Chapter 1: BASIC ASPECTS

Definition of Food and Nutrition

Food is any substance consumed to provide nutritional support for the body. It is typically of plant or animal origin and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, and minerals, that are necessary for life.

Nutrition is the science that interprets the interaction of nutrients and other substances in food (in relation to maintenance, growth, reproduction, health, and disease) of an organism. It involves the entire process of ingestion, digestion, absorption, transport, assimilation, and excretion.

Importance of Food

Food is vital as it satisfies three fundamental aspects of human existence:

1. Physiological Importance: Food provides the necessary energy (calories) for all bodily functions, including breathing, muscle movement, and maintaining body temperature. It supplies the building blocks (like protein) required for growth, tissue repair, and the regulation of metabolic processes through hormones and enzymes.

2. Psychological Importance: Food is closely linked to emotions and well-being. A satisfying meal can provide comfort, security, and pleasure, positively influencing mood and mental state. Dietary choices can also affect cognitive functions, such as concentration and memory.

3. Social Importance: Food plays a crucial role in social gatherings, celebrations, and cultural identity. Sharing a meal is a fundamental way to connect with family and friends, celebrate traditions, and establish social bonds within a community.

Functions of food (in maintaining good health)

Food performs three primary, interrelated functions in the body:

1. Body Building and Repair: Proteins and minerals (like calcium) are essential for building new cells and tissues, particularly during growth spurts, pregnancy, and recovery from injury or illness.

2. Energy Provision: Carbohydrates and fats are the main sources of energy, or fuel, needed for voluntary activities (like walking and running) and involuntary functions (like heartbeat and digestion).

3. Regulation and Protection: Vitamins, minerals, protein, and water help regulate body processes such as maintaining fluid balance, blood clotting, enzyme activity, and hormone production. They also provide protection by supporting the immune system, helping the body fight off infections and diseases.

Chapter 2: CLASSIFICATION OF NUTRIENTS

Nutrients are classified based on the quantity required by the body into Macronutrients (needed in large amounts) and Micronutrients (needed in small amounts).

Macro Nutrients

These are nutrients needed in large quantities daily to provide energy and support bodily functions.

1. Carbohydrates (Carbs): The body's primary source of energy, composed of carbon, hydrogen, and oxygen.

- **Simple Carbohydrates (Sugars):** Easily and quickly digested, providing a rapid energy release.
    - **Monosaccharides:** Single sugar units, the simplest form. (e.g., Glucose, Fructose, Galactose).
    - **Disaccharides:** Two sugar units linked together. (e.g., Sucrose (table sugar), Lactose (milk sugar), Maltose).
- **Complex Carbohydrates:** Made up of long chains of sugar units, taking longer to digest and providing sustained energy.
    - **Polysaccharides:** Many sugar units linked together. (e.g., Starch, Fiber, Glycogen).

2. Fats (Lipids): A concentrated source of energy, also vital for hormone production and nutrient absorption.

- **Saturated Fats:** Solid at room temperature (e.g., butter, lard). They typically have no double bonds in their chemical structure and are generally associated with increased health risks when consumed in excess.
- **Unsaturated Fats:** Liquid at room temperature (e.g., oils). They contain one or more double bonds in their chemical structure.
    - **Monounsaturated Fats (MUFAs):** One double bond. (e.g., Olive oil, avocado).
    - **Polyunsaturated Fats (PUFAs):** Two or more double bonds. Includes essential fatty acids like Omega-3 and Omega-6. (e.g., Sunflower oil, fatty fish).

3. Proteins: The body's fundamental building blocks, essential for growth, maintenance, and enzyme production. They are large complex molecules made up of amino acids.

- **Based on structure:**
    - **Fibrous:** Long, parallel strands, typically insoluble and providing strength. (e.g., Keratin in hair, Collagen in tendons).
    - **Globular:** Compact, spherical, soluble proteins involved in functions like metabolism and immunity. (e.g., Enzymes, Hemoglobin, Antibodies).
    - **Intermediate:** Proteins that share characteristics of both fibrous and globular structures.
- **Based on composition:**

    - **Simple:** Composed only of amino acids. (e.g., Albumins, Globulins).
    - **Conjugated:** Composed of amino acids plus a non-protein part (called a prosthetic group). (e.g., Lipoproteins, Glycoproteins).

