger abnormal auto immune response that destroy the beta-cells of pancreas which produce insulin.

Increased tissue breakdown	Excessive glycogen (liver sugar) breakdown. Diabetes is caused by metabolic abnormalities caused by the breakdown of tissue protein and fat.
Stress	Stress is a factor that contributes to the onset of this illness.

- Cortisol and corticosteroids: It promote protein breakdown and limit sugar utilisation by tissues, resulting in an increase in blood sugar levels.
- Adrenaline: This hormone stimulates the breakdown of glycogen (the liver's storage form of glucose). It also decreases insulin secretion, raising blood sugar levels.
- Thyroid hormone: An excess of thyroid hormone worsens diabetes. Diseases, in addition to hormonal imbalance, could be an etiological cause.
- Diseases: An underlying condition may be a significant cause of diabetes in the elderly. Diabetes develops as a result of several illnesses that cause insulin insensitivity or reduced insulin production. Pancreatitis is one of these disorders. (pancreatic inflammation), pancreatic cancer, pancreatectomy (pancreatic duct surgery). Insulin resistance is common in type II diabetes.

Gestational diabetes: Gestational Diabetes is a kind of diabetes that occurs during pregnancy. This is due to increased synthesis of hormones that inhibit insulin production.

Check your progress Exercise 1

1. **Fill in the blanks for following statements:**
   a. Insulin is produced by beta cells of _____.
   b. In India, an estimated ___ million people over the age of 18 have type 2 diabetes, and almost ___ million are prediabetics
   c. IDDM stands for _____
   d. In IGT, ____ gm oral glucose load is given to the patient.
   e. Gestational diabetes occurs during _____.

2. **Enlist 5 major types of diabetes.**
3. **What type of dietary habits can result into diabetes?**

4.2.4 Metabolic alterations

We all know that insulin plays a crucial role in maintaining normal blood glucose levels by influencing carbohydrate metabolism.

Reduced utilisation of glucose by body cells, resulting in an increase in blood sugar levels ranging from 300 to 1200 mg/dl. As a result, the glucose metabolism is harmed, and the body cells do not receive fuel for energy needs.

Increased mobilisation of fats from fat storage sites results in aberrant fat metabolism as well as lipid accumulation in arterial walls, which promotes atherosclerosis. As a result, the body relies more on fat-derived energy than carbohydrate-derived energy. When this happens, the levels of acetone, acetoacetic acid, and hydroxybutyric acid in the bodily fluids rise, resulting in acidosis. A second, more significant consequence is the direct increase in ketoacids. The kidneys have a low excretion threshold for these ketoacids.

Every day, 100-200 grammes of ketoacids might be eliminated in the urine. Because these are powerful acids, they mix with sodium obtained from extracellular fluid, replacing the sodium in the extracellular fluid with hydrogen ions, causing the urine to become more acidic. This results in quick and deep breathing. These extreme effects occur in severe or poorly controlled diabetes, resulting in acidic coma and, in extreme cases, death.

The third impact is protein depletion in bodily tissues, which causes alterations in protein metabolism. Diabetes accelerates the catabolic activity of muscle protein, resulting in an increase in nitrogen that must be expelled following deamination. In addition, the cellular potassium in the blood increases, which must be expelled in the urine.

Clinical symptoms

There may be no symptoms of diabetes mellitus in mild cases. The diagnosis could be made by chance during a blood or urine test. Clinical signs are more evident in the most severe forms of diabetes. Table 4.2 has a list of these.

Polyuria, polydipsia, polyphagia, weight loss, and paranesthesia are the first symptoms of diabetes. The osmotic diuretic impact of glucose in the renal tubules causes polyuria. Polydipsia, in turn, is caused by dehydration caused by polyuria. The body's inability to use glucose (and protein) results in weight loss and a tendency towards polyphagia. The loss of body protein appears to be another cause of paranesthesia.

Table 4.2 Clinical symptoms of Diabetes

Polyuria	Urinary production that is excessive, especially at night. Bed wetting is quite common in very young children.
Polydipsia	Excessive thirst
Polyphagia	Increased appetite due to loss of glucose in urine
Weight loss	Despite eating more (polyphagia), there is weight loss.
Fatigue	Tiredness due to lack of energy
Paresthesia	Tingling sensation in hands and feet
Blurred vision	Excess sugar deposits on the eye lens cause refraction alterations, resulting in vision blur.
Delayed wound healing	Lack of nutrients delays wound healing

4.2.5 Complications of Diabetes

Diabetes, as you are aware, is a chronic disease. We already stated that it can be controlled but not cured. Controlling diabetes by maintaining normal blood levels is vital for preventing complications, however they can occur as acute or chronic problems. Let us continue reading to learn what we mean by these problems.

Acute complications of Diabetes

Hypoglycemia: The most common cause of low blood sugar is improper meal and snack scheduling. As you are aware, the treatment program is centered on maintaining a good balance of insulin, food consumption, and exercise. As a result, by limiting food intake, skipping or delaying a meal or snack, the amount of sugar in the blood will be lower than if the typical meal was followed. As a result, there is more insulin in the blood than is required for the sugar. The insulin will act on whatever sugar it can get its hands on, lowering the blood glucose levels even further. The second reason could be that you are exercising more than normal without adding an extra meal or snack to your diet.

Inadvertently taking too much insulin might also result in low blood sugar.

When this happens, the body produces more insulin than is required. The excess insulin acts on the glucose (sugar) already present in the blood, resulting in abnormally low blood sugar levels. Insulin responses or hypoglycemia are the signs of low blood sugar. These responses occur suddenly and must be handled as soon as possible.

Shaking, anxiousness, sweating, dizziness, weakness, irritability, and hunger are the first symptoms to occur. Crying, anger, tiredness, confusion, staggered walk, inability to complete tasks, impaired vision, and headache are symptoms that develop gradually.

If the foregoing symptoms are not addressed immediately, more serious symptoms may develop. Increased disorientation, delirium, convulsions, and unconsciousness are among the symptoms. Encourage the individual to fast if he or she is conscious. Carbohydrate, such as sugar, honey, sweet or chocolate, and coca cola can be consumed. Stop all activities and relax for 10-15 minutes. The glucose in the diet should swiftly elevate blood sugar levels. If it doesn't work, try again. If you are unconscious, a friend or family member should come to your aid. The individual may require a glucagon injection (glucagon is a hormone similar to insulin that is produced by the alpha cells of the islets of Langerhans and the pancreas).It has the opposite effect of insulin in that it raises blood sugar.

Hyperglycemia

All medical authorities throughout the world have emphasised the need of keeping blood glucose levels within or close to normal ranges. Even with diligent work, there may be occasions when

The blood sugar level is unusually high or abnormally low. If either of these two disorders is not treated, it might lead to major complications. We've already discussed hypoglycemia (low blood sugar), now let's look at ketoacidosis, which can occur during hyperglycemia.

This situation happens when there is insufficient insulin to meet the body's needs and the shortage is left untreated. Sugar in the urine is expelled at a rapid rate when blood sugar levels are high. Furthermore, the body uses fat for energy, and ketones are produced: Ketosis refers to increased ketones generation, while ketonemia refers to elevated amounts of ketones in the blood. Ketonuria refers to their increased excretion in urine, while ketoacidosis refers to all of the above-mentioned illnesses related with accelerated fat breakdown. Ketoacidosis is a dangerous illness that can result in "Diabetic coma" or even death. Ketoacidosis develops gradually, but when ketones are detected, it is critical to test for both glucose and ketones in the urine.

Do you know how ketoacidosis develops?

1. Because of the increased energy required, illness, infection, injury, or mental stress may raise the body's requirement for insulin. The effectiveness of accessible insulin would also necessitate the release of additional glucose from the liver (which is already stored as glycogen) or fat sources.

2. Skipping insulin injections, which decreases the quantity of insulin accessible to the body.

3. Reducing exercise, which upsets the balance of diet, insulin, and activity. This component, together with the others mentioned above, may aggravate the proclivity for ketoacidosis.

4. Excessive carbohydrate consumption may worsen ketoacidosis.

What will occur? Two things can happen if there is insufficient insulin. For starters, the body's cells will be unable to use the glucose in the blood for energy. Second, glucose cannot be converted to glycogen for future usage in the liver. As a result, blood sugar levels rise, and sugar levels exceed 180mg/100ml. The additional sugar will leak into the urine, resulting in elevated sugar levels. So, in order to make energy accessible, fat sources will be utilised, resulting in a rise in ketoacids in the blood and urine.

The onset of ketoacidosis is gradual, although it is more rapid among young diabetics. Diabetic coma can occur within 12-24 hours. Many symptoms are similar to hypoglycemia, although others may appear. Excessive urine, thirst, increased hunger, lethargy, unexplained weight loss, sluggish healing of cuts and wounds, dry itching skin, vaginal itching, abdominal pain, and rapid shallow breathing with an acetone odour are some of the symptoms.

Chronic complications of diabetes

These occur gradually when diabetics do not monitor their blood sugar and are careless about eating, exercise, and medications, resulting in excessive blood sugar levels. Diabetes with uncontrolled blood sugar and cholesterol levels causes vascular damage. The chronic complications of uncontrolled diabetes are highlighted here.

Atherosclerosis

Degeneration of walls of the arteries due to fatty plaques deposition on arterial walls. Diabetics are more prone to myocardial infarction, stroke and deep arteryblockages in extremities. Atherosclerosis is a common complication in the diabetics. Lipoprotein abnormalities are common in diabetics and responsiblefor this condition.

Nephropathy

The thickening of the capillary basement membrane causes changes in the nephrons of the kidney, resulting in glomerulonephrosis (kidney disease). These changes result in filtration abnormalities, which increase the proteins in urine (protein urea), producing uremia and, eventually, renal failure.

Retinopathy

Long time span Diabetes with uncontrolled blood sugar levels can harm the small blood vessels in the eyes (microangiopathy). This can cause rapid degeneration of vision (retinopathy).

Neuropathy

Peripheral nerve system lesions (neuropathy) can produce tingling, burning, or numbness in the upper and lower limbs.

Infections

Diabetics are also vulnerable to bacterial, viral, and fungal infections. Cuts and wounds heal slowly in diabetics. Individuals are susceptible to tuberculosis, skin, urinary tract, and foot infections. A doctor must be consulted, and necessary antibiotics must be administered. Foot care is critical since the most frequent foot disorders are a lack of circulation and neuropathy. Amputation is required in 5% of diabetics due to neglect.

Check your progress Exercise 2

1. **State true or false for the following statements:**
    a. Too much insulin can result into low blood glucose levels.
    b. Sugar in urine is sign of hyperglycemia.
    c. Ketoacidosis is a dangerous illness that can result in "Diabetic coma" or even death.
2. **What is the difference between Ketonemia and Ketonuria?**
3. **Enlist chronic complications of Diabetes.**

4.3 Management of Diabetes

Diabetes cannot be cured, but it can be managed such that a person can live a normal life. Patients who keep their blood glucose levels within the normal range have fewer issues than those who have frequent variations in their blood glucose levels. A proper synchronisation of nutrition, lifestyle, and medications can help prevent/delay the onset of problems.

As dietitians, our primary goal is to help patients achieve life-long sustainable quantitative and qualitative changes in their nutrient consumption, dietary habits, and food choices based on their insulin/drug dosage and lifestyle. The dietician should collaborate closely with the doctor and other members of the patient care team. We will now go over the specifics of diabetic dietary management, which will be followed by a briefing on lifestyle changes and drug/insulin administration. While reading the following topics, keep in mind that good diabetes care requires a multifaceted strategy that includes diet, lifestyle, and hypoglycemic drugs/insulin. Let us begin by discussing dietary management.

4.3.1 Dietary management

Diet is particularly important in diabetes management since it has a direct effect on blood glucose levels. Aside from the medical, exercise, and behavioral aspects of the treatment, it is a critical component in diabetes control. Let's start with the diet. Diet treatment aims to preserve and extend a healthy, productive, and joyful life. This means that dietary assessment is critical for establishing feasible and acceptable goals for the patient. A goal that the patient can understand, relate to, and easily follow. Only then can we plan and carry out the diet. Clinical parameters should be examined on a regular basis to increase adherence to the programme and make appropriate changes if necessary.

Calories, Proteins, Fats and Carbohydrates

We previously learned that adequate calories should be provided to adults in order to maintain an optimal weight, to allow for normal growth and development in children and adolescents, and to meet the increased needs during pregnancy, nursing, and illness.

Calories

Adult patients' energy requirements are determined by their current body weight and the need to maintain a desirable or ideal body weight. Remember how we learned about calculating energy requirements based on optimal bodyweight?

Proteins

Proteins should be consumed in sufficient quantities to maintain normal body composition and prevent lean tissue mass depletion. Adult diabetics with no difficulties can maintain good health by consuming 1.0 gramme protein per kg ideal bodyweight per day. During youth, adolescence, pregnancy, and lactation, the requirements exceed the RDI, and patients typically benefit from increasing protein intake by 10 to 15%. However, in the event of renal difficulties, protein intake should be limited in accordance

with the clinical criteria of the renal function test. In such cases, the patient should be given no more than 0.8 gmper kg IBW per day.

Fats

WHO recommends that total fat be less than 30% of total calories. However, due to the widely existent Asian paradox in India, it is typically recommended that no more than 20% of total energy be provided by dietary fat. This is especially relevant in the case of obese diabetics with hypertension or heart problems. Vegetable oils high in mono/poly unsaturated fatty acids should be preferred to animal fats high in saturated fatty acids.

Diabetics with no difficulties should limit their dietary cholesterol intake to less than 300 mg per day. However, if the patient is at risk or has hyperlipidemia or CAD, the daily cholesterol intake should not exceed 200 mg. We hope you recall the cholesterol-containing foods we discussed in the previous unit. A brief recapitulation would have led you to sources of cholesterol such as whole milk and its derivatives, egg yolk, red meat, and organ meats (liver, kidney, and brain).

Carbohydrates

These are heavily influenced by dietary patterns. Complex carbohydrates with higher fibre are preferred over simple carbs such as sweets.

The amount should give 55-65% of the calorie intake for the day. The percentage and distribution of carbohydrate will vary depending on insulin regimes, treatment goals, and individual habits. Remember that diabetics do not need to limit their carbohydrate intake, but they may change the kind of carbs in their diets by eating complex carbohydrates (whole grains, legumes, and vegetables) and avoiding items high in simple carbohydrates (honey, jaggery, sugar, and jams).

Dietary fibre

Dietary fibre is the portion of food that the intestines do not digest. High fibre meals have been demonstrated to improve glycemic management in diabetes. It not only decreases blood sugar but also blood cholesterol, making it beneficial for cardiovascular disease, constipation, and some types of cancer. Fibre can be found in a variety of meals, including whole cereals, legumes, fruits, and green leafy vegetables (insoluble fibres). Many soluble fibres, such as those found in beans and fenugreek seeds, have been found to be more effective.

A diabetic should consume 25 g of dietary fibre per 1000 calories per day.Remember that rich fibre diets are low in calories and have a low glycemic index. A food product with more than 6g of fibre per 100g is termed high fibre. As a result, diabetics must consume more of these items.

Vitamins and minerals

The vitamin and mineral recommendations are the same as for the general population. Lower magnesium levels, on the other hand, are linked to an increased risk of diabetes. Magnesium deficiency has been linked to insulin insensitivity, which may improve with oral supplementation. Supplementing with chromium has been demonstrated to be effective in diabetic people.

Mineral and vitamin supplementation should be considered during infections and complications, as well as in conditions such as extreme weight loss diets, strict vegetarians, pregnant, breastfeeding women, the elderly, and people on medications who have malabsorption disorders and other diseases. For hypertensive diabetics or those with renal complications/oedema, sodium restriction is advised.

We learned about nutrient requirements in our previous discussion. In summary, diabetics should avoid simple carbohydrates, use fat sparingly, consume less saturated fats and more polyunsaturated fats, consume whole cereals and pulses in appropriate amounts, consume fiber-rich foods in sufficient quantities, and consume vegetables and fruits sparingly.

4.3.2 Food exchange system

The calorie intake and quantity of food taken by a diabetic should not vary greatly on a daily basis. Also, the diet should not become boring and inflexible, forcing the patient to consume the same items day after day. Food variety makes life more fascinating. Don't you agree? As a result, we have the food exchange system, which delivers nearly the same number of calories, carbohydrates, proteins, and fats. This allows us to maintain a constant overall nutrient intake while also providing variety in foods. As a result, the weight of the food that offers the consistent nutrients may vary. Take, for example, the milk exchange mentioned in Table 4.3.

Table 4.3 Milk exchange list (provides 8gm of protein)

Food	Quantity	Energy (Kcal)	Protein (g)
Buffalo milk	217	233	8
Cow milk	245	179	8
Paneer	42	108	8
Khoa	49	155	8

Skim milk	320	93	8
Skim milk powder	21	75	8
Curd	258	158	8
Cheese	33	117	8
Full cream milk	250	218	8
Toned milk	250	152	8

Isn't this fascinating? If we know how many milk exchanges we have to do in a day, we can choose from a variety of milk replacements that have the same nutritious value as milk. We might have curds, buttermilk, cow's milk, even cheese, khoa, or skimmed milk on occasion. So, if we can educate diabetics about all food group exchanges, they will be able to tinker with their diet on their own. Exchanges for vegetables, fruits, grains, pulses, meat, and fats have also been calculated. Each exchange list will include a number of goods that can be exchanged among members of the group or with members of each food group.

You will be more familiar with these exchange lists because you will be using them to plan your diets in the practical.

4.3.3 Glycemic Index (GI)

Although the use of exchange lists is still common for diabetic diet planning, it has recently been discovered that while different foods in exchange lists have the same quantity of nutrients, the rise in blood sugar after the meal (post-prandial) differs and is not the same. This has given rise to the emerging idea that different carbs boost blood sugar levels to varying degrees. In diabetic diets, it is critical to understand how much blood sugar rises from particular foods or combinations of foods. As a result, the notion of the glycemic index was established.

What exactly is the glycemic index? The glycemic index is a numerical index assigned to carbohydrate-rich foods that is based on the average increase in blood glucose level that occurs after the food is consumed. The greater the number, The larger the blood sugar reaction, the bigger the blood sugar response.

It would be a better approach of planning diabetic meals if you took a specific food and measured the rise in blood sugar in reaction to the food taken in contrast to the response to an equivalent amount of glucose and knew the glycemic index in percentage. Individual dietary items, such as wheat, rice, legumes, and vegetables, do have a glycemic index. Cereals such as wheat, rice, vegetables (potato and carrots), and

fruits have a high glycemic index (65-75%), while lentils (peas, beans, green gramme, Bengal gramme) have a low glycemic index (30-40%). Glucose has a 100% glycemic index. Diabetics benefit more from diets with a lower glycemic index. These foods typically have more fibre.

Using this formula, we can compute the glycemic index of food:

GI= Area under 2 hours blood response curve of test food/ Area under 2 hours blood response curve of reference food * 100

A GI of 70 or above is considered high, a GI of 56 to 69 is considered medium, and a GI of 55 or less is considered low.

As a result of our discussion above, it is evident that the glycemic index tells us how quickly a specific carbohydrate converts to sugar. It surely does not tell us how much carbohydrate is in a serving of a particular dish. This information is also important in determining the true impact of carbohydrate consumption. To understand this, we must first grasp another notion known as glycemic load. A food's glycemic load is calculated by dividing its glycemic index by 100 and multiplying it by its accessible carbohydrate content (carbohydrate minus fibre) in grammes.

The glycemic load is a relatively recent method of assessing the impact of carbohydrate consumption that incorporates the glycemic index but provides a more complete picture than the glycemic index alone. As an example, consider watermelon. Watermelon has a high glycemic index (about 72). However, a portion of 120 g watermelon has just about 6 grammes of accessible carbohydrate.

4.3.4 Oral hypoglycemic drugs and Insulin

When diet, exercise, or even weight loss do not help diabetic symptoms and blood sugar levels, hypoglycemic medicines must be used. NIDDM patients are typically prescribed oral hypoglycemic medications. There are several sorts of oral medications accessible. They function by stimulating the pancreas to produce more insulin or by assisting the body's cells in appropriately using insulin. Among the most widely used hypoglycemic medications are:

Sulphonylureas

Tolbutamide is the mildest, and its impact lasts for 8 hours, therefore 2-3 doses are required. Because chlorpropamide is a stronger and longer acting medication, it just requires a single dose. They cause the pancreas to produce more insulin. Tolbutamide and talzamide are first generation sulphonylureas, whereas glyburide, utilizati, and utilization are second generation sulphonylureas.

Biguanides

They are anti-diabetic medications that have no effect on insulin production. Sulphonylureas are favoured over these since they do not promote weight gain. Metformin belongs to this class and is typically provided to obese patients, whereas sulphonylureas are prescribed to non-obese individuals.

Skin rashes, itching, loss of appetite, and stomach trouble are all symptoms of weight loss. These must be disclosed to your doctor if they exist. Depending on the severity of the diabetes condition, the doctor may prescribe a combination of oral medications or insulin. Let us learn more about insulin and its various forms.

Insulin

The discovery of insulin transformed the lives of patients with type 1 diabetes. Diabetics can live a normal, happy, and productive life with the help of this wonder medicine.

In order to establish an optimal diet and meal pattern for diabetics, a dietician should be well acquainted in the salient properties of different forms of insulin. Let us look at these facts:

1. Insulin is counted in units. A unit of insulin reduces blood glucose by a specific amount. The quantity of insulin units required by a diabetic per day will be determined by the doctor.

2. Insulin is typically manufactured in two strengths: U100 and U40. This means that if the diabetic consumes U100, each cubic centimeter has 100 units of insulin. Likewise, U40 has 40 units of insulin per cubic centimeter.

3. Insulin comes in three varieties. The type differs in how quickly it begins working (reducing blood glucose), the time of peak activity (when they work the hardest), and the length of time it works. Short acting, intermediate acting, and lengthy acting are the three varieties.

Short acting insulin: This type of insulin begins functioning rapidly, is most effective two to three hours after injection, and is totally gone by 4-6 hours. If a diabetic uses this sort of insulin, they will require an injection every 4-6 hours. This is also referred to as regular insulin. A tiny amount of zinc is sometimes added to conventional insulin because it prolongs its activity. This is referred to as the ‘Semilente’.

Intermediate acting: It moves more slowly than short acting. It is most effective 8-12 hours after injection and continues to act to some extent 24 hours afterwards. Neutral Protamine Hagedorn (NPH) insulin is one type of this type of insulin. The developer’s name is Hagedorn, and protamine is a simple protein that has been added to it. Lente is a type of intermediate acting insulin.

Long acting insulin: It does not begin to operate until 4 to 8 hours after injection. It reaches its maximal activity 18 to 24 hours after injection and continues to work to some extent after 36 hours. This is used less frequently because it is more convenient to work with 4 hours or 24 hours rather than 36 hours. The doctor may employ a combination of short and intermediate insulin.

The carbohydrate distribution varies depending on the type of insulin used. Keeping note of the amount of CHO in each meal is a recent trend in diabetes diet calculation and is known as carbohydrate counting.

4.3.5 Carbohydrates counting

Carbohydrates, or carbs, are naturally present in some foods. Carbohydrate content varies amongst grains, sugars, starches, legumes, and dairy. Learn about the three types of carbohydrates and the foods that contain them.

When carbohydrate-containing foods and beverages are digested, the carbs are broken down into glucose to fuel our cells, and the body's blood glucose, or blood sugar, level rises. Blood sugar levels rise after eating in those who do not have diabetes, but the body's insulin response prevents them from climbing too high.

If you have type 1 diabetes, your pancreas no longer produces insulin, therefore you must take background insulin as well as mealtime insulin dosages to offset the carbs in your food. To do so, you must first determine how many carbohydrate gm are in your meal—cue carb counting!

At its most basic, carb counting entails counting the number of grammes of carbohydrate in a meal and matching that to your insulin dose.

If you use meal time insulin, you must first account for each carbohydrate gramme consumed and then dose meal time insulin based on that total. To manage your blood sugars after eating, you will use an insulin-to-carb ratio to establish how much insulin you should take. This advanced carb counting method is advised for patients on rigorous insulin therapy via needles or pump, such as those with type 1 diabetes and certain persons with type 2.

Carbohydrate counting is a way of calculating the number of grammes of carbs taken during meals and snacks.

Counting CHO servings offers an accurate prediction of how blood glucose levels would rise after consuming that particular meal.

Monitoring and measuring carbohydrates is an effective technique for type 1 diabetes control.

- 1 carbohydrate count / serving = 15gms of CHO.

Examples of serving size of fruits contain 15gm of Carbohydrates

- 120gm apple
- 120gm banana
- 180gm orange
- ½ cup juice
- 90gm grapes
- 1 cup raspberries

Examples of serving size of starchy foods contain 15gm of Carbohydrates

- 1/3 cup rice
- 30gm bread or 1 slice of bread
- ½ cup oat meal
- ½ cup corn
- 1/3 cup of pasta
- 90 gm potato

Depending on the type of insulin, mid-meal and bedtime meals may or may not be given.

A bedtime snack, for example, is not required if the patient is on a combination of long and quick acting insulin.

Low carbohydrate foods should be recommended as a mid-meal snack for people on quick acting insulin.

Carbohydrate counting tools

- Food labels as it mentions serving size and grams of carbohydrates per serving
- ADA or other approved scientific exchange lists
- Carbohydrate counting books
- Restaurant menus with nutrition information
- Cook books that provides nutrient breakdowns

Check your progress Exercise 3

1. What is Glycaemic Index and Glycaemic Load?
2. What are the various side effects of hypoglycaemic drugs?
3. What is Carbohydrate counting?
4. Dietary fibre plays an important role in Diabetes control. Justify sentence.

4.4 Let us sum up

Diabetes, as we all know, is a disease that is becoming more common in our society.

It is defined as a disease utilization 76 d by abnormal metabolism and inappropriate hyperglycemia caused by a lack of insulin secretion or a combination of insulin resistance and inadequate insulin secretion.

This unit taught us about the many kinds of diabetes and reduced glucose tolerance in various age groups. There is also a brief discussion of the signs and complications of diabetes, as well as the common diagnostic procedures used to identify and monitor diabetes.

The course went into greater detail about diabetes treatment in general, with a focus on dietary aspects. We discovered that diabetes management entails coordinating the patient's diet, medications, and exercise pattern. The nutrient requirements are expounded upon, as is the utilization of alternate dietary components/supportive therapy. This course also discussed the relevance and benefits of regular exercise in keeping blood glucose levels within normal ranges. Following then, the usage of several types of drugs/insulin, their characteristics, and duration of action were examined.

A dietitian is frequently involved in counselling sessions aimed at assisting the patient in becoming self-reliant in the day-to-day control of blood glucose fluctuations. Some helpful hints for running an effective education course were also provided.

4.5 Glossary

Acidosis: It is a condition in which the body's alkali reserves are depleted, causing an upset in the acid-base balance. Excessive acidity in the blood and bodily fluids.

Ascites: It is a kind of oedema utilization 78d by fluid buildup in the abdominal cavity.

Insulin resistance: It is a condition in which cells fail to respond to insulin in the same way that they do in healthy people.

Polyuria: It is defined as increased urination caused by glucose in the urine.

Polyphagia: It is an increase in appetite caused by insufficient glucose utilization.

UNIT 5 MEDICAL NUTRITION THERAPY IN GASTROINTESTINAL DISORDERS

STRUCUTRE

5.1 Introduction

Prior sessions covered significant metabolic issues. In this unit, we will learn about conditions affecting the gastrointestinal (GI) system. Have you ever had unusual digestive symptoms? The intensity of common symptoms like nausea, anorexia, and weakness can range from mild to quite severe, including the dumping syndrome, malabsorption syndromes, and many other disorders that we will learn about in this course. Abdominal pain, gas and flatulence, delayed stomach emptying, diarrhoea, and many other symptoms are among the more severe ones. In this course, the typical gastrointestinal illnesses and disorders will be covered in order to highlight their causes, important signs and symptoms, and nutritional management.

Objectives

Following completion of this unit, you will be able to:

- Describe the disease symptoms, causes, and complications of gastrointestinal problems.
- Enumerate the principles of nutritional management in various gastrointestinal disorders and diseases
- Discuss the impact of diseases on the normal functioning of the gastrointestinal tract, and describe how to modify a regular or normal diet to suit these disease conditions.

5.1.1 Functions of GI Tract

- Store food,
- Combine the meal with digestive enzymes released in various areas of the digestive tract to break down complex foods into simpler forms of food;
- Transport the food combination to the anus via the mouth, oesophagus, stomach, duodenum, small, and large intestines, and
- Absorb various nutrients into the blood, particularly from the small intestine and outer section.

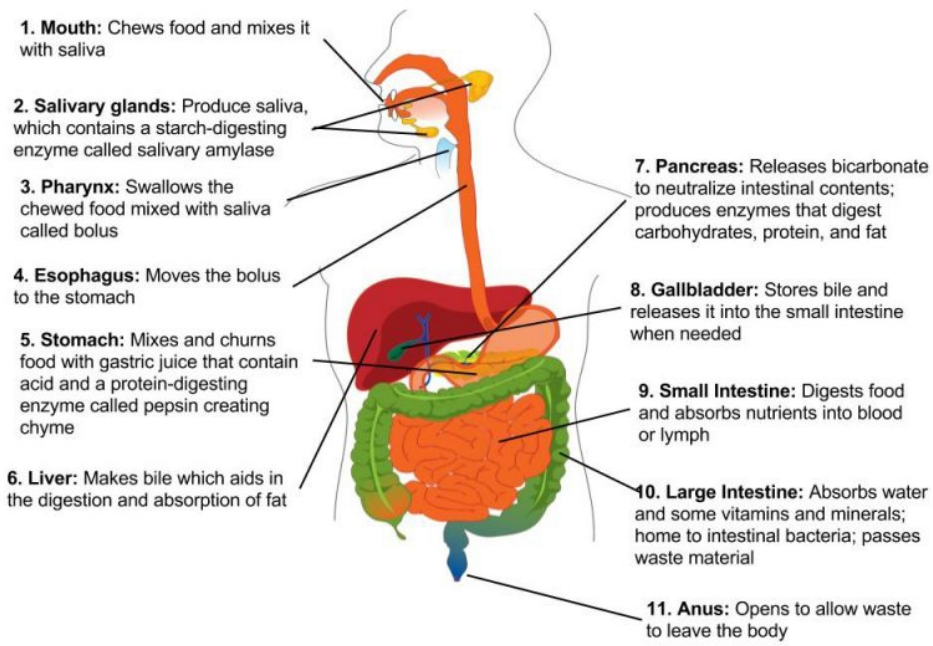


Figure 5.1 Functions of GI tract

5.2 Gastro Intestinal Disorders

When you consider how each component of the body performs its functions, you can see how any problem or disease of that part can affect how that part stores, propels, digests, and produces vitamin inadequacies.

We'll talk about it in this section and start with diarrhoea, which is one of the most prevalent and deadly GI tract issues.

5.2.1 Diarrhoea

Diarrhoea is distinguished by excessive fluid and electrolyte loss, especially sodium and potassium, as well as the frequent passing of watery stools that are frequently larger than 300 ml in volume. When there is abnormally rapid transit of intestinal contents through the small intestine, less enzymatic food digestion, less fluid and nutrient absorption, or increased fluid secretion into the GI tract, this occurs. It is important to stress that in this situation, diarrhoea is a symptom and not a disease. There are two types of diarrhoea episodes: acute (rapid onset) and chronic (extended duration and recurrent occurrences). Diarrhoea may also result from a number of other conditions, such as metal poisoning, an enzyme deficiency, adverse drug reactions, and structural or functional abnormalities in the organs. 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

Osmotic diarrhoea: Osmotically active chemicals in the intestinal tract, which in turn induce the drawing of huge amounts of water in the gut, are what produce this type of diarrhoea. Examples include dumping syndrome (a collection of symptoms brought on by the removal of a part of the stomach) and diarrhoea caused by lactose intolerance (lactose sugar cannot be digested because the intestines lack the enzyme lactase).

Secretory tummy aches: It is brought on by bacterial and viral infections, which cause the intestinal epithelium to actively secrete water and electrolytes. Exotoxins are produced as a result, and intestinal hormone output is boosted.

Exudative diarrhoea: This type of diarrhoea is characterised by mucosal injury that causes blood and plasma proteins, as well as mucus, to leak out, resulting in a net accumulation of water and electrolytes in gut.

Diarrhoea with little mucosal contact: It happens as a result of inadequate chyme, a semi-liquid food material that passes through the intestines, and Inadequate exposure of chyme to intestinal epithelium due to surgically-induced damage and reduced mucosa. Diarrhoea of this kind is generally made more difficult by steatorrhoea (increased faecal fat content)

What happens after diarrhoea?

Well, most of us undoubtedly have had anorexia, dizziness, and weakness. Furthermore, our skin ages and sags. Indicators that more water is being lost than usual during diarrhoea include the looseness and high water content of the faeces. Additionally, the faeces include a substantial amount of electrolytes as a result of enhanced peristaltic movements, or motions of the stomach and intestines. The term for the body's loss of water and electrolytes as a result of this is dehydration. Hypovolemia, or a decrease in total blood volume, is the result of dehydration, which lowers extracellular blood volume.

Low blood volume is associated with low cardiac output and hypotension. By raising the number of cardiac cycles per minute, the heart is attempting to counteract hypotension when the pulse rate is high. The patients' pulse rates are often higher than usual despite the fact that diarrhoea frequently lowers blood pressure. The amount of blood and nutrients that reach all body parts and organs is insufficient despite increased cardiac cycles as the degree of dehydration increases. The patient's extremities feel icy to the touch as a result. The tissues of various organs may experience ischemic damage if severe dehydration is not addressed because oxygen and nutrients are not getting to those tissues.

The renal and brain damage is the most significant. Low urine production is caused by a reduced glomerular filtration rate, which is caused by a decreased blood volume.

This can subsequently lead to the buildup of toxic waste products in the blood, which can be identified by the level of blood urea nitrogen. Other changes, such as azotaemia, which is typified by excessively high levels of urea and creatinine as well as metabolic acidosis, are present in acute renal failure. The most common circumstances leading to acute renal failure include severe diarrhoea and improper or tardy hydration management. Another effect that we were addressing was modifications to the neurological system.

Minor light headedness brought on by inadequate oxygen, glucose, and other nutrients reaching the brain cells might be one of the symptoms, as can severe coma brought on by an excessive buildup of nitrogenous waste products and other toxic metabolites in the blood. The importance of maintaining a healthy blood volume in order to prevent dehydration and its possibly catastrophic side effects becomes obvious as a result.

5.2.2 Management and Treatment of Diarrhoea

Objectives for management:

1. Replacement of fluid and electrolytes

2. Removal of the cause, particularly if it is an infection

3. issues with nutrition (chronic diarrhoea)

Replacement of fluids and electrolytes as soon as possible is essential to prevent morbidities and mortality associated with dehydration. The next step is to eliminate the cause, which is a medical problem and won't be discussed in detail here. To remove the reason, it can be necessary to perform surgical procedures, gastric leavage, or antibiotics, to mention a few. We'll now explore how to treat diarrhoea in depth.

