

CHAPTER - 3

NUTRITION AND HEALTH

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3.1 INTRODUCTION

❖ Nutrition

- The foods we eat contain nutrients. Nutrients are substances required by the body to perform its basic functions. Nutrients must be obtained from our diet, since the human body does not synthesize or produce them.
- Nutrients have one or more of three basic functions: they provide energy, contribute to body structure, and/or regulate chemical processes in the body.

3.1.1 BASIS OF NUTRITION

Nutrients are classified mainly into two types-



❑ Macronutrients

- Macronutrients are essential nutrients in the body needs in large quantities to remain healthy.
- Macronutrients provide the body with energy, help prevent disease, and allow the body to function correctly.
- Macronutrients contain the components of food that your body needs to maintain its systems and structures.

They are 3 main types of macro nutrients-

➤ Protein

Proteins are extremely large molecules composed of many amino acids. Proteins are complex organic compounds rich in carbon, hydrogen, oxygen, nitrogen, and sometimes phosphorous and sulphur.

Proteins are needed by the body for the following :

- Growth and development
- Repair and maintenance
- Synthesis of antibodies, enzymes, and hormones

Nutritionally, amino acids belong to two categories:

- Essential amino acids:** These are amino acids that cannot be synthesized in the animal body and must be supplied with food, e.g. leucine.
- Non-essential amino acids:** Which can be synthesized in the body, particularly from carbohydrates, and need not be supplied in the diet. e.g. alanine.



✓ Digestion of protein health

Like fats, proteins cannot be absorbed in the tissue until they are broken down into their amino acids. Digestion of proteins occurs in the stomach and small intestine, where acids and enzymes break up proteins into amino acids.

✓ Sources:

- **Animal sources:** Milk, eggs, fish, beans, meat, and liver.
- **Plant sources:** Whole cereals, pulses, nuts, grams, and legumes.
- Intake of more than one plant protein in the same meal (dal-roti, sambar-idli) can produce a mixture containing all the essential amino acids.
- Proteins are structural components of the body. For example, the protein keratin is present in hair and nails. Collagen present in the connective tissue is also an example of a protein. Actin and myosin are examples of contractile proteins present in the muscles.

✓ Functions of proteins

- Proteins are required for building and maintaining body tissues.
- Proteins are found in all enzymes, e.g. trypsin, pepsin, and rennin.
- Some proteins function as hormones that regulate many body functions. For example, insulin is a hormone which regulates blood glucose levels in the body.
- Proteins also act as antibodies and protect the body from antigens.
- Transport proteins carry different substances from the blood to the tissues in the body. Haemoglobin is a transport protein.

➤ Fats

Fats are members of the lipids family. Like carbohydrates, fats are also made up of carbon, hydrogen, and oxygen. However, fats contain more carbon and hydrogen and less oxygen. Fats are the richest source of energy. Fats are insoluble in water but soluble in solvents like acetone, and benzene. Chemical fats are triglycerides.



✓ Sources:

- **Animal sources:** Ghee, butter, fish oil, meat, eggs.
- **Plant sources:** Vegetable oil from the seeds of coconut, mustard, sunflower, safflower, milk, nuts, soyabean, and cheese.

✓ **Functions of fats**

- Fats are the richest source of energy. On biological oxidation, one gram of fat provides 37 kJ of energy.
- From structural components of the cell cytoplasm and cell membrane.
- Help in the absorption of fat-soluble vitamins A, D, E, and K.
- Act as a precursor of various hormones.
- Can be stored for subsequent use by the body.
- Sub-cutaneous fats serve as insulators in the body, thus protecting it from cold weather and pressure.
- Stored fat provides padding to protect the vital organs of the body from shocks.
- Help in the synthesis of vitamin D and steroid hormones in the body.



➤ **Carbohydrates**

Carbohydrates are chemical compounds made up of carbon, hydrogen, and oxygen. They release energy from biological oxidation with the help of cellular enzymes. They are the cheapest source of energy. Complete biological oxidation of one gram of carbohydrate yields about 18 kilo joules of energy. One kilo calorie of heat is required to raise the temperature of 1 litre of water to 1°C.

The three types of carbohydrates that we consume in our food are:

I. Sugar

II. Starch

III. Cellulose

Common sources of carbohydrates

Sugar

- Cane sugar, beet root, fruits (banana, mango, sapota, or chiku), milk, honey, and cereals.