4. Water: Though it does not provide energy, water is the most essential nutrient for survival, making up approximately 60% of the adult human body weight.

Micro Nutrients

These are nutrients needed in very small amounts (milligrams or micrograms) but are crucial for regulating body processes.

1. Vitamins: Organic compounds required in small quantities for metabolic regulation.

- **Water Soluble:** Cannot be stored in the body and must be consumed regularly. (e.g., B-Complex Vitamins, Vitamin C).
- **Fat Soluble:** Can be dissolved in fat and stored in the body's fatty tissues and liver. (e.g., Vitamin A, D, E, K).

2. Minerals: Inorganic elements essential for bone structure, fluid balance, nerve function, and other metabolic roles.

- **Macro Elements (Major Minerals):** Required in amounts greater than 100mg/day. (e.g., Calcium, Phosphorus, Sodium, Potassium).
- **Trace or Micro Elements:** Required in very small amounts, typically less than 100mg/day. (e.g., Iron, Iodine, Zinc, Selenium).

Chapter 3: MACRO NUTRIENTS

Carbohydrates

Functions of Carbohydrates:

- Primary source of quick energy for the body and the brain.
- Protein-sparing action: ensures protein is used for body building instead of energy.
- Fiber (a carb) aids in peristalsis (movement of food through the digestive tract) and preventing constipation.
- Stored as glycogen in the liver and muscles for reserve energy.

Sources: Cereals (wheat, rice), potatoes, fruits, milk, sugar, honey, legumes (beans, lentils).

Recommended Daily Allowances (RDA): Generally, 50-60% of total daily energy should come from carbohydrates, with an emphasis on complex carbohydrates and fiber-rich foods.

Effects of Deficiency and Excess Intake of Carbohydrates:

- **Deficiency:** Weight loss, fatigue, breakdown of protein for energy (leading to muscle wasting), and ketosis (body burning fat for fuel, leading to acidic blood).

- **Excess:** Weight gain and obesity (excess carbs are converted and stored as fat), increased risk of Type 2 diabetes (especially from excess simple sugars), and dental caries.

Fats

Functions of Fats:

- Most concentrated source of energy (providing 9 kilocalories per gram).
- Carries and aids in the absorption of fat-soluble vitamins (A, D, E, K).
- Insulates the body against cold and protects vital organs.
- Essential for cell membrane structure and the synthesis of hormones.
- Provides satiety (feeling of fullness) in meals.

Sources: Oils (sunflower, olive, coconut), nuts, seeds, butter, ghee, fatty meats, avocado, cheese.

Recommended Daily Allowances (RDA): Fats should generally provide 20-30% of total daily energy intake, with a focus on replacing saturated and trans fats with unsaturated fats.

Effects of Deficiency and Excess Intake of Fats:

- **Deficiency:** Deficiency of essential fatty acids (EFAs) can lead to dry, flaky skin, poor growth, and impaired wound healing. Difficulty absorbing fat-soluble vitamins.
- **Excess:** Overweight and obesity, increased risk of cardiovascular diseases (due to elevated cholesterol and triglyceride levels), and certain types of cancer.

Proteins

Functions of Proteins:

- Primary function is growth and repair of all body tissues, including muscles, organs, and skin.
- Production of essential regulatory substances like enzymes, hormones, and antibodies (immune function).
- Maintenance of fluid balance (osmotic pressure) in the body.
- Acts as a secondary energy source if carbohydrate and fat intake is insufficient.

Sources: Meat, poultry, fish, eggs, dairy products (milk, cheese), legumes, nuts, seeds, and grains (to a lesser extent).

Recommended Daily Allowances (RDA): The general requirement for adults is around 0.8 grams of protein per kilogram of ideal body weight, which should account for 10-15% of total daily energy.

Effects of Deficiency and Excess Intake of Proteins:

- **Deficiency:** Malnutrition (like Kwashiorkor or Marasmus, seen in children), impaired growth, muscle wasting, poor wound healing, weak immune system, and edema (swelling due to fluid imbalance).

- **Excess:** Strain on the kidneys (as they must excrete the by-products of protein metabolism), potential dehydration, and increased loss of calcium.