The first thing you should do is determine if you are dehydrated. Mild, moderate, and severe dehydration—the three types—have already been covered. In mild to moderate cases, fluid, electrolyte, and acid-base homeostasis should be preserved. The use of antibiotics should be done in conjunction with improving nutritional status. Treatment is required for convulsions, abdominal distension, and other related problems such persistent vomiting.

Thus, the treatment for diarrhoea entails:

1. Determining the level of dehydration

2. Fluid administration

Oral Rehydration Salts (ORS), either prepared at home or purchased, are used in oral rehydration therapy (ORT).

Emergency care and medication administration

3. control of nutrition

1. A child who is severely dehydrated needs to be hospitalised.

2. Fluid management: Prompt replacement of depleted fluids is essential to managing diarrhoea .Of fluid consumed orally or intravenously that ends up in the stools. While dextrose and electrolyte solutions must be administered intravenously in severe cases, mild to moderate cases can be handled at home. Any liquid that is available at home, such as coconut water, buttermilk, salted rice kanji, lemon sugar salt beverage,

or weak tea, can be used to manage the patient. The Oral Rehydration Therapy (ORT) is the popular name for this.

3. Giving the patient fluids and/or salt solutions for oral rehydration is known as oral rehydration therapy (ORT). Even in cases of severe diarrhoea, the small intestine may readily absorb this solution, replacing the electrolytes and fluids that have been lost.

A simple oral rehydration solution can be made at home by combining a litre of potable water with a teaspoon of salt, three tablespoons of sugar, and either lemon juice or none at all. Small packets of the oral rehydration salt formulations recommended by the WHO are easily accessible commercially. Here, we'll talk about the recommended formula from the WHO. However, WHO and UNICEF have also developed an improved ORS solution with low osmolarity that can be used even for patients who are experiencing cholera-related diarrhoea

Box 5.1 Composition of ORS

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. Bicarbonate (mEq/L) = 30 (builds base reserves)
6. Osmolality (mOsm/L) = 330 (maintains osmotic balance and favours early rehydration).

Intensive dehydration is lethal and necessitates IV fluids, which necessitates hospitalisation. You are aware that several protozoa, viruses, and bacteria can cause diarrhoea because you have read about its causes. Some bacilli kinds create a large number of toxins that are damaging to the mucosal lining, necessitating medication therapy.

5.2.3 Nutritional Management of Diarrhoea

The conventional method of treating diarrhoea did not recommend giving the patient enough food. However, as a result of the discovery of numerous underlying causes and unfavourable consequences of the starvation therapy, it is now obvious that effective nutritional treatment is crucial to enabling enhanced recovery and proper rehabilitation. The management of diarrhoea through diet has seen a significant change over time, and it is now advised that the patient be given a diet that is best suited for the underlying cause of the diarrhoea. Today, we are aware that not all forms of diarrhoea may require the same dietary requirements or level of consistency in a diet.

Nutrition recommendations

Giving the patient enough food was not recommended in the standard approach to managing diarrhoea. However, it is now clear that effective nutritional treatment is essential to enabling enhanced recovery and appropriate rehabilitation as a result of the uncovering of several underlying causes and adverse repercussions of the starvation therapy. It is now advised that the patient be provided a diet that is best suited for the underlying cause of the diarrhoea because the management of diarrhoea through diet has undergone a major change over time. Today, we are aware that not every type of diarrhoea may call for the same dietary needs or degree of diet consistency. During acute episodes, all macro- and micronutrients are more crucial, but the need for fluids and electrolytes is greater.

The diet should consider the typical RDA and various modifications made to the type and quantity of meals to be provided. You can better comprehend these ideas by reading the information below.

Energy: During the acute stage of diarrhoea, the patient's tolerance might be taken into account when a steady increase in caloric intake is made. A practical goal is a 200–300 Kcal increase. Diarrheic patients should never be fed since even with acute diarrhoea, digestive enzymes are still active and over 60% of digestion can still occur. Resting the gut can be especially harmful since it can alter the structure of the gut membrane, increasing the risk of problems.

According to recent research, children who are fed the right kinds and amounts of food throughout the acute phase of diarrhoea absorb a significant amount of nutrients and are consequently less likely to experience nutritional deficiencies. These kids gain weight more quickly, experience diarrheal episodes for a shorter time, and recover more quickly. Carbohydrates that are simple to digest can give calories. Avoiding too much sugar can help prevent the fermentative effect, which could make the diarrhoea worse.

Protein: Due to the accompanying tissue depletion, requirements are only enhanced in persistent diarrhoea. In addition to the usual requirements, an extra 10 g of protein may be advised. As a high

residue food or if it is suspected that diarrhoea may have developed due to a relative lactase shortage in the gastrointestinal system, milk, a source of high-quality protein, should be avoided. Curds, a fermented form of milk, are more easily accepted since they are simple to digest and support intestinal health. A light porridge, paneer, and other cooked and diluted milk products can also be tolerated in moderation. In addition to them, simple-to-digest protein-rich foods such minced meat, eggs, and skimmed milk can be served.

Fats: Because its digestion and absorption are impaired, the total amount of fat may be limited. Emulsified fats or those high in medium chain triglycerides may be added to the diet in small amounts to improve the calorie density. Butter, ghee, and other simple to digest fats are available. Avoid eating anything fried. Invisible form of fat, or fat that is naturally found in food (such as egg yolk, whole milk, paneer, curd, and meat foods), is more tolerable than visible form of fat.

Carbs: The patient should receive an adequate amount of carbs, or 60–65% of the total energy. Starches, which are easily digested carbs, should be favoured. To make foods like khichdi, vegetable/pulse puree, fruit liquids, soufflé, drinks, custard, and kanji, ingredients like glucose, sugar, honey, jaggery, potato, yam, colocasia, rice, sago, semolina, refined flour, and pastas can be added. Dietary fibre should be kept to a minimum, with insoluble fibre being especially discouraged.

Diets low in fibre and residue reduce the volume of waste food that must pass through the large intestine.

These diets may reduce abdominal pain and diarrhoea while improving the enjoyment of food.

List of Low Fibre Foods

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

List of Low Residue Foods

1. Cereals Rice, refined cereals such as maida, suji, white bread sweet biscuit, cornflour
2. Vegetables Tender, well-cooked, pureed low fibre vegetables
3. Fruits Fruit juices or pureed fruits
4. Meat and its products Chicken and fish
5. Pasta plain macaroni, noodles, sphagetti etc.

6. Sweets White sugar, brown sugar, honey, clear jelly

The degree of mucosal damage brought on by persistent diarrhoea is connected with vitamin and mineral loss, which in turn reduces the body's capacity to absorb and synthesise a number of essential nutrients. The B complex vitamins are essential, especially folic acid, vitamin B12, and vitamin C. Fat-soluble vitamins (A, D, E, and K) can be lost if fat is not digested and passes through the bowels undigested. One mineral that is crucial is iron, especially if there is a bleeding problem. Potassium and sodium replacement may be necessary. Potassium supplements may enhance digestive health and stimulate hunger.

Fluids: To reduce the danger of dehydration, intake should be liberal. Keep in mind that we have already discussed fluid management in this part.

Effective tips for easy management:

1. Cooking methods including steaming, baking, and pressure cooking should be promoted.
2. To replace the lost nutrients, eat little, frequently spaced meals rather than three large ones.
3. To replace lost fluids, drink plenty of lemon juice, fruit juices, vegetable soups, watery dals, lassi, coconut water, etc.
4. Eat fruits like apples and bananas because they are high in potassium, which supports fluid equilibrium.
5. Milk and dairy products should be consumed in moderation because they are difficult to digest.
6. Skip the fried meals.
7. Steer clear of fresh foods like salad.

Nutritional management of diarrhoea in children:

Children regularly get diarrhoea, and undernutrition frequently causes this symptom since undernourished people are more prone to it. Often, lack of education, poor sanitation, and poverty are the underlying risk factors. Children's diarrhoea is a common occurrence in India. According to estimates, about 250 million episodes of diarrhoea occur in children under the age of five each year, and as a result, nearly 1.5 million of these result in death. Controlling infantile diarrhoea is therefore a top priority.

Rehydrating the child is the first goal. Consequently, employing ORS would be the best modality. The WHO-ORS standard preparation is helpful, but newer studies have recommended that the solution's osmolarity be decreased from 311 mmol/liter to 200-250 mmol/liter by lowering the content of glucose. Thus, following 20 years of continuous research, WHO and UNICEF have developed "reduced (low) osmolarity ORS solution," an improved ORS solution. This new solution has decreased the requirement

for additional IV fluid after first rehydration by 33% when compared to the old standard ORS solution. Additionally, it aids in a 20% reduction in stool volume and a 30% reduction in vomiting episodes.

Table 5.1 Composition of ORS

BY WEIGHT		BY MOLAR CONCENTRATIONS	
Reduced osmolarity	grams/litre	Reduced osmolarity ORS	mmol/ litre
Sodium Chloride	2.6	Sodium	75
Glucose,anyhdrous	13.3	Chloride	65
Potassium chloride	1.5	Glucose, anhydrous	75
Trisodium citrate	2.9	Potassium	20
		Citrate	10
		Total Osmolarity	245

Children with diarrhoea can also take this 245 mmol/litre solution.

Young infants who are experiencing diarrhoea should continue to be breastfed. This shortens the length of the diarrhoea and reduces the frequency and size of faeces.

Starving a child who is experiencing diarrhoea could worsen their nutritional status

In addition to breast milk, children 4-6 months old or older should be fed an energy-dense combination of soft weaning foods. Mothers should be advised to eat a diet appropriate for their child's age that contains little lactose. A daily consumption of at least 110 kcal/kg should be the target. Cereal, pulses, roots, green leafy vegetables, and easily digestible fats like ghee and butter can all be included in the energy-dense mixture. By employing amylase rich flour (ARF), or flour made from germinated grains that is rich in amylase and can be made into a soft, thin porridge without losing any of its nutritional content, the caloric density of the feeds can be raised. Bread, idli, dosa, and other fermented meals may included in the diet.

- Foods to stay away from include spicy and greasy foods, sweets, mithai, and chocolates, raw fruits and veggies, and chocolates.
- The use of B-complex vitamins as supplements, particularly folic acid, vitamin B12, and Zinc-containing minerals aid in restoring intestinal balance.
- Good urine output, eye, skin, buccal mucosa, and weight increase appearance are the parameters for assessing the level of hydration and nutritional health.
- Seek medical advice, if necessary.

Check Your Progress Exercise 1

1. **What are the functions of GI tract?**
2. **List down the foods low in fibre**
3. **What is the full form of ORS?**
4. **Suggest easy management tips for diarrhoea**

5.3 Constipation

Faecal transit that is irregular, infrequent, or challenging is known as constipation. It is the gastrointestinal tract's most prevalent physiological disorder. It is indicated by the insufficient evacuation of dry, hard faeces. Children, teenagers, those with low-fiber diets, patients who are bedridden, invalids, and the elderly are frequently affected. It is a condition in which someone consumes a high residue diet and passes less than three stools per week, less than 35 grammes of stools per day, and more than three days without passing a stool.

The three basic forms of constipation are as follows:

The most typical type of constipation is atonic, sometimes known as "lazy bowel." Weak peristalsis is caused by a loss of muscle tone, which can be attributed to:

a) a deficiency in fluids, potassium, and sodium.

b) A lack of the vitamin B Complex

c) an inconsistent urination pattern and inadequate personal hygiene.

d) extensive enema or purging use.

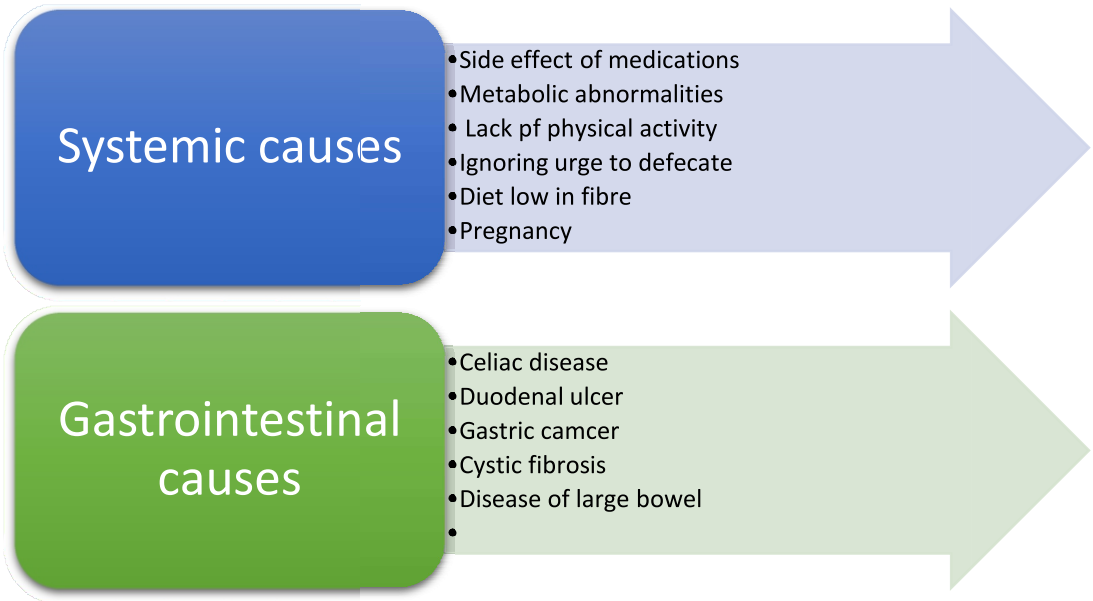
e) a sedentary lifestyle or inactivity

1. **Spastic constipation**: This condition is brought on by overly tight intestinal muscles.

2. **Obstructive constipation**: It typically results from cancer, obstruction in the colon, or any other obstruction brought on by inflammation or lumen narrowing.

5.3.1 Etiology

Poor elimination habits, a lack of fibre in the diet, insufficient fluid intake, a lack of exercise, and a loss of tone in the gut musculature are the most typical reasons of constipation. In addition to these, frequent overuse of laxatives, stress, and worry are other prevalent causes. The reasons can be divided into two categories: gastrointestinal and systemic.



The symptoms included bloating, stomach pains or cramps, difficulty urinating, a feeling of fullness in the lower belly, tiredness, irritability, a dullness in the body, and even mild headache discomfort. These are the constipation symptoms.

5.3.2 Complications of 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 Rectal prolapse through the anus)
- Rectal hernia
- Faecal impaction (hard stools in the bowel)
- Uterine hernia
- Uterine prolapse (downward displacement)

5.3.3 Nutritional Management of Constipation

The normal bowel motions can be greatly maintained with the help of correct food and lifestyle control. Only when constipation results from a structural or functional alteration in the gastrointestinal tract are medical therapies necessary. We'll talk about managing constipation with nutrition in our upcoming sessions. Let's start by defining the goals of the patient care procedure.

- Dietary and lifestyle management objectives include:
- establishing regularity in eating patterns
- consuming a diet high in fibre
- drinking enough fluids
- increasing physical exercise

Constipation can be controlled by building healthy habits like regular meal and elimination times, adequate intake of fibre and fluids, and sufficient exercise, as well as by establishing regularity of habit through a bowel training plan.

However, dietary fibre and fluid intake continue to be the mainstays of treatment for constipation. Let's find out more about dietary fibre, including its origins and any potential benefits.

The phrase "dietary fibre" refers to plant polysaccharides that may resist hydrolysis by the digestive enzymes present in the human gastrointestinal tract. It is made up of structural polysaccharides (insoluble fibre) present in plant cell walls, such as cellulose, hemicelluloses, lignin, and other non-carbohydrate substances.

Pectins, gums, and mucilage are non-structural polysaccharides (soluble fibres).

5.3.4 Sources

Dietary fibre can be obtained through whole grain cereals, legumes, whole pulses, vegetables such peas and beans, fruits including sapota, guava, apple, and citrus fruits, nuts, oilseeds like flaxseeds, and methi seeds.

According to the ICMR, an adult's daily intake should be 40g/2000 kcal.

5.3.5 Importance of Fluid Intake in Constipation

At least 2litres of fluid should be consumed each day. This covers other than water, liquid-containing foods and beverages. Lemon juice, citrus fruit juices, coconut water, vegetable soups, watery dal, lassi, and watermelon juice consumption may also offer important nutrients like potassium that enhance muscular tone.

Objectives for Nutritional management should be:

- establishing routines for evacuation
- adhering to a regular and balanced meal schedule

- consuming a diet high in fibre and sufficient in fluids
- increasing physical activity and exercise

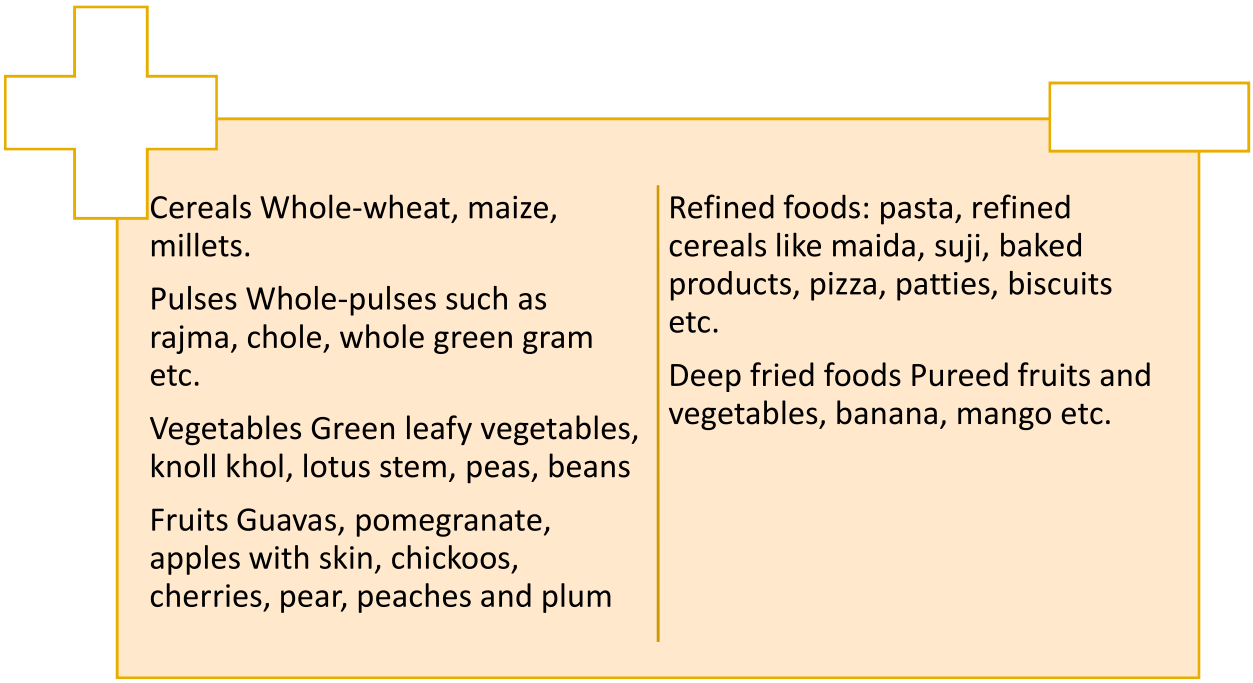


Figure 5.2 Foods allowed &Not allowed

5.4 Peptic Ulcers

Peptic ulcers are one of the more serious gastrointestinal conditions that primarily damage the stomach. Over the past few years, there have been major dietary and lifestyle changes, which have led to a rise in ulcer prevalence.

A peptic ulcer is any localised erosion or disintegration of the mucosal lining that comes into contact with stomach juice. Damage to the lining of the oesophagus, stomach, and duodenum is the primary cause of peptic ulcers (stomach and duodenal ulcers). The deterioration of tissues can also result in necrosis, or the death of cells or tissues. Normally, the mucosal barrier defends the stomach and duodenal mucosa from the gastric juice's proteolytic effect.

Affected areas are:

1. the lower oesophageal portion.

2. stomach (antrum with less curvature, where food remains for a longer period of time).

3. The first part of the duodenum, commonly known as the duodenal bulb.

5.4.1 Etiology

The mechanisms that ordinarily maintain mucosal integrity are disrupted by neurological and hormonal abnormalities, which allows proteolytic and acidic erosion of the mucosal tissue to occur.

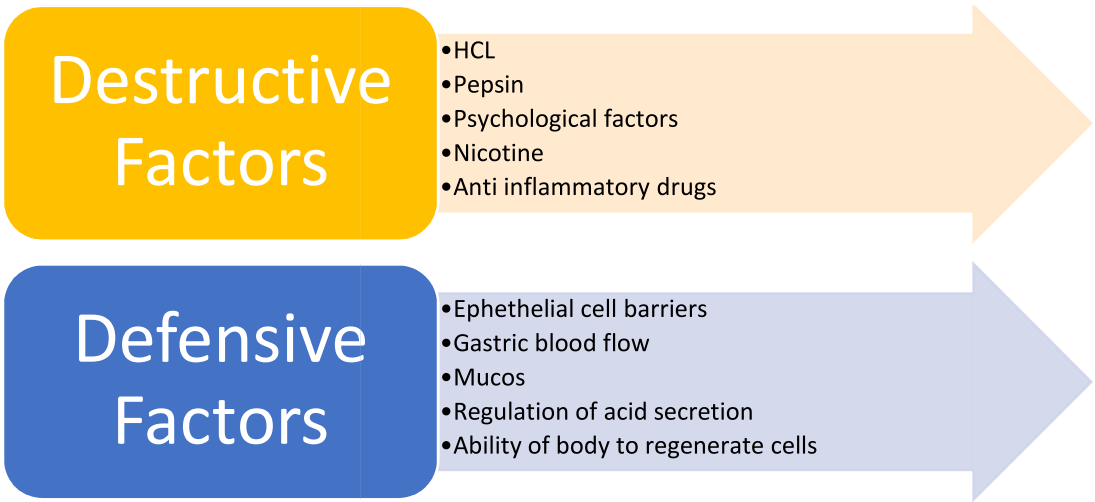


Figure 5.3 Factors affecting peptic ulcers

- A 3 cm space between the duodenal bulb and the pylorus, where the gastric fluids are not neutralised, is where duodenal ulcers develop. It has a multitude of causes, including:
- Strong evidence points to H. pylori infection, which negatively affects mucosal defence and makes people more susceptible to ulceration.
- Increased gastric emptying rates; increased parietal cell count; increased acid secretion
- The duodenum's capacity to manage an acid load is decreased.
- Stress (both physical and mental) and excessive corticosteroid and non-steroidal anti-inflammatory medication (NSAID) use.

Gastric ulcers form at the area of the stomach's antrum with the smaller curvature. It is believed that the main causes of stomach ulcers are bile reflux and circumstances that weaken the mucosal barrier, allowing hydrogen ions to enter the mucosal tissue and destroy it. Cell death and eventual ulceration arise from the damage (induced by a problem with the pyloric sphincter). The systemic suppression of prostaglandin synthesis caused by NSAIDs greatly raises the risk of ulcers. As a result, the gastric mucosa's capacity to protect itself against acidity is diminished. Another pathogenetic cause is H. pylori infection and the impaired mucosal defence that results from it.

Symptoms:

Heightened gastric tone and excruciating hunger pangs when stomach is empty. The main issue is hunger constriction 1-3 hours after meals. The most common ways that people describe pain are as dull, penetrating, scorching, and gnawing. Frequent vomiting, occasionally accompanied by blood, causes weight loss and anemia.

Over the course of many months to several years, ulcers steadily worsen. The majority of the patients are malnourished and lack certain nutrients in their bodies.

Food consumption-related pain, nausea, and anaemia brought on by haemorrhages due in part to anorexia, bleeding causes lower food intake. This is a key factor in weight loss. The primary goal of the dietician is to maintain an ideal nutritional condition in order to aid in healing and effective rehabilitation.

5.4.2 Management of Ulcers

Resting the affected area should be the cornerstone of treatment in order to encourage physiological rest and support tissue recovery. Pectic ulcers are best treated with appropriate pharmaceutical therapy and dietary modifications. The recent invention of new medications like Cimetidine and Ranitidine (H2 blockers), which are based on milk and contain insufficient protein and protective foods leading to nutritional inadequacies, has fundamentally changed dietary regimens previously used. The new drugs mentioned above outperform earlier drugs at the moment.

As a result, the following should be part of the nutritional care process' objectives:

1. Restoring a healthy nutritional status through dietary changes and guidance.

2. Make the symptoms better.

3. Make acids neutral.

4. Decrease acid production.

5. Maintenance of epithelial resistance to gastric juice's damaging activity

Energy: The patient's energy consumption should enable him or her reach and maintain a healthy weight. To prevent further weight loss and save the proteins for ulcer repair, one must consume enough calories.

Proteins: Ulcers are a type of wound that, if not treated promptly, can bleed and become perforated. Consuming enough protein guarantees the production of new tissues required for healing.

Because the by-products of protein digestion—amino acids and polypeptides—reach the antrum and stimulate the release of gastrin and gastric acid, normal milk protein is praised for its buffering activity

but is only intended to offer momentary relief. After drinking milk, stomach acidity is only neutralised for 20 to 60 minutes before returning to baseline levels. According to recent studies, the high calcium content of a diet high in milk has a negative impact on how quickly ulcers heal. In turn, this can encourage the formation of too much acid.

As a result, milk should only be used sparingly and as a temporary symptom reliever. Due to the prostaglandin PGE2 that it contains, milk consumption restrictions provide temporary relief from stress-related ulcers.

Fats: These stall the emptying of the stomach. In the small intestine, the byproducts of fat digestion trigger enterogastrone, which prevents the release of gastric juice. Recently, it was discovered that polyunsaturated fatty acids like linoleic and eicosapentaenoic acid can prevent duodenal ulcers by preventing the growth of H. Pylori in vitro. You can include about 25 to 30 g of visible fat in your daily diet. To make fats easier to digest, emulsification is preferred. Avoid eating fried meals because they can create intestinal issues.

Carbohydrates: These should make up between 55 and 65 percent of the daily calorie intake. The intake of both simple and complex carbs should be prioritised, but in soft, well-cooked forms. In light of its physical characteristics, soluble fibre is preferable to insoluble fibre. The inclusion of fibre in the diet is encouraged because it postpones stomach emptying, preventing the mucosal damage caused by acidic gastric juice.

pH: Except for people who have lesions in the mouth or oesophagus, the pH of food has minimal therapeutic significance. The pH of the stomach is normally 1.6, therefore most foods are significantly less acidic than that. Both grapefruit juice and orange juice have a pH range of 3.2 to 3.6. Acidic fruit juices should therefore be acceptable parts of the diet for people with ulcers because of their quick acidity. Alkaline ash diets are generally associated with fruits. Avoid them if certain people do not accept them well.

Foods that harm the GI mucosa: The majority of people with ulcers have been found to have little to no sensitivity to a number of spices, herbs, and other condiments. The cephalic phase of gastric secretion is typically triggered by the appearance, smell, and taste of most foods, although no one meal or drink has been shown to significantly alter the gastric pH, with the exception of alcohol, coffee, black pepper, and meat extracts.

Alcohol: Regardless of the amount of stomach acid present, alcohol is known to harm the intestinal mucosa. High amounts are therefore not recommended.

Smoking cigarettes: Smoking cigarettes has a negative impact because cigarettes contain nicotine, which results in pyloric incompetence, increased stomach acid reflux by promoting gastrin secretion, and decreased pancreatic biocarbonate synthesis. Smoking cessation is strongly advised for those who have peptic ulcer disease.

Food texture: According to recent studies, a peptic ulcer patient cannot benefit from strict fibre avoidance. People with high soluble fibre diets were shown to have considerably decreased rates of peptic ulcer recurrence. Additionally, this has been linked to greater salivation brought on by more chewing, which has been demonstrated to have a buffering effect.

Box 5.2 Feeding tips for patients with ulcers:

Stage I: This stage is marked by melena (passing of black, tarry stools indicative of GI bleeding) and haematemesis (vomiting of blood that may originate from the mouth, stomach, oesophagus, or duodenum). If a patient has a bleeding ulcer and is severely nauseous or vomits, he must initially be kept on NBM (nil by mouth). Then comes an initial hourly feeding after that. A small feeding of easily digestible foods like soft cooked eggs, custards, refined flour products, cottage cheese, low-fiber vegetables like gourds, clear soup without seasoning and herbs, soft overripe fruit whips, and light desserts should be given after 100 g of milk and cream per hour (especially in stages of acute pain).The diets must be consumed orally and must be soft, semi-liquid, or liquid in form.

Stage II: The features of this stage include: marked recovery from pain; 6 meal pattern followed; mechanical/thermal, chemical irritation of gastric mucosa to be avoided; avoid late night feeding as the by-products of digestion may cause the epigastric pain; and avoid late night feeding.

Stage III: During this stage, the following factors are present: reduction in the number of feeds to 3–4, as recent studies have shown little benefit in terms of gastric acid secretion; increased amount/feed after being released from the hospital

Stage IV: At this stage, the diet is liberalised based on the patient's unique tolerance and schedule, the best possible intake of calories, protein, fats, and vitamins and minerals is made, eating is done in a calm environment, and lifestyle changes (such as quitting smoking, drinking alcohol, or using caffeine) are made.

5.4.3 Guidelines & Tips

1. Eating more than three normal meals each day.

2. Consume small meals to prevent bloating.

3. Refrain from consuming too much alcohol or coffee.

4. Reduce or stop smoking cigarettes.

5. Refrain from using excessive amounts of aspirin, NSAIDs, and other medications that are known to harm the lining of the stomach.

6. Steer clear of inflammatory foods and beverages. Reduce the amount of pepper, especially black and red. Increase your intake of n-3 and n-6 fatty acids.

7. As much as you can, eat your meals in a calm setting.

8. Take antacids before bed and one and three hours after meals, respectively.

9. Get enough rest, downtime, and sleep.

Check your Progress Exercise 2

1. List down the complications of Constipation
2. What is the importance of fluid I management of constipation?
3. Suggest some guidelines and tips for peptic ulcers
4. What are the symptoms of peptic ulcers?

5.5 Let us sum up

We are all now aware of the significance of having a healthy gut and how even a small disturbance can result in a number of chronic diseases. We learned about the GI tract's functions in this lesson, as well as some of the most prevalent GI tract illnesses.

Diarrhoea is the most typical and widespread ailment, but as we have learned, it can impact the body's regulatory functions generally. Dehydration and weakening episodes are brought on by significant fluid loss. We learned about ORS, which aids in a speedy replenishment of the body's electrolytes, and suggestions for managing diarrhoea.

Constipation was the next subject we talked about. Due to a diet poor in fibre and water and leading an unhealthy lifestyle, many people have chronic constipation on a daily basis. We were aware of the food treatment for constipation and how drinking enough fluids can relieve its symptoms.

Finally, peptic ulcers were also discussed because they irritate the mucosal lining and can result in complicated conditions and bleeding. In order to manage ulcers nutritionally, we learned which foods to eat and which to avoid while undergoing therapy.

5.6 Glossary

Azotaemia : increase or accumulation of blood creatinine, nitrogenous wastes, and other secondary waste products

Dumping syndrome : a set of symptoms brought on by the removal of a portion of the stomach.

Enterogastrone: a hormone secreted by the duodenal mucosa when fatty food is in the stomach or small intestine.

Hypovolemia: A state of low extracellular fluid volume, generally secondary to combined sodium and water loss.

Metabolic acidosis: a clinical disturbance defined by a pH less than 7.35 and a low HCO3 level

Steatorrhea: increased faecal fat content

UNIT 6 MEDICAL NUTRITION THERAPY IN DISEASES OF THE LIVER

STRUCTURE

6.1 Introduction

One of the most crucial organs in the human body, the liver is involved in virtually every nutrient's metabolism. Without liver, it is impossible to survive. The liver and pancreas are essential for digestion and metabolism. Although it is particularly important, if the gallbladder is removed, the body will easily adapt to living without it. Medical nutrition therapy (MNT) is necessary when these organs are unwell since it is crucial to comprehend their structure and functions.

We will discuss the functions, significance, and vital role that the liver plays in numerous metabolic processes in this unit. We will also gain insight into the symptoms and causes of numerous liver diseases and disorders. The management of the diseases and nutrition therapy would receive more attention.

Objectives

Following completion of this module, you will be able to:

- Describe the many functions of the liver, gallbladder, and pancreas,
- Explain the causes of the disease and the symptoms that are produced.
- Describe the principals involved in the nutritional and dietary management of these disorders.
- List the foods that can be given and those that should be avoided in these disease conditions.
- Discuss the disease conditions of these organs and how the functioning of these organs is compromised in various disease conditions.

A person's nutritional health may be affected by any changes to the liver's regular operation because it performs such a wide variety of varied and extensive functions. The liver is one of the most important organs in the metabolism of each and every nutrient.

Damage to the liver can affect these and other important body processes. Lipids (fatty acids), proteins (amino acids), vitamins, minerals, and carbohydrates (glucose, fructose, and galactose) that are easily digested by the body are sent to the liver. The liver retains a range of nutrients in addition to creating new compounds that can be protein- and fat-containing and aid in blood coagulation.

Additionally, the kidneys are ultimately responsible for removing urea from the circulation after the liver transforms the nitrogen produced by protein breakdown into urea. It also removes a great deal of contaminants. The liver has a significant impact on how proteins, lipids, and carbohydrates are metabolized.

1. **Carbohydrate metabolism:** The process of carbohydrate metabolism releases the glycogen that liver cells store as energy as glucose when it is required. The process by which carbohydrates are changed into sugar is known as glycolysis. In the absence of carbohydrates, proteins can also be converted to glucose by a process in the liver cells known as gluconeogenesis. Glycogenolysis and gluconeogenesis both help to keep blood sugar levels within normal range.

2. **Fat metabolism:** It has been linked to the production (synthesis) of triglycerides and phospholipids. Lipoproteins must be created in the liver in order for lipids to be transported to peripheral organs for use or storage. It produces cholesterol, which is then transformed into bile and conjugated bile salts to the tune of 80%, with the remaining 20% being transported by lipoproteins. Furthermore, it takes part in bile synthesis, conjugation of bile salts, and the oxidation of fatty acids to acetyl CoA, which is a source of energy.

3. **Protein metabolism:** The liver uses a process called deamination to take the nitrogen out of amino acids so they can be transformed into carbohydrates and lipids and used as an energy

source. It also converts urea, a consequence of the breakdown of proteins, into ammonia. There, most of the plasma's protein production takes place. It acts as a store of these proteins to replace serum proteins. Non-essential amino acids are maintained at a level that promotes tissue growth.