Starch

- Cereals (wheat, rice, maize), millets (bajra, jowar, barley), roots, and tubers (sweet potato, tapioca, potato).

Cellulose

- Cell walls of fruits, vegetables, and cereals.
- During digestion, both starch and sugars are absorbed as glucose. The surplus glucose is changed into glycogen which is stored in the liver for subsequent use.
- Cellulose is a fibrous substance that is not digested by the human body. However, it serves as roughage and facilitates bowel (stool) movement.

Table 3.1 Percentage of carbohydrates present in some common food items

FOOD	PERCENTAGE (PER 100 G OF FOOD)
Sugar	99.4
Rice	78.2
Wheat flour	69.4
Potato	22.7
Banana	24.7
Mango (ripe)	11.8
Green gram	69.4
Red gram	57.6
Carrots	1.6
Cow's milk	4.4

✓ **Functions of carbohydrates**

- Lactose sugar promotes the growth of intestinal bacteria that facilitate the absorption of calcium.
- Excess carbohydrates are converted into glycogen and fat and served as a reserve.

✓ **Sources of energy**

- Cellulose provides faecal bulk and helps in bowel movement.

Vitamins, their functions, sources and deficiency diseases are as follows :

❖ **Fat - soluble vitamin**

❑ **Vitamin : Vitamin A (Retinol)**

Daily requirement: 750 mg

Function : Maintenance of vision and skin, essential for the synthesis of visual pigment.

Best food sources : milk, cheese, butter, eggs, cod liver oil, carrots, mangoes, papaya, yellow pumpkin, spinach, and sweet potatoes.

Deficiency disease: Night blindness, Xerophthalmis or keratinol acid, dry skin.

Symptoms : Cannot see in dim light; retarded keratinization of epithelia.

❑ **Vitamin: Vitamin D (Calciferol)**

Daily requirement: 200 IU

Function: Keeps teeth and bones healthy; absorption of calcium and phosphorus.



Best food sources: Milk, cheese, egg yolk, cod liver oil, fish, butter, and exposure to sunlight.

Deficiency disease : Rickets in children.

Symptoms : Failure to grow bones to calcify, bow legs, pigeon chest, softening of bones.

❑ **Vitamin: Vitamin E (Tocopherol)**

Daily requirement: Trace

Function: Antioxidant, and ageing vitamins.

Best food sources: Grains vegetable oil, green leafy vegetables, nuts.

Deficiency disease: Reproductive failure in males and females.

Symptoms: Sterility in males, miscarriage, or death of embryos during pregnancy in females.

❑ **Vitamin: Vitamin K (Phylloquinone)**

Daily requirement: Trace amount

Function: Clotting of blood.

Best food sources: Green leafy vegetables, soyabeans, tomatoes.

Deficiency disease: Faulty blood clotting, haemorrhage.

Symptoms: Delayed blood clotting.

❖ **Water-soluble vitamins**

❑ **Vitamin: Vitamin B₁ (Thiamine)**

Daily requirement: 1.3 mg (boys); 1.2 mg (girls).

Function: Carbohydrate metabolism, sharpening appetite.

Best food sources: Yeast, liver; milk, cheese, leafy vegetables, meat, and whole grain cereals.

Deficiency disease: Beri-beri.

Symptoms: Pain in hands and feet, swelling of body, paralysis of the limbs, oedema.

❑ **Vitamin: Vitamin B₂ (Riboflavin)**

Daily requirement : 1.6 mg (boys); 1.4 mg (girls).

Function: Carbohydrate and protein metabolism; keeping skin healthy.

Best food sources : Milk, liver, meat, egg, yeast, whole grains, green leafy vegetables.

Deficiency disease : Riboflavinosis, Photophobia.

Symptoms: Retarded growth and mental disorder; cracking of skin in the corners of the mouth, lesions of eyes.

❑ **Vitamin: Vitamin B₃ (Niacin)**

Daily requirement: 1.8 mg (boys), 1.5 mg (girls).

Function: Coenzymes for protein, fat and carbohydrate metabolism. Keeps the skin healthy.

Best food sources: Fish, eggs, meat, legumes, whole grains, leafy vegetables, peanuts, beans.