Water

Functions:

- Acts as a universal solvent, facilitating chemical reactions in the body.
- Regulates body temperature through perspiration (sweating).
- Transports nutrients to cells and removes waste products.
- Lubricates joints and cushions organs.
- Essential component of blood and digestive juices.

Source: Drinking water, beverages (juices, milk, tea), and all foods (fruits and vegetables have high water content).

Recommended Daily Allowance (RDA): The recommendation is highly variable but typically 8-10 glasses (or 2.5 to 3 litres) of fluid per day, adjusted for climate, physical activity, and physiological state.

Chapter 4: MICRO NUTRIENTS

Vitamins

Vitamins of B-Complex Group (Thiamine, Riboflavin, Niacin, Folate, B12, etc.)

- **Functions:** Act as co-enzymes in energy metabolism, nerve function, and DNA synthesis. Folate and B12 are crucial for red blood cell formation.
- **Sources:** Whole grains, meat, eggs, dairy, leafy green vegetables, and legumes.
- **RDA:** Varies greatly by vitamin, typically in microgram (ug) or milligram (mg) range.
- **Deficiency / Excess:**
    - **Deficiency:** Beriberi (Thiamine), Pellagra (Niacin), Anemia (B12/Folate), nerve damage.
    - **Excess (Water Soluble):** Generally low toxicity as excess is excreted in urine, but very high doses can cause nerve damage (B6).

Vitamin C (Ascorbic Acid)

- **Functions:** Essential for collagen formation (skin, bones, blood vessels), acts as a powerful antioxidant, aids in iron absorption, and supports immune function.
- **Sources:** Citrus fruits, berries, tomatoes, bell peppers, broccoli.
- **RDA:** 75-90 mg/day for adults.
- **Deficiency / Excess:**
    - **Deficiency:** Scurvy (bleeding gums, joint pain, poor wound healing).
    - **Excess:** Diarrhoea, stomach cramps, and possible kidney stone formation.

Vitamin A (Retinol)

- **Functions:** Essential for vision (formation of rhodopsin), cell differentiation, and immune function.
- **Sources:** Liver, milk, eggs, and beta-carotene (found in carrots, sweet potatoes, dark leafy greens).
- **RDA:** 700-900 ug/day.
- **Deficiency / Excess:**
    - **Deficiency:** Night blindness (Nyctalopia), Xerophthalmia (dry eye leading to blindness).
    - **Excess (Toxicity):** Headache, nausea, dizziness, joint pain, and liver damage.

Vitamin D

- **Functions:** Promotes calcium absorption in the gut and maintains adequate blood calcium and phosphate concentrations for bone growth and remodelling.
- **Sources:** Sunlight exposure (main source), fatty fish, fortified milk and cereals, and egg yolks.
- **RDA:** 15-20 ug/day (or 600-800 IU).
- **Deficiency / Excess:**
    - **Deficiency:** Rickets in children (softening of bones), Osteomalacia in adults.
    - **Excess (Toxicity):** Hypercalcemia (high blood calcium), leading to calcification of soft tissues like the heart and kidneys.

Vitamin E

- **Functions:** Powerful fat-soluble antioxidant, protecting cell membranes from damage by free radicals.
- **Sources:** Vegetable oils, nuts, seeds, and leafy green vegetables.
- **RDA:** 15 mg/day.
- **Deficiency / Excess:**
    - **Deficiency:** Rare, but can cause nerve damage and red blood cell fragility.
    - **Excess:** Increased risk of bleeding (due to interference with Vitamin K).

Vitamin K

- **Functions:** Essential for blood clotting (coagulation) and bone metabolism.
- **Sources:** Dark green leafy vegetables (spinach, kale), broccoli, and produced by gut bacteria.
- **RDA:** 90-120 ug/day.
- **Deficiency / Excess:**
    - **Deficiency:** Hemorrhagic disease (excessive bleeding). Often seen in newborns or people on long-term antibiotics.
    - **Excess:** Rare, but can interfere with the function of some anticoagulants (blood thinners).

Minerals

Calcium

- **Functions:** Essential for building and maintaining strong bones and teeth, muscle contraction, nerve signalling, and blood clotting.