4. **Vitamins & Minerals:** The liver stores iron as ferritin, which is essential for the creation of haemoglobin. The liver, which also removes the iron, annihilates the RBC. Zinc, copper, and a host of other vitamins and minerals, used in enzymatic activities that take place throughout metabolism, are also stored in the liver. The liver serves as a storage location for all lipid-soluble vitamins. It aids in the conversion of retinol from carotene. It is necessary for both the activation of prothrombin and the conversion of vitamin D into its biologically active form, 1,25 dihydroxycholecalciferols.

Check Your Progress Exercise 1

1. List down the Functions of Liver
2. What is the role of liver in Fat metabolism?
3. How does liver help in metabolizing carbohydrates?

6.2 Diseases of Liver

Liver diseases can be genetic or acquired, acute or chronic. There are several categories for liver disease: fulminant viral hepatitis, chronic hepatitis, nonalcoholic steatohepatitis (NASH), alcoholic hepatitis and cirrhosis, cholestatic liver illnesses, hereditary disorders, and other liver conditions

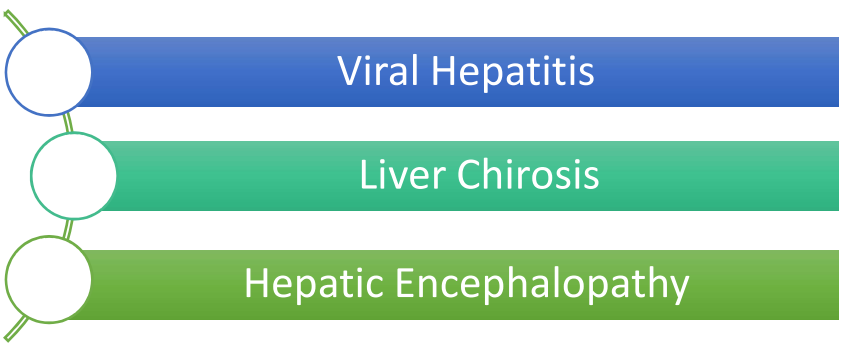


Figure 6.1 Disorders of Liver

6.2.1 Viral Hepatitis

Acute viral hepatitis is a widespread liver inflammation caused by hepatitis viruses A, B, C, D, and E. Hepatitis B, C, and D are the serum varieties (shared by bodily fluids such as blood), while hepatitis A

and E are the contagious types (usually spread by the faecal-oral route). Less dangerous infections such the Epstein-Barr virus, CMV, herpes simplex, yellow fever, and rubella can also cause acute hepatitis.

Hepatitis A

Hepatitis A is transferred through the faecal-oral channel and can be contracted by contaminated food, water, and sewage. Anorexia is the most common and harmful symptom. Jaundice (icterus), nausea, right upper quadrant stomach pain, and dark urine are additional common symptoms. Effects that last a long time are rare, and recovery is typically complete. High-risk patients may experience serious issues, thus proper nutritional intake must be prioritised.

Hepatitis B & C

Both chronic and carrier types of hepatitis B and C are possible. Saliva, sperm, blood, and blood-derived products can all transmit HBV and HCV. For instance, the illness can be spread through sexual contact, contaminated needles, blood transfusions, open wounds, splashes of blood in the mouth or eyes, and more. Chronic active hepatitis can potentially result in cirrhosis and liver failure.

Hepatitis D

Hepatitis D is a rare virus that relies on HBV to survive and spread among people. A super infection or coinfection of HDV is possible. Usually, this hepatitis develops into a chronic condition.

Hepatitis E

HEV is spread by the oral-faecal route. Contaminated water appears to be the source of illness, which typically affects those who live in overcrowded, unclean settings.

Typically, Hepatitis E is acute rather than chronic.

The common signs of acute viral hepatitis appear in four stages. The early prodromal phase, which is defined by fever, arthralgia, arthritis, rash, and angioedema, affects about 25% of individuals. Malaise, tiredness, myalgia, anorexia, nausea, and vomiting dominate the subsequent preicteric phase. Patients occasionally complain of soreness in their epigastrium or right upper quadrant. Jaundice appears during the third stage, the icteric phase. As the patient enters the convalescent stage, jaundice and other symptoms begin to gradually disappear.

6.2.2 Etiology

Here is a list of the numerous causes of both acute and chronic liver disease.

- Recent-onset acute liver disease
- Hepatitis is a viral infection.
- Alcohol, Drugs (paracetamol), Poisons (aflatoxin).
- Others, including pregnancy problems

6.2.1.1 Non-alcoholic Steatohepatitis

Non-alcoholic steatohepatitis (NASH) is a stage between fatty liver disease and chronic liver disease. Fat droplets are collecting on the hepatocytes, which are surrounded by both acute and chronic inflammatory cells. Steatohepatitis is associated with a buildup of fibrous tissue in the liver.

Non-alcoholic reasons include medications, inherited metabolic faults, and acquired metabolic issues (such as type 2 diabetes mellitus, lipodystrophy, jejunal ileal bypass, obesity, and malnutrition).

6.2.1.2 Alcoholic Liver Disease

Acetaldehyde, a toxic by-product of alcohol metabolism, alters the composition and functionality of mitochondrial membranes. Acetaldehyde is produced by a number of metabolic pathways, including one involving alcohol dehydrogenase. Due to a number of variables, certain people are prone to alcoholic liver disease. Hepatotropic virus infections, gender (more so in women than in men), concomitant drug use, genetic polymorphisms of alcohol-metabolizing enzymes, immunologic factors, and poor nutritional status are a few of these.

6.2.2 Liver Cirrhosis

Cirrhosis is a liver disease complication marked by abnormal liver structure and function. It is the most severe stage of liver deterioration and destruction. Untreated chronic hepatitis can lead to liver cirrhosis. In this, the liver cells enlarge, degenerate, develop fibrous septa, and finally form nodules, resulting in clogs and liver failure.

The liver cells that are still alive try to expand to replace the ones that have died. Regenerative nodules, which are collections of recently formed liver cells, form in the scar tissue as a result. These scar tissues result in portal hypertension, which is an increase in blood pressure in the portal vein. The body may go through a lot of pathological changes if it climbs above 10 mmHg.

The following are some of the common symptoms of hepatic encephalopathy:

- GI disturbances (anorexia, nausea, vomiting, abdominal pain, and distension)
- Electrolyte and fluid imbalance
- Weight loss and muscle wasting
- Abnormal serum amino acid levels
- Fatty infiltration of the liver
- Severe jaundice
- Bleeding tendency Ascites (accumulation of fluid in the abdominal cavity)
- Osteomalacia and osteoporosis HIV infection

Etiology

Cirrhosis's etiology can be enumerated as follows:

- Neglected acute/chronic hepatitis, malnutrition-related alcoholism, viruses, and poisons
- Metabolic conditions
- Long-lasting biliary stasis.
- Modified immune reaction
- Chronic liver inflammation
- Fibrosis and fatty infiltration of the liver
- Necrosis (death of cells)
- Ascites (accumulation of fluid in the abdominal cavity)
- Osteomalacia and osteoporosis High drug sensitivity

The excessive copper accumulation in bodily tissues, particularly the brain, kidney, cornea, and liver, which results in cirrhosis, is brought on by a malfunctioning copper transport and storage system. An uncommon autosomal recessive disease is Wilson disease.

However, chronic alcohol abuse, which has a hepatotoxic effect and results in malnutrition, is the primary cause of cirrhosis in the majority of cases. since excessive alcohol consumption is a major contributor to liver damage.

Alcohol consumption can harm the liver by causing inflammation, necrosis from cellular fat accumulation, which impairs the liver's ability to function normally and leads to serious protein and vitamin deficiencies that can result in malnutrition, as well as changes in the metabolism of carbohydrates, proteins, and fats. A consequence of portal hypertension could be the development of

ascites and varices. High uric acid levels can cause mineral deficiencies and gout. Alcoholism may lead to several issues and malnutrition.

The pathophysiology of alcohol-induced liver injury has three stages. Let's review these stages briefly.

Stage :1Fatty Liver or Hepatic Steatosis

At this point, the fat invades the liver's active cells, reducing the liver's capability to operate normally. The excess weight may be caused by the body's fat stores or a rise in the liver's capacity to synthesise fat. Abstinence from alcohol can turn this stage around, but if usage continues, it can advance to cirrhosis and hepatitis.

Stage 2 :Alcohol-Related Hepatitis

Alcoholic hepatitis is characterised by hepatomegaly, or liver enlargement. Patients report having a fever, anorexia, weight loss, nausea, and stomach pain. If the patient quits consuming alcohol, their hepatitis may go away.

Stage 3: Alcohol-related Cirrhosis

More ascites problems, gastrointestinal bleeding, portal hypertension, hepatic encephalopathy, and other liver disease symptoms are present in this stage's patients.

Complications

Some of the most significant side effects of cirrhosis include ascites (a build-up of fluid in the abdomen), upper gastrointestinal bleeding (oesophageal varices), hepatic coma, or hepatic encephalopathy.

6.3 Hepatic Encephalopathy

Hepatic encephalopathy, often known as brain and nervous system injury, is a side effect of liver diseases that impair liver function, such as cirrhosis or hepatitis.

Neurological abnormalities characterise this complex illness. GI bleeding, infection, constipation, vomiting, TIPS, non-compliance with lactulose medication, and other symptoms are precursors to the disease. The signs include mild confusion, euphoria or depression, decreased attention, a slowing of mental activity, irritability, and disorder of sleep pattern, drowsiness, lethargy, speech disorientation, incomprehensible speech, and finally coma. Its symptoms include changes in mental state, consciousness, personality, and behaviour.

BOX 6.1 Malnutrition in Alcoholic Liver Disease

MALNUTRITION IN ALCHOHOLIC LIVER DISEASE :

1. People who regularly and in moderation consume alcohol don't need to ingest enough calories and nutrients since they can replace alcohol in their diets with food. It is also known as empty calories, and it is generally used by light drinkers as an additional energy source (Stickel et al., 2003). Alcohol yields 7.1 kcal, but when ingested in large amounts, it is not a reliable fuel source. Due to the increase in calories from alcohol (so-called alcohol addition), regular drinkers who do not fit the criteria for alcohol abuse commonly gain weight. This is different from the heavy drinker, who replaces calories with alcohol.

2. Intestinal mucosal morphologic and functional abnormalities, as well as pancreatic insufficiency, are related to impaired digestion and absorption in alcoholics, according to Stickel et al. (2003). Long-term and short-term alcohol use impairs the liver's capacity to synthesise and secrete proteins, prevents the conversion of amino acids into proteins, and accelerates the rate of catabolism in the gastrointestinal tract.
3. Using carbohydrates and lipids is dangerous. An excess of reduction equivalents (like NADPFI) and inadequate triglyceride oxidation lead to fat accumulation in the hepatocytes and an increase in circulating triglycerides. Insulin resistance is also common among alcoholics.
4. Alcohol is a source of empty calories (7 Kcal/g) and does not contain any other essential nutrients. The energy supplied is also lost to a great extent due to the wasteful pathways which alcohol metabolism takes. Alcohol causes inflammation of the stomach, pancreas, and intestines and interferes with the normal processes of digestion and absorption. It may result in malabsorption of nutrients like the B vitamins.

In addition to the neurological alterations, the blood analysis reveals certain anomalies. These include:

1. Increased blood ammonia levels (liver does not convert ammonia to urea)

2. Increased levels of the ammoniotelic amino acids methionine, lysine, glutamine, asparagine, histidine, threonine, glycine, and serine as well as high blood levels of aromatic amino acids (AAA), particularly phenylalanine, tyrosine, and tryptophan. In other words, they can release ammonia, which makes the situation worse.

3. Decreased gluconeogenesis and ketogenesis, which are the mechanisms through which branched chain amino acids (BCAA), leucine, isoleucine, and valine are used as an energy source by skeletal muscle, the heart, and the brain.

The hepatic encephalopathy has four clinical phases.

Stage I: Moderate confusion, euphoria or depression, diminished attention, agitation, impatience, disturbed sleep, and a slowdown of mental function.

Stage II: Lethargy, confusion, improper behaviour, and impatience when completing mental tasks.

Stage III : When awake, somnolent but arousable, with unclear speech and aggressive conduct.

Stage IV: Coma

The causes of this liver disease are listed below.

Etiology

Although encephalopathy's cause is unknown, there are three potential contributing factors. These consist of:

1. Increased toxin build-up as a result of compromised liver processes. The main toxicity is too much ammonia.

2. Modified composition of plasma amino acids. Reduced BCAA to AAA ratio causes erroneous neurotransmitter signals in the brain, which in turn causes neurological symptoms.

3. An increase in brain and serum levels of neuro-inhibitory compounds, such as gamma-amino butyric acid (GABA).

Check Your Progress Exercise 2

1. **What are the types of Viral Hepatitis?**
2. **List down the stages of Hepatic encephalopathy**
3. **How does excessive alcohol consumption lead to liver damage?**
4. **Answer the following**

1. **Which of the following viral hepatitis causes due to contaminated food pr water**

(i) Hepatitis A **(ii) Hepatitis D**

2. **Which of the following is also known as brain and nervous system injury?**

(i) Alcoholic liver disease **(ii) Hepatic encephalopathy**

3. **Which of the following is a type of liver cirrhosis ?**

(i) Hepatic encephalopathy (ii) Fatty liver

6.4 Nutritional Management

Nutrition Assessment

Before beginning an appropriate nutrition therapy, a nutrition assessment must be completed to determine the extent and cause of malnutrition.

These qualities and the subjective global assessment (SGA) method may make it the best method for assessing nutrition. When used to evaluate people with liver disease and transplantation, the SGA has demonstrated acceptable levels of validity and reliability.

Malnutrition that ranges from mild to severe usually affects patients with advanced liver disease. This is quite pertinent given that malnutrition has a poor impact on prognosis and is a major contributor to the pathophysiology of liver injury.

The factors utilised for nutrition assessment, the type, severity, and socioeconomic status of the liver illness all affect the prevalence of malnutrition.

It should be evident after going over the information in the section(s) above that malnutrition predominates in liver diseases and can be connected to a number of factors, such as decreased food intake, impaired digestion and malabsorption, increased energy needs, ineffective protein synthesis, accelerated protein breakdown, and increased protein oxidation. A personalised diet is required for the patient.

The primary goals of nutritional therapy for a patient with liver disease should be to maintain adequate nutrition, stop the breakdown of body protein tissue, manage oedema and ascites, and prevent encephalopathy symptoms.

Nutrients	Hepatitis	Cirrhosis	Encephalopathy
Energy (Kcal)	25-30 kcal/kg	30-35 kcal/kg	25-30 kcal/kg
Protein(g)	High 1.5-2 g/ kg	0.8-1g/kg	0.6 to 0.8g/kg/BW
Fat(g)	Moderate 30%	Low 25% total Kcals	Initially restricted total Kcal slowly increase to 25-30%

Carbohydrates(g)	300-400	300-400	450
Vitamins & Minerals	Vitamin B , C, Folic acid , calcium , zinc	B complex vitamins .Ironif anaemia, calcium,Mg and Zinc	B complex vitamins .Ironif anaemia, calcium,Mg and Zinc

Table 6.1 Nutrient Requirements for Liver disease

6.4.1 Medical Nutrition Therapy for Viral Hepatitis

Dietary Recommendations

Carbohydrates: A liberal intake of CHO (300–400 g) is recommended. In addition to increasing the (intra hepatic) glycogen stores to improve function and protect the liver against viral agents, this is done to limit endogenous protein degradation, which has the effect of sparing proteins. Adults are encouraged to consume 35–40 Kcal/kg IBW of calories per day, or as needed to maintain a healthy weight.

Proteins: A moderate protein intake in the diet is essential for the following reasons: to prevent negative N2 balance, which can lead to hypoproteinemia; to provide proper tissue regeneration, particularly of parenchymal cells; and stop the entry of fat into liver cells**.** Protein intake of 1.5 to 2.0 g/kg IBW is advised. In-between-meal supplements of high-protein beverages are advised.

Fats: Because they can make meals tasteless, fats shouldn't be drastically controlled.Fat should make up about 20% of the total calories. MCTs are recommended because they can be assimilated and are readily absorbed (40–50 g). For instance, butter, cream, and other dairy fats are preferred.

Freely given foods	Foods to be avoided
Cereals - Bread or chapatties of wheat; rice, maida, suji, maize, jowar, bajra or ragi	Whole pulses (dal) or beans
Breakfast cereal of broken wheat, rice, oatmeal or maize	Red Meat, high fat organ meats
Milk or milk products	Egg
Soups	Fried foods, butter (restricted)
Vegetable salad	Nuts and oilseeds, dry fruits
Vegetables, cooked	Condiments and spices
Potato, sweet potato, or yam	Papad, chutney or pickles
Fruits, fruit juices	Strong tea or coffee
Sugar, jaggery or honey	Alcoholic beverages
Jam or murabba, jellies and other sugar concentrates	
Biscuits	
Desserts as light custard or ice-cream	
Beverages, water (liberal), glucose water	

Table 6.2 Foods Allowed & Foods not allowed

6.4.2 Medical Nutrition Therapy for Liver Cirrhosis

A diet strong in carbs, moderate in protein, and low in fat is suggested for a patient with liver cirrhosis. Supplements with vitamins and minerals are frequently advised. Because anorexia is at its worst, the meal should be provided in a series of little meals.

serves sufficient for 6–8 feedings. The diet must transition from a liquid, soft diet to conventional food depending on the acute stage and recovery. To stimulate hunger, spices and condiments must be used with care. High-calorie, high-protein beverages are beneficial between meals. If there are problems with encephalopathy, protein should be changed as appropriate. Fat must also be decreased, then gradually increased as the person advances.

The nutritional status should be improved or maintained through nutrition treatment. Personalised diets must be provided based on the level of tolerance.

Proteins: Amounts should be adjusted based on the patient's needs and the severity of the ailment. It is suggested to ingest an amount of protein that is both high enough to maintain a healthy nitrogen balance and low enough to avoid the onset of hepatic coma. It is advised to ingest 1 g of protein per kg of dry body weight each day if you don't have complicated hepatitis or cirrhosis without encephalopathy in order to keep your nitrogen balance. To promote nitrogen accumulation or a positive nitrogen balance, at least 1.2 to 1.5 g/kg per day are needed. Protein intake is temporarily restricted to 0.6–0.8 g/day depending on precipitated ammonia levels and the existence of signs of an impending coma. At least 1.5 g of protein per kg per day should be given in instances of stress, such as alcoholic hepatitis or sepsis, infection, GI bleeding, or severe ascites.

Carbohydrates: Because of the liver's diminishing functional condition, which increases preference for alternative fuels, it is challenging to determine the amount of carbohydrates that are needed. Depending on the health of the liver, the carbohydrate intake is maintained at an adequate level. Due of its capacity to preserve protein, (300–400 g/day). It protects and advances the liver's health.

The quantity of calories required to maintain weight must be emphasised. A focus on raising the patient's total consumption should also be made. To prevent overfeeding, calculations should be based on an intake of 25 to 35 Kcal/kg of predicted dry body weight.Only if there is significant nausea and vomiting should intravenous glucose administration be used.

Fats: Due to the possibility of steatorrhoea or fatty infiltration of the liver in cirrhotic patients, a moderate intake of medium chain triglycerides (MCTs) may prove to be effective in reducing malabsorption of fat.

Vitamins: Vitamin supplementation is crucial to mend damaged tissue and replenish liver stores in patients with anorexia. This is due to both the detrimental effects of the drugs taken, as well as the liver's critical role in the transport, storage, and metabolism of nutrients. The water-soluble vitamins pyridoxine, cyanocobalamin, folate, niacin, and thiamine are notably associated to alcoholic liver disease, which results in Wernicke's encephalopathy, and are hence significant. Because of malabsorption and the ill liver's decreased capacity to store nutrients, it has been observed that patients are deficient in fat-soluble vitamins.

Minerals: The crucial minerals for serum include calcium, magnesium, and zinc.

Due to steatorrhea-related malabsorption, levels often decline in cirrhotic. As a result, supplements should be added in appropriate doses.

Sodium: The presence of oedema and ascites calls for sodium restriction. Although salt restriction with ascites can be as high as 500 mg per day, diuretics usually allow for a relaxation to 2 g per day. A sodium-deficient diet can make food taste bland and raise the possibility of hyponatremia. The use of table salt and salt used in food preparation must be minimised in favour of low sodium diets. Without increasing sodium intake, it is also vital to consume enough protein.

Fluids: If sodium restriction is helpful in treating oedema and ascites, significant fluid restriction may not be necessary. A maximum of 1500 ml of fluid can be given per day. In order to manage nutrition in liver, gallbladder, and pancreatic diseases, fluid needs are typically calculated based on urine production from the previous day along with the insensible losses (perspiration, breath, faeces, etc.), which typically amount to 500 ml/day.

Fibre: In advanced cirrhosis, reducing the amount of fibre is important to reduce the risk of haemorrhage from oesophageal varices. Small meals and a watery and soft diet are therefore encouraged.

Foods Allowed	**Foods not allowed**
Bread (wheat), rice, maize, jowar, bajra, breakfast cereals, pasta and other refined cereals like maida, suji etc.	Fried foods
Tonned milk and its products like paneer, curd	Organ meat , egg yolk

Washed and split pulses and bean	Whole pulses and fibre rich cereals like oats, barley
Sugar, jaggery, honey, jam or muraba, jellies	Extra salt and baking soda, preserved foods and foods containing salt like papads, chutneys, pickles
Lean meat, egg white, fish or chicken	

Table 6.3 Foods Allowed & Food not Allowed

Binding agents, sometimes referred to as chelating agents, are frequently utilised for copper removal in cirrhotic individuals with Wilson disease. A low-copper vegetarian diet is additionally advised.

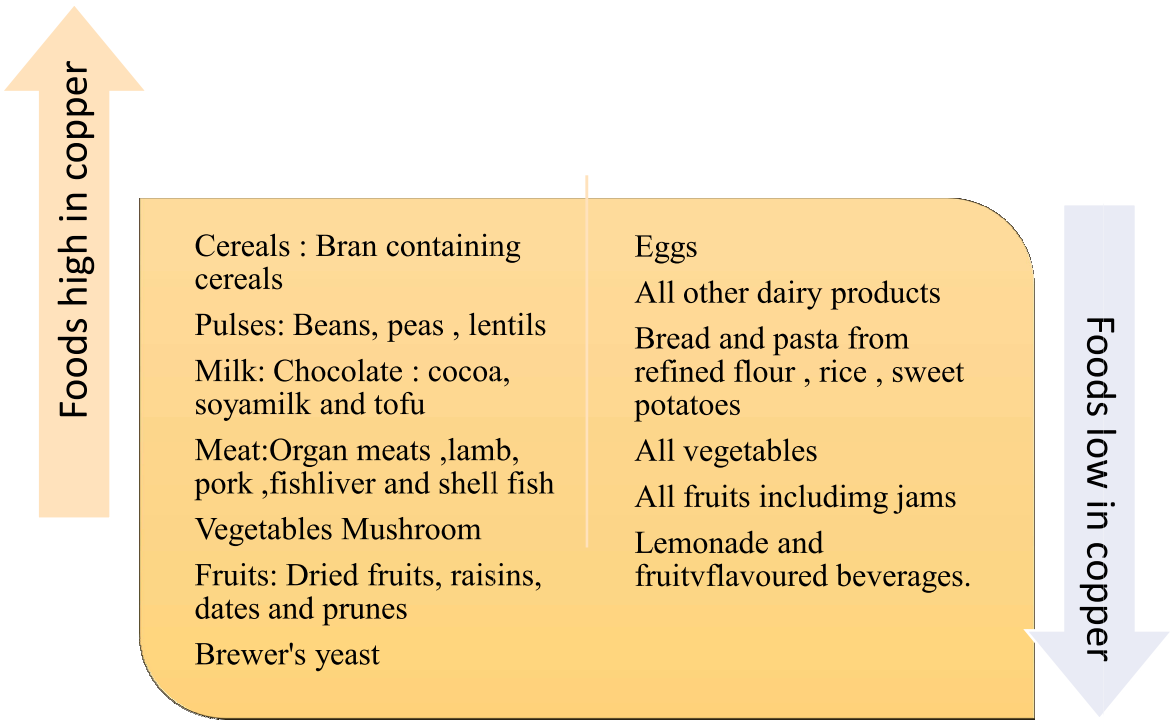


Figure 6.2 Foods sources of copper

6.4.3 Medical Nutrition Therapy for Hepatic Encephalopathy

Dietary management goals for hepatic coma include preventing tissue protein catabolism, restoring the plasma amino acid balance, and consuming as little protein as possible to minimise the amount of ammonia produced.

There isn't a therapy that covers everything. A personalised diet is necessary.

In order to prevent tissue protein from being broken down for energy, a diet of 1500–2000 Kcal is recommended. Its primary source is carbohydrates. It may be supplied parenterally or through a feeding tube, as needed. By boosting liver glycogen levels, carbohydrates play a protective function in the healing process.

Carbohydrates: It is advised to consume more carbs because they are the primary source of energy and spare protein. It encourages glycogen replenishment, which is enhanced by enough carbohydrate intake. It also guards against hypoglycemia.

Proteins: Extreme protein restriction does not improve the mental health of hepatic encephalopathy patients, according to a growing body of studies. Any unnecessary protein restriction must be avoided because it could accelerate the body's protein loss. More than 95% of people with cirrhosis can eat diets high in mixed proteins. For grades III or IV, the protein intake may begin at 0.6 to 0.8 g/kg IBW/day depending on the ammonia levels. The protein intake can be gradually increased to 1g/kg IBW per day if the patient experiences no symptoms after a week or if the grade falls to I or II.

Research indicates that caesin and vegetable proteins may enhance mental state in comparison to animal protein. Vegetarian diets had higher levels of BCAAs and lower levels of AAAs than meat-based diets. The possible advantage of vegetable protein is that it contains fewer methionine and ammoniogenic amino acids. BCAA supplements are preferred in cases of liver impairment. These amino acids are converted by the muscles without the assistance of the liver into energy, more amino acids, or minute nitrogenous molecules that help maintain a favourable nitrogen balance. Plant proteins contain a significant amount of BCAA. Red meat and dairy products are two typical food sources of BCAA. Egg and whey protein supplements are two additional choices.

Experts agree that individuals with encephalopathy who are unable to tolerate common proteins should be encouraged to take BCAA-enriched formulations. If required, enteral and parenteral BCAA supplement formulations that are commercially accessible could be used.

An increase in BCAA is beneficial in several ways. These include:

- Improves muscles' ability to absorb AAA.
- Boosts the muscles' production of protein.
- Enhances the production of liver protein.
- Lowers the levels of cerebral AAA by vying for the same transporter across the blood–brain barrier

Fats: Since a damaged liver cannot metabolise fats, fat consumption must be limited by up to 20%.

Because MCTs are easily absorbed through the portal route and do not require the creation of micelles or bile salts for absorption, substitution with them is advised.

Vitamins: It is advised to consume more B-complex vitamins, such as folate, thiamin, B12, and vitamin C, as these nutrients function as coenzymes in a number of metabolic processes.

Sodium: Depending on the patient's condition, a 2 g/day sodium restriction along with the use of diuretics is advised.

Fluid: Hyperaldosteronism is linked to liver failure, which causes the kidneys to exchange more sodium for potassium. The use of diuretics worsens this potassium loss through the urine. Evident fluid retention is present. Consequently, based on the patients' level of hydration

Check Your Progress Exercise 3

1. **List down the foods allowed and not allowed during Liver cirrhosis**
2. **What are the steps for nutrition assessment of liver diseases**
3. **What is the medical nutrition therapy for viral hepatitis?**

6.5 Let us sum up

As we now understand, the liver is essential for the metabolism, digestion, and control of several substances. To maintain a good body homeostasis, it is crucial to have a healthy liver. There are numerous ways that the liver might be harmed. We discussed liver problems and diseases in this section, as well as how they affect the human body. Major illnesses such viral hepatitis, liver cirrhosis, and hepatic encephalopathy were explored in depth. Alcohol abuse and a diet high in processed foods can seriously harm the liver and increase the risk of conditions like alcoholic liver disease and fatty liver.

We also considered how to treat these liver illnesses nutritionally. Today, fatty liver is increasingly common, and in order to combat the growing issues with liver health, we must maintain a healthy diet and way of life. We have researched the different macronutrients advised for treating various ailments as well as the permitted and prohibited foods during therapy. This subject gave us a basic understanding of the significance and administration of liver health.

6.6 Glossary

Diuretics : A diuretic is any substance that promotes diuresis, the increased production of urine

Faecal-oral route: The term "fecal-oral route," also known as the "oral-fecal route" or "orofecal route," refers to a specific method of disease transmission in which germs found in faeces travel from one person's mouth to another person's mouth.

Hepatotropic virus infections: The hepatotropic viruses are the main contributors of viral hepatitis. With the exception of Hepatitis B, which is a DNA virus, they are all RNA viruses. While Hepatitis B, C, and D are typically blood-borne infections, Hepatitis A and E are spread by the faecal-oral route.

Phospholipids: phospholipids are a class of lipids whose molecule has a hydrophilic "head" containing a phosphate group and two hydrophobic "tails" derived from fatty acids, joined by an alcohol residue.

Triglycerides: Triglycerides are a form of fat known as a lipid that circulates in the bloodstream. They make up the majority of the fat in your body. Foods, particularly butter, oils, and other fats you consume, are the source of triglycerides.

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UGHN-109
DIET THERAPY

BLOCK
3

MEDICAL NUTRITION THERAPY IN CARDIO VASCULAR SYSTEM, KIDNEY AND FEVER.

Block 3 Medical Nutrition Therapy in Cardio Vascular System, Kidney and Fever

The foundation of growth, development, health, and fitness is nutrition. Maintaining proper nutrition throughout life might help stop or postpone the onset of various disorders connected to nutrition. The function of medical nutrition therapy (MNT) in the management of chronic diseases is explained in this section.

Seventh chapter of this block includes topics of medical nutrition therapy for cardiovascular diseases. It includes pathophysiology, causes, clinical symptoms, dietary changes of various Cardiac disorders such is Atherosclerosis, hyperlipidemia, Congestive heart failure and ischemic heart diseases.

Eighth chapter of this block covers medical nutrition therapy for renal disorders such as Acute and chronic renal failure, nephrotic syndrome, dialysis, end stage renal disorders and various types of kidney stones. It also emphasizes on Role of nutrition in Hypertension.

UNIT 7 MEDICAL NUTRITION THERAPY IN DISEASES OF THE CARDIO VASCULAR SYSTEM

Structure

7.1 Introduction

You must have realized in the previous units that nutrition is a basic requirement for keeping a healthy body weight and that diet plays an important role in the prevention and treatment of numerous degenerative diseases. We now know that being overweight is one of the risk factors for cardiovascular disease (CVD). As we all know, risk factors are diseases and behaviour that have been linked to an elevated risk of disease. In this section, we will learn about cardiovascular disorders and the genetic and environmental variables that lead to high serum lipids, elevated blood pressure, and the development of other clinical symptoms associated with coronary artery disease (CAD). This section will also go over the dietary management of several types of heart problems.

Objectives

Following completion of this unit, you will be able to:

- Describe the various types of coronary heart disease,
- List the risk factors (genetic and environmental) in CHD pathogenesis,
- Address the etiology, symptoms, and complications of many types of heart disease(s),
- Elaborate on the goals of dietary management and the nutrition care procedure,
- Explain illness treatment, management, and prevention with a focus on behaviour modification.

7.2 Coronary heart disease

Coronary heart disease is a wide phrase that refers to a group of diseases that are caused by problems with the circulation, heart muscles, or heart vessels in particular.

We've all come across certain common words linked with heart disease that are frequently used interchangeably. You've probably seen the terms coronary heart disease, coronary artery disease, and ischemic heart disease used interchangeably.

But have you ever realized that they don't signify the same thing? As previously stated, coronary heart disease comprises all disorders of the heart, including those involving the blood, circulation, and structure.

Coronary artery disease (CAD) refers to artery illnesses that are primarily caused by arterial obstruction. Ischemic heart disorders (IHD) are typically the result of coronary artery disease, such as myocardial infarction, which is caused by increasing atherosclerosis.These terminology will be used throughout this

unit. The heart problems indicated above can be congenital or acquired. In this unit, we will cover acquired forms of CHD, which arise as a result of dietary mistakes or sedentary lifestyle practices.

Table 7.1 Common disorders and complications of Coronary Heart Diseases (CHD)

Disorder	Definition
Dyslipidemia	Altered lipid levels in blood
Hypertension	High level of systolic and diastolic blood pressure
Atherosclerosis	A thickening and constriction of the walls of big and medium-sized blood arteries caused by an increase in lipids and cholesterol levels.
Myocardial Infarction	A necrosis (dying/dead myocardial cells) region in a tissue.
Congestive Cardiac Failure	A clinical syndrome caused by heart disease that manifests as shortness of breath, chest discomfort, and inappropriate salt and water retention.
Rheumatoid Heart Disease (RHD)	A complication of rheumatic fever that comes after an incident of the disease.
Angina Pectoris	A distinct soreness or discomfort in the chest.

7.2.1 Prevalence

CVDs are a category of heart and blood vessel disorders that include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis, and pulmonary embolism. In 2016, an estimated 17.9 million individuals died from CVDs, accounting for 31% of all global deaths. Heart attacks and strokes were responsible for 85% of these deaths. Obesity, diabetes, and cardiovascular disease (CVD) are becoming more common in India across all age groups. Obesity, which is a major risk factor for hyperlipidemia and atherosclerosis, is currently on the rise. This is because the metropolitan population is more rich, leads a sedentary lifestyle, and prefers to consume refined meals.

Individuals at risk of CVD may have elevated blood pressure, glucose, and cholesterol levels, as well as being overweight or obese. Identifying people at highest risk of CVDs and ensuring they receive adequate therapy can save lives. It is critical that all primary health care facilities have access to necessary NCD drugs and basic health technologies in order to ensure that people in need receive treatment and counselling.

7.2.2 Causes of Cardiovascular diseases

Why do some people have heart disease while others do not must have crossed your mind countless times. The most evident reason is that they are more vulnerable as a result of the presence of certain risk factors. Risk factors of cardiovascular diseases are classified as modifiable and non-modifiable risk factors. Modifiable risk factors are ones over which we have influence. Obesity, smoking, high blood pressure, high cholesterol, physical inactivity, and so forth. They are substantial risk factors in and of themselves, increasing our chances of having CHD. Positive healthy living, smoke-free air, decent nutrition, frequent physical activity, and supportive living and working situations can all help to reduce the risk of coronary heart disease. Non-modifiable risk variables are those over which we have no control, such as heredity, age, gender, and so on.

In the following section, we will discuss some of these prevalent risk factors.

Family history: People who have a family history of heart disease are more likely to develop it. Genetic factors have a significant impact on the likelihood of developing early cardiovascular disease.

Obesity: Obesity, or being overweight, is the leading cause of cardiovascular disease. It is a risk factor for heart disease on its own. Obesity is often related with high triglycerides, high low density lipids, high blood pressure, and poor glucose tolerance. These anomalies improve with weight loss. Maintaining a body mass index in the normal range (18.5-24.9) can help to delay the start of CAD. Furthermore, the android form of obesity makes us more susceptible to heart disease than the gynoid form of obesity. As you may recall from Unit 9, abdominal fat is thought to be more dangerous than hip fat. The waist/hip ratio (WHR) can be used to determine this. WHR is normally 0.85 for females and 1.0 for males.