Deficiency disease: Pellagra.

Symptoms: Dermatitis (bad skin), diarrhoea (loose motions), dementia (mental disorder).

❑ **Vitamin: Vitamin B₁₂ (Cyanocobalamin)**

Daily requirement: 0.2-100 mg

Function: Blood formation, nervous tissue metabolism, nucleic acid synthesis.

Best food sources: Liver, fish, cheese, milk, eggs, and meat.

Deficiency disease: Pernicious anaemia.

Symptoms: Paleness of skin, breathlessness, retarded growth.

❑ **Vitamin: Vitamin C (Ascorbic Acid)**

Daily requirement: 40 mg

Function: Resistance to infections; keeping teeth, gums, and joints healthy; healing of cuts and wounds; maintenance of connective tissue.

Best food sources: Amla, cabbage, tomatoes, lemon, orange, mangoes.

Deficiency disease: Scurvy

Symptoms: Bleeding gums, pain in joints, general weakness.

➤ **Minerals**

Minerals are micronutrients required in varying amounts for proper functioning, normal growth, and keeping good health of our body.

Table 3.2 Minerals required in large and trace amount

MINERALS	
Required in larger amounts	Required in trace amounts
Calcium, Phosphorus, Sodium, Potassium, Sulphur Chloride, Magnesium	Iron, Iodine, Zinc, Chromium, Cobalt, Copper, Fluoride, Manganese, Molybdenum, Selenium, and Boron

Minerals perform the following functions :

- Essential for the development of bone and teeth, e.g. calcium, and phosphorus.

- Regulate fluid balance and acid alkalinity of the body fluids e.g. sodium, potassium, and chloride.
- Iodine is required for the synthesis of the thyroid hormone thyroxine, which regulates the rate of oxidation energy sources within cells.
- Zinc, copper, and magnesium regulate a host of vital reactions in our body.

Minerals required by and in our body, their sources, and functions:

☐ Minerals: Calcium

Functions: Formation of bones and teeth, necessary for nerve, teeth and muscles.

Food sources: Milk and milk products, fish, meat, beans, green leafy vegetables, broccoli, tapioca.

Deficiency diseases: Rickets, osteomalacia.

Symptoms: Softening of bones, deformities, pain in bones.

☐ Minerals: Iron

Functions: The formation of haemoglobin, acts as carrier of oxygen.

Food sources: Liver; green leafy vegetables, eggs, spinach, groundnuts, cereals, jaggery.

Deficiency diseases: Anaemia

Symptoms: Loss of weight, pale appearance, tiredness, loss of appetite.

☐ Minerals: Phosphorus

Functions: Formation of bones and teeth

Food sources: Milk; cereals, green leafy vegetables, nuts, bajra meat.

Deficiency diseases: Rickets and osteomalacia

Symptoms: Softening of bones, bowlegs, pigeon chest.

☐ Minerals: Iodine

Functions: Metabolic control of the hormone thyroxine; controls growth

Food sources: Iodized salt, sea food, fish, and green leafy vegetables.

Deficiency diseases: Goitre

Symptoms: Iodized salt, sea food, fish, and green leafy vegetables.

☐ Minerals: Sodium and Potassium

Functions: Maintenance of normal water balance in the body.

Food sources: Common salt, meat, poultry, fish, fruits.

Deficiency diseases: High blood pressure, oedema.

Symptoms: Severe malnutrition, high blood pressure, fatigue.

➤ Water

Water is an important constituent of our diet. 75% of an infant body and 60% of an adult body are nothing but water.

The various functions of water are as follows:

- Essential for the transport and digestion of food material, excretes waste, maintains body temperature, acts as solvent in various reactions in the body.



✓ Sources of water

Water is replenished by:

- Drink plain water or tea, coffee, milk and fruit juices.
- Eating fruits, vegetables and fish.
- Some amount of water comes as a by-product of oxidation of glucose in the body.



3.2 IMPORTANCE OF WATER AND FIBER IN DIET

❑ Water

We are made up of more than 50% water. We need to drink it regularly to survive, and we need more than average suggested amounts in certain conditions. A general recommendation for water intake is roughly 1 ounce of water per kilogram of body weight.