- **Sources:** Milk, yogurt, cheese, leafy green vegetables (broccoli, kale), and fortified foods.
- **RDA:** 1000-1200 mg/day for adults.
- **Deficiency / Excess:**
    - **Deficiency:** Osteoporosis (brittle bones), Rickets.
    - **Excess (Hypercalcemia):** Constipation, impaired absorption of other minerals, and kidney stones.

Iron

- **Functions:** Essential component of hemoglobin, which transports oxygen in the blood, and myoglobin, which stores oxygen in the muscles. Also vital for energy production.
- **Sources:** Red meat, liver, egg yolks, legumes, and dark leafy greens.
- **RDA:** 8-18 mg/day (higher for women of childbearing age).
- **Deficiency / Excess:**
    - **Deficiency:** Iron-deficiency anemia (fatigue, weakness, shortness of breath).
    - **Excess (Hemochromatosis):** Can accumulate in organs (heart, liver), leading to serious damage.

Iodine

- **Functions:** Necessary for the synthesis of thyroid hormones, which regulate metabolism, growth, and development.
- **Sources:** Iodized salt, seafood, and dairy products.
- **RDA:** 150 ug/day.
- **Deficiency / Excess:**
    - **Deficiency:** Goiter (enlarged thyroid gland), Cretinism in children (severe mental and physical disability).
    - **Excess:** Can also impair thyroid function and lead to goiter.

Sodium

- **Functions:** Major electrolyte responsible for maintaining proper fluid balance and blood volume. Essential for nerve impulse transmission and muscle contraction.
- **Sources:** Salt (Sodium Chloride), processed and packaged foods, condiments.
- **RDA:** Limit intake to < 2300 mg/day (or about one teaspoon of salt).
- **Deficiency / Excess:**
    - **Deficiency (Hyponatremia):** Nausea, vomiting, headache, confusion.
    - **Excess (Hypernatremia):** High blood pressure (Hypertension), increased risk of cardiovascular disease, fluid retention.

Phosphorus

- **Functions:** Works with calcium to build strong bones and teeth. Part of every cell, essential for energy storage (ATP) and genetic material (DNA and RNA).
- **Sources:** Meat, fish, milk, cheese, eggs, nuts, and legumes.
- **RDA:** 700 mg/day.
- **Deficiency / Excess:**
    - **Deficiency:** Rare, but can cause muscle weakness, bone pain, and fatigue.

    - **Excess:** Common in kidney disease, which can lead to cardiovascular disease and bone disorders by upsetting the calcium-phosphorus balance.

Chapter 5: CONSERVING NUTRIENTS

Nutrients, especially water-soluble vitamins (B and C) and some minerals, can be lost or destroyed during the journey from farm to plate. Conservation methods aim to minimize this loss.

During Storing

- **Principle:** Minimize exposure to air, light, heat, and pests, which degrade nutrients.
- **Methods:**
    - Store fruits and vegetables in cool, dark, and humid conditions (like a refrigerator crisper drawer) to slow down respiration and vitamin degradation.
    - Keep dry goods (flour, nuts, spices) in airtight containers to prevent oxidation and pest infestation.
    - Use food items on a first-in, first-out basis (FIFO) to avoid losses due to prolonged storage.

During Food Preparation (Pre-cooking)

- **Washing:** Wash vegetables quickly before cutting to prevent nutrient leaching into the water. Avoid soaking cut vegetables.
- **Peeling:** Peel fruits and vegetables thinly, or not at all, as many nutrients (like fiber and vitamins) are concentrated just beneath the skin.
- **Cutting, Chopping, Slicing:** Cut items into larger pieces just before cooking. The smaller the size and the longer the exposure to air, the greater the loss of water-soluble vitamins due to oxidation.
- **Pounding/Grinding:** Minimise the time between pounding/grinding and cooking to reduce nutrient loss from increased surface area exposure.
- **Soaking:** Soaking pulses/legumes is necessary to reduce anti-nutritional factors and speed up cooking, but discard the soaking water only if advised, as it can contain leached nutrients.
- **Sprouting:** This process actually **increases** the nutritional value, especially Vitamin C and B-complex vitamins, and improves protein digestibility.
- **Fermentation:** This process also increases B-vitamin content and protein digestibility, while also acting as a natural preservative. (e.g., making yogurt or idli batter).
- **Mixing:** Prepare mixed dishes immediately before cooking.