High blood pressure: It is also a risk factor for cardiovascular disease, and it is commonly associated with hyperlipidemia (extra lipids in the blood). Increased coronary artery wall strain is thought to hasten the atherosclerotic process by encouraging arterial smoothmuscle cell proliferation and hypertrophy, resulting in fibromuscular thickening.

Diabetes: Chronic hyperglycemia is linked to tissue damage and cardiomyopathies.In the following unit, you will learn about diabetes and its link to cardiovascular disease. Controlling blood glucose levels is critical for preventing heart disease

Age: Previously, men under the age of 55 were more vulnerable, but heart disease is increasingly affecting people as young as 30. Indeed, postmortem studies have shown that the process of

atherosclerosis can begin as early as two years of age and that the sites of blockage may be predicted in hypercholesterolemia women's wombs.

Smoking and tobacco: Tobacco and cigarette smoking are substantial independent risk factors for myocardial infarction and cardiac failure. Coronary artery disease has been diagnosed in 80% of smokers. Inhaling nicotine, carbon monoxide, and other contaminants constricts the coronary arteries, limiting blood flow to the heart muscle. It warrants special consideration in the prevention of cardiovascular disease.

Alcohol: Excessive alcohol use is also a risk factor. Because alcohol has a positive association between the amount drank and blood pressure levels, it is advisable to avoid it or consume it in moderation.

Lack of physical activity: Sedentary and inactive people are more likely to develop CVD.

Metabolic syndrome: It is a group of disorders that include central abdominal obesity, diabetes, dyslipidemia, or hypertension, as well as high triglycerides, decreased HDL, and blood sugar irregularities, all of which are risk factors for cardiovascular disease.

Psychological, social, cultural and religious factors: They increase the risk of cardiovascular disease through influencing the type and quantity of food ingested, as well as the amount of cigarette and alcohol consumed. Highly competitive job stress and physical activity, as well as persons who are impatient and workaholics (Type Apersonalities), can all have a negative impact on the heart and its vessels.

In the preceding discussion, we emphasized the most prevalent risk factors connected with heart disease. It is important to note that additional risk factors are being uncovered on a daily basis. Risk factors like as viral infections, low birth weight, and blood homocysteine levels are currently being examined to better understand the high prevalence rate among developing-country urban poor and the early development of CHD. Let us now look at the basic illness process in more detail.

7.2.3 Pathophysiology of CHD

We all know that a heart attack, also known as a myocardial infarction, is the final step of the acute clinical presentation of CHD. Several clinical trials and autopsy studies have shown that the development of atherosclerotic lesions can begin as early as infancy and that it may take several decades for the lesions to develop into fatty streaks and fibrous plaques that eventually cause stenosis (complete blockage) of the arteries. Diffuse intimal thickening throughout infancy, which is considered a normal physiological process rather than a pathological process, might result in the onset of early clinical symptoms in the smooth muscle cell layer between the endothelium and the internal elastic lamina. These lesions may

grow and develop into fatty streaks, reaching their maximal extent in the aortas over a two-decade period in those with high cholesterol and/or triglyceride levels. There is also focal proliferation of smooth muscle cells, which are referred to as gelatinous lesions because they contain little lipid but a lot of water.

Some of these lesions can grow to be quite large, with a greyish opaque centre that remains soft and translucent around the edges. Transitional lesions are what they're called. Fibrous plaques are formed when these lesions produce a fibrous cap with atheromatous lipids in the centre. Such fibrous plaques may merge, resulting in artery obstruction and thus restricted blood supply to the tissues. The irritating presence of plaques may induce harm to the artery intima, resulting in thrombosis. Myocardial infarction/cerebral stroke is the end effect of artery stenosis.

Check your progress Exercise 1

1. **Fill in the blank for following statements:**
   a. IHD Stands for _____
   b. A necrosis (dying/dead myocardial cells) region in a tissue is known as _____
   c. Heart attacks and strokes were responsible for ____ % of these deaths.
   d. A clinical syndrome caused by heart disease that manifests as shortness of breath, chest discomfort, and inappropriate salt and water retention is_____
   e. Age, gender and genetic factors are _____ risk factors for occurrence of CVD.
2. **Define Atherosclerosis.**
3. **How diabetes can result into cardiovascular diseases?**

7.3 Hyperlipidemia

Dyslipidemia has been linked to increased severity and prevalence of atherosclerosis for more than five decades. Dyslipidemia is typically shown as a rise in the content of either cholesterol or triglycerides, or both. There are various forms of blood lipid problems, each with its own set of dangers and treatment options. Hyperlipidemia is diagnosed by measuring the proportions and total levels of certain lipoproteins in the blood.

Because blood lipids (cholesterol, triglycerides, and phospholipids) are insoluble in blood, they require a ship to move through our bodies; as a result, they frequently bind to proteins and form complex particles known as lipoproteins, which vary in size, composition, and density.

Lipoproteins are classified into five types in the blood. These are some examples:

1. **Chylomicrons:** These are generated in the intestines after consuming a fatty meal. These enter the bloodstream via the lymphatics. It has over 90% triglycerides and 5% cholesterol.
2. **Very Low Density Lipoproteins (VLDL):** These are triglyceride transporters produced by the liver. The majority of LDL in the plasma is produced by VLDL. It comprises around 60% triglycerides and 10% cholesterol.
3. **Intermediary Density Lipoprotein (IDL):** This type of lipoprotein is high in cholesterol and triglycerides. It contains around 40% triglycerides and 10% cholesterol.
4. **Low Density Lipoproteins (LDL):** This type of lipoprotein is thought to be the most atherogenic of all lipoproteins. However, it is only one of many risk factors for developing cardiovascular disease. It has 10% triglycerides and 45% cholesterol.
5. **High Density Lipoprotein (HDL):** A high HDL content is connected with a lower risk of atherosclerosis because it transports excess cholesterol from the body to the liver. It has roughly 3% triglycerides and 20% cholesterol.

It is worth noting that the clinical reports of the majority of cardiac patients would reflect the values of the aforementioned parameters. As a dietician, you should be able to evaluate and use this information to plan the patient's food regimen. Table7.2 shows the normal and increased levels (indicative of illness status) for some of these markers.

Table 7.2: Classification of Lipid/Lipoprotein Levels

Total cholesterol	
Total cholesterol (mg/dl)	Interpretation
<200	Desirable
200-239	Borderline
≥240	High

Classification of Triglycerides levels

Triglycerides	
Triglycerides (mg/dl)	Interpretation
<150	Normal
150-199	Borderline
200-499	High
≥500	Very High

Classification of HDL cholesterol

HDL cholesterol	
HDL cholesterol (mg/dl)	Interpretation
<40	Low
40-60	Normal
≥60	High

Classification of LDL cholesterol

LDL cholesterol	
LDL cholesterol (mg/dl)	Interpretation
<100	Optimal
100-129	Near optimal
130-159	Borderline
160-189	High
≥190	Very high

7.3.1 Etiology

Dyslipidemia/hyperlipidemia can be caused by environmental (dietary/lifestyle) factors, genetic factors, or related to particular illness conditions or medicines. We've already covered these, but let's go over them again.

1. Environmental influences include high saturated fat diets, excessive calorie intake, alcohol consumption, and sedentary lifestyle. A change in food and lifestyle can aid in the normalisation of increased blood lipid levels.
2. Familial hyperlipidaemia is caused by genetic abnormalities. In such circumstances, lipid levels may be shockingly high, and the risk of CHD is extremely significant. Within the first two decades of life, a myocardial infarction can occur. Dietary changes, in addition to pharmacological therapy, are effective.
3. Secondary hyperlipidaemia caused by other conditions: Poorly controlled diabetes mellitus, kidney illness (nephrosis and end-stage renal disease), liver disease, hypothyroidism, and the

use of medicines such as oral contraceptives, thiazide diuretics, and corticosteroids can all disrupt lipid metabolism.

7.3.2 Symptoms

The presence of xanthoma is the primary symptom. This is a yellowish swelling, nodule, or plaque in the skin caused by fat accumulation. There are other varieties of xanthoma, for example, type 2b xanthoma may appear on the hand, buttocks, knees, or upper eyelids. Planar xanthomas can be detected in the creases of the palms and fingers of people with type 3. Type 5 xanthoma may appear on the back of the neck or buttocks.

7.3.3 Goals of Dietary Treatment

Dietary management (alone or in conjunction with exercise or lipid-lowering medicines) aims to minimize excess total fat, saturated fat, and cholesterol intake. This is an attempt to lower total cholesterol, LDL cholesterol, and triglyceride levels, hence lowering the risk of atherosclerosis and slowing its progression in people who already have it.

The 2018 Guidelines for the Management of Blood Cholesterol emphasized the need of including the following items in a balanced diet:- Fruits, vegetables, and whole grains, Low fat dairy products Legumes and nuts, Low-fat poultry (no skin) Fish and Seafood Non-tropical Vegetable Oils.

Based on the foregoing, patients should reduce their consumption of saturated and transfat, sweets, sugar-sweetened beverages, and red meats. So let us begin with dietary fats.

Dietary Fats: There is consistent evidence that both the quantity and quality of fat are directly related to the rise of most blood lipids, particularly LDLc. It has been widely documented that a high diet of fat, particularly saturated fat, resulted in an increase in blood total cholesterol, particularly LDLc. Foods contain cholesterol, saturated, monounsaturated, and polyunsaturated fatty acids. They might be invisible, like fats found in foods, or visible, like fats utilized in cooking.

a) **Cholesterol:** Mutton, hog, gammon, sausages, lamb, poultry, eggs (yellow), whole milk, cheese, ice cream, butter and desi ghee are all naturally high in it. Cholesterol exists solely in the animal kingdom and does not exist in the vegetable kingdom. Hypercholesterolaemia is an increase in blood cholesterol that leads to atherosclerosis.
b) **Saturated Fatty Acids (SFA):** At room temperature, they are typically found in animal fats as a white marble-like solid. It is abundant in red foods. Milk fat, butter, ghee, coconut oil, palm oil, margarine, and hydrogenated fats (vanaspati) are other sources of saturated fats. These saturated

fats in the diet also cause elevated LDL cholesterol, which leads to atherosclerosis. Cholesterol levels are raised by the three saturated fatty acids lauric acid, myristic acid, and palmitic acid. Saturated fat energy should always account for 10% of total calories.

c) **Monounsaturated fats (MUFA):** These are liquid at room temperature and are abundant in olive oil, canola oil, rapeseed oil, and, to a lesser extent, mustard oil. MUFA is a beneficial fat because it lowers LDL levels while increasing good HDL levels and cholesterol, hence reducing atherosclerosis. Oleic acid is a monounsaturated fatty acid with significant therapeutic significance.

d) At room temperature, **polyunsaturated fatty acids (PUFA)** are also liquid.

There are two forms of dietary PUFAs that are important:

- Linoleic acids (LA/n-6) are abundant in safflower, sunflower, maize and sesame oils.
- Alpha linolenic (ALNA/n-3) fish oils, as well as some olive, mustard, and rapeseed oils.

A healthy n-6:n-3 ratio of 5-10 is recommended. This can be obtained by combining two oils. A ratio of 5-10 can be obtained by combining safflower, corn, sunflower or sesame oil (rich in n-6) with equal parts mustard oil or rapeseed oil (rich in n-3). This is non artherogenic and so beneficial to the heart. Fish oils and fish contain n-3, which is good for the heart since it lowers plasma triglycerides

Table 7.3 Rich sources of polyunsaturated fatty acids (PUFA)

Rich in n-6 (Linoleic acid)	Rich in n-3 (alpha linolenic acid
Safflower, sunflower, sesame, corn oil	Canola, olive oil, rapeseed oil, mustard oil, soyabean oil, fish oil (mackerel, sardines, trout, and tuna), wheat, bajra, green leafy vegetables, methi, mustard (rai), almonds, Black gramme, cow pea (lobia), rajmah, and soya are all examples of plant oils.

To summarise, we now know that saturated fats and dietary cholesterol raise LDL and cholesterol levels in the blood. A 1% reduction in SFA calories results in a 3 mg/dl decrease in blood cholesterol. Monounsaturated fatty acids (MUFA) are beneficial because they lower LDL and cholesterol levels in the blood. Polyunsaturated fats (PUFA) lower LDL cholesterol levels. Thus, the energy provided by fats should stay less than 30% of total calories; saturated and polyunsaturated fatty acids should each offer

less than 10% of total calories; and mono-unsaturated fatty acids may provide the remainder, i.e. more than 10% of total calories.

Hydrogenated fat

All vanaspati preparations are the result of oil hydrogenation, which converts unsaturated fat to saturated fat for flavour and shelf life. As an approximation of pure ghee, this is frequently favoured by housewives. It is, however, saturated and includes trans fatty acids. Trans fatty acids are known to elevate LDL levels in the blood, hence promoting atherosclerosis. This is why hydrogenated fats are dangerous to the heart.

The type and quality of carbs that can assist reduce hyperlipidemia will be discussed next. Simple carbs, as we know, can result in high levels of VLDL and triglycerides when consumed in excess of the requirements.

Carbohydrates: As previously said, carbs supply 4 Kcal/g of energy in our diets. Because we consume a lot of carbohydrates, they fulfil 60-70% of our overall calorie needs. When consumed in excess, it is turned to fat in the body. You may recall reading about several forms of carbs, which are an important element of our diet. In this section, we'll brush up on our knowledge of these topics and learn about the role of carbs in heart disease.

Carbohydrates' Role

It is critical to understand these carbs because they all have different digestion qualities. Absorption occurs at a varied rate. Monosaccharides absorb the fastest, while polysaccharides absorb the slowest. This is due to the fact that polysaccharides contain more fibre. The latter are beneficial for a variety of ailments, including digestive infections, diabetes, and even cardiac difficulties. Fibre is useful for cardiovascular disease and comes in two varieties: water-insoluble and water-soluble.

Soluble fibres such as pectins, gums, and mucilages have been demonstrated to lower cholesterol levels. A daily intake of 20-40 g of soluble fibre has been shown to be helpful. Soluble fibre is abundant in legumes, oats, whole grains, fruits (apples, pears, and citrus fruits), and vegetables, as well as psyllium (isabgol). Soybeans are high in fibre, and soy proteins have an estrogenic action, which causes lipid reduction.

According to a recent review of 38 completed trials, the positive effects of soya protein are in the amount of 47g/day.

Proteins: While the quantity of protein has no effect on serum lipoproteins, the quality of protein may be important. Patients should be counselled to choose plant-based proteins over animal-based proteins. This is due to the fact that plant-based foods, which are high in protein, are also high in dietary fibre, have low levels of saturated fat, and are cholesterol-free. In the case of animal foods, egg whites and lean meats (meat without fat) should be favored.

Vitamins: Antioxidants and flavonoids, natural vitamin E, vitamin C, and A are nutrients (vitamins) that scavenge cell-damaging free radicals and act as antioxidants, as you may recall from previous Units. It is critical to understand this since free radical damage is extremely severe in patients with Syndrome X, a risk factor for cardiovascular disease.

Minerals: Chromium, zinc, and magnesium are the three most significant minerals. These minerals are essential for sustaining appropriate insulin activity. These mineral deficiencies raise the chance of Syndrome X, a risk factor for cardiovascular disease. Excess sodium consumption and a deficiency of potassium have both been linked to hypertension. Calcium deficiency might also put you at risk for heart disease. In cardiovascular disease, sodium added to food or sodium-rich foods should be avoided.

Antioxidants and Flavonoids: You've probably heard of the various antioxidants found in our diets. The body employs a wide range of antioxidants and free radical scavengers for a number of reasons and to protect tissues with varying demands.

As previously stated, vitamins A, C, and E have vital antioxidant properties. Although not technically antioxidants, B vitamins frequently serve as a co-factor with antioxidants. Flavonoids are found naturally in fruits, vegetables, tea, and wine.

It is vital to remember that dietary adjustments must be personalised for each patient and suited to the irregularities of the specific component.

Initially, lipid problems are addressed with dietary changes and physical activity.If there is no change after three to six months, medications are administered in addition to diet and exercise. Prior to making dietary adjustments, a diet history must be evaluated. The approximate intake of cholesterol, total fat, unsaturated fat, alcohol, simple and complex carbs should be examined, and the subject should be addressed accordingly. Some dietary suggestions for hyperlipidemic people include:

- Reduce your cholesterol and fat intake by avoiding whole milk, cheese, and curds prepared from whole milk. Skimmed or toned milk can be used.
- Avoiding organ meats (brain, liver, kidneys), limiting egg yolks, cold meats, tinned and sausages, gammon, frankfurters and peanut butter in favour of fish and fowl (baked and steamed).

- Baked items produced with refined flour (maida), such as cookies, patties, pastries, cakes, samosas, and so on, should be avoided. Snacks made with whole wheat flour may be promoted.
- All fats, including butter, margarine, cream, coconut oil, and hydrogenated fats, should be avoided. Oils high in polyunsaturated fatty acids (safflower, soyabean, and sunflower) and monounsaturated fatty acids (olive oil, peanut oil, and rapeseed oil) can be used instead.
- Fresh fruits, canned or dried fruits (in moderation), and fruits with cream, butter, ice cream, or dips should be avoided. Except for root vegetables, veggies could be consumed in enormous quantities.

Triglycerides can be reduced by:

- Reducing high-fat meals
- Lowering sugar and sugar-containing meals (carbonated beverages, fruit drinks, sweet snacks and desserts, honey, jam, jelly, chocolates and sweets)
- Reducing alcohol intake
- Reducing portion size
- Attempting to lose weight and
- Increasing physical activity

We will now learn about an essential clinical manifestation of high cholesterol that remains asymptomatic for a long time after we have comprehended the aetiology, symptoms, and dietary therapy of dyslipidemia.

Check your progress Exercise 2

1. **State true or false for following statements.**
    a. Familial hyperlipidemia is caused by genetic abnormalities.
    b. A yellowish swelling, nodule, or plaque in the skin caused by fat accumulation.
    c. Cholesterol exists solely in the plant kingdom and does not exist in the animal kingdom
    d. Canola and olive oil are rich in omega 6 fatty acids.
    e. Antioxidants and flavonoids are protective in nature.
2. **What is the difference between LDL and HDL cholesterol?**
3. **What are the dietary recommendations to reduce triglycerides levels?**

7.4 Atherosclerosis

Fibrous plaques are lesions that produce a fibrous crown with atheromatous lipids in the centre. These fibrous plaques can clump together, clogging the arteries and reducing blood flow to the tissues. Plaques can irritate the artery intima, resulting in thrombosis. The end effect of artery stenosis is myocardial infarction/cerebral stroke. The plaque reduces the size of the arterial lumen and, as a result, the volume of blood flow. Reduced blood flow results in insufficient nutrition and oxygen supply, as well as water removal from the tissues, resulting in ischemia. Angina pectoris is a condition that produces pain in the chest that spreads down the left arm. A heart attack can occur when the lumen narrows so much that a blood clot forms in a coronary artery and blood flow is cut off. An infarct is the dead tissue that occurs. The myocardium is the cardiac muscle that receives blood. As a result, such an event is known as an acute myocardial infarction (MI).

Atherosclerosis is thus classified as fatty streaks, intermediate lesions, fibrous plaques, and complex lesions. Atherosclerosis progresses through five stages.

Phase 1: The asymptomatic phase is characterised by fatty streaks, which are non-obstructive, lipid-filled cells.

Phase 2: Plaque with a high lipid concentration that is prone to rupture; the lipid is usually LDLc.

Phase 3: Acute complex phase characterised by rupture and a non-occlusive thrombus

Phase 4: Acute complex lesions with occlusive thrombus that cause angina/mycordial infarction and even rapid death.

Phase 5: Occlusive or fibrotic lesion. Large thrombi can result in severe acute problems.

7.4.1 Etiology

Atherosclerosis is caused by a variety of reasons. These are some examples:

1. **Hyperlipidemia:** Excess circulating fats in the blood, particularly low density lipoprotein (LDL) and low HDL levels, can predispose to atherosclerosis.
2. **Hypertension:** HT can hasten atherosclerosis and lead to problems.
3. **Diabetes mellitus:** An major risk factor usually associated with hypertension, diabetes mellitus can be a high risk for atherosclerosis due to abnormalities in coagulation, platelet adhesion and aggregation, increased oxidative stress, and abnormalities in vascular vasomotion.

4. **Obesity:** Excess triglycerides (hyperglycemia) and LDLc levels are prevalent in obese people, and decreased HDL levels are a significant independent risk factor for atherosclerosis.
5. **Low physical activity and cigarette smoking**: It may impact the pace of atherosclerosis and raise the risk of CAD. On the other hand, regular exercise appears to be beneficial.
6. **Endothelium damage factors:** Elevated blood homocysteine a (which is genetically determined) and viral infections of the lungs may damage the endothelium and induce harm, leading to atherosclerosis.

7.4.2 Symptoms

Excess weight, hypertension, excessive cholesterol and triglyceride levels

Complications

Myocardial infarction, systolic and diastolic dysfunction, inflammatory issues (pericarditis), stroke, gangrene (body tissue death and decay), and aneurism (blood-filled dilatation of a blood artery).

Now that we understand the pathophysiology of atherosclerosis, let us look at the nutritional management goals of this condition.

7.4.3 Nutritional Management Objectives

The dietary management goals include:

- Weight loss if overweight or obese
- A reduction in total fat, saturated fat, and cholesterol intake.
- Medication, if necessary, for treating lipid problems and managing blood pressure.
- Increased physical activity and moderation in alcohol consumption are examples of lifestyle modifications.
- There will be no smoking and coffee will be limited.
- Consuming a balanced adequate diet rich in calcium, chromium, iron, and zinc Medical management is accomplished by the use of several lipid-lowering medicines.

Dietary management and dietary requirements during atherosclerosis are the same as for dyslipidemia control. As a result, we will not go into specifics here.

Check your progress Exercise 2

1. **State true or false for following statements.**

a. Familial hyperlipidemia is caused by genetic abnormalities.
b. A yellowish swelling, nodule, or plaque in the skin caused by fat accumulation.
c. Cholesterol exists solely in the plant kingdom and does not exist in the animal kingdom
d. Canola and olive oil are rich in omega 6 fatty acids.
e. Antioxidants and flavonoids are protective in nature.

2. **What is the difference between LDL and HDL cholesterol?**
3. **What are the dietary recommendations to reduce triglycerides levels?**

7.5 Congestive heart failure

It is an advanced form of cardiac disease that contributes significantly to morbidity and mortality, particularly in the elderly population. Congestive heart failure is a type of chronic decompensated illness because it develops over time. It is caused by a heart muscle injury caused by atherosclerosis, hypertension, or rheumatic fever, which causes in progressive weakening of the heart muscle. This results in insufficient blood circulation and, as a result, an insufficient delivery of nutrients and oxygen to the tissues.

This results in malnutrition and being underweight. When oedema is prevalent, it conceals the presence of malnutrition. There are mostly hemodynamic disturbances. Over time, congestive heart failure causes left ventricular systolic dysfunction. The heart muscle - myocardium - gradually weakens and is unable to sustain adequate cardiac blood output or blood circulation. For starters, it can induce pulmonary oedema, which causes breathing problems due to insufficient blood pumping, resulting in blood collection on the right side of the heart, impairing regular circulation. This disrupts the usual passage of fluid between the tissue space and the blood vessel, generating oedema in the tissue.

Congestive heart failure develops over time when necrotic tissues are not replaced by functional connective cells, reducing the heart's contraction and relaxation capabilities. Heart muscle weakness can occur for a variety of reasons, some of which are listed here.

7.5.1 Etiology

This condition can have a variety of reasons. Chronic hypertension, left ventricular hypertrophy, coronary heart disease (recurrent episodes of IHD, particularly myocardial infarction), diabetes, advancing age, viral damage, alcohol misuse, and injury are all established risk factors.

7.5.2 Symptoms

Congestive cardiac failure is a kind of cardiomyopathy that worsens with time. The most common symptom is fluid imbalance caused by insufficient cardiac output, which causes cardiac/pulmonary oedema, which may later impact other organs in the abdomen.

Because haemodynamic alterations may or may not occur concurrently, clinical symptoms can vary greatly from patient to patient. The following are the most prevalent symptoms: Fatigue, faintness, and weakness Swelling of the feet and ankles.

Shortness of breath even when lying down, loss of appetite, indigestion, nausea, and vomiting Congestion, Inadequate cardiac output, Oedema, Cardiac cachexia (severe starvation) and Reduced urine output.

7.5.3 Dietary management

Nutritional care might be challenging in congestive heart failure. This is because oedema complicates the subject's nutritional assessment. Because of cardiac cachexia, the person may lose 10-15% of their normal weight and have a loss of lean body mass. There are also insufficient supplies of vital vitamins, calcium, and iron. Let us first determine the aims of dietary management in light of the symptoms and therapeutic objectives.

Dietary management goals include:

- Minimising stress burden on the heart;
- Correcting and maintaining fluid and electrolyte imbalances;
- Maintaining a desirable body weight; and
- Maintaining an appropriate nutritional status.

Energy: Due to the presence of oedema, it is frequently impossible to calculate calorie requirements based on body weight. Thus, energy requirements are determined by the patient's residual heart function and normal body weight. Short-term fluctuations in body weight caused by changes in fluid balance should be separated from adiposity gain. A 1200 Kcal diet is recommended for patients on artificial oxygen support systems and/or those who are obese. Patients who are ambulatory and/or of normal weight may usually tolerate roughly 25 Kcal/kg IBW or average body weight per day. There is little effort made to increase weight in severely malnourished patients since greater food intake would place an additional stress on the heart.

Protein: Protein requirements for healthy adult men and women stay the same.Orally or through specific feeding methods, approximately 1g of protein per kg of normal or ideal body weight should be introduced into the diet. Because congestive heart failure is a kind of cardiomyopathy with cardiac muscle weakening, it is critical to provide adequate amounts of dietary proteins, particularly high biological value proteins, to enable tissue synthesis. Plant proteins, which are naturally low in salt, should be prioritised above animal proteins.

Carbohydrate: While the quantity of carbohydrate remains close to the RDI, at 60% of total energy, the quality of carbohydrate must be adjusted.

Because complex carbohydrates require more oxygen for digestion and metabolism than simple carbohydrates, it is recommended that the diet be low in fibre and high in simple carbohydrates (semolina, refined four, rice, dehusked pulses, papaya, mango, brinjal, pumpkin, gourd, and so on). Avoid whole cereals and pulses, legumes, lotus stem, cabbage, and soyaflour.

Fat: The amount and quality of fat consumed would be determined by the severity of hyperlipidemia and obesity. The emphasis should always be on oils high in MUFAs and PUFAs. SFA-rich fats should be avoided. In any event, lipids should not account for more than 20% of total energy, and the diet should be low in cholesterol (200 mg/day) depending on the patient's lipid profile.

Minerals: Because sodium and potassium are the key electrolytes linked to oedema, sodium consumption should be 135-145 meq/L and potassium intake should be 3.5-5.0 meq/L. Most patients benefit from mild to moderate sodium restriction (2.0 - 3.0 g Na per day). All patients should limit their intake of table salt and cooking salt. High sodium fruits and vegetables, such as fenugreek leaves, lettuce, spinach, beetroot, tomato, grapes, lichi, and musk melon, should be avoided, as should processed meals and preserves. The extent of sodium restriction should be prescribed by the dietician based on the severity of sodium and water retention.

Vitamins: The RDI needs for all vitamins remain the same. If the patient additionally has hyperlipidemia/atherosclerosis, a high dose of vitamins A, C, and folic acid may be beneficial.

Fluid intake should be evaluated in relation to urine output and oedema severity. Fluid restriction is especially significant if the patient is not taking diuretics. Patients using diuretics can drink typical amounts of fluids, up to 1.5 litres per day.

Other considerations

- Small frequent meals are frequently tolerated better by subjects with congestive heart failure than larger infrequent meals, which are tiring to consume, can contribute to stomach distention, and significantly increase oxygen use.
- If salt restriction is moderate to severe, alternative spices and flavouring agents such as mild herbs and condiments may be used sparingly to guarantee enough meal intake.
- The menu should be designed with the fluid allowance for the day in mind.
- The patient should be instructed to chew his or her food slowly. Sweating and chest pain are symptoms of an oxygen deficiency. In such cases, food consumption should be avoided.
- Meals should be tender and thoroughly prepared. Raw foods should be avoided at all costs.
- A liquid diet can be developed to a semi-soft, soft, and normal food over time.
- Oral intake may be impossible if the patient is on a ventilator. In such cases, enteral parenteral tube feeding should be initiated.

Next, we'll look at another type of coronary heart disease, rheumatic heart disease, which mostly affects youngsters.

7.6 Rheumatic Heart Disease (RHD)

Rheumatic Heart Disease (RHD) is a leading cause of cardiovascular disease in Indian children and adolescents. The entire heart and its membranes are damaged with this condition. It is a complication of rheumatic fever (caused by an untreated Streptococcus throat injection) that frequently arises following rheumatic fever bouts.

Rheumatic fever can cause heart valve damage. If the heart valves are damaged, they will not function properly. Rheumatic Heart Disease is a disorder that occurs when this damage is persistent.

7.6.1 Symptoms

Symptoms often occur 1 to 6 weeks after the fever, and the infection may have been too mild to be recognized in some cases. Fever, exhaustion, shortness of breath, fainting, palpitation, and chest discomfort are among the symptoms. Nodules or small protuberances that are swollen, sensitive, red, and painful may occur. There may be a red, raised, lattice-like rash as well as uncontrollable movements of the arms, legs, and facial muscles.

7.6.2 Complications

Anaemia, cardiac enlargement, valve abnormalities (mitral and tricuspid valves), embolism, arrythmia, abdominal pain, fever, arthritis, and other conditions.

After learning about the signs and complications. Let's go through the nutritional aspects as well.

Except for patients with congestive heart failure, whose fluid and sodium consumption should be regulated, the diet should be nutritious and without limits. Because of the mineralocorticoid impact of corticosteroids and diuretics (if used), potassium supplementation may be required.

7.7 Myocardial infraction

It is the first stage of acute cardiovascular disease caused by a blockage of a coronary artery providing blood to the heart. Myocardial infarction occurs when fibrous plaques combine with blood clots to form a full blockage or stenosis in an artery supplying oxygen and nutrients to the heart via blood.

Consistently high blood lipids, notably LDLc and serum triglycerides, chronic hypertension, and changes in the balance of prostacyclins (a prostaglandin) and thromboxanes are all linked to the development of arterial occlusion.

Myocardial infarction is a serious disease with high morbidity and fatality rates.

Medical and dietary management are both important in controlling the disease and preventing recurrence/death. Proper dietary treatment is also required if the patient has surgery to improve his quality of life. Let us examine some critical areas of dietary care in depth.

7.7.1 Dietary management

Patients who have a myocardial infarction are usually hospitalised and maintained under rigorous medical observation. Most patients are on intravenous support and, if necessary, an artificial ventilator for the first 24 to 48 hours to meet their oxygen requirements. Oral meal intake is initially restricted and not suggested since the failing heart cannot support oxygen and food absorption. Oral food intake is resumed based on multiple cardiac function tests that aid in determining the heart's remaining functional capacity following injury. A low fat soft diet is often recommended, and foods can be introduced in very little amounts every hour or every two hours during the initial phases. To rule out the elicitation of angina pectoris or another incident of myocardial infarction, the patient must be observed during meal consumption and for at least 12 to 1 hour after eating.

Objectives:

The following are the goals of dietary therapy for myocardial infarction patients:

- To provide rest to the wounded heart;
- To maintain an optimal nutritional status;
- To reach and maintain a desirable body weight; and
- To prevent the formation of another MI attack.

Energy: As previously said, patients who have just suffered from a myocardial infarction are admitted to the intensive cardiac care unit, where their movement is carefully restricted and they are often recommended not to socialise too much.

As a result, physical exercise consumes relatively little or no energy. As a result, a low-calorie diet is recommended to supply enough calories to meet the basal requirements. The calorie intake may begin with 800 Kcal and gradually proceed to a 1200 Kcal diet until the patient is discharged. Following that, the patient's calorie intake should be based on maintaining a body weight that is 1 to 2 kg below IBW.

Protein, Carbohydrates, and Fat: Protein intake remains consistent with the RDI, i.e. 1.0 gm protein per kg body weight per day. A sufficient amount of proteins are required to induce regeneration of necrotic tissues in the heart. As previously stated, plant proteins and low fat animal products (skimmed milk, low-fat paneer, chicken, fish, and other marine foods) should be prioritised.

The vast majority of MI patients are hyperlipidemic, with increased serum triglyceride levels. In such instances, the fat calorie contribution should not exceed 20%, and dietary cholesterol intake should not exceed 200 mg per day.

Carbohydrates should account for 60% of total energy. However, the incorporation of simple carbs that are easy to digest and low in fibre should be prioritised.

Low fibre grains, roots, and tubers should be served soft and well cooked/blended (purees, for example).

Vitamins and minerals: Vitamin and mineral requirements are mostly determined by the patient's current nutritional state and clinical characteristics. If the patient is hypertensive or at danger of developing oedema owing to congestive heart failure, mild to moderate sodium restriction is often advised. Incorporating low-fiber, low-sodium fruits and vegetables will help provide adequate iron and B-group vitamins, particularly folic acid and vitamin B12.So far, we've talked about nutrient requirements during a heart attack.The following are a few useful pointers to consider when planning the patient's nutrition care approach.

Other considerations

You must have realized by now that a MI patient's nutrient requirements change from the moment he or she is admitted to the hospital in an emergency to the time they are discharged.When patients are admitted to the intensive cardiac unit, they are extremely unwell and may be on life support.

They are first maintained on intravenous fluids to maintain a desirable blood volume and to provide some calories. As the patients' health improves, they may be placed on enteral tube feeding (intubated with ventilator to administer oxygen) or given modest sips of full-fluids every 1 to 2 hours. The diet is progressively progressed to semi-soft, then soft. A few days before discharge, the patients are constantly monitored while on a soft to normal diet. As a result, significant care must be taken to ensure the consistency and quantity of food supplied to the patient.

Even after discharge, the patient should be instructed to consume slowly and in small, frequent portions. Rest after meals is recommended, and the patient should avoid all forms of activity following meals. If the patient is overweight or obese and needs to be operated on, a low-calorie diet to aid with weight loss is essential. If the patient is also diabetic, you must be especially cautious as his insulin needs may fluctuate dramatically throughout the post-MI period. Dietary counselling is essential, especially if congestive heart failure is present.

Check your progress Exercise 3

1. Describe 5 phases of Atherosclerosis.
2. What are the various goals of dietary management for Congestive heart failure?
3. What are the various signs and symptoms of Rheumatic Heart Diseases?