- Normalizing blood pressure
- Aiding digestion
- Cushioning joints
- Regulating body temperature
- Maintaining electrolyte balance
- Preventing constipation
- Flushing bacteria from the bladder

Some common importance of water

- **Help in digestion:** When the smaller food particles reach to the stomach or intestine they are converted into absorbable form in the presence of water. Finally, water helps in the softening of faecal matter for easily pass out from the rectum.
- **In circulation:** Each and every organ requires the water for its proper functioning and metabolism. Eg- brain, heart, lungs, kidney, liver.
- **Joint and muscles activity:** For the activity of muscles and joints water is very important. Joint and muscle activity works in the presence of ions.

❑ **Fibers**

On average, an adult living in the US only gets about 12-16 gm fiber per day. How much fiber you should eat depends on your gender and how many calories you consume.



Avoid hyper-focusing on a particular fiber or type of food and instead focus on eating a wide variety of plant foods like vegetables, fruits, legumes, nuts, and whole grains. When increasing fiber intake, often adding an additional serving or two each week to get your body used to it works best.

Importance of fiber in the diet

- **Digestion:** Dietary fiber helps our digestive system as it increases the weight and size of our stools, which makes them easier to pass, decreasing the risk of constipation.
- **Cardiovascular Health:** The cardiovascular system comprises intricate workings of the heart, blood and vessels that ensure all our cells receive the oxygen and nutrients we need to survive.
- **Cholesterol:** Fiber is effective at reducing LDL cholesterol, which is often referred to as the 'bad' cholesterol.
- **Blood sugar:** Foods high in fiber are also frequently recognized to offer slowly released energy. High GI foods, such as jelly sweets, quickly raise blood sugar levels, but this effect is frequently fleeting since energy slumps soon follow.

3.3 BALANCED DIET

A balanced diet is a way of eating that offers the proper amount of each nutrient to support general health and wellbeing. To make sure the body gets a wide range of vital nutrients, such as carbs, proteins, fats, vitamins, and minerals, it entails eating a variety of meals from several dietary categories.

A balanced diet has the following qualities:

- It meets the nutrient requirements of the body.
- It consists of different types of food items.
- It provides an adequate amount of energy.
- A balanced diet leads to a good physical and a good mental health.



3.3.1 MALNUTRITION

“Malnutrition is a serious condition that happens when your diet does not contain the right amount of nutrients”.

- Malnutrition is the condition that develops when the body is deprived of vitamins, minerals and other nutrients it needs to maintain healthy tissues and organ function. Malnutrition occurs in people who are either undernourished or over nourished.

Types of malnutrition:

- **Under-nutrition** - Not getting enough nutrients.
- **Over-nutrition** - Getting more nutrients than needed.



➤ **Malnutrition can lead to:**

- Slow recovery from wounds and illness.
- A higher risk of infection.

✓ **Symptoms**

- A lack of appetite or interest in food or drink.
- Tiredness and irritability.

✓ **In children there may be**

- Lack of growth and low body weight.
- Tiredness and a lack of energy.

✓ **Risk factors**

- People who are socially isolated for example due to mobility issues health problems or other factors.
- People with chronic eating disorders such as bulimia or anorexia nervosa.

✓ **Treatment**

- Ongoing screening and monitoring.
- Making a dietary plan, which might include taking supplements.

3.3.2 NUTRITION DEFICIENCY DISEASES

Nutritional deficiency occurs when the body is not getting enough nutrients such as vitamins and minerals. There are a number of conditions that are caused by nutritional deficiency such as anemia. Some people may have a greater need for certain vitamins.

There are three type of deficiency diseases:

- **Protein Energy Malnutrition (PEM)**
- **Mineral deficiency diseases**
- **Vitamin deficiency diseases**

(A) Protein Energy Malnutrition (PEM): Generally, growing children suffer from protein energy malnutrition as the required amount of proteins needed for their growth and development is not available.

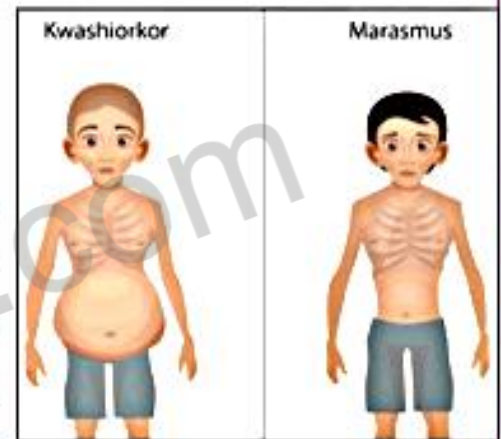
PEM is due to two reasons:

- (a) Lack of proteins, carbohydrates, or both in the diet
- (b) More intake of carbohydrates than proteins.