During Cooking

- **Principle:** Use minimal water, shortest cooking time, and moderate heat.
- **Methods:**
    - **Steaming:** The best method for nutrient retention as the food does not directly contact the water.
    - **Pressure Cooking:** Reduces cooking time significantly, minimizing the destruction of heat-sensitive nutrients.

- **Stir-frying:** Quick cooking at high heat, preserving most nutrients and texture.
- **Avoid Discarding Cooking Water:** Use the water remaining after boiling vegetables (the stock) to make soup or gravy, as it contains leached water-soluble nutrients.
- **Cover the Pan:** Cooking with a lid reduces cooking time and minimizes the loss of volatile nutrients.

Chapter 6: BALANCED DIET

Definition and its importance

A **Balanced Diet** is a diet that provides all the nutrients—carbohydrates, fats, proteins, vitamins, minerals, and water—in the correct proportion and quantity required by an individual to maintain good health.

Importance:

- **Optimal Health:** Ensures the body receives all necessary resources for growth, energy, and maintenance.
- **Disease Prevention:** Reduces the risk of non-communicable diseases like diabetes, hypertension, and heart disease.
- **Strong Immunity:** Provides the nutrients required for the immune system to function effectively and fight off infections.
- **High Energy Levels:** Ensures a steady supply of energy for daily activities and sustained concentration.

Factors Affecting Balanced Diet

The quantity and proportion of nutrients needed by an individual vary significantly based on several factors:

1. Age:

- **Infants/Children:** Need proportionally more protein and fat for rapid growth and brain development.
- **Adolescents:** Have high energy and calcium requirements due to growth spurts and bone development.
- **Adults:** Energy requirements stabilise, but nutrient density becomes important to maintain body mass and prevent age-related diseases.
- **Elderly:** Calorie needs decrease, but requirements for vitamins (like D and B12) and protein often remain high or increase.

2. Gender:

- **Men:** Generally have a higher basal metabolic rate (BMR) and greater muscle mass, requiring more energy (calories) and slightly higher protein intake than women of similar body size and activity level.
- **Women:** Have specific needs, particularly for iron (due to menstrual blood loss) and folic acid (crucial before and during childbearing years).

3. Physiological State:

- **Pregnancy:** Requires significant increases in total calories, protein, iron, calcium, and folic acid to support the growth of the fetus and maternal tissues.
- **Lactation (Breastfeeding):** Requires the highest energy and fluid intake of any physiological state to support milk production.
- **Illness/Convalescence:** Nutrient needs vary; fever increases calorie needs, while certain diseases may require specific dietary restrictions or nutrient boosts (e.g., high protein for burn victims, fluid restriction for kidney disease).
- **Physical Activity:** Highly active individuals (e.g., athletes) require more energy (carbohydrates and fats) and slightly more protein to support muscle repair and endurance.

Chapter 7: MENU PLANNING

Menu planning is the strategic process of creating a sequence of meals that are safe, appealing, economically viable, and, most importantly, nutritionally adequate.

Nutritionally balanced meals as per three food group system

A common, simple method is the three food group system, which ensures a mix of macronutrients for a balanced meal:

1. **Energy Yielding Foods (Carbohydrates & Fats):** Grains (rice, bread, pasta), oils, sugar, potatoes. These provide the fuel.
2. **Body Building Foods (Proteins):** Meat, fish, eggs, dairy, pulses, legumes, nuts. These provide materials for growth and repair.
3. **Protective and Regulatory Foods (Vitamins & Minerals):** Fruits and Vegetables. These provide the micronutrients and fiber needed to regulate body processes and protect against disease.

A nutritionally balanced meal should incorporate foods from all three groups in appropriate proportions, ensuring that the bulk of the meal comes from protective and energy-yielding foods, with adequate body-building foods.