7.8 Let us sum up

We learned about the etiology, metabolic changes, clinical symptoms, and nutritional therapy of heart disease in this unit. Cardiovascular diseases, hypertension, dyslipidemia, atherosclerosis, myocardial infarction, and congestive heart failure are all examples of cardiovascular diseases. Heart failure and RHD are a set of heart illnesses that we briefly reviewed in this unit.

Finally, we focused on the numerous dietary recommendations offered by WHO for the prevention of heart disease, as well as the American Heart Association (AHA) dietary guidelines.

7.9 Glossary

Antioxidant: Group of vitamins include vitamin C, E, selenium, and carotenoids.

Arteriosclerosis: It is the thickening or sclerosis of the walls of the smaller arteries.

Atherosclerosis: It is a hardening of the artery walls caused by fatty deposits that form on the inner walls of the arteries, interfering with blood flow.

Carditis: It is defined as inflammation of the heart tissues.

Coronary Heart Disease: A disease that affects the network of blood vessels that surround and serve the heart's myocardial.

Homocysteine: It is an amino acid that exists naturally in the body and has been linked to an increased risk of coronary artery disease.

Infarction/Infarct: A coagulation necrosis in a tissue caused by local ischemia caused by blockage of circulation to the area.

Ischemia: A lack of blood in a tissue caused by a functional or physical obstruction of a blood artery.

Linoleic acid: It is an omega-6 fatty acid that acts as the starting point for the synthesis of additional -6 fatty acids such as arachidonic acid.

Linolenic acid: It is a liquid polyunsaturated fatty acid found in plant oils.

UNIT 8 MEDICAL NUTRITION THERAPY IN DISEASES OF KIDNEY

Structure

8.1 Introduction

We examined gastrointestinal tract illnesses and their dietary management in prior units. In this unit, we will learn about one of the most common ailments, renal problems. Following that, in this unit, we will learn about different kidney function tests that incorporate both

Clinical examination and biochemical analyses. We will later learn about renal disorders such as Kidney stones, nephrotic syndrome, acute renal failure (ARF), chronic renal failure (CRF), end stage renal disease (ESRD), and others, as well as their dietary management. This would include a list of items to avoid while suffering from these ailments.

Objectives

You will be able to:

- Recapitulate and describe the physiology of the kidneys,
- Discuss renal function and diagnostic tests,
- Identify different renal disorders, their aetiology, clinical and metabolic manifestation, and
- Rationalize dietary modifications in renal disorders, particularly proteins, minerals, and fluids, after studying this unit.

8.2 Common Renal diseases

Kidney diseases can be infectious, inflammatory, or degenerative in nature.

These can lead to renal failure if the severity or duration increases. Kidney diseases can affect the nephrons, tubules, or glomerulus. Nephritis is an inflammation of the nephrons. Glomerulonephritis (GN) is the involvement of the glomeruli particularly. Tubules are frequently impacted by glomerular injury.

Stones can also form in the kidneys, which is known as renal calculi or nephrolithiasis. Nephrosclerosis is a condition in which the blood arteries of the kidneys become constricted due to degenerative or vascular diseases. This results in decreased blood and oxygen delivery, and so kidney injury.

Kidney illnesses can be acute or chronic, with a variety of underlying causes. The treatment is determined by the cause of the disease, the extent and kind of damage, and the clinical and metabolic results. Diet is vital in treatment since kidneys have a direct effect on nutritional status via balance of fluid, electrolytes, and nutrients in the body. Few of them are listed below:

- Nephrotic syndrome

- Acute renal failure
- Chronic renal failure
- Dialysis
- Renal calculi

The etiological variables for each of these illnesses are examined separately later in this unit. Although the management of various problems differs, there are a few similar characteristics associated with dietary management in renal diseases. Before delving into each condition individually, we'll go over some broad ideas.

8.2.1 General principles of dietary management in kidney disorders

Several universal principles govern the nutritional therapy of diverse renal disorders.

This is because, as you will soon see, diverse symptoms, clinical and biochemical signs may be prevalent in distinct renal illnesses. The primary goals of dietary management in renal diseases are to:

- Reduce excretory work of the kidneys while maintaining near normal fluid, acid-base, and electrolyte balance;
- Maintain satisfactory nutritional status; and
- Prevent progression of renal damage and the development of uremia (an accumulation of nitrogenous waste products in the blood).

To meet these objectives, modifications in the diet are required mainly for protein, electrolytes like sodium and potassium and fluids are required.

Energy: It should be normal or increased if you are losing weight. A low-protein, moderate-to-high-carbohydrate, and unsaturated-fat diet is preferred.

Protein: The amount of protein supplied is determined by GFR. Proteins must be sufficient to prevent muscle atrophy and malnutrition, but adjustments are required to prevent the accumulation of nitrogenous wastes in the blood and uremia. Good quality proteins from milk and eggs are advised to meet the body's need for essential amino acids while avoiding overloading the body with non-essential amino acids.

1. **Sodium intake** should be restricted based on whether it is retained in the body or lost excessively in urine. Oedema, hypertension, and congestive heart failure (CCF) can all be caused by sodium and water retention.

2. If **potassium (K)** is retained, it must be restricted to avoid hyperkalemia (excess K in the blood), which can lead to cardiac arrest. Both electrolytes may need to be replaced if they are lost in excess in urine.

Vitamins and minerals:

1. Calcium and vitamin D supplements may be required in chronic or severe instances.

2. Phosphate is generally restricted since it is retained in the body.

3. Iron supplements are required when erythropoietin synthesis is hindered.

4. Renal patients require vitamin B and C supplements due to higher demands.

Fluid: In most individuals, this must be reduced due to a decrease in GFR. If polyuria occurs, fluid requirements may increase.

If you understand these fundamental concepts, you will be able to change the diet in various renal problems more rationally, as you will discover as you learn about the numerous renal ailments discussed next.

8.3 Nephrotic Syndrome

Nephrotic syndrome is a condition in which the kidneys have been damaged, leading protein from the blood to seep into the urine. When it develops in childhood, it is a very benign condition, but it can progress to chronic renal failure in adults.

Nephrotic syndrome is another name for nephrosis. Massive oedema and proteinuria are symptoms of this condition, which is caused by degenerative lesions of the tubules, mesangium (the central component of the renal glomerulus), or basement membrane of the glomeruli.

8.3.1 Etiology

There are numerous etiological variables that contribute to nephrotic syndrome. This syndrome can be caused by progressive glomerulonephritis, disease such as diabetes, collagen disease, or drug reactions, heavy metal exposure, or even a reaction to toxic venom following a bee sting.

Following that, the clinical signs of this illness are highlighted.

8.3.2 Pathophysiology

Massive oedema and proteinuria, hypoalbuminemia, hypercholesterolemia, and improper bone metabolism are all symptoms of nephrotic syndrome. Denegerative lesions of the glomerular capillary

basement membrane result in the loss of the glomerular protein barrier. A significant amount of protein (up to 4-10 g/day) is thus lost in the urine as albumin. This proteinuria causes a significant decrease in plasma proteins, resulting in large hypoproteinemic oedema due to a decrease in plasma albumin, which is primarily responsible for maintaining tissue and circulation fluid balance. Pedal (foot) and periorbital (around the eye orbit) oedema, as well as ascites (fluid in the abdominal cavity), are prevalent.Other proteins that have been lost include globulins, thyroid hormone, and iron binding protein. Continued protein loss causes tissue breakdown and starvation, which is sometimes hidden by oedema. Oedema is exacerbated by the development of fatty liver and salt retention.Another hallmark of this condition, which is associated to hypoproteinemia, is an increase in serum lipids, particularly cholesterol, to levels more than 300 mg/dl.

8.3.3 Dietary management

Dietary management's key goals are to 1) control and correct protein deficiencies, 2) correct and prevent oedema, and 3) maintain appropriate nutrition to provide greater resistance to infection.

The following eating advice will help you achieve this goal:

Calories: To retain proteins, a high daily intake of 35 to 40 Kcal/kg of ideal body weight for adults and 100 Kcal/kg or higher for children is recommended. This enables a suitable amount of energy and effective protein utilisation for tissue formation.

Protein: A decrease in plasma albumin level of 20% or less than normal is the most common cause of nephrotic ascites and oedema. Proteinuria can be greater than or equivalent to 3.5 g/day, and serum albumin levels can drop to 3 g/dl or below.

As a result, in the past, these patients were given a high protein diet in order to replenish lost protein and raise serum albumin levels. However, fresh research indicates that protein consumption of 0.8g/kg IBW + 1g/g proteinurea aids in lowering protein loss in urine while having no negative effects on serum albumin.

Cow's milk, skimmed milk, eggs, fish, dry fish, poultry, lean meat, paneer derived from cow's milk, cheese, sprouts, lentils, and legumes are all high in protein. A minimum of 60-70% of this protein should be of high biological value (milk and milk products, egg whites, and meats).

Carbohydrates: For the protein sparing function, a substantial carbohydrate intake is suggested.

High fat consumption should be avoided since cholesterol and triglyceride levels in nephrotic syndrome patients are elevated. To conserve proteins, the diet must be high in calories while being low in fat. Excessive consumption of oily foods and saturated fats (ghee, margarine, and so on) should be avoided. If

the patient has hyperlipoproteinemia and hypercholesterolemia, total fat and cholesterol consumption should be limited to less than 30% energy from fat and 300 mg cholesterol per day.

Sodium: To minimise oedema, sodium consumption must be reduced. Approximately 2-3 g of salt per day is suggested. Added salt is usually forbidden in these patients. Refer to Table 16.2, which lists the foods that are high in salt.

Avoid including these foods in the nephrotic syndrome patient's diet. Diuretics are typically prescribed to prevent additional oedema.

Potassium restriction is not required if oliguria and anuria are absent.

In fact, sufficient potassium is critical since losses might occur as a result of tissue protein breakdown and diuretic use.

Calcium: If a calcium deficit causes bone rarefaction, increasing calcium intake or calcium supplementation is indicated, along with a slight increase in protein.

Fluid: Normal until GFR is decreased.

8.4 Acute renal failure

Acute renal failure (ARF), also known as Acute Kidney Injury (AKI), is a sudden loss of renal function caused by kidney damage, resulting in the retention of nitrogenous (urea and creatinine) and non-nitrogenous waste products normally discharged by the kidney. This accumulation is accompanied by metabolic disturbances such as metabolic acidosis (acidification of the blood) and hyperkalaemia (elevated potassium levels), changes in body fluid balance, and effects on many other organ systems, depending on the severity and duration of the renal dysfunction. It is distinguished by oliguria or anuria (a reduction or cessation of urine output), albeit nonoliguric ARF can occur. It is a dangerous sickness that requires immediate medical attention.

Acute renal failure is a quick loss of the kidneys' ability to eliminate waste, concentrate urine, and retain electrolytes. It is a dangerous disorder characterised by the above-mentioned rapid shutdown of kidney function due to reduced renal flow, acute glomerular or tubular injury. It causes a decrease in glomerular filteration rate (GFR), which is frequently accompanied with azotemia (an accumulation of nitrogenous waste products in the blood) and a decrease in urine output.

8.4.1 Etiology

AKI can be caused by a variety of causes.

- Circulatory shock, large blood loss and reduced renal blood flow as in traumatic injury, shock, severe burns, surgery, septicemia, dehydration and fluid loss,
- Mismatched blood transfusions,
- Nephrotoxins like carbon tetrachloride,
- Certain poisonous mushrooms, infections, snake bites, bee stings, etc.

8.4.2 Pathophysiology

GFR is drastically reduced to 1-2% of normal. Along with this, haematuria and proteinuria are common. Because of decreased GFR and tissue protein degradation, serum urea nitrogen and creatinine levels rise. Uremia can be accompanied by symptoms such as disorientation, fatigue, nausea, vomiting, and anorexia. When sodium and bicarbonate levels are low, blood pressure rises and potassium, phosphate, and sulphate levels rise. Water balance is critical, and if not controlled, the condition can be fatal, primarily owing to potassium poisoning or excessive fluid retention, resulting in heart failure. Return to renal function is marked by an increase in urine output, often known as diuresis.

When diuresis is established, the urine volume gradually increases to 3 to 5 litres per day, as does the excretion of sodium, potassium, urea, and other solutes.

In 7 to 10 days, blood urea returns to normal, indicating that glomerular filtration has significantly improved.Although the excretory function of the kidney has been restored, the regulatory function of the tubules has taken longer to recover. The patient's internal environment is still at risk due to high losses of water, salt, potassium, bicarbonate, and magnesium.

If the patient survives the oliguric phase, the kidneys will recover with little or no residual damage in the vast majority of cases. However, in a few cases, persistent tubular function loss might be found even after blood urea levels have returned to normal.

After reading the preceding material, you should realize that acute renal failure is a medical emergency. The management of life-threatening complications becomes critical. Diet is also very essential. Following that, we will study about dietary management.

8.4.3 Dietary management

The following are the most prevalent dietary issues in AKI: (1) poor appetite, (2) inability to take food/or fluids orally due to intubation, and (3) hypercatabolism (increased metabolism) due to underlying conditions such as infection or surgical recovery.

Recovery may take a few days or weeks with cautious medical and dietary treatment. If oliguria persists with an increase in nitrogenous wastes and potassium, intensive therapy such as haemodialysis with nutritional support may be required. Dietary management is thus a problem and a vital function. Oral feeding is preferable, but if nutritional support is required, exercise cautious to avoid fluid excess and uremia.

Calories: In most adults with AKI who are in a normal catabolic condition, the energy need is 25-30 Kcal/kg body weight, increasing to 30-35 Kcal/kg in hypercatabolic cases due to an increase in energy expenditure of 10-30%. Carbohydrates are the primary source of energy, followed by fat. When oral intake is inadequate due to vomiting and diarrhoea, an intake of 100-200 g or more of sugar / glucose per 24 hours is supplied. Children require adequate calories to grow. Because of fluid restrictions, enteral or parental non-protein concentrated calorie sources may be required in some circumstances

Protein: Excessive protein restriction in AKI should be avoided in order to postpone renal replacement therapy (RRT). As a result, KDIGO (2012) advises 0.8-1.0 g/kg/day of protein in non-catabolic AKI patients who do not require dialysis. Patients on RRT should consume 1.0-1.5 g/kg/day, with CRRT patients consuming up to 1.7 g/kg/day. To decrease unneeded nitrogen burden, at least 60-70% of good quality proteins are advised with improvement.

A balanced amino acid solution including both essential and non-essential amino acids should be supplied if total parenteral nutrition (TPN) is necessary. Aside from necessary amino acids, arginine, histidine, serine, taurine, and tyrosine may be beneficial.

Sodium: Sodium should be limited to 500-1000 mg (20-40 mEq) per day during the oliguric phase. With the commencement of diuresis, it might be liberalised.

Potassium: Because hyperkalaemia is a potentially fatal consequence of acute renal failure, it must be treated as soon as possible. Potassium consumption should be limited to 1000-2000 mg (25-50 mEq) and should be closely and routinely monitored. The intake may be raised if renal function improves.

Fluid intake is based on fluid balance but is typically limited to a basic allocation of 500 ml/day for an average adult, with adjustments made for losses through other pathways. The fluid limit is normally determined by urine output and any additional losses from vomiting or diarrhoea. Fluid balance must be strictly monitored; the patient's weight and blood salt levels are strong markers of fluid balance and the amount of fluid necessary. Dialysis is usually needed if fluid intake is insufficient for metabolic waste elimination.

8.5 Chronic renal failure

Chronic renal failure is characterised as an unusually low glomerular filtration rate, which is usually assessed indirectly by the creatinine level in blood serum over a period of months or years.

CRF is thus a disorder caused by extensive and progressive kidney deterioration with impairment of renal function. Few functional nephrons remain, and CRF causes what is commonly referred to as uremia. Uremia, as you may already know, is a hazardous condition caused by renal failure in which kidney function is reduced and urea, a waste product ordinarily eliminated in the urine, is retained in the blood.

Unlike acute renal failure, which is characterised by a sudden and reversible loss of kidney function, chronic renal failure is characterised by a gradual and cumulative loss of the kidneys' ability to eliminate wastes, concentrate urine, and store electrolytes. CRF symptoms can range from minor renal dysfunction to severe kidney failure. End-stage renal disease (ESRD) is caused by CRF that causes severe sickness and necessitates some sort of renal replacement therapy (such as dialysis).

Table 8.1 Stages of CKD

CFR (ml/min/1.73m2)	Terms
≥90	Normal or high
60-89	Mildly decreased
45-59	Mild to moderately decreased
30-44	Moderately to severely decreased
15-29	Severely decreased
<15	Kidney failure

8.5.1 Etiology

CRF can be caused by a variety of nephron-related disorders, including primary glomerular diseases such as immunological complex glomerulonephritis.

- Diabetes mellitus, particularly IDDM,
- Hypertension,
- Toxic substance exposure,
- Kidney stones and infections,

- Renal vascular diseases,
- Renal tubular diseases,
- Chronic pyelonephritis, and congenital abnormalities of both kidneys are all examples of metabolic diseases with renal involvement.

These disorders can result in significant alterations in kidney shape and function. CRF causes fluid and waste product accumulation, which can lead to a variety of clinical symptoms and consequences, which are listed below.

8.5.2 Pathophysiology

Progressive nephron loss with decreased renal blood flow and glomerular filtration results in significant impairment of the kidney's excretory, metabolic, and endocrine processes. The kidneys' ability to regulate body water balance, concentrate solutes in bodily fluid (osmolality), and maintain electrolyte and acidbase balance is impaired. Other clinical manifestations that develop may be related to practically every system of the body as a result of the body's overall pervasive metabolic abnormality.

Due to the kidney's decreased ability to concentrate urine, an increased solute load of metabolic wastes causes osmotic diuresis at first. This results in sodium and potassium depletion. However, when renal impairment progresses and GFR falls, salt, potassium, and nitrogenous wastes are stored in the body. This contributes to oedema, hypertension, hyperkalemia, and azotemia.Azotemia is defined as an accumulation of nitrogen waste products in the blood. Phosphate, sulphate, and organic acid retention induces metabolic acidosis due to bicarbonate loss. Impaired calcium and phosphorus balance caused by low vitamin D3 and secondary hyperparathyroidism results in renal osteodystrophy, or renal bone disease, with bone and joint aches. Soft tissue calcification is another potential consequence.

Anaemia due to decreased RBC synthesis is another clinical characteristic. Hypertension develops as a result of decreased renal blood flow stimulating the renin angiotensin system, resulting in vasoconstriction. The resulting cardiovascular disease deteriorates renal function. Shortness of breath and weariness are other linked complaints. Anorexia, weight loss, gastrointestinal irritation, nausea, vomiting, and diarrhoea are all symptoms of azotemia and other metabolic abnormalities. Because of increased capillary fragility, subcutaneous nasal or gastrointestinal bleeding can develop. Mouth ulcers, taste abnormalities, neurological problems, and increased susceptibility to infection as a result of malnutrition are also prevalent.

Controlling symptoms, minimising consequences, and reducing disease development are thus the primary goals of CRF therapy, particularly nutritional management, which is covered next.

8.5.3 Dietary management

Feeding is difficult with CRF because anorexia and taste alterations limit food intake. Dietary management is primarily concerned with protein, salt, potassium, phosphate, water, and enough non-protein calories. Individual changes are required based on the patient's clinical profile, treatment, and reaction. Keeping in mind the overall goals of renal disease diet treatment, the following changes are required.

Energy: For adults, 2000-2500 Kcal/day is recommended, or 30-35 Kcal/kg/day, and for children, 100-150 Kcal/kg/day. If calorie intake is insufficient, endogenous protein catabolism and gluconeogenesis occur to provide energy and worsen uremia. As a result, 300-400 g of carbs are advised.

Protein: Protein must be limited. However, enough must be given to prevent tissue catabolism.A dose of about 0.6 g/kg/day is advised, however it must be adjusted based on diminishing renal function.A protein intake of 35-40 g/day (60-70% of high biological value protein) for a 60 kg adult with a high calorie intake can keep the nitrogen balance stable for lengthy periods of time while minimising azotemia. Patients who are unable to maintain adequate dietary intake with such a low protein intake can have their prescription increased to 0.8 g/kg/day. To provide all of the required amino acids, high biological value proteins from milk and eggs are advised.

Sodium intake will range from 500 mg to 2.0 g per day. Weight loss and decreased urine volume usually suggest a need for more salt, however sodium intake should be controlled if hypertension and oedema are present.

Potassium: Because the failing kidney cannot eliminate potassium adequately, consumption is limited to about 1500 mg/day (35 to 40 mEq/day). To keep blood potassium levels normal, potassium intake must be adjusted. If the serum potassium level is normal, there is no need to significantly limit potassium intake in the diet. Significant potassium losses might occur with acute vomiting and diarrhoea, necessitating cautious potassium supplementation.

Calcium and phosphorus: Calcium supplements (1-2 g/day) with a maximum of 1500mg from phosphate binders are indicated to maintain calcium and phosphorus balance and prevent or postpone renal bone disorders, while phosphate is limited to 800-1200 mg/day or 10-12 mg/g of protein. To limit absorption, phosphate binding agents may be utilized. Calcium carbonate supplements, if available, can assist buffer metabolic acidosis. To avoid soft tissue calcification, it is critical not to begin calcium supplementation unless phosphate is controlled.

Vitamin: Multivitamin supplements are recommended for a protein-rich diet of 40 g per day. Vitamin D3 supplements may be recommended based on need.

Fluid: Fluid consumption is determined by urine output and water balance. Fluid intake should be sufficient to encourage urine output for waste disposal while avoiding excessive fluid retention.

Check your progress Exercise 1

1. **Fill in the blanks for following statements:**
   a. ARF stands for _____
   b. Formation of kidney stone is known as _____
   c. _____ is a condition in which the kidneys have been damaged, leading protein from the blood to seep into the urine.
   d. To minimize edema, _____ consumption must be reduced.
   e. Acute renal failure is also known as _____ .
2. **What are the primary goals of dietary management in renal disorders?**
3. **What are the various causes of CRF?**

8.6 End stage renal disease (ESRD)

Do you know that in India, which has a population of over one billion people, around 100,000 people get ESRD? 90% of these people never see a nephrologist, and the 10% who do see one have difficulty affording the treatment.

End stage renal disease (ESRD) is a condition in which the kidneys have lost all or most of their ability to function with a GFR of less than 15ml/minute. There are now new and improved treatments for ESRD that replace the work of healthy kidneys. Dialysis - both haemodialysis (HD) and peritoneal dialysis (PD) - and kidney transplantation are the preferred treatments.

8.6.1 Dialysis

So, what exactly is the dialysis procedure? Yes, dialysis includes cleaning the blood of metabolic wastes using the principles of osmosis and diffusion.

In dialysis, a semipermeable porous membrane is used to separate the patient's blood, which contains excess fluid and metabolic wastes, from the hypotonic "dialysis fluid" known as dialysate. The metabolic waste and surplus water enter the dialysate via osmosis and diffusion. Large particles such as protein and

RBC cannot flow through the pores of the semipermeable membrane, while tiny water-soluble molecules can.

You may also recall learning about the two forms of dialysis. These are

a) haemodialysis and b) peritoneal dialysis.

A quick description of these two sorts follows.

Haemodialysis (HD) - A patient's blood is circulated outside the body via what is frequently referred to as a "artificial kidney machine" in this procedure. A hole is made to link an artery with a vein. Blood leaves the body by the artery, enters the dialyser, and returns to the body via the vein after purification.

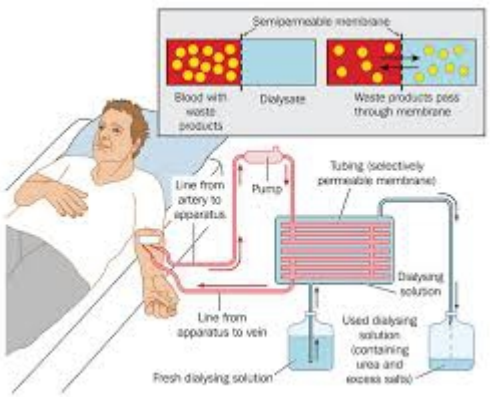

Figure 8.1 Hemodialysis

Peritoneal dialysis (PD) - In this procedure, the patient's peritoneum serves as a semipermeable membrane, and excess water and metabolic wastes are eliminated by injecting dialysis fluid into the peritoneal cavity, as shown in Figure 8.2. After a while, the fluid containing the metabolic waste is evacuated from the peritoneum. Peritoneal dialysis is less successful than haemodialysis and can result in the loss of intact big molecules.

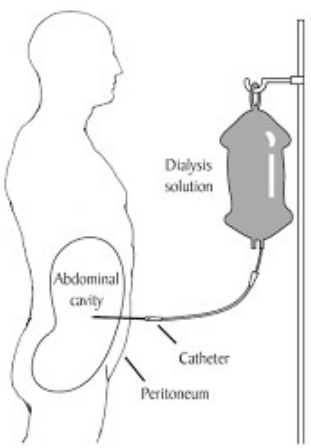

Figure 8.2 Peritoneal dialysis

Depending on the facilities available, continuous ambulatory peritoneal dialysis (CAPD) may be employed for long-term use. The dialysis fluid is switched 4-5 times per day in this procedure. It is also critical to prevent and control infection. Continuous cyclic peritoneal dialysis (CCPD) or intermittent peritoneal dialysis (IPD) may be employed in some instances.

The role of nutritional management during dialysis is then discussed.

8.6.2 Dietary management

Once dialysis is started, the diet in ESRD can be liberalised, with the goal of preventing the accumulation of metabolic wastes and water between treatments and maintaining biochemical equilibrium.

Thus, the goals of nutritional management are to maintain protein, energy, fluid and electrolyte balance, calcium and phosphorus balance, while compensating for water-soluble nutrient losses during dialysis.

Energy: To meet the body's needs while minimising tissue protein degradation, adults should consume up to 30-35 Kcal/kg/day and children should consume 100 Kcal/kg/day or more.

Energy requirements for peritoneal dialysis patients must be prescribed with caution.

Because, depending on the PD regimen, the dialysate also contains glucose, which can account for 300 kcal or more. The primary energy sources are fats and carbs. Because dialysis patients are predisposed to cardiovascular disease, some restriction of total and saturated fats may be required.

Protein: The demand is increased due to dialysis losses. A single dialysis treatment can result in the loss of 15-25g of protein. As a result, the protein need in haemodialysis is 1.2g/kg/day, and in peritoneal dialysis it is 1.2-1.3 g/kg/day, provided 50-60% of these are of high biological value; for example, milk, egg, fish, chicken, while potassium and phosphate levels are taken into account.

This protein intake helps to maintain positive nitrogen balance, replace losses, and prevent excessive nitrogen waste accumulation between treatments. In the event of significant losses, amino acid supplementation may be required.

Sodium: To reduce fluid retention and hypertension, a daily sodium intake of 1500 to 2500 mg may be permitted. This restriction aids in the prevention of pulmonary oedema and congestive heart failure caused by fluid overload. It is critical to test the kidneys' ability to manage sodium and water on a regular basis in order to calculate the intake.

Potassium: To prevent hyperkalemia, a daily dose of 1500-2500 mg of potassium is recommended. Potassium buildup can easily lead to heart arrhythmias or cardiac arrest.

Phosphorus: This may necessitate certain limitations. If blood phosphorous levels exceed 5.5mg/dl or PTH levels exceed 300 pg/ml, the daily need is 800-1200mg.

Minerals and vitamins: Because water-soluble vitamins and minerals are lost in the dialysate, they are routinely supplemented daily. Vitamins that are fat-soluble may be preserved.

As a result, all supplements, with the exception of vitamin D, are avoided. Mineral supplements such as calcium, iron, and zinc are advised.

Fluid: Fluid requirements are unique to each individual.Typically, 400-500 mL (basal losses) + urine output is advised. To maintain equilibrium, the fluid intake must take into consideration all sources of fluid input and output. Mild fluid retention is common between treatments.

Patient counselling and assistance is an important aspect of dietary management since it helps renal patients understand their dietary adjustments, which items they can eat and which they should avoid. Counselling regarding how to make limited diets more appealing can persuade patients to increase their dietary intake.

8.7 Nephrolithiasis (Renal calculi)

Renal calculi or stones can form in the kidney, pelvis, or ureter when the concentration of components in urine reaches a threshold that allows crystallisation. The production of stones is also known as nephrolithiasis or urolithiasis.

The kidney stone is depicted in Figure 8.3. Akidney stone is a solid mass made up of thousands of small crystals. There may be one or more stones in the kidney or ureter at the same moment. They are typically made up of calcium salt, uric acid, cystic acid, or struvite (a triple salt of ammonium, magnesium, and phosphorus). These chemicals can form stones of varied sizes when crystals of these substances are interleaved in an organic matrix or base.

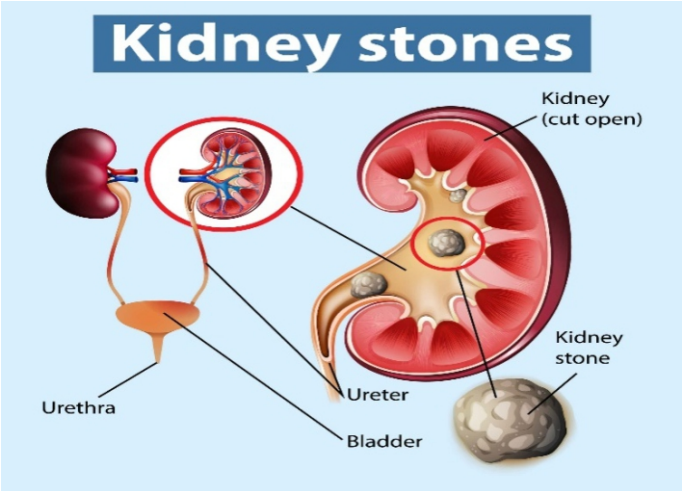

Figure 8.3 Kidney stone

8.7.1 Etiology

When urine becomes overly concentrated with specific compounds, kidney stones might form. These chemicals can form tiny crystals that grow into stones. Different sorts of stones form under various conditions. Although the specific aetiology of renal stones is unknown, several factors, particularly related to urine composition and urinary tract environment, may play a role directly or indirectly. Some probable etiological causes in various forms of calculi are listed below:

- Excess calcium, oxalate, hypervitaminosis D, hyperparathyrodism, extended bed rest, renal tubular acidosis, idiopathic hypercalciuria are all risk factors for calcium stones (oxalate, phosphate, and carbonate).
- Struvite stones are most commonly caused by a urinary tract infection (UTI).
- Uric acid stones are caused by impaired purine metabolism and increased uric acid excretion in the urine.
- Cystine stones are caused by a hereditary metabolic deficiency in renal tubular reabsorption.

Hot conditions cause overconcentration of urine, and variations in urine pH also predispose to stone development. Despite a high consumption of animal protein, vitamin B6 and magnesium deficiencies are thought to play a role in the formation of these stones.

Some stones have a tendency to run in families. Some varieties are linked to bowel disorders, ileal bypass surgery for obesity, or renal tubule abnormalities. So, whatever the aetiology of the kidney stones, it generates discomfort and the expected symptoms. These signs are emphasised next.

8.7.2 Clinical symptoms

The kidney stones may not cause symptoms until they migrate down the ureter and cause pain. The pain is usually strong and begins in the flank region before moving down to the groyne. The patient has blood in his or her urine, acute pain, weakness, and, in certain situations, fever. Laboratory inspection and chemical analysis can assist in determining the location, size, and principal constituents of stones in order to establish treatment.

So, what is the best way to treat or manage renal calculi? This will be covered in the following section, with a particular emphasis on dietary management.

8.7.3 Dietary management

The purpose of renal calculi treatment is to alleviate symptoms and prevent additional problems. As a result, treatment differs based on the type of stone and the severity of symptoms or consequences.

Kidney stones typically dissolve on their own. In the acute stage, stones less than 5 mm in diameter may pass in the urine by drinking large amounts of liquids, particularly water, and no additional treatment is required. Stones larger than 7 mm in diameter may necessitate surgical intervention or lithotripsy, a procedure that breaks down big stones and excretes them in the urine.

Although the function of nutrition in the production of urinary stones is not well established, it is recommended to drink enough of fluids, eat a balanced diet, and limit meals based on the main element of the stones. Table 8.2 contains information about various stones and the food restrictions that go with them.

Table 8.2 Different stones and their corresponding diet restrictions

Main constituent	Dietary restriction	Urinary pH
Calcium stones	Calcium – upto 600mg	Acid
Struvite stones	Low phosphorus diet	Acid
Uric acid stones	Low purine diet	Alkaline
Cysteine stones	Low methionine diet	Alkaline

Aside from adequate fluid intake and some dietary restrictions, urine pH regulation is beneficial dependent on the chemical composition of the stone, primarily through acidifying or alkalinizing medications or diet. Binding agents may also be employed to bind the stone ingredient.

Let us now look at the dietary origins of various kidney stone ingredients.

8.7.4 Dietary sources of various constituents of kidney stones

This section contains dietary sources of potassium, salt, calcium, oxalate, and uric acid. We begin our investigation with potassium dietary sources.

a. Sources of potassium

Potassium sources are listed in Table 8.3. Following this part, the methods or directions for leaching potassium are also highlighted.

Table 8.3 Sources of potassium in the diet (mg/100gm of food)

(0-100)mg	(101-200)mg	201mg and above
Tinda	Onion	Green leafy vegetables
Snake gourd	Cucumber	Peas
	Zucchini	Carrot
	Star fruit	Radish
	Capsicum	Ladies finger
	Bottle gourd	Bitter gourd
	Green mango	Field beans
	Raw papaya	Brinjal

Table 8.3 shows that it is not always possible to consume exclusively meals with low potassium content. As a result, we will now show you how to leach potassium and significantly lower its level in meals.

Methods for leaching potassium

Method I: Wash, peel, and cut veggies into small pieces using Method I. Soak for 2-3 hours in warm water. Remove the water. Cook the vegetables in a large amount of fresh water.Remove the water.

Method II: Peel and cut vegetables into small pieces. Bring a huge amount of water to a boil. Cook in a big volume of fresh water, discarding any surplus water. Remove any surplus water.

b. Sources of Sodium

Foods with a high salt level (which should be avoided):

- Baking powder with salt

- Sodium bicarbonate
- Canned, preserved, and processed foods such as processed cheese, sauce, margarine, and so on.
- Meat and yeast extracts, such as marmite
- Chips, nuts, popcorn, and biscuits with salt
- Salad dressings and sauces sold in stores
- Malted beverages such as Boost, Bournvita, and Proteinex.
- Flavour enhancers such as Monosodium glutamate (MSG).

c. Sources of calcium, oxalate and uric acid

Calcium

Calcium-rich foods include beans, cauliflower, egg yolk, figs, milk and milk products such as cheese, paneer, curds, molasses, and potatoes.

Oxalate

Cashewnuts, chickoo, chocolate, cocoa, custard apple, groundnuts, spinach, strawberries, tomatoes, and tea are all high in oxalate.

Uric acid

Fish herring, fish roe, salmon, sardines, kidney, liver, meat extracts and soups, and sweet bread are some of the products available.

Check your progress Exercise 2

1. What is ESRD?
2. Which are the two types of dialysis?
3. What are the different types of kidney stones?
4. What are the various methods to leach potassium from food?

8.8 Hypertension

As you can see from the preceding sections, hypertension is a substantial risk factor for cardiovascular and renal disease. It is the most prevalent public health issue and is often referred to as a silent killer. If left untreated, it might cause serious health problems. Many difficulties will result. We shall learn more about this medical condition in this part.

We've all felt our hearts beat on countless occasions. We can hear it better with a stethoscope. The sound you hear is ‘lup dup’. The first lup sound is the systolic sound, which happens as the heart contracts and

pushes blood into various parts of the body. This refers to the higher pressurerange known as systolic blood pressure (SBP), which is measured in millimetres of mercury (mm Hg). The sound dup represents the heart's relaxation period when blood enters the heart chambers.The lower blood pressure is shown by the diastolic blood pressure (DBP).

Table 8.4 Classification of Hypertension

Blood pressure range (mmHg)	Classification
120/80	Normal
120-139/80-89	Pre-hypertension
140-159/90-99	Stage 1 hypertension
≥160/≥100	Stage 2 hypertension

In contrast to many other disorders, hypertension develops slowly (without symptoms).

The cause of hypertension is unknown in 90% of instances. This is known as essential or primary hypertension. The other cases of hypertension have an identifiable cause and are classified as secondary hypertension. This suggests that hypertension is caused by another condition, such as diabetes, thyroid and adrenal gland issues, or kidney disease.

8.8.1 Etiology

We learned about the numerous risk factors for cardiovascular disease earlier in the unit.

We shall now discuss the causes of hypertension briefly.

1. **Genetic factors:** It is currently considered that there is polygenic inheritance, and that when environmental variables are not healthy, hypertension occurs.

2**. Body weight and height:** As weight and height grow, so does hypertension. Obese people have greater blood pressure levels as a result. Hypertension is exacerbated by an increase in BMI.

3. **Age:** Rises sharply with age. Scientists have discovered changes in BP. It is found in both teenagers and children.

4. **Gender:** Men have a higher rise than women, although the difference disappears after menopause decreases.

5. Factors that enhance **sodium reabsorption** can lead to hypertension.

6. Changes in the **rennin-angiotensin-aldosterone** system and adrenocorticoid and prolactin excretion may impact blood pressure.

7. Obese **hyperinsulinemia** may influence blood pressure susceptibility via renal salt reabsorption and transport.

8. **Dietary factors:** Too many calories, fats, especially saturated fat, and cholesterol can all raise blood pressure. Refined carbohydrates (sugars) may have an effect, however human studies are unclear. High fibre intakes (soluble fibre) are advantageous. A possible function for chloride, low potassium (K), and high salt diets is being investigated. Hypertension may be caused by a lack of calcium and magnesium in the diet.

9. **Modern lifestyle:** A sedentary lifestyle devoid of exercise, stress, smoking, nicotine consumption, and alcohol consumption all indicate to a rise in blood.

8.8.2 Management of Hypertension

The first line of treatment and management for primary hypertension is to change one's eating habits and lifestyle patterns. Patients who are unable to maintain near normal levels after dietary and lifestyle changes are given medicines. Even for such individuals, dietary management is critical in order to avoid drug dependency, side effects, and dose. We will now go into the nutritional management of hypertension in depth. But first, let us define the goals of nutritional management.

Objectives of treatment

The goal of nutritional management of hypertension is to:

- Achieve gradual weight loss in overweight and obese individuals and maintain weight slightly below normal levels,
- Reduce sodium intake and maintain fluid and electrolyte balance,
- Maintain adequate nutrition,
- Lead a healthy lifestyle (no smoking, alcohol consumption, but high physical activity), and
- Delay the onset of complications.

To achieve the aforementioned goals, we must first understand the dietary requirements during hypertension. Let's start with the calorie needs.

Energy: Calorie requirements should be calculated with the goal of maintaining an appropriate body weight in mind. Excess calories from fats and carbohydrates must be minimized in order to maintain weight.

Proteins: A normal protein intake is advised. Protein should supply 15-20% of total energy requirements. Excess non-vegetarian foods, particularly red meat and egg yolks, should be avoided because they contain a higher proportion of saturated fatty acids.

Fats: Dietary fats should be rich in unsaturated fatty acids and should not account for more than 20% of total energy (for further information, see dietary therapy of dyslipidemia).

Carbohydrates: Polysaccharides (complex carbs) should give 60-65% of the energy, rather than simple sugars (monosaccharides and disaccharides).

Let us now look at the most crucial aspect of dietary management: the intake of minerals and electrolytes, which are strongly related to blood volume maintenance. As we all know, hypervolemia causes increased artery pressure.

Minerals and electrolytes: Clinically important minerals and electrolytes include calcium, salt, and potassium. Let us go over them one by one.

- **Calcium:** Appropriate calcium intake is an important aspect of the treatment and can be obtained by consuming milk and milk products, green vegetables, as well as appropriate grains and pulses.
- **Sodium:** Studies have indicated that sodium restriction, coupled with weight loss, is useful in managing mild to severe hypertension, when combined with diuretics. Sodium is limited to 1-2 g per day, which amounts to 2.5-5 g of salt per day. This is calculated as grammes of sodium x 2.5 equals grammes of salt. 1 teaspoon of salt has approximately 2300 milligrammes of sodium.
  However, it is prudent to keep salt at a lower level (2.5 g) because the remainder of the sodium can be accounted for in a day's food.Different quantities of salt consumption can be recommended depending on the severity of hypertension. These are as follows:

  Mild Sodium Restrictions: 2-3 g sodium (2000-3000 mg). Salt may be used sparingly in cooking, but no salt is permitted at the table. Natural occurring fresh foods are not restricted, however processed foods should be avoided.

  Moderate Sodium Restrictions:1 g sodium (1000 mg) is a moderate sodium limitation. In addition to the restrictions listed above, limited control over naturally occurring fresh foods and no

salt in cooking are imposed. Avoid canned vegetables and baked goods.Meat and dairy products are used in moderation.

Strict Sodium Restrictions: 0.5 g sodium (500mg).Aside from the limits listed above, meat, milk, and eggs are permitted in limited quantities.0.25 g sodium (250 mg) is the severe sodium limitation. This level is extremely rigid, nutritionally deficient, and unrealistic to be employed in practice.Only a small amount of meat and eggs are used in this recipe.

Potassium: Increasing potassium intake decreases blood pressure and improves hypertension. This could be accomplished by eating more fruits and vegetables, which are high in potassium and fibre.

Fluids: Fluid restriction is only required if edema is present. Some diuretic patients may experience dehydration. As a result, normal amounts of fluids, particularly basic drinking water, can be consumed.

Thus, keep the following elements in mind when developing a hypertensive patient treatment plan:

- Avoiding smoking, cigarette use, and excessive alcohol consumption are all examples of lifestyle adjustments.
- Physical activity, such as walking for 40 minutes four times a week, is beneficial.
- Medications such as Diuretics, calcium channel blockers, and other medications should be taken on a regular basis.
- A hypertensive's diet should be healthful and well-balanced. It should be modest in calories and fat (if necessary), with a moderate protein level. It should have a low salt content but be high in potassium, calcium, magnesium, and fibre.
- The DASH diets are now recommended. These are high in fruits and vegetables, low in total and saturated fats, and high in whole grains.

This concludes our explanation of hypertension.

Check your progress Exercise 3

1. **State true or false for following statements:**
   a. Unit of hypertension is mg/dl
   b. Hypertension is the most prevalent public health issue and is often referred to as a silent killer.
   c. Obesity and hyperinsulinemia may influence blood pressure.
   d. Potassium supplementation may increase blood pressure.
   e. Fluid restriction is required if edema is there.

2. **What are the goals of nutritional management for hypertension?**
3. **How dietary factors can contribute for hypertension?**

8.9 Let us sum up

We learned in this lesson that the kidney has many functions, including excretory, endocrinal, and metabolic. The kidney regulates blood fluid, electrolyte balance, volume, pH, and osmolality. Toxins and metabolic waste products are produced. The kidneys re-absorb important nutrients that are discharged from the body.

Furthermore, the unit concentrated on kidney problems. These disorders impair the kidneys' ability to execute their duties. Glomerulonephritis, nephrotic syndrome, acute renal failure, chronic renal failure, and renal calculi are frequent disorders in which nutrition plays an essential role. We discovered that these disorders are caused by a variety of etiological causes, and that clinical symptoms and biochemical markers govern nutritional therapy.

The primary goals of dietary management are to lower the excretory strain of the kidney and to avoid the progression of renal damage while maintaining a sufficient nutritional status and close to normal fluid, acid-base, and electrolyte balance. To achieve these goals, dietary changes are primarily required for protein, salt, potassium, hydration, calcium, and phosphate.

The fundamental goal is to keep the body's internal environment stable. In the event of inadequate oral consumption, commercially available supplements on the market may be required. Dialysis or kidney transplants are recommended when kidney function fails.

Finally, the section concentrated on renal calculi. Patients with kidney stones must be treated according to the type of stone, and food therapy is then prescribed. Thus, dietary therapy will be heavily influenced by the kind of renal disease as well as biochemical and clinical signs.

8.10 Glossary

Anuria: It is defined as a complete lack of urine output.

Anorexia: It is characterized by a decrease of appetite.

Ascites: It is a fluid buildup in the abdominal cavity.

Azotemia: It is defined as an abnormal accumulation of urea, uric acid, creatinine, and other nitrogenous wastes.

Dialysate: a dialysis solution used to eliminate waste materials and excess fluid from the blood.

Diuretic: It is a substance that promotes urine secretion.

Oedema: It is the swelling of tissues.

End-Stage Renal Disease: A condition in which the kidney is unable to eliminate waste products, maintain fluid and electrolyte balance, or create hormones.

Haematuria: Blood in the urine.

Hyperkalemia: It is characterised by elevated potassium levels in the blood.

Hypoproteinemia: It is defined as low protein levels in the blood.

Nephrotic syndrome: It is a disorder characterized by severe oedema and proteinuria, hypoalbuminemia, hypercholesterolemia, and aberrant bone metabolism caused by a loss of the glomerular barrier to protein.

Oliguria: It is defined as a urine output of fewer than 500 mL per day.

Osmosis: The passage of a solvent through a semipermeable membrane to separate solutions of varying concentrations. Water is commonly used as a solvent.

Renal failure: It is the inability of a kidney to discharge wastes on a daily basis.

Uremia: It is a clinical illness characterized by weakness, nausea, vomiting, muscle cramps, metallic taste, and, in certain cases, neurological damage.

UNIT 9 MEDICAL NUTRITION THERAPY FOR FEVER

STRUCTURE

9.1 Introduction

In this section, we will discuss defense mechanisms as well as the significance of nutrition in managing fevers and infections caused by immune system dysfunction.

Examine the two examples below to get a sense of the types of challenges we'll be dealing with in this unit.

Case 1: Neema is a laid-back 21-year-old college student who enjoys munching and testing out different types of food, from "dhabas" to "branded" ones. She became ill this monsoon... She had a fever that she had never tracked before, but it continued climbing day by day. She was anorexic, bloated, and complained of abdominal cramps and diarrhoea. She lost a lot of weight. What do you believe the issue is with Neema?

Case 2: Mukesh is a workaholic. He lives at the train station's nearby hutments, which have poor drainage, lighting, and ventilation. He has recently been suffering from upper respiratory infection (cold, cough, and moderate fever). This has been going on for a year now. He is now feeling weak, and his cough has worsened, with thick sputum and occasionally blood in the sputum. What do you believe mukesh is going through?

- What factors/conditions have contributed to Neema and Mukesh's current situation?
- What is the primary distinction between the two situations presented?
- How do the two scenarios differ in their management?

These are some of the questions addressed in this unit.

As you are undoubtedly aware, infection causes a slew of unfavorable physiological changes that must be addressed by correct nutrition. What are the different types of infections/fevers? What metabolic changes occur under these circumstances?

These are the topics we will cover in this unit. Finally, we will look at the etiology, clinical symptoms, and dietary therapy of several illnesses, such as typhoid and HIV-AIDS.

Objectives

After completing this unit, you should be able to:

- Discuss the various defense mechanisms in the body that protect us from infections,
- Explain the relationship between nutrition and infection,

- Distinguish 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.

9.2 Nutrition and infection

Nutrition and infection interact synergistically, with nutritional inadequacy lowering resistance to infection and infection exacerbating existing malnutrition.

Chronically malnourished people not only succumb to infection more easily, but they also take longer to recover than well-nourished people. A number of studies have been conducted to demonstrate the precise involvement of nutrients such as vitamin A, vitamin C, vitamin E, omega 3 fatty acids, trace minerals such as iron, and zinc in the maturation, number, and/or activity of T and B cells. These have an impact on both cellular and humoral immunity.

Malnutrition, poor immunity, and infection can form a trio or vicious cycle that works synergistically to aggravate an individual's condition. For example, if a typhoid patient is not given adequate nutritional assistance, his nutritional status will deteriorate and he may develop nutrient deficiencies, which will harm his immune system. A weakened immune system would make you more susceptible to infections.

9.3 Metabolic changes during infection

When the body temperature rises above normal (98.4°F or 37°C) owing to infection, various metabolic changes occur in the body, increasing dietary requirements. The following are some significant changes:

1) In cases of severe infection with fever, the Basal Metabolic Rate (BMR) rises. Every 1°F increase in body temperature causes a 7% increase in BMR, while every 1°C increase causes a 13% increase in BMR. Energy requirements are predicted to be 20% higher than BMR for mild diseases and 70% higher than BMR for severe infections. Injury factors might also be included when calculating the actual calorie expenditure.
2) Higher sweating, vomiting, and diarrhoea may result in higher nutrient losses. The body loses minerals such as sodium, potassium, zinc, magnesium, and phosphorus.
3) Infection and fever create a catabolic (breakdown) condition in the body. Infection is often associated with a state of physiological stress. The body reacts to stress by increasing the levels of numerous hormones to fulfil the increased demands (Acute Phase Response). Furthermore, higher insulin levels and insulin resistance at the cellular level reduce the body's capacity to use carbs as

a substrate for energy. As a result, the body prefers protein breakdown (catabolism) followed by fat breakdown (lipolysis) as the primary substrate for supplying energy requirements.

4) Infection and fever are almost always accompanied by anorexia (loss of appetite), which limits food intake, resulting in lower energy intake, which is insufficient to satisfy the increased energy requirements. As a result, weight loss occurs, which is especially noticeable in severe infections.
5) Nutrient absorption is also reduced when there are intestinal illnesses.
6) Excessive sweating and urine result in additional fluid and electrolyte loss.
7) This could be the result of a serious infection with a high fever. Sweating occurs in reaction to a high fever, while urine output increases to eliminate nitrogen wastes created by catabolic activity.
8) Increased energy consumption causes a considerable decrease in glycogen and adipose tissue reserves.

Changes in appetite, increased energy needs, protein losses owing to catabolic activities, fluid or electrolyte loss due to perspiration, vomiting and diarrhoea, or poor absorption of specific nutrients all contribute to weight loss.

Poor eating habits cause weight loss, especially if the infection is severe. As a result, illness may have a major impact on nutritional status.

9.4 Classification of infection

Infections and fevers are divided into two types.

Acute infection: Acute fevers are short-lived with acute symptoms, and the body temperature can climb above 104°F. Chickenpox, tonsillitis, influenza, pneumonia, typhoid, and malaria are examples of such illnesses.

Chronic infection: These are usually of a longer and more persistent duration.The patients have a history of recurring bouts or periods of infection. As with tuberculosis, such an infection may be accompanied by a low-grade fever that lasts for several months. Thus, chronic fever is one that has a delayed, gradual development and may be of low severity.Tuberculosis, HIV infection, and AIDS are all examples of persistent fever infections.

9.5 Etiology

Fevers can be caused due to,

1. Internal factors: This could be caused by something in the body. Antigen-antibody responses, malignant malignancy, and graft rejection are among examples.
2. External factors: These are caused by bacteria, fungus, viruses, and other organisms that infiltrate the body. The source of the problem is external to the body.

9.6 Typhoid

Typhoid fever is also known as enteric fever because the infection or bacterium is discovered in the intestines and binds to the epithelium of the intestinal wall, where it multiplies or eventually reaches the blood, causing damage and an increase in body temperature.

Typhoid is an enteric fever, which refers to a short-term acute infection. Salmonella typhosa is the bacteria that causes it.

This infection spreads primarily through the fecal-oral pathway. The drinking water, milk, and food are contaminated by the intestinal contents (through faeces and urine) of the patients or "carriers" or by flies that transmit the disease. It can affect people of various ages, but it is more common in children. Because of improved sanitation, vaccines, and efficient medications, the incidence and severity of typhoid fever have been considerably reduced in the current setting.

It is critical that you understand that this fever has a number of negative impacts on the body because it is particularly catabolic in nature, creating weakness and a compromised state of nutrition, resulting in significant weight loss.

9.6.1 Metabolic changes in fever

1. Massive loss of lean body mass or muscle tissue due to tissue breakdown (250-500 g muscle tissue lost per day), resulting in high nitrogen losses.

2. Due to increasing energy demands, glycogen stores in the body are rapidly drained.

3. The gastrointestinal tract is inflamed and unpleasant because the Peyer's patches of the gut are the site of typhoid infection. The bacteria clings to the epithelium of the intestinal wall, penetrates and multiplies in the mesentery lymph nodes, and finally enters the bloodstream, causing secondary infection of the intestines.

4. Excessive diarrhoea, vomiting, and sweating might result in significant fluid and electrolyte loss.

5. Intestinal ulcers and bleeding can result from GI tract inflammation.

9.6.2 Clinical signs and symptoms

1. A fever that is graded on an ascending scale.

2. Constipation, cramping, and diarrhoea.

3. Vomiting and anorexia.

4. Internal bleeding and melena (gastrointestinal bleeding and black tarry stools)

9.6.3 Dietary management

"Feed the fever" is the golden rule in fever dietary management.

Because enteric (typhoid) fever is accompanied by anorexia, vomiting, and high grade fever, the diet must be varied according to the patients' tolerance.

It is necessary to persuade the patient to eat. Tolerance is improved by feeding numerous times each day. The texture of the foods provided would be determined by the severity of the infection.

Foods that are bland, low in fibre, and soft are helpful.

The enteric diet is based on the following nutritional principles: high calorie, high protein, high carbohydrate, moderate fat, high fluid, low fibre, and soft diet.

Energy: Fever is characterized by an increase in BMR, which increases caloric requirements. The increase in calorie requirements is determined by the severity of the infection and the degree of temperature rise. There is a decrease in hunger and tolerance owing to enteric illness during fevers, thus a desired increase in calories is 10-20% above the typical suggested requirements. The real intake can be regulated and given based on the tolerance of the patients.

Protein: Typhoid causes enormous tissue loss, which increases the need for protein. As a result, protein intake should be raised above the normal of 1g/kg/day to 1.5-2g/kg/day. To promote efficient protein utilization for anabolic or tissue building goals, a high protein diet should be accompanied by a high carbohydrate intake. Foods with significant amounts of high-quality protein (high biological value) should be consumed in large quantities. Protein supplements should be used to increase nutrient density without increasing the bulk of the diet.

Carbohydrates: Carbohydrates should give around 60% of total calories. Carbohydrates that are thoroughly prepared and quickly digestible, such as simple starches, glucose, honey, and jam, should be included because they require significantly less digestion and are well assimilated. Because glucose is less

sweet than sucrose and adds to overall calorie intake, it can be supplemented in a variety of beverages/light desserts.

Dietary fibre: The intestinal mucosa of a typhoid patient is irritated, which can readily perforate and ulcerate, resulting in internal bleeding. Thus, high-fiber foods such as certain green leafy vegetables, whole pulses or cereals, thick skins or fruits or vegetables, and so on, must be avoided. (These are high in soluble fibre). Soluble fibres can be administered.

Fats: Fats should be consumed in moderation. This is owing to the typhoid patient's impaired capacity to digest and assimilate due to peyer's patches (prolonged thickening of the intestinal epithelium), which causes diarrhoea.

Fats serve to increase the energy density of food without increasing the bulk of the diet, however the kind of fat must be emphasised. Dairy fats, such as butter, cream, fats in milk products, egg yolk, and so on, aid digestion since they include medium chain triglycerides. Excessive fat in cooking, as well as consuming fried foods, can worsen nausea, hinder digestion, and result in severe diarrhoea. These are must be avoided.

Minerals: Diarrhoea results in electrolyte and water loss. Thus, reducing sodium consumption through salty soups and beverages is desired. Potassium intake can be raised by eating more cooked fruits and vegetables, as well as washed and dehusked pulses. Food preparations such as juices, stews, soups, and dalwater are advantageous.

Other minerals that are important include iron, which is especially important if blood is lost owing to intestinal haemorrhage. Zinc and chromium losses have also been recorded.

Vitamins: B complex vitamins should be prioritised, given the increased energy demand and the intestine's lower ability to absorb and synthesise some of the B complex vitamins due to weakened digestive processes and changed microbial flora. Antibiotics are therefore prescribed. Furthermore, vitamins A and C are required to increase immunity, promote wound healing, and maintain the integrity of the epithelial membrane (gut mucosa). When the patient is anorexic and has a limited food tolerance, vitamin supplements may be administered in the early stages of the infection.

Fluids: To compensate for fluid losses from the body, a high fluid intake is recommended.

A daily hydration intake of 2.5 to 3.5 litres is suggested. Aside from ordinary water, fluid intake can be achieved through a range of beverages, soups, juices, broths, and dal. Adequate fluid intake aids in the elimination of waste and the maintenance of water balance in the body.

Remember to incorporate the following foods:

- Juices, soups, dal water, and broths.
- Refined cereals and their derivatives (for example, maida, rava, bread, rice, noodles, cleaned dals, pureed vegetables, and stewed fruits). These foods are poor in soluble fibre.
- Eggs, cottage cheese, steamed or roasted chicken, and fish. These contain proteins with great biological importance.
- Fruit juices, gelatin, honey, sugar, and milk products are all examples. Desserts high in calories and protein could be made.

Foods to be prohibited:

- Excessive milk and milk products, as well as dairy fats such as cream and butter

Foods to be avoided:

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

Check your progress Exercise 1

1. **Fill in the blanks for following statements:**
   a. Malnutrition, _____, and infection can form a trio or vicious cycle.
   b. Normal body temperature is _____°F.
   c. Breakdown of fat is known as _____.
   d. Chickenpox and influenza are examples of _____ infection.
   e. Bacteria _____ is responsible for typhoid fever.
2. **Describe classification of infections.**
3. **What are the metabolic changes takes place in typhoid fever?**

9.7 Tuberculosis

Tuberculosis is a long-term infectious disease caused by the bacteria Mycobacterium tuberculosis. It most usually affects the lungs, but it can also affect other organs such as the lymph nodes, kidney, bone, and so on. Pulmonary tuberculosis is the most common type of tuberculosis in India.

Previously, tuberculosis was thought to be limited to lower socioeconomic strata due to inadequate hygiene, sanitation, and food quality. In the current context, tuberculosis is becoming more common in people from upper socioeconomic strata as well. In most situations, a strong genetic history is revealed.

This disease manifests itself in two stages: acute and chronic

The acute stage of the condition is quite similar to acute fever, and the chronic stage is very similar to chronic fever. Because the chronic phase is accompanied by low-grade fever, the increase in metabolic rate is not as pronounced. The prolonged disease results in the wasting of body tissues.

9.7.1 Salient Features of Pulmonary Tuberculosis

The acute phase is similar to pneumonia with a high temperature. The chronic phase is characterized by low-grade fever, tiredness, cough, expectoration, and weight loss. The condition may advance slowly, with the cough gradually worsening. This can result in pulmonary blood vessel erosion. The tubercle germs may then get access to other body organs, generating multiple secondary foci of infection.

9.7.2 Dietary management

You must be aware that the majority of tuberculosis patients are emancipated and malnourished. Proper food management during and after the infection is critical to ensuring complete treatment, proper rehabilitation, and recurrence avoidance. Let us go over the patient's energy and nutrient requirements.

Energy: The body weight status, together with the rise in body temperature, is used to determine energy intake. Given that the BMR is not significantly higher in the chronic stage of the condition, energy intake may be increased by 300-500 Kcal/day over the typical recommended consumption.

Protein: Achronic infection is distinguished by a protracted period of fever. This causes muscle atrophy, increased nitrogenous loss, and a subsequent drop in serum albumin levels. As a result, a substantial protein intake is required throughout the chronic stage of the condition. A protein intake of 1.2 to 1.5 g/kg body weight per day is recommended. To promote effective utilization, the emphasis should be on energy and protein dense diets combined with high biological value of protein rich sources. If the disease is found in poor socioeconomic groups, inexpensive protein-dense foods such as pulses, soya, and nuts in combination with coarse cereals for mutual supplementation may be chosen.

Carbohydrates: Carbohydrate sufficiency will also promote optimal protein utilization. A total caloric to nitrogen ratio of 150:1 should be achieved in a high calorie, high protein diet to promote anabolism. Carbohydrate, the body's main energy substrate, has a protein sparing impact.

Fats: Fats contribute to the diet's calorie density. Fat digestibility (medium chain triglycerides and emulsified fats are preferable) and fat-based preparations should be taken into account.

Vitamins: Preformed vitamin A or the retinol form of vitamin A should be emphasized in the diet of TB patients because vitamin A metabolism is impaired. Carotene appears to convert poorly to vitamin A. Given that the retinol form is limited to milk, milk products, dietary fats, and animal foods, a vitamin A supplement may be advised.

The B-complex vitamin demand increases as the energy requirement of the tuberculosis patient grows. The B complex group's most notable members are pyridoxine, folic acid, and vitamin B12.

Neuritis (inflammation of the peripheral nerves) can be avoided by taking 50 to 100 mg of pyridoxine per day. Folic acid and vitamin B12 are also included.

Vitamin C promotes collagen formation and aids in the healing of tubercle lesions. Foods high in vitamin C, such as amla, guava, drumsticks, cabbage, capsicum, and citrus juice, should be incorporated freely in the diet of tuberculosis patients.

Minerals: Calcium consumption should be increased because it is required for the healing of TB lesions. It is recommended that patients consume half a liter to one liter of milk in various ways that are well accepted by them. Calcium supplementation (500 mg/day) with active vitamin D may also be recommended.

Iron deficiency may be a concern in cases of blood loss caused by expectoration or haemorrhage. Haemoglobin levels in the patient should be checked. The diet should be adapted to the individual's requirements. Iron supplementation is advised if blood haemoglobin levels are low.

Zinc and chromium are two more important minerals. These minerals serve to strengthen the immune system. These are lost in TB patients.

Foods to be included:

- Cereals (such as ragi, jowar, and bajra).
- Pulses (including black channa, chawli, moth, and rajmah).
- Oilseeds and nuts.
- Methi, chaulai, mint, spinach, cabbage, drumstick leaves, colocasia, and cauliflower greens are examples of green leafy vegetables.
- Fruits of citrus (guava, amla, capsicum).
- Milk and dairy products.

- Sugar and jaggery.

Foods to be restricted:

- Excess fat, fried foods, organ meats (liver, kidney, brain), red meat, and refined sugars are all bad for you.

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

Another example of a chronic infection is HIV/AIDS. Its presence was very recently discovered in 1981. HIV infection is widely distributed and can escalate to AIDS. It has been proven that it is caused by a retrovirus because it is one of the most feared viruses and is spreading rapidly. Let us learn a little more about it.

9.8.1 Stages of HIV infection

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

1. Acute HIV infection
2. Asymptomatic HIV infection
3. Symptomatic HIV infection
4. AIDS

Acute HIV infection

This period lasts 4 to 7 weeks following the initial illness. During this time, the virus replicates rapidly, and the infected person develops an acute syndrome that includes fever, malaise, pharyngitis, headache, lymphadenopathy syndrome (swollen, firm, and sometimes tender lymph nodes), influenza, or lymph node cancer; and myalgia (muscle pain/weakness).

Asymptomatic HIV infection

Asymptomatic HIV may manifest with relatively little visible symptoms. This stage could last up to ten years. Subclinical signs such as a loss in lean body mass without an apparent change in weight have been recorded. There is an increased sensitivity to infections found in food and drink.

Symptomatic HIV

The AIDS-defining symptoms arise in this. Nutritional condition and body composition may deteriorate. Fevers, sweating, skin issues, and weariness are all possible.

AIDS

The term AIDS refers to a group of potentially fatal clinical diseases caused by HIV-induced immune deficiency. A small percentage of HIV-positive people will acquire AIDS within months of being infected. AIDS is the final stage of HIV infection. Bacterial, viral, fungal, and protozoal infections are prevalent. They are frequently responsible for diarrhoea, malabsorption, fever, and weight loss. Cancer, such as Kaposi's Sarcoma, and neurological diseases (HIV enrephalopathy) myelopathy.

Many additional organs, including the gastrointestinal tract, liver, kidney, and pancreas, can be damaged. Mycobacterium avium complex can be found in patients' lymph nodes, liver, bone marrow, blood, and urine. The majority of cases are caused by tuberculosis of the lungs. Many patients get acute renal failure. As a result of AIDS enterophathy, chronic diarrhoea may persist in the absence of identified enteric pathogens.

Malnutrition is a significant AIDS consequence. Protein energy malnutrition manifests as weight loss, a decrease in body cell mass, a drop in skinfold thickness, a decrease in midarm circumference, a decrease in iron binding capacity, and hypoalbuminemia. It is typical to hear about AIDS wasting syndrome.

The underlying cause of AIDS is primary HIV infection. This infiltrates the genetic code of CD-4 cells, also known as T helper lymphocyte cells. Infection spreads from infected person to infected person by body fluids such as blood, sperm, vaginal secretions, lymph system, and central nervous system. The virus (HIV) induces increasing CD-4 cell depletion. This results in immunological dysfunction and other problems, eventually leading to AIDS. Breast milk, saliva, tears, and urine all carry sufficient virus to infect humans. Unprotected sex, sharing contaminated needles, and passing infected body fluids through the placenta to the newborn are all common methods of coming into contact with infectious body fluids. When working with bodily fluids, workers must take steps to protect themselves and others.

The virus is not spread through casual contact, such as touching, hugging, kissing, or sharing utensils, glasses, and so on.

9.8.2 Dietary management

Energy: Energy requirements vary according to the individual's health status at the time of HIV infection, the advancement of the disease, and the development of comorbidities that impede nutrient intake and utilization. Activity can also have an impact on energy usage. The energy level rises in proportion to the activity. In the event of a fever, the calorie intake should be increased further to prevent weight loss.

Protein: High protein diets may promote positive nitrogen balance and lean body mass repletion while remaining safe. More research is needed to determine whether high protein diets can restore HIV-related malnutrition and body composition abnormalities. Given the increased protein requirements, an intake of 1.0 to 1.4 g/kg for maintenance and 1.5 to 2.0 g/kg for repletion has been recommended. Protein restriction is only advised in people with severe hepatic or renal impairment.

Fats: A modest fat intake is advised for an HIV patient to increase the caloric density and palatability of the food provided. Fat tolerance varies from individual to person. According to studies, the usage of medium chain triglyceride (MCT) oil is superior to long chain triglyceride (LCT) based supplements in terms of decreasing stool fat and nitrogen content, as well as reducing the number of bowel movements and abdominal symptoms. MCTs are easier to absorb than long chain triglycerides. Fish oil (omega 3 fatty acids) combined with MCT oil may boost immunological function since this combination is less inflammatory than omega 6 fatty acids.

Fluids and electrolytes: Fluid requirements in HIV-infected people are similar to those in the general population, and are calculated to be 30-35 mL/kg (8-12 cups for adults), with additional amounts to compensate for losses due to diarrhoea, nausea and vomiting, night sweats, and prolonged fever. In the context of vomiting and diarrhoea, electrolyte replacement (Na, Kand Chloride) is also advised.

Vitamins and minerals: Although the precise vitamin and mineral requirements are unknown, increased intake of the following micronutrients is advised: -carotene, vitamin E, ascorbic acid, vitamin B12, vitamin B6, and folic acid. It is also recommended to take a vitamin mineral supplement that contains 100% of the RDA.

Water safety: HIV/AIDS patients are vulnerable due to immunological suppression.

As a result, water-borne diseases are a worry. Water safety is critical. Boil water, filter tap water, and use boiled water wherever practical.

Symptoms related with drugs, malnutrition, and malabsorption have been observed in HIV and AIDS patients.

9.8.3 Nutritional Considerations for Children Suffering from HIV

Children under the age of five are among the most vulnerable to HIV infection. This is especially crucial because almost one-fifth of the world's population is between the ages of 10 and 19, and HIV can be passed from the mother to the foetus.

Nutritional issues in HIV-infected infants and children are associated with:

- Poor growth/weight gain
- Impaired immunological function and recurrent infections
- Depressed gastrointestinal tract function (malabsorption of fat, protein, and carbs even in the absence of diarrhoea).
- Malnutrition with numerous dietary deficiencies
- Dysregulation of lipid metabolism and the fat redistribution syndrome
- Poor appetite, limited food preferences, and takes a long time to eat.

Before designing a meal plan for HIV-infected children, a nutrition assessment is critical. Because developmental delays might occur, the infant/child's developmental age, rather than their actual age, should be considered to determine the best textures, feeding position, and utensils. As a dietician, you must aim to discover the type/timing of meals that the kid/caregiver can manage, particularly the time (length) the child takes to eat a given meal.

The nutrient requirements of young patients can be significantly higher than those of adults.

- Because of their movement, fever, and catch-up growth, their energy requirements increase by 100%. Height for age data can be used to estimate energy requirements in children with restricted growth.
- Protein requirements rise by 150% to 200% beyond the recommended dietary amount to counterbalance nutritional demands imposed by HIV infection and to support sufficient infant/child growth/development.
- The vitamin and mineral requirements of paediatric patients are unknown.
- However, because micronutrient supplements are generally not suggested, it is recommended to enhance intake by 100% through the absorption of natural foods.
- Alternative feeding methods, such as gastrostomy, may be required. Semi-elemental or elemental formulae, as well as age-appropriate sip-feed supplements, may be used to complement or substitute the patient's diet.
- Paediatric patients with low appetites should be fed modest frequent meals with palatable snacks in between. Prevent youngsters from drinking excessive amounts of water or beverages before meals.
- HIV-infected children may take their time eating meals at times. In such cases, keep meal times to no more than 30 minutes. Encourage completion with praise and extra food if desired.
- When introducing new foods to infants, caution must be exercised. Keep a close eye on the youngster for any signs of allergic response.

9.9 Novel Corona Virus Disease 2019 (COVID 19)

Coronavirus disease 2019 (COVID-19) is a contagious virus-borne illness caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first known case was discovered in December 2019 in Wuhan, China. The disease soon spread throughout the world, resulting in the COVID-19 pandemic.