Factors affecting meal planning

Effective meal planning considers the following constraints:

- **Nutritional Adequacy:** The meal must meet the RDA for all family members.
- **Economic Factors:** The budget must accommodate the cost of ingredients.
- **Satiety Value:** The meal should be satisfying and provide a feeling of fullness.
- **Sensory Factors (Acceptability):** Meals must appeal to the senses—variety in colour, texture (crisp, soft, chewy), flavour (sweet, sour, salty), and temperature.
- **Time and Labour:** The available time, cooking skills, and kitchen equipment must be considered.
- **Availability:** Ingredients must be available locally and seasonally.

Calculation of Nutritive value of dishes and meals

This involves assessing the nutrient content of the prepared food.

1. **Ingredient Analysis:** Determine the exact weight/measure of each ingredient used in the dish.
2. **Reference to Food Composition Tables:** Use standard food composition tables to find the energy (calories), protein, fat, and specific vitamin/mineral content for the raw quantity of each ingredient.
3. **Summation:** Total the nutrient contributions of all ingredients to find the total nutritive value of the dish.
4. **Portion Sizing:** Divide the total nutrient value by the number of servings to determine the nutritive value per portion. This is then compared against the RDA for the target individual.

Critical evaluation of a given meal

Evaluating a meal involves judging its effectiveness based on the factors of planning.

- **Nutritional Score:** Is the meal balanced according to the three food groups? Is the protein source adequate? Are there enough fruits/vegetables? Does it contain excessive fat or sugar?
- **Cost Analysis:** Is the meal within a reasonable budget for the target group?
- **Sensory Evaluation:** Was the colour attractive? Was the texture varied? Were the portions correctly sized?
- **Time and Labour:** Was the preparation time realistic given the constraints? Could it be made simpler?

Chapter 8: MENU PLANNING – FOR SPECIAL NEEDS

Planning menus for individuals with special health needs, often referred to as therapeutic diets, requires modification of the normal diet to prevent, manage, or treat specific diseases.

Obesity (Weight Reduction Diet)

- **Goal:** Create a calorie deficit to promote gradual weight loss.
- **Key Modifications:**
    - **Energy:** Reduce total calorie intake drastically.
    - **Carbohydrates:** Limit refined sugars and simple carbs; emphasize high-fibre, complex carbs (whole grains, vegetables) to promote satiety.
    - **Fats:** Severely restrict high-fat foods and fried items; use lean protein and low-fat dairy.
    - **Protein:** Maintain adequate intake to prevent muscle loss.
    - **Frequency:** Encourage smaller, more frequent meals to control hunger.

Diabetes Mellitus

- **Goal:** Maintain blood glucose levels within a safe, target range.
- **Key Modifications:**

    - **Carbohydrates:** Control the total amount and timing of carbohydrate intake to match insulin action (or medication). Emphasis must be on complex carbohydrates (low Glycemic Index foods) and high fibre.
    - **Sugars:** Completely eliminate or severely restrict refined sugars (sucrose, glucose) and sugar-sweetened beverages.
    - **Fats:** Control fat intake, especially saturated and trans fats, to manage the increased risk of heart disease associated with diabetes.
    - **Frequency:** Consistent meal times and portion sizes are essential.

Hypertension (High Blood Pressure)

- **Goal:** Reduce blood pressure and manage fluid balance.
- **Key Modifications:**
    - **Sodium:** Severely restrict the intake of sodium (salt). This means avoiding added salt, processed foods, canned foods, and salty condiments.
    - **Potassium/Calcium/Magnesium:** Increase intake of these minerals through fruits, vegetables, and low-fat dairy, as they have blood pressure-lowering effects.
    - **Fats:** Limit total fat, particularly saturated fat, to maintain a healthy weight and cardiovascular system.

Cardiac (Heart Diseases)

- **Goal:** Reduce the workload on the heart and manage risk factors like high cholesterol and atherosclerosis.
- **Key Modifications:**
    - **Fats:** Strictly limit saturated fat, trans fat, and dietary cholesterol. Encourage monounsaturated and polyunsaturated fats (Omega-3 rich foods) to improve cholesterol profile.
    - **Sodium:** Restrict sodium intake to prevent fluid retention and manage blood pressure.
    - **Fibre:** Increase soluble fibre (oats, beans, apples) to help lower blood cholesterol.
    - **Fluid:** Fluid restriction may be necessary if the patient has Congestive Heart Failure.