Coronaviruses are a type of virus that can cause sickness in both people and animals. Several coronaviruses can cause respiratory infections in humans, ranging from the common cold to more serious disorders including Middle East Respiratory Syndrome (ERS) and Severe Acute Respiratory Syndrome (SARS) (https://www.who.int). SARS-CoV-2, the most recently found coronavirus, has produced a potentially devastating global pandemic- COVID-19.

The most prevalent COVID- 19 symptoms are fever, dry cough, and shortness of breath. Other symptoms that are less prevalent include sore throat, diarrhoea, pains, nasal congestion, conjunctivitis, loss of taste or smell, and a skin rash. Older adults and those with underlying medical conditions such as high blood pressure, heart and lung difficulties, diabetes, or cancer are at a higher risk for consequences.

Transmission

Close contact with respiratory droplets while coughing or sneezing allows the virus to spread from person to person. These viruses can persist on surfaces and objects for varying lengths of time. As a result, proper hygiene, hand washing, and food safety practices are critically necessary.

9.9.1 Nutrition and COVID-19

The interdependence of immunity and infection is well recognized and has been covered before in this chapter. A healthy dietary status is essential for maintaining a strong immune system, especially when confronted with a pandemic situation such as COVID-19. There is no specific meal that protects against infectious diseases. As a result, it is advised to maintain a healthy and well-balanced diet that includes foods from various food groups such as whole grains, legumes, vegetables, fruits, nuts, and animal source foods such as milk and its products.

Micronutrients are essential for a healthy immune system, and they should be obtained through a nutritionally balanced and diverse diet wherever possible. Vitamin C, Vitamin D, and Zinc are examples of immune-boosting micronutrients. Vitamin A, Vitamin E, Selenium, Omega 3 fatty acids, and B group vitamins are some other nutrients that may be beneficial. Plant phytonutrients (derived from plant meals) may have antioxidant, anti-inflammatory, and antiviral properties.

Fruits and vegetables are the most important food groups for providing our bodies with vitamins, minerals, and fibre needed to sustain good health and optimal immunological function. It is best to eat a range of colourful fruits and vegetables since they contain varied combinations of vitamins, minerals, and phytochemicals. However, if one is unable to obtain the necessary nutrients through diet, micronutrient supplementation (in conjunction with a medical practitioner) is indicated to improve the immune system.

Check your progress Exercise 2

1. **State true or false for following statements:**
   a. Patients suffering from tuberculosis are generally malnourished.
   b. Vitamin A promotes collagen formation and aids in the healing of tubercle lesions.
   c. There are five stages of HIV infection.
   d. COVID 19 infection is contagious in nature.
   e. Fruits and vegetables are having protective effects against infections.
2. **What are the salient features of pulmonary tuberculosis?**
3. **Micronutrients plays important role in COVID 19. Justify sentence.**

9.10 Let us sum up

We learned about our body's defense mechanisms in this unit. As you may know, the defiance mechanism includes both generalized and specialized lines of defense, which include cell-mediated and humoral responses.

We next moved on to infections and fevers. We discovered that infection and fever can coexist here. As you may have noticed, fevers differ depending on the type of infection. Acute and persistent infections are both possible.

Typhoid and malaria are examples of acute infections/fevers, whereas tuberculosis and HIV/AIDS are examples of chronic infections. We learned about the aetiology, medical treatment, and nutritional therapy for each of them. Finally, we concentrated on metabolic abnormalities, accompanying symptoms, dietary adjustments (due to drug and nutrient interactions), and a short list of items to include and exclude, among other things.

9.11 Glossary

- **AIDS (Acquired Immune Deficiency Syndrome:** a state of HIV infection combined with a CD-4 Deficiency Syndrome), dementia, wasting syndrome, malignant illness, or one of 26 opportunistic diseases.

- **Asymptomatic HIV infection:** people who have no previous indications or symptoms that would place them in group III or IV.
- **Basal Metabolic Rate**: the amount of energy required to keep the body operating at rest.
- **Cachexia:** It is characterized by widespread weight loss, wasting, and a decrease in bodily and mental energy.
- **Candidiasis:** It is a condition caused by a yeastlike fungus that affects the skin and nails.

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UGHN-109
DIET THERAPY

BLOCK
4

MEDICAL NUTRITION THERAPY FOR FOOD ALLERGY AND CANCER

Block 4 Medical Nutrition Therapy for Food Allergy and Cancer

The number of diseases that can be treated with nutrition intervention rises as knowledge base expands. The availability of complex feeding and nutrient-supplementing techniques places more duty on those who provide nutrition care.

These problems can be avoided or at the very least well controlled by dietary adjustments based on current knowledge. Exceptions are mentioned in terms of the evidence for prevention as well as the proper nutrition care in sickness, such as some types of cancer.

Ninth chapter of this block includes medical nutrition therapy for infections including acute and chronic fever conditions such as typhoid, tuberculosis, HIV AIDS and pandemic COVID 19.

Tenth chapter of this block explains difference between food allergy and food intolerances including its signs, symptoms and anaphylactic reactions. It also explains dietary modifications in gluten sensitivity and lactose intolerances.

UNIT 10 FOOD ALLERGY

STRUCTURE

10.1 Introduction

We are going to talk about the adverse effects of food in this unit. You may have read or heard of incidents when a person reported having quick, frequently extreme physical reactions after taking a certain food. These reactions included vomiting, diarrhoea, cramps, wheezing, swelling of the airways, a sharp drop in blood pressure, etc.

On the other hand, you might have also encountered people who are intolerant to certain foods, such as milk, wheat products, etc. For instance, those who are lactose intolerant cannot digest the lactose found in

milk. When they ingest milk products, they experience bloating, gas, and pain in their abdomens. In reality, there are several different situations that connect food with negative effects.

Food intolerance and allergies can cause much more than just bothersome gastrointestinal symptoms. And occasionally they have no outward symptoms until a chronic illness manifests later in life. As a result, it's critical to identify and treat food allergies and intolerances as soon as possible. We will learn about various forms of adverse food responses in this section, including their causes, consequences, and dietary treatment.

Objectives

After studying this unit, you will be able to,

- Separate food allergies from food intolerances
- Categorise adverse food reactions
- Explore the causes, symptoms, metabolic abnormalities, and repercussions of adverse food responses.
- Describe how to diagnose unfavourable food reactions
- Illustrate how people with food allergies and food intolerance are managed with diet

10.2 Adverse food reactions

What exactly do we mean when we say "adverse food reactions"? We'll look at a few case stories to assist us understand this concept.

Case 1: While on vacation, a 12-year-old school boy was rushed to the hospital as an emergency. His parents thought he was allergic to nuts. He vomited for around 1 minute after consuming cake containing nuts when he was 7 years old. Three years later, he got severe angioedema (swelling of the blood vessels) of his face, lips, and tongue, which was followed by throat constriction and vomiting: this happened 2-3 minutes after her friends pushed his to eat peanuts. Inadvertent consumption of hazelnuts and almonds had resulted in less severe episodes. As a result, he avoided eating peanuts and other nuts whenever feasible.

Case 2: At school, a ten -year-old child displayed hyperactivity and disruptive behaviour. She was depressed and had chronic rhinitis and colds on a regular basis. This child has always been challenging and irritable. She suffered from colic, insomnia, and screaming outbursts as an infant on cow's milk formula.

Case 3: A 30-year-old IT Consultant from Delhi who suffers from loose stools, gas, irritable bowel syndrome, difficulty to gain weight, back acne, poor endurance, and hypoglycemia/needing to eat every 2-3 hours. Gluten allergy testing revealed a significant allergy. Within two days of eliminating gluten from his diet, his irritable bowel syndrome was completely resolved.

There are two types of food reactions, toxic and non-toxic. Toxic food reactions occurs due to food toxins or poisoning. Food-borne illnesses are caused by toxins released from contaminated food or microorganisms (bacterial or fungal) or parasites in food. This unit is not concerned with hazardous adverse responses. This unit focuses on non-toxic adverse food reactions generated by the consumption of certain foods, which are classed as "hypersensitivity" or what is widely known as food allergy, and/or reactions caused by digestive or metabolic disorders, which are known as food intolerance. Food allergies and intolerances are also distinct from food poisoning, which is caused by damaged or poisoned food and affects more than one person.

Let us now go over these non-toxic undesirable reactions in more depth. We'll start with allergic hypersensitivity.

10.2.1 Food allergy

Above presented case 1 and case 2 are examples of food allergy (hypersensitivity). An immune system reaction known as a food allergy happens quickly after consuming a particular meal. A very small amount of the food that causes allergies can cause signs and symptoms like stomach issues, rashes, or enlarged airways. Some people may experience severe symptoms from a food allergy, including the potentially fatal anaphylactic reaction. This non-toxic food allergies are immune mediated.

Antibodies are immunoglobulins produced by plasma cells in response to an antigen or allergen. As you may know, an antigen is a foreign material (protein, bacteria, virus, polysaccharide, etc.) that stimulates antibody formation. Allergens, on the other hand, are chemicals that are alien to the body and induce an allergic reaction when they interact with the immune system. Antibodies have been classified into five types. Immunoglobin A (IgA), Immunoglobin D (IgD), Immunoglobin E (IgE), Immunoglobin G (IgG), and Immunoglobin M (IgM) are the four immunoglobins.

Immunoglobin E (IgE) aids in the elimination of parasites (helminthes) and is responsible for classic allergic reactions known as food hypersensitivity or food allergy, which occur when the immune system reacts to a normally harmless food protein that the body has mistakenly identified as harmful. As a result, we refer to this immunological response as an IgE-mediated reaction. Immune reactions are classified into

four types: Type I, Type II, Type III which are antibody dependent and Type IV which is T cell dependent.

10.2.2 Types of food allergies

Type I: Immediate hypersensitivity: This is a food allergy that develops quickly. Anaphylactic IgE-mediated reactions occur when an allergen reacts with sensitized on mast cells. This promotes mast cell degranulation, which releases mediators such as histamine and cytokines, causing unpleasant reactions. In other cases, IgG has also been implicated in this type of reaction.

Type II: Cytotoxic hypersensitivity: In this process, IgG antibody binds to the cell membrane or an antigen associated with the cell membrane, causing complement-mediated cell death. It is rarely thought to play a role in food allergies.

Type III: Arthus reaction, antigen antibody (IgG and IgM) complex hypersensitivity: In such a type of reaction, antigen and antibody (IgG and IgM) create a complex to cause complement hypersensitivity fixation and subsequent local inflammatory response Several hours after antigen exposure, reaction.This reaction may play a role in a variety of food-related inflammatory conditions (such as colitis, enteritis with bleeding, malabsorptive disorders, and so on).

Type IV: Cell-mediated immunity or delayed hypersensitivity:T-cells are responsible for mediating this reaction. T-cells have direct interactions with antigens. This type of reaction has been linked to celiac disease, protein-losing enteropathies, and inflammatory bowel diseases including ulcerative colitis.

10.2.3 Signs and symptoms of allergic reactions

The most common symptoms are those related to the cutaneous, respiratory, cardiovascular, and gastrointestinal systems. A summary of these symptoms is included in Table 10.1. The most extreme allergic reaction is systemic anaphylaxis (severe allergic hypersensitivity), which can include abdominal pain, nausea, vomiting, cyanosis, a drop in blood pressure, chest discomfort, diarrohoea, shock, and death.

Table 10.1. Symptoms of food allergy

Gastrointestinal symptoms	Skin related symptoms	Respiratory tract symptoms	Neurological symptoms
Nausea, vomiting, abdominal pain,	Itching, rashes, redness on skin, patches,	Running nose, cough, difficulty in	Headache, irritability, restlessness

GI bleeding, diahoreal episodes, colitis	eczema, swelling	breathing, asthma, wheezing	

Anaphylaxis

Anaphylaxis is a severe allergic reaction that can occur as a result of a food allergy in some persons. Life-threatening symptoms and signs that can result from this include:

- Tightness and constriction of the airways
- Breathing is made challenging by a swollen throat or the sense of a lump in your throat.
- Shock accompanied by a sharp drop in blood pressure
- Fast heartbeat
- Unsteadiness, faintness, or unconsciousness

Anaphylaxis requires immediate medical attention. Anaphylaxis can result in a coma or even death if left untreated.

A genuine food allergy occurs when the body has an immunological reaction in response to the consumption of a specific food. In other words, exposure to a food (antigen) or a component of the food (allergen, usually a protein) is required for the development of food allergy. Excessive exposure to a certain food — for example, rice is a common food allergen in Japan, where rice is a staple; codfish is a common allergen in Scandinavia; and chickpeas are a popular allergen in India. Most allergic reactions in children are caused by eggs, cow's milk, peanuts, wheat, soya, and fish. Most allergic reactions in adults are caused by peanuts, walnuts or almonds, fish and shellfish (such as prawns, crabfish, lobsters and crab).

Other risk factors outside food allergens include inheritance, gastrointestinal permeability, and environmental variables. It is assumed that heredity has a significant influence in the development of atopic disease. Atopy is a condition in which an individual is predisposed to develop allergies due to a hereditary state of hyperresponsiveness to allergens. Most allergies begin when a person with a genetic sensitivity to certain allergens is exposed to the material. We are more likely to acquire allergies, especially food allergies, if we have a family history of allergies.

Antigen penetration and presentation to lymphocytes may be facilitated by gastrointestinal permeability. The permeability of the gastrointestinal tract is greatest in infancy and decreases with intestinal

development. Other diseases that may be associated with increased permeability and the chance of developing food allergies include gastrointestinal disorders, malnutrition, preterm, and immunodeficiency states. Early exposure to microorganisms, tobacco smoke, exercise, and cold are all environmental variables. Because of their premature immune systems, allergies are most likely to harm new-born and young children.

10.3 Food intolerance

What exactly is food intolerance? What distinguishes it from food allergies? A food intolerance, like a food allergy, is a negative reaction to food. Food intolerance differs from food allergy in that it does not affect the immune system of the body. Food intolerance is a digestive system reaction, not an immune system one. It happens when a meal component irritates a person's digestive tract or when a person is unable to digest or breakdown the food effectively.

It can be triggered by a physical reaction to a food or food additive, or it can be caused by a metabolic reaction to an enzyme deficiency such as the inability to digest milk properly (lactose intolerance), pharmacologic agents in foods, food poisoning such as eating contaminated or spoiled fish, or a food idiosyncrasy such as sulphite-induced asthma. As a result, the scenario differs from that of a food allergy, in which a specific person's body reacts to a certain food for whatever cause. The most common causes in this case are food intolerance or excessive consumption of a specific type of food.

Food intolerance can be caused by a variety of circumstances. In other situations, such as lactose intolerance, the person lacks the chemicals known as enzymes that are required to effectively digest particular proteins found in food. In addition, intolerances to several chemical additives added to food to create colour, enhance flavour, and prevent bacteria growth are widespread.

10.3.1 Lactose intolerance

Lactose intolerance is caused by a lack of the enzyme 'lactase,' which is found in the jejunum. Individuals may have varying degrees of lactase insufficiency. Lactase enzyme converts lactose, a disaccharide found in milk, to glucose and galactose. Lactose goes unmodified into the large intestines, where it is transformed to lactic acid by the bacteria present, resulting in diarrhoea and accompanying symptoms of discomfort, distension, cramping, and stomach pain. The condition is most common in infants and young children, although it can also affect adults.

When you consume foods or beverages that contain lactose, you could have digestive symptoms like bloating, diarrhoea, and gas. A naturally occurring sugar called lactose can be found in milk and dairy products like cheese and ice cream.

Lactose intolerance is typically caused by insufficient amounts of the enzyme lactase, which is produced in the small intestine. You can digest milk products even if your lactase levels are low. However, if your levels are too low, you develop lactose intolerance and experience symptoms after consuming dairy products.

Digestion symptoms in lactose intolerance are brought on by lactose malabsorption. A problem known as lactose malabsorption occurs when your small intestine is unable to fully digest or break down the lactose you consume.

After consuming lactose, not all people with lactose malabsorption experience digestive problems. Lactose intolerance only exists in those who exhibit symptoms.

The majority of lactose intolerant persons may tolerate little amounts of lactose without experiencing any symptoms. Different amounts of lactose can be consumed without causing symptoms in different persons.

A milk allergy is distinct from lactose intolerance. A condition of the immune system is a milk allergy.

10.3.2 Etiology

- Lactose intolerance in babies and young children is frequently hereditary.
- Infections in the gut may also cause a decrease in jejunal lactase activity, resulting in lactose intolerance.
- The jejunal villi are physically destroyed in celiac disease and colitis, resulting in lactose intolerance.
- Lactose intolerance may result from surgical excision of significant portions of the jejunum.

10.3.3 Symptoms

Individuals may have varying levels of lactose tolerance. As a result, the degree of symptoms may vary. Anorexia, nausea, and intestinal distention are common symptoms of lactose intolerance. Constipation, gas, flatulence, and diarrhoea are all symptoms of constipation. It may result in weight loss and consequent malnutrition over time.

10.3.4 Types of lactose intolerance

Primary (resulting from a decrease in your small intestine's lactase synthesis).

Secondary (resulting from an illness or accident that harms your small intestine).

Congenital Lactase deficiency present at birth causes this condition

Developmental issue (resulting from premature birth, when the small intestine is undeveloped).

10.3.5 Nutritional management

The dietary treatment is determined by the degree of lactose intolerance and the level of lactase activity. Dietary management will differ depending on the degree of lactose intolerance. The diet should be well-balanced, with regular regularity and frequency.

Very low level of lactase activity

At very low levels of lactase activity, all milk products must be avoided; alternative milks such as soy milk, groundnut milk, and their preparations may be provided. Lactaid and Maxilact enzyme preparations, when added to milk or milk products, can digest 90 percent of the lactose in milk, reducing lactose intolerance symptoms. Because many processed meals, such as soups, sauces, and sweets, may contain lactose, it is important to read labels carefully and avoid consuming such foods.

Moderate level of lactase activity

Milk consumption is controlled based on tolerance. Fermented and boiled milks are recommended since they are more easily accepted. Fermentation transforms the majority of lactose to lactic acid, and boiling binds lactose, reducing the concentration of free lactose. Milk is tolerated better in the form of buttermilk, curd, custard, and cottage cheese, or when blended with cereals, chocolate, and other foods.

These enable for progressive lactose breakdown and alleviate lactose intolerance symptoms. Curds may be tolerated better due to the microbial culture, which aids lactose digestion in the colon.

Milk in small amounts can be consumed with meals. Soymilk, groundnut milk, and their derivatives may be used as milk substitutes. The absence of milk in the diet may result in a lack of important nutrients such as calcium. As a result, it is critical to take calcium-rich foods such as whole grains, green leafy vegetables, and so on. Calcium supplements may be used if necessary.

Dietary modifications in lactose intolerance

You might not have to entirely abstain from lactose-containing foods and drinks, such as milk and dairy products. You might not receive enough calcium and vitamin D if you completely forgo all milk and milk products.

Different amounts of lactose can be tolerated by those with lactose intolerance. According to research, many people might consume 12 gm of lactose, or roughly 1 cup of milk, without experiencing any symptoms or only minor ones.

10.3.6 Celiac diseases

Celiac disease (CD), the most well-known autoimmune illness, is characterized by inflammatory damage to the intestinal mucosa following gluten consumption. Specific amino acid sequences identified in the prolamin fractions of wheat, barley, and rye induce an inappropriate immunological response. Notably, CD pathogenesis can develop only in those with an extremely particular genetic profile that includes the human leukocyte antigen (HLA)-DQ2 or DQ8 allele.

Celiac disease is an immune mediated illness that causes jejunal mucosal destruction. It is caused by the consumption of gluten, a protein present in cereals such as wheat, rye, and barley. The presence of elevated blood tissue transglutaminase levels and a flat look of the jejunal mucosa leads to the diagnosis.

Symptoms range from lethargy and fatigue to diarrhoea, bloating, abdominal discomfort, and weight loss. Gluten sensitivity has a wide spectrum. The sole treatment for celiac disease is to avoid gluten for the rest of one's life. This is a significant effort for individuals to accomplish, and all patients with celiac disease should always get competent dietetic guidance, as well as an annual dietetic evaluation.

10.3.7 Estimation of Nutritional Requirements

Nutritional changes are critical in the treatment of CD.

According to research, a gluten-free diet (GFD) can increase the likelihood of energy shortage by up to 36%.

There has been evidence of inadequate consumption of dietary fiber, calcium, magnesium, vitamin D and E, as well as potassium, iron, zinc, and thiamine.

If the gluten-free diet is not followed, it may contribute to the disease's return.

If a suitable GFD is not followed, nutrient shortages might emerge, resulting in poor development and anemia, growth retardation, or osteoporosis.

Exclusion of wheat and wheat products adds to complex carbohydrate deficit in CD children. Secondary disaccharide deficit in children with CD has been convincingly established to cause clinically significant diarrhea at the time of diagnosis, and in this clinical situation, avoidance of lactose or low-lactose diet at the outset of nutritional therapy may hasten recovery.

A sufficient amount of protein is essential for appropriate growth.

Patients on GFD may have a B vitamin shortage, which can be remedied by taking gluten-free multivitamin supplements at the recommended dietary allowance (RDA). In this clinical situation, it is particularly critical to avoid calcium and vitamin D shortages, which can be supplied within the RDA.

Meticulous and long-term gluten-free dietary compliance in CD children, particularly in locations where gluten-containing foods are commonly consumed. Clinically, improved dietary compliance is characterized by increased hunger, increased height and weight, enhanced alertness and physical activity, and an overall sense of well-being.

10.3.8 Nutritional Strategies for the Management of Treatment

A Strict Gluten Free Diet

At the moment, the only effective treatment for CD is to adhere to a rigorous GFD for life."' rigorous GFD adherence in CD results in the regeneration of damaged intestinal villi, remission of intestinal and extra intestinal symptoms. The diet also protects the person from developing a number of complications. However, these significant and critical benefits are accompanied by some drawbacks, such as vitamin and mineral deficiencies, metabolic syndrome, an increased risk of cardiovascular disease, and frequently constipation. Among these include a negative impact on quality of life, psychological issues, and a fear of involuntary/inadvertent gluten contamination.

The majority of these issues and diseases can be treated and managed by educating the patient about the dangers of uncontrolled diabetes.

The gluten free diet

Foods are classified into three types:

Meals containing obvious amounts of gluten derived from wheat and flour, such as bread, pasta, wheat-based breakfast cereals, cakes, and biscuits

‘Hidden' sources of gluten, such as when it is employed as a thickening, filler, or flavor carrier. Many manufactured soups, sauces, sausages, cheese spreads and ready meals fall into this category.

Naturally gluten-free foods and ingredients include rice, maize, milk, eggs, fresh fruit and vegetables, fresh meats including poultry, fresh fish and seafood, butter, margarine, and cooking oils. These can be used without restriction on a gluten-free diet.

Foods allowed and not allowed for gluten free diet

Food group	Allowed	Not allowed
Cereals	Rice and rice products like rice flakes murmura, rice noodles, idli, dosa • Baby foods like cerelac rice Maize and its products like popcorn, and crumbs, muesli corn puffs, makki-ki-roti, baby corns, Bajra-Ki-roti, jowar-roti Aloo-arrowroot-roti	Wheat and wheat products like suji (semolina), maida (refined flour), breads, cakes, biscuits, cookies, pizza, patty, burger, all kinds of pastas rice like noodles, spaghetti, macaroni, bread crotons Wheat-based baby food like cerelac Barley water, barley drinks, beer Namkeens, bhujias, Kulchas, chat-papdi
Pulses	All pulses whole or split or washed and food made from them • Roasted chanas	Tinned, canned, preserved or processed such as baked beans
Vegetables	All fresh vegetables	Tinned, creamed vegetables, canned vegetables
Fruits	All fresh fruits	linned, canned fruits, thick-ended or pureed fruits • Fruit pie filings
Milk and milk products	Milk and milk • Milk, cream, curd, buttermilk, lassi, products	Loosely available milk and milk products

	paneer	
Eggs	Boiled, fried, scrambled, poached	Eggs in sauce made from gluten-containing ingredients, mayonnaise
Sweets	Home prepared rice-Kheer, rasgullas, Homemade besan burfi	Most commercially prepared cakes, cookies, sandesh, caramel custard, carrot instant pudding-mixes, mousse, ice cream, halwa, ghiya halwa chocolates, chocolate-coated nuts
Soups	Homemade broths and soups	Canned soups and soup-mixes, soup cubes or soup powder
Thickening agents	Arrow root, corn starch, potato flour corn flour, rice bran, rice flour, rice starch	Wheat flour and all flours made out of rye,barley, and oats

Check your progress Exercise 1

1. **Fill in the blanks for following statements:**

a. Toxic food reactions occurs due to _____.

b. _____ are immunoglobulins produced by plasma cells in response to an antigen or allergen.

c. _____ is a severe allergic reaction that can occur as a result of a food allergy.

d. Lactose intolerance is caused by a lack of the enzyme _____.

e. Celiac disease is caused by the consumption of _____ a protein present in cereals such as wheat, rye, and barley.

2. **What are the symptoms of lactose intolerance?**
3. **What is celiac disease?**

10.4 Let us sum up

The word "hypersensitivity" is broad and can refer to real allergies, reactions that do not involve the immune system (food intolerance), and reactions for which the origin is unknown. This section concentrated on immune-mediated and non-immune-mediated adverse food reactions, specifically food allergy and food intolerance. Food allergy is an uncommon condition in which specific foods elicit an instant and frequently violent physical reaction such as vomiting, diarrhea, cramping, wheezing, swelling of the airways, a severe drop in blood pressure, and so on. Food causes an IgE-mediated reaction in the body, which is known as food allergy.

The majority of allergy responses in children are caused by eggs, cow's milk, peanuts, wheat, soya, and fish. The majority of allergy reactions in adults are caused by peanuts, walnuts or almonds, fish and shellfish (such as prawns, crayfish, lobsters and crab). Food intolerance, on the other hand, is frequently associated with other health concerns since it occurs when the body has difficulties digesting a specific food and hence reacts against it, and its symptoms are similar to food allergies but significantly less defined. Lactose intolerance and phenylketonuria are two well-known intolerances.

We learned that the diagnosis of these adverse reactions (food allergies and food intolerance) is based on clinical history as well as the response to a well tailored elimination diet and food challenge. The basic treatment for food allergies is to avoid the offending meal or foods. However, in the case of food intolerance, the goal must be to consume a diet with a manageable quantity of food chemicals that includes a wide variety of foods.

Primary, secondary, and tertiary preventive methods are available. The most important level is the tertiary level, which focuses on controlling the variables that generate symptoms. Environmental management at home, school, and work, avoidance of elements that produce symptoms (allergens, environmental irritants), and patient and family education are all key components of tertiary preventive strategy.

10.5 Glossary

Anaphylaxis: It is a quickly developing and dangerous allergic reaction that affects multiple parts of the body at the same time. Severe anaphylactic reactions are potentially lethal.

Atopic: pertaining to or caused by an inherited proclivity to develop hypersensitive reactions to certain antigens, such as hay fever, asthma, or chronic urticaria.

Dermatitis: It is a medical term that literally means "skin inflammation."

Perinatal: Refers to the time period preceding and following childbirth, particularly the five months before and one month after birth.

Phenylketonuria: It is a hereditary condition in which the body does not produce the enzyme required to convert phenylalanine to tyrosine.

Rhinitis: It is an inflammation of the nasal mucous membrane that causes sneezing, itching, nasal discharge, and congestion.

Urticaria: It is described as the appearance of hives in response to a specific trigger. A hive, also known as a wheal, is a round, red, spongy lesion that forms and changes over the course of minutes to hours.

UNIT 11 CANCER

STRUCTURE

11.1 Introduction

In this section, we will look at the most prevalent types of cancer, how they develop, significant etiological variables, pathological/metabolic alterations, and other cancer-related problems. We will also talk about the nutrition and food counselling that the patients receive. Cancer patients. Cancer patients will face numerous nutrition issues as a result of their treatment. So we'll learn more about how to deal with these patients. We must remember that each patient is unique, and dietary alterations should be based on individual needs, preferences, treatment, and so on. When dealing with cancer patients, we must exercise extreme patience.

Objectives:

After completing this unit, you will be able to

- Explain how cancer develops, list the etiological (risk) factors in cancer formation,

- Define the metabolic alterations, clinical manifestations, and complications in cancer,
- Classify the many types of cancer based on the site of development,
- Examine the various modes of treatment,
- Manage cancer patients in relation to food therapy and feeding problems, and
- Explain preventive measures.

The term 'cancer' is derived from the Latin word for crab. It refers to any malignant growth or tumor caused by unregulated and aberrant cell division.

Body cells, as we all know, are the fundamental units of life, with trillions of them in each of us. Our cells assist us in carrying out all of life's activities, from heartbeat to football throw. Cancers are new cell growths in our bodies. It is possible that the development of these traits will result in the destruction of key organs and, in certain circumstances, life-threatening disruptions in body function. Let us investigate why this occurs.

Cancer is a condition when a few of the body's cells grow out of control and spread to other bodily regions. In the trillions of cells that make up the human body, cancer can develop almost anywhere. Human cells often divide (via a process known as cell growth and multiplication) to create new cells as the body requires them. New cells replace old ones when they die as a result of ageing or damage. Occasionally, this systematic process fails, causing damaged or abnormal cells to proliferate when they shouldn't. Tumors, which are tissue masses, can develop from these cells. Cancerous or non-cancerous (benign) tumours are both possible.

Nearly 10 million deaths, or nearly one in six deaths, will be caused by cancer in 2020, making it the leading cause of death globally (World Health Organization, 2022). The use of tobacco, having a high body mass index, drinking alcohol, eating few fruits and vegetables, and not exercising account for about one-third of cancer-related fatalities. In low- and lower-middle-income nations, cancer-causing infections including the human papillomavirus (HPV) and hepatitis are thought to be the cause of 30% of cancer cases.

If caught early and appropriately treated, many tumors are curable. Breast, lung, colon, rectum, and prostate cancers are the most prevalent types of cancer.

11.2 Metabolic alterations in cancer

The fundamental unit of life in the body is the cell. Various cell types make up the body.

These cells multiply and expand in order to create the additional cells required to replenish the body's cell population. But occasionally, this systematic procedure fails. To create abnormal cancer cells, the normal cells undergo mutation (uncontrolled cell division).

Instead of dying, cancer cells outlive healthy cells and continue to divide abnormally. Normal cells and cancer cells differ from one another in that cancer cells have the ability to infiltrate (grow into) other tissues. A cancer cell has the capacity to spread to other tissues and develop out of control.

DNA damage causes cells to develop into cancerous cells. A cell's genetic makeup (DNA) may be harmed or altered, leading to mutations that interfere with regular cell development and division. When this occurs, cells do not decompose as they ought to and develop new cells when the body does not require them. As a result, the process is uncontrolled, and the excess cells may group together to form a mass of tissue known as a tumour. This process is known as carcinogenesis.

Tumours are not always cancerous; they can also be benign or malignant. Cancer-free benign tumours do not exist.

They can frequently be eliminated, and they rarely come back. Benign tumours do not disseminate their cells to other body regions. Cancerous malignant tumours exist.

These tumours' cells have the ability to spread to different bodily parts by invading surrounding tissues. Metastasis is the term used to describe the spread of cancer from one area of the body to another.

Leukaemia, a blood and bone marrow cancer, is one example of a malignancy that does not cause tumours.

Carcinogenesis

It is a biological process via which healthy cells develop into malignant tumour cells. Three distinct phases make up this process.

1. **Initiation:** When exposed, the cancer-causing agent penetrates the cell. The cellular DNA is then modified by this carcinogen.

2. **Promotion:** When the growth of cancer is accelerated and unchecked cell division starts.

3. **Progression:** The development of the tumour occurs. It could spread to different organs or tissues. As a result, the cells are liberated and spread to other bodily parts; this process is known as metastasis.

11.3 Types of cancer

More than 100 different cancers exist. Typically, cancer types are named after the organs or tissues in which they first appear. For example, brain cancer begins in the brain and lung cancer begins in the lung. The type of cell that gave rise to a cancer, such as an epithelial cell or a squamous cell, can also be used to describe the condition.

Carcinoma

The most prevalent kind of cancer is carcinoma. Epithelial cells, which are the cells that line the interior and exterior surfaces of the body, are responsible for their formation. Epithelial cells come in a variety of varieties, and when they are magnified under a microscope, they frequently resemble columns.

There are different types of carcinoma that begins in various epithelial cells.

Adenocarcinoma is a type of cancer that develops in mucus- or fluid-producing epithelial cells. Occasionally, glandular tissues are referred to as epithelial tissues. Adenocarcinomas make up the majority of cases of breast, colon, and prostate cancer.

The basal (base) layer of the epidermis, which is a person's outer layer of skin, is where basal cell carcinoma, a type of cancer, first appears.

Squamous cells, which are epithelial cells found just below the skin's surface, are where squamous cell carcinoma develops. Numerous other organs, such as the stomach, intestines, lungs, bladder, and kidneys, are lined with squamous cells. Squamous cells appear flat under a microscope, similar to fish scales. Epidermoid carcinomas are another name for squamous cell carcinomas.

The epithelial tissue known as transitional epithelium, or urothelium, is where transitional cell carcinoma, a type of cancer, develops. The linings of the bladder, ureters, renal pelvis, and a few other organs are made up of this tissue, which is composed of numerous layers of ectoderm cells that can develop bigger and smaller. Transitional cell carcinomas are a type of cancer that can develop in the bladder, ureters, or kidneys.

Sarcoma

Sarcomas are tumours that develop in the muscle, fat, blood, lymph, and fibrous tissues (such as tendons and ligaments) that make up soft tissues as well as bone.

The most typical type of bone cancer is osteosarcoma. Liposarcoma, Kaposi sarcoma, malignant fibrous histiocytoma, liposarcoma, and dermatofibrosarcoma protuberans are the most prevalent varieties of soft tissue sarcoma.

Leukemia

Leukaemias are cancers that start in the bone marrow, which produces blood. Solid tumours are not produced by these malignancies. Instead, the bone marrow and blood become overpopulated with aberrant white blood cells (leukaemia cells and leukemic blast cells), which drive out healthy blood cells. It may be more difficult for the body to manage bleeding, fight infections, or deliver oxygen to its tissues when the normal blood cell count is low.

Lymphoma

Cancer that starts in lymphocytes (T cells or B cells) is called lymphoma. These white blood cells, which are a component of the immune system, combat disease. In lymphoma, abnormal lymphocytes accumulate in the body's lymph nodes, lymph vessels, and other organs.

Multiple myeloma

Plasma cells, another type of immune cell, are where multiple myeloma develops. Myeloma cells, which are abnormal plasma cells, accumulate in the bone marrow and develop into tumours in bones all throughout the body. Kahler disease and plasma cell myeloma are other names for multiple myeloma.

Brain and spinal cord cancer

Tumours of the brain and spinal cord can take many distinct forms. These tumours are given names based on the cell type in which they originated and the region of the central nervous system where the tumour first appeared. For instance, astrocytes, which assist maintain the health of nerve cells in the brain, are the origin of an astrocytic tumour. Benign (not cancer) or malignant (cancer) brain tumours are both possible.

11.4 Etiological risk factors in cancer

Cancer risks are rising as a result of more sedentary lifestyles and diets heavy in fat and sugar but low in fruits, vegetables, legumes, and whole grains. The risk is increasing in developing countries as the urban poor migrate from rural areas into large cities. It has long been recognized that migration results in the loss of traditional agricultural and dietary patterns, as well as an increase in the consumption of processed foods and beverages. Obesity is another important contributor to the expanding cancer threat.

People are continually exposed to a variety of risk factors. First and foremost, different types of cancer will have different etiological or risk factors.

Cancers are generally caused by a breakdown of control over normal cell reproduction. This loss of cell control is caused by a number of causes. They include genetic variables, environmental factors, dietary factors, carcinogens, radiation, oncogenic viruses, and other factors like as stress. Let us learn more about these cancer etiological risk factors.

Genetic factors

Genes control the development of several malignancies. One or more regulatory genes in the cell nucleus cause gene mutations. It may be inherited, but environmental variables also play a role in its manifestation. A person with a cancer family history is more likely to develop cancer than someone who does not have such a genetic predisposition.

Environmental factors

Cancer is recognized to be caused by environmental factors such as smoking, water and air pollution, and sun exposure.

Dietary factors

Dietary elements can potentially cause cancer. However, it is unknown to what extent nutrition plays a role in cancer development. Cancer rates are higher in areas of the world where people consume a lot of strongly smoked, pickled, or salt-cured foods that contain carcinogenic nitrosamines.

Alcohol has also been linked to an increased risk of certain malignancies, including cancers of the mouth and throat. Beer and scotch, for example, may contain harmful nitrosamines as well as alcohol. Other beverages, such as wine and brandy, may include urethane, a carcinogen formed during fermentation.

Nitrosamines have been linked to the development of cancer. Nitrosamines are a diverse group of chemicals that are generated via the nitrosation of substituted amides, ureas, and guanidines. Nitrosamides are direct acting carcinogens, which means that they are activated non-enzymatically through spontaneous hydrolysis.

According to several epidemiological research, high protein intake increases the risk of cancer. Cancers of the breast and colon, for example, are more common in developed countries. Some researchers have proposed a link between high total protein or animal protein diet and the risk of these specific malignancies.

In animals, both the kind and amount of fat are thought to influence tumour growth.

In humans, a high fat consumption has been related to an increased risk of breast and colon cancer. A high fat consumption may boost intestine anaerobic bacteria and biliary steroid release, according to one putative mechanism. These anaerobic bacteria have the ability to produce oestrogen. The oestrogens are thought to be carcinogenic in mammary tissues. Furthermore, intestinal bacteria degrade bile acids to secondary bile acids such as deoxycholate and lithocholate. In the colon, they may behave as carcinogens. Trans-fatty acids, according to another idea, are more carcinogenic than cis fatty acids.

Non dietary factors

Oncogenic Viruses: Certain viruses have been identified that interfere with the actions of regulatory genes. These viruses are referred to as oncogenic viruses.

According to some research, these viruses are the second most major risk factor. A large number of DNA and RNA viruses have been shown to cause cancer in animals. Let us investigate these viruses.

Chemical carcinogens: Chemicals have been proved to cause cancer. Some are naturally occurring plant and microbial organism components. Some are manufactured synthetically by industry. Chemical carcinogens are categorised into two broad categories based on their capacity to bind to DNA.

Genotoxic substances bind to DNA, whereas epigenetic compounds are carcinogenic yet show no evidence of DNA binding.

Alkylating agents, acylating agents, and aromatic amines are examples of important chemical carcinogens. Chemical carcinogens include aflatoxin B1, betel nuts, nitrosamines and amides, vinyl chloride, nickel, chromium insecticides, and fungicides.Cancer is also known to be caused by tobacco, smoking, and drug misuse.

Radiant energy: Radiant energy, whether in the form of ultraviolet rays from the sun or as ionizing electromagnetic and particle radiation, has the ability to alter all cell types in vitro and produce neoplasia in both humans and experimental animals.

Stress factors

Emotions playing a role in cancer is not a novel concept. However, these interactions are extremely difficult to quantify. The intriguing reality is that more findings of correlations between cancer and measurable stress variables are being made. Psychic trauma appears to have high associations with cancer, according to clinicians and academics. This association can be attributed to two fundamental

physiological factors. The first is thymus gland and immune system damage. The second type of effect is neuroendocrine, which is mediated by the hypothalamus, pituitary, and adrenal cortex.

Other factors

Several dietary and non-dietary factors (including genetics) can raise the risk of cancer development. The following are some major etiological factors:

1. Many malignancies are linked to poor eating habits, such as a lack of fruits and vegetables, which give vitamin C, carotene, and fibre.

2. Excess fats (saturated vegetable and animal fat) are associated with an increased and long-term risk of cancer.

3. People who consume more than two to three glasses of beer, wine, or whisky each day increase their risk of developing cancers of the mouth, throat, voice box, neck, and liver.

4. Tobacco is the most prevalent cause of cancer; smoking, snuffing, or chewing tobacco are all dangerous.

5. Certain cancers, such as colon and breast cancer, appear to run in families (genetic origin).

6. Some cancers may be increased by viruses, carcinogens, and radiation.

7. Certain substances may increase the risk of cancer.

8. Excessive sun exposure causes almost all incidences of skin cancer.

11.5 Medical nutrition therapy for cancer patients

Cancer, as we know, is a chronic degenerative disease characterized by cancer cachexia, a stage of severe physical malfunction, general illness, malnutrition, anorexia, and anaemia. Other symptoms include xerostomia, nausea, and vomiting.Food intake is hampered by vomiting, cheilosis, and glossitis.

We will now address the nutrient requirements of cancer patients (in general) in order to achieve the aforementioned goals. Our discussions would begin with calorie requirements and go to the demands of other micro and macronutrients. So let us begin with individual nutrient requirements.

Energy: Cancer must be obvious to you because of the hypermetabolic nature of the disease process and the increased energy required to spare proteins for tissue mending and promote weight gain. Given the inhibitory variables associated with food intake (cancer cachexia), increasing intake above 2000 Kcal/day may not be practical. Malnourished individuals, on the other hand, can be persuaded to take roughly 30-

35Kcal/kg bodyweight / day (2500-3000 Kcal/day) with the use of appetite stimulants and/or nutrition support systems (enteral tube feeding). A high-energy diet can assist to reduce the negative effects of chemotherapy and cancer cachexia.

Protein: Both cancer's metabolic stress and treatment cause enhanced tissue catabolism. Anaemia and hypoalbuminemia are also prevalent.

Tissue protein synthesis, which is required for healing and rehabilitation, necessitates the use of essential amino acids and nitrogen. Efficient protein utilization, which is dependent on the protein:energy ratio, promotes tissue anabolism, prevents catabolism, and aids in the accumulation of bodily reserves. To achieve maintenance needs and assure anabolism, an adult patient with average nutritional status will require 80-100 gm protein per day.

A malnourished patient, on the other hand, must take 100-150 gm protein per day to replace stores and reestablish a positive nitrogen balance. Of course, high biological value protein-rich dietary sources such as milk, eggs, sea foods, and poultry should be included. Under these circumstances, renal and liver function tests must be closely watched. However, as a general guideline, 1.2-2.0 g/kg ideal body weight protein can be given.

Fats: Fat should offer 25-30% of the modified energy requirements because it helps to make meals calorie dense and improve palatability. The incorporation of emulsified fats and vegetable oils, particularly those high in medium chain triglycerides, should be prioritised. Animal fat (pure ghee, lard, etc.) and flesh food (red meat) should be limited in the diet. A blend of vegetable oils (olive, coconut, safflower, etc.), cream, butter, and other ingredients can assist improve taste and provide flavour variation in various dishes.

Carbohydrates: A sufficient amount of carbs (60% of total energy) should be delivered. If a very high calorie diet is prescribed, an emphasis on easy-to-digest carbohydrates (mono/disaccharides and starches) may be required to keep meals compact in volume and energy dense. If the patient has gastrointestinal cancer or digestive problems, his or her fibre consumption may need to be reduced. Some patients, however, may develop hyperglycemia. In such cases, including foods high in soluble fibre (pulses and legumes) would be beneficial.

Vitamins, minerals and phytochemicals: Several vitamins, notably those of the B group, are required for proper energy and protein metabolism. Vitamins A, C, and E should be given in large amounts since they aid to reduce cancer morbidity and death (they are essential for tissue synthesis, cell differentiation,

and cell integrity). Zinc and selenium are particularly important minerals, and their intake should be somewhat augmented by supplementation.

Phytochemicals (carotenoids, flavonoids, plant sterols, allium compounds, indols, phenols, and so on) have gained prominence in recent years. Incorporating a good number of fresh fruits and vegetables, especially with their edible peels, soyabean, and specific Indian condiments/herbs such as turmeric will assist promote phytochemical consumption. The impact of peigallacatechin gallate in green tea, curcumin in turmeric, genistein in soya, and folic acid in lowering cancer morbidity is being studied.

Fluids: Adequate fluid intake is essential to replenish losses caused by gastrointestinal disturbances. Infection/fever can also help the kidneys dispose of metabolic breakdown products from the killed cancer cells as well as harmful medications used in treatment. Cyclophosphamide, for example, requires 2-3 litres of water to prevent cystitis.Adequate fluid/beverage consumption aids in the alleviation of xerostomia and other swallowing issues.

Meal pattern and other dietary considerations

Meal timing is critical for maintaining proper food intake. Cancer patients frequently report a reduction in their capacity to eat as the day passes. This could be due to delayed stomach emptying, decreased gastric secretion production, and gastrointestinal mucosal atrophy. Small, regular meals with a focus on the morning are advised.

Patients with changed taste perceptions may benefit from increased usage of flavourings and seasonings, especially those high in antioxidants (mint, coriander, turmeric, and so on).

Chemotherapy may cause meat aversions in some persons. This may entail the elimination of red meats (lamb, pork, buffalo, cow, and so on), which have a greater flavour than lean meats (marine foods, chicken, and so on). Alternative protein sources should be included in the diet of such patients.

Those with dysphagia or lesions in the mouth or oesophagus should be offered semi-soft/ full fluid meals

To support a high energy intake, high energy nutrition dense foods (cream soups, creamed vegetables, puddings/ soufflé, honey/ jam toppings on fruit, milk shake, custard, sandwitches with cheese/ egg, addition of dextrose, sugar, etc. to fruit juice, milk shakes, etc.) should be provided.

Although the oral route is always the preferred method of feeding, additional routes of feeding (enteral, parenteral) are indicated as supplements/substitutes based on feasibility. Long-term feeding formulas based on soy or milk are quite popular, especially among home-based patients. TPN solutions containing

glucose and a blend of amino acids that supply 25-35 Kcal/kg/day and 1.2 to 2.0 gm protein per kg/day are also widely used to aid in nutritional status maintenance.

11.6 Dietary management of cancer patients related to treatments

We began by reviewing the overall nutritional needs of cancer patients.

However, in order to be effective in preserving the patient's optimum nutritional status, it is also necessary to feed the right type of diet through an appropriate manner and route while keeping the characteristics of the condition and mode of treatment in mind.

We'll now go over the various sorts or forms of cancer treatment, as well as the feeding issues that come with them. While reading the information provided below, keep in mind that the course of treatment for cancer patients will be determined by the site of cancer development.

Cancer therapy frequently entails substantial nutritional issues as well as eating issues that might occur not only from the malignant disease but also from specialized treatment used to manage the neoplastic process.

So our conversation will now begin with a review of various cancer medicines, feeding issues associated with these medications, and nutritional control.

Surgery

Surgery is typically performed when there is no evidence of metastasis, i.e. when a tumour is localized. Nutritional support would differ based on the location of operation and its association with food digestion/absorption. For example, surgical removal of an appendix tumour may not necessitate extensive nutritional support, whereas surgical removal of a portion of the liver/pancreas may necessitate specialized feeds and feeding support procedures (enteral/total parenteral).

Nutritional support

Tube feeding is typically initiated. If tube feeding is not practicable, parenteral nutrition can be administered via peripheral or central vein.

Foods that are appealing and have a good aroma can be provided before to therapy. Foods with a high energy value should be consumed. We should do everything we can to boost their total food intake. If the patients are able to swallow, nutritional meal formulae can be given to them after treatment. If they are having difficulty, nasoesophageal tube feeding can be initiated. Gastrostomy tubes should be placed in patients who require such support on a long-term basis.

Radiation therapy

Radiation therapy is one treatment option for many tumours. Patients encounter acute radiation poisoning with radiation delivery. This poison causes nausea, vomiting, and diarrhea. This form of toxicity normally goes away. Within a few weeks of finishing radiation therapy (RT). Chronic, late gastrointestinal problems develop and can result in significant morbidity and mortality. Abdominal cramps and watery diarrhoea may occur after 2 to 3 weeks of RT. Weight loss is quite common.

Nutritional support

Diet treatment can be quite effective in managing symptoms and ensuring enough nourishment. In severe situations, enteral and parenteral feeding might also be employed.

Enteral feedings comprising amino acids or partially digested protein with a very low fat content are possible. According to studies, patients who got solely such meals during RT had reduced diarrhoea and weight loss. Though this sort of feeding is beneficial, there are some practical challenges. As a result, such enteral feedings should be reserved for individuals who experience severe/acute toxicity. Total parenteral nutrition should be reserved only for patients who are malnourished prior to beginning a course of RT.

Chemotherapy

Chemotherapy has numerous adverse effects. This is because the drug's effects are not limited to cancer cells. Chemotherapy will have an effect on the host cells as well.

The intensity of these adverse effects is determined by factors such as drug type, dosage, duration of treatment, nutritional health of the patient, and individual susceptibility. The alimentary tract and bone marrow are the most affected by adverse effects. Significant effects on renal tubules, as well as hepatic, cardiac, pulmonary, and nerve cells, have been observed in some cases.

Nausea and vomiting might develop suddenly, or they can be delayed for 24 hours or more after treatment. Patient sensitivity, kind of medicine, dosage and frequency, and mode of administration are all factors that influence emeses'vomiting.

The nitrogen equilibrium that existed before to chemotherapy shifts to a negative nitrogen balance. Despite continued intravenous nutrition assistance, protein turnover, synthesis, and catabolism decrease with medication therapy.

A detailed investigation of the most regularly used chemotherapeutic drugs, their methods of action, and potential adverse effects affecting nutritional status should be conducted. Let us now look at dietary support throughout chemotherapy.

Nutritional support

Antiemetic are medications used to treat chemotherapy-induced nausea and vomiting.

Antiemetic have become critically important in order to promote increased adherence to therapy programmes and improved intake of food and water.

11.7 Cancer prevention

There is an ongoing and pressing need to take all possible precautions to prevent cancer. Cancer rates are expected to rise by another 75% globally by 2030. Certain cancer preventive measures are proposed based on current understanding and research results. These are emphasized in the next section.

Guidelines for cancer prevention

1. Include a plant-based diet, with red meat in particular limited.

2. Reducing fat consumption, particularly saturated fat. The overall amount of fat consumed should not exceed 30% of total energy intake.

3. Avoiding or minimizing alcohol consumption.

4. Limiting your intake of high-energy foods.

5. Eat more vegetables and eat less cereal.

6. Increase your fiber consumption to 20 to 30 grammas per day.

7. Eat a range of veggies and fruits on a daily basis.

8. Limit your intake of salt-cured, salt-pickled, and smoked foods.

9. Maintain a healthy body weight and avoid obesity.

Another suggestion is to vary your meal selections. Instead than eating the same sort of meal every day, try to incorporate a variety of other things. This will aid in diluting whatever is in one food with what is in the others.

11.8 Role of antioxidants in cancer prevention

What exactly are antioxidants? Simply explained, antioxidants are naturally occurring substances (vitamins and minerals) that assist to protect the body from some types of cancer. Vitamins A, C, and E have been shown to be effective antioxidants in the treatment of cancers such as gastrointestinal, cervical, and breast cancer. Furthermore, antioxidants reduce the chance of cancer mortality.

We discovered that these free radicals are highly unstable and steal components from other biological molecules such as fat, protein, or DNA, spreading the damage. This damage causes a chain reaction, and entire cells are soon harmed and die. This is known as peroxidation. Peroxidation is beneficial since it assists the body in destroying cells that have outlived their function while also killing bacteria and parasites. However, if left unregulated, peroxidation kills or damages healthy cells. Antioxidants aid in the prevention of extensive cellular death by voluntarily giving components to stabilise free radicals. Furthermore, antioxidants return to the cell's surface to stabilise rather than destroy other cellular components.

Lycopene is a pigment that colourizes fruits and vegetables and is plentiful in the prostate gland. This carotenoid has been found in studies to lessen the incidence of a variety of fatal malignancies, including prostate, colon, and rectum cancers.

Patients with prostate cancer who consume a lot of lycopene had a lower risk of dying from the condition.

Retinol, retinal, and retinoic acid are fat-soluble vitamin A molecules. This category is essential for ocular and retinal function, as well as protecting the mucous membrane and lowering the risk of infection. As a result, it is known as an immunological booster, and it lowers the risk of cancer. Apart from lowering cancer mortality, it also aids in the treatment of cancer patients who have undergone surgery to remove primary tumours.

Antioxidant and immunological stimulatory properties of vitamin A and carotenoids have evolved synergistic cancer therapy applications. During chemotherapy, vitamin A levels fall. As a result, extra vitamin A intake is advised during chemotherapy.

According to research, vitamin C has a significant function in the prevention and treatment of cancer.

Check your progress Exercise 1

1. **Fill in the blanks for following sentences**
    a. Blood or bone marrow cancer is known as _____.

b. Incorporation if medium chain triglycerides and _____ should be prioritized for cancer patients.
c. Non-cancerous tumours are _____ in nature.
d. _____ are medications used to treat chemotherapy-induced nausea and vomiting.
e. Vitamin A and C are having _____ properties.

2. **Explain process of carcinogenesis.**
3. **What is the difference between lymphoma and sarcoma?**
4. **How much amount of protein is required for the cancer patients?**
5. **Antioxidants are important for cancer prevention. Justify sentence.**

11.9 Let us sum up

This unit taught us about cancer, how it grows, and how cancer cells differ from normal cells. We also learned about cancer's characteristics and types.

Then we concentrated on the primary etiological (risk) factors linked to cancer causation. As you may recall, these include genetic influences, environmental factors, dietary and non-dietary factors, and stress factors. Following that, we discussed several metabolic problems associated with cancer, often known as cancer cachexia.

Finally, we looked at the nutritional issues and clinical indications of cancer.

11.10 Glossary

Anti-emetics: These are medications that prevent or alleviate nausea and vomiting.

Anorexia: It is defined as a loss or lack of appetite for food.

Benign tumour: It is a mass of abnormal tissue that is enclosed and does not invade neighbouring tissue.

Cancer cachexia: It is characterised by severe physical malfunction, general illness, malnutrition, anorexia, and anaemia.

Carcinogen: Any substance or agent that causes cancer.

Cytokines: These are non-antibody proteins that are released by inflammatory leukocytes and some non-leukocytic cells and act as intercellular mediators.

Dumping syndrome: It occurs when food passes too quickly from the stomach to the small intestine.

Dysphagia: It is a difficulty swallowing.

Malignant: An aberrant tissue mass that is not encapsulated and infiltrates neighbouring tissue.

Melanocarcinoma: A malignant tumour or melanocytes that primarily affects the skin.

Neoplasm: An abnormal tissue development that might be benign or cancerous.

Odynophagia: Extreme pain or difficulty swallowing caused by an oesophageal disease.

Phytochemicals: Any chemical or nutrient obtained from a plant that has a good influence on health or plays an active part in disease treatment and/or prevention.

Stupor: It is a state in which a person is cognizant and may move voluntarily, but has a significantly diminished reaction to stimuli.

Tachycardia: An unusually fast heartbeat defined as a resting heart rate of more than 100 beats per minute.

Xerostomia: It is characterized by a significant decrease in salivary gland production.

UNIT 12 : ADAPTATION OF NORMAL DIET

STRUCTURE

12.1. INTRODUCTION

Normal nutrition is the basis of therapeutic reforms. The main principle of diet therapy/nutrition therapy is that it is based on the patient's natural nutritional needs. Any therapeutic regimen is simply a modification of a person's normal nutritional needs to match the needs of that person's particular condition. A person's "diet" is defined as that person's food and drink intake.

All detailed dietary changes should be accompanied by supporting information about options, clear instructions, menu guides and possible substitutions. Patients should be encouraged to understand the important relationship between food and diet. The value of a food is determined by the amount of nutrients it contains and how often it is consumed. If people are provided with clear explanations and simple instructions as to why they are needed, they are more likely to follow through on the necessary dietary changes. The Recommended Dietary Allowance (RDA) is often used as a basis for assessing the adequacy of diets. When planning your diet, you should consider the specific nutritional needs of your particular disease or disorder. As a nutritionist, you must remember that a person's diet is influenced by various factors such as lifestyle, income, knowledge, taste preferences, religious beliefs and various other socio-cultural factors. Not considering these things can make the planning of treatment regimen unrealistic.

12.2. QUALITATIVE AND QUANTITATIVE ADAPTATION

Adaptation of the usual diet can be done using quantitative or qualitative methods. In some cases, a combination of both may be required. What do these methods mean? How are they done? Read the next section to find out. Let's start with a qualitative method.

a) ***Qualitative Methods*:** Here we provide support information such as individual selections, clear instructions, menu guides and advice on suitable manufactured products. Patients should understand the important relationship between food and diet. The value of food is determined by the amount of nutrients in it and how often it is consumed. Different qualitative methods are:

- Publication of healthy eating guidelines
- Food guide pyramid
- A list of preferred food options, and
- Elimination diet

b) *Quantitative Methods*: These are often necessary to create treatment regimens. There are two ways to do this:

i) Use an exchange system that provides a constant amount of nutrients for each food item. An example of this is carbohydrate exchange systems used in meal planning for insulin-dependent diabetics. The desired amount of consumption is determined and a meal is created from the exchange list.

ii) Determine the amount of food and its frequency of consumption. The diet includes portions of normal-sized foods, but foods with the highest content of a specific nutrient per serving are excluded from the diet. We also learned about this aspect earlier and learned about diets limited in fat, Na and K. We also reviewed foods that are allowed and excluded based on their nutrient content.

12.3. TYPES OF DIET

A person's diet is the total amount of food and drink they normally consume. A diet is an attempt to achieve or maintain a certain weight by restricting food intake. People's food choices are often influenced by various factors, including moral and religious beliefs, clinical needs, and the desire to control weight.

Not all meals are healthy. Some people continue to eat unhealthy foods out of habit rather than consciously choosing unhealthy foods. The terms of this type of diet include "junk diet" and "western diet". Many diets have serious health risks, but doctors believe the long-term benefits are minimal. This is especially true of "crash" or "fad" diets, which are short-term weight loss programs that involve significant changes in a person's normal eating habits.

Normal or General Diet

This diet is planned to meet Recommended Dietary Allowances (RDAs) for nutrients and is based on food groups. It is usually based on periodic menus planned according to the region, type of hospital and customers. Adequacy of nutrition is determined by the patient's choice of food and the amount of food

received by the patient. The role of the clinical dietitian is to monitor food selection and consumption to ensure adequate nutrition. General diets are intended for hospitalized patients whose medical conditions do not require therapeutic changes. A sample meal plan for reference is shown in Table 3.1.

Table 2.1: A Day's Normal Diet for an Adult

Foods	Quantity (g)	Energy (g)	Protein (g)	Carbohydrates (g)	Fats
Cereals and cereal products	370	1386.62	37	277.5	9.25
Milk and milk products (3% fat)	300	174	9	14.4	9
Pulses and legumes	75	250	17.48	42.48	2.25
Roots and Tubers	200	100	3	20	0.6
Green Leafy vegetables	100	30	3	2.5	0.5
Other vegetables	200	60	4	7	0.6
Fruits	100	45	1	10	-
Fat	25	225	-	-	25
Sugar	20	80	-	20	-
Total		~2350	~75	~394	~47

Source: Dietary Guidelines for Indians, 2011, National Institute of Nutrition, Hyderabad, India

Approximate amount of food: calories = 2350 kcal. Carbohydrates = 394 grams, protein = 75 grams, fat = 47 grams.

For non-vegetarians: 1 egg = 1/2 cup milk. 75 grams of lamb/chicken = 1 bowl of beans

+ Card bowl

This diet is used for all patients who do not need a special diet.

Liquid Diets

A Liquid diets include foods that can be prepared in liquid or strained form at room temperature. These are usually prescribed after certain types of surgery. The two main types of liquid diets are clear liquid and complete liquid.

Clear Liquid Diet*:* This includes low-residue foods that minimize the food load that must be digested in the intestines. Clear liquid diets provide foods and liquids that are clear and liquid at room temperature. The type of fluid provided will vary depending on the patient's clinical condition, the test or diagnostic procedure, or the specific surgery the patient is undergoing. The goal of the clear liquid diet is to provide fluids and electrolytes to prevent dehydration. The diet is insufficient in terms of calories and essential

nutrients. Do not use clear liquid diets as your sole source of nutrition for more than 1 to 3 days without supplemental protein, calories, vitamins, and minerals. A clear liquid diet leaves the least amount in the digestive tract. It also minimizes gastrointestinal irritation.

The diet is used as an initial feeding progression between intravenous feeding and a full liquid or solid diet that follows surgery. It could be used as a dietary preparation for bowel examination or for surgery. It is also useful at times of acute disturbance of gastrointestinal function. It has application in many illnesses characterized by a high fever.

Recommended food items include:

- Clear and fat-free soup/broth.
- Coffee, light tea (without milk or cream)
- Strained fruit juice
- Soft coconut water, whey, oat water
- Gelatin, fruit ice cream, ice cream
- Sugar and salt added to liquids.
- Carbonated drinks are acceptable.
- Commercial supplements with high protein and high calories (dissolved in drinks or water).
- Honey.
- Ice
- Do not use other foods.

Small amounts of fluids are given at frequent intervals (50 to 100 mL every 1 to 2 hours). The nutritional composition of clear liquid diets varies depending on the type and amount of liquid provided and consumed by the patient. Do not use solid foods.

Full Liquid Diet **:** This diet provides liquid or semi-liquid foods and liquids at room temperature. Depending on the clinical condition of the patient, the type of meals provided may be different. It is used as a step between a clear liquid diet and a regular diet.

The purpose of diet therapy is to provide oral hydration to people who are unable to chew, swallow and digest solid foods. It is used in parenteral nutrition or in combination with parenteral nutrition as an intermediate step for solid food after surgery.

If you have trouble chewing or swallowing, or if you have certain procedures such as jaw wiring. It is also used in cases of esophageal or digestive tract narrowing, during moderate inflammation of the digestive tract, and in patients with acute illness. Do not use solid foods.

Recommended food items include:

- Soup and soup
- Cereal porridge (refined cereals)
- Milk and milk drinks, yogurt
- Coffee, tea, fruit juice, carbonated drinks
- Butter, cream and oil are added to food
- Simple pudding, custard, ice cream, jelly,
- Sugar, honey, salt, mild taste.

The food composition of the diet depends on the type and amount of liquids available to the patient. This diet is deficient in iron, vitamin B12, vitamin A and thiamine. With careful planning, you can meet your maintenance needs with the exception of dietary fiber. You can also add liquid nutritional supplements or mixed foods to improve nutritional adequacy. Breastfeeding is usually done 2 to 4 hours apart. This diet is generally low in fiber and can lead to constipation if used for a long time. If long-term use is required, vitamins, iron or liquid nutritional supplements should be added.

Soft Diets

Soft meals offer soft, whole foods that are lightly seasoned and relatively low in fiber. This food has a soft texture and is easily digested. Small meals are offered until the patient's tolerance to solid foods is established.

Soft foods provide a transition between liquid and regular foods. It may be prescribed for post-operative cases, acute infections, digestive disorders or patients with chewing disorders.

Soft diets should be individualized based on clinical diagnosis, surgery, patient appetite, food tolerance, previous nutritional status, and ability to chew and swallow. If the patient is able to consume adequate amounts of food, soft food can be nutritionally adequate. Supplements and feeding between meals can also be used to increase nutrient intake.

Foods allowed in soft diet include:

- Soups – mildly flavored soups and creamy soups.
- Drinks - everything
- Meat - moist, soft meat, fish or chicken, cottage cheese, eggs (except) fried in oil)
- Fats – butter, cream, oils, salad dressings.
- Milk – milk, milk drinks, yogurt.

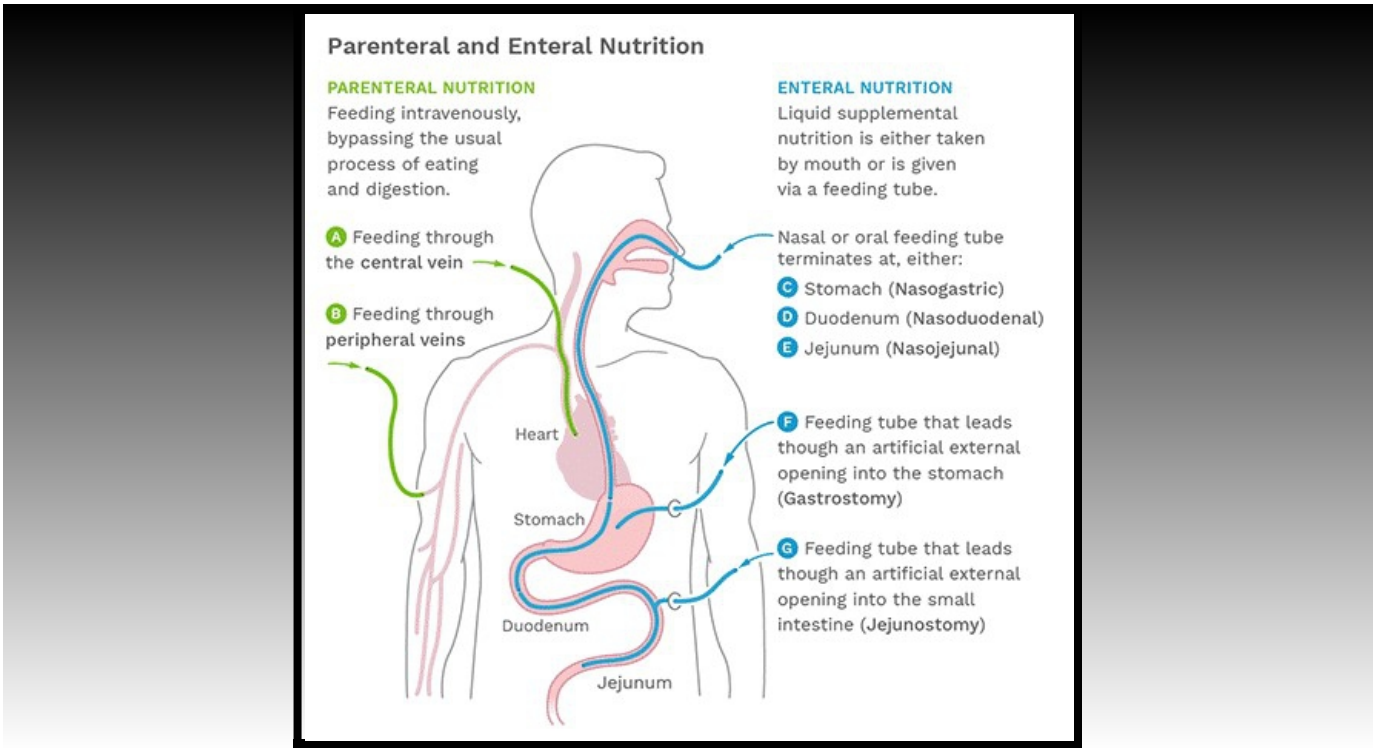
- Cereals – soft cooked refined grains – rice, pasta, bread, porridge.
- Vegetables – cooked soft vegetables.
- Fruits - soft cooked fruits, juices
- Dessert - custard, ice cream, jelly, cake (sponge), pudding without nuts.
- Sweets - sugar, honey, plain candy

Foods to avoid include:

- Fried foods and nuts.
- A wide selection of sweets and desserts.
- raw vegetables,
- Spicy foods;
- Vegetables that produce gas.
- Skin and seeds of vegetables and fruits.

Avoid heavy sauces, dressings, pickles, fried foods, rich cakes and nuts. Mechanical soft food is a regular food, only the texture has been changed to make it easier to chew. This method is used when patients are unable to chew or use their facial muscles due to a variety of dental, medical and surgical conditions. Foods in the diet can be liquid, crushed, pureed or regular foods with a very soft consistency. Now that we've covered the different hospital foods, we'll finally look at the different feeding methods used for therapeutic purposes.

12.4. MODE OF FEEDING



Enteral

The term "intestinal" refers to nutrition that takes place through the digestive system. It may be administered orally or by oral gavage.

Oral

Oral nutritional supplements (ONS) are nutritional support products that provide an effective and non-invasive way for people to meet their nutritional needs or increase their food intake. People taking ONS can eat a normal diet, but their regular diet alone cannot meet all their nutritional needs, so they need nutritional supplements. Also, patients requiring a fluid-based diet may benefit from ONS. ONS products are often prescribed or recommended by a physician or registered dietitian. In some cases, people rely on ONS as their only source of power.

Tube Feeding

If you have a condition or disease that limits or prevents oral intake, enteral nutrition (EN) therapy can be administered directly into your digestive tract as a tube feed. Tube feeding is a stable form of feeding and is often needed. If your dog cannot eat solid food or has a digestive disorder, this is the first feeding method. EN treatment consists of specialized liquid nutritional supplements containing proteins, carbohydrates, fats, vitamins, minerals and other nutrients necessary for survival. These nutritional support products are formulated to meet individual needs for a variety of medical conditions and symptoms.

Parenteral

Parenteral nutrition (PN) is the intravenous injection (intravenous delivery) of nutrients directly into the systemic circulation, bypassing the digestive tract. A special liquid mixture containing proteins, carbohydrates, fats, vitamins, minerals and other essential nutrients. for life. PN represents an alternative or additional approach to nutritional intervention when oral or enteral routes alone cannot meet nutritional needs or are contraindicated.

12.5. LET US SUM UP

Therapeutic nutrition refers to the role of food and nutrition in the treatment of various diseases. Illness or disability In this section, you will learn about diet therapy and its types of food treatments. Types of dietary modifications that are made in the patient's usual diet to meet the patient's medical needs. You also learned that all therapeutic diets are modifications of normal diets.

Then we discussed the purpose of diet modification and different types of diets. Treatment is possible. These include liquid foods, soft foods, and other types of meals. Feeding modes such as oral feeding, tube feeding, peripheral injection feeding and complete feeding parenteral nutrition. Nutritional support is an essential part of medical treatment. As Careful awareness and sensitivity are essential for clinical nutritionists to translate nutrition Translate knowledge into languages appropriate to customer needs. Enough Achieving or maintaining favorable conditions requires knowledge, skills and correct attitude nutritional status.