Protein energy malnutrition results in two diseases:

- i. Marasmus
- ii. Kwashiorkor

➤ **Marasmus:** Marasmus literally means "to waste". It mainly occurs in children under one-year of age. Marasmus is predominantly due to a deficiency of calories. This is usually observed in children given watery gruels (of cereals) to supplement the mother's breast milk.



A child suffering from Marasmus disease shows the following symptoms:

- Folded skin.
 - Sunken eyes, thin face, thinning of limbs and abdominal walls.
 - Retarded physical and mental growth.
 - Ribs become prominent (Pigeon chest).
- **Kwashiorkor:** This disease develops when mothers stop feeding their babies with breast milk and the child is given traditional family food low protein.

A child suffering from Kwashiorkor disease shows the following symptoms:

- Underweight
- Has a protruding belly
- The skin is dark and scaly



(B) Mineral Deficiency Diseases:

Common deficiency diseases of iron, calcium, and iodine are given below:

- **Anaemia (Iron deficiency):** Iron is important for the formation of the respiratory pigment haemoglobin present in blood. A deficiency of iron results in a reduction of red blood cells. This reduces the oxygen carrying capacity of the blood. A person suffering from anaemia becomes pale, loses appetite, and loses weight.

Cure: This disease can be cured by eating food rich in iron and vitamin B₁₂, e.g., eggs, meat, liver, milk, green leafy vegetables such as spinach, and fruits like apples, bananas, and guava.

- **Deficiency of calcium, phosphorus, and vitamin D**
Chief constituent of bones and teeth; it regulates heartbeat and muscle contraction and helps in the clotting of blood. Calcium metabolism is closely related to that of phosphorus and vitamin D.

Deficiency of calcium causes: Rickets in children and osteomalacia in adults.

- (i) The bones become soft, get deformed, or bend easily.
- (ii) Bow legs (bent legs)
- (iii) Pigeon chest

- **Osteomalacia:**

People suffering from osteomalacia show

- (i) Softening of bones
- (ii) Pain in bones that tend to fracture easily.

Cure: Rickets and osteomalacia can be prevented by giving a diet rich in calcium, like milk, cod liver oil, egg yolks, and green leafy vegetables.

- **Goitre:**

Goitre iodine is essential for the synthesis of thyroxine (hormone produced by the thyroid gland). Iodine deficiency causes thyroid gland to enlarge and swell; this is called goitre.

Symptoms:

- (i) Protruding eyes
- (ii) Stunted growth
- (iii) Puffy appearance
- (iv) Irregular heart beat
- (v) Low intelligence
- (vi) A deficiency of iodine results in another disease called cretinism

Table 3.3 Example of nutritional deficiency

NUTRIENTS	DISEASE	SYMPTOMS
Vitamin A	Blindness	Vision loss
Vitamin B ₁	Beriberi	Weight Loss, weakness, pain in limb
Vitamin B ₂	Angular Cheilitis	Inflammation at mouth corners
Vitamin B ₃	Pellagra	Diarrhoea, dermatitis, dementia
Vitamin B ₅	Huntington Disease	Fatigue, apathy, irritability
Vitamin B ₆	Celiac Disease	Depression dermatitis
Vitamin B ₉	Alopecia	Hair loss, anxiety, itching, or small dents in nails
Vitamin B ₁₂	Megaloblastic	Abnormal paleness or lack of color of the skin, decreased appetite, irritability
Vitamin C	Scurvy	Bleeding Gum, swelling in joints

3.3.3 ILL EFFECT OF JUNK FOOD

- The term "junk food" refers to low-cost foods that are heavy in calories from fat or sugar but low in fiber, protein, vitamins, and minerals. This term is used to insult certain foods.
- Other examples of these types of eateries are fast food restaurants. The popularity of junk food among the general public has significantly increased in recent decades as a result of the introduction of products such as Hostess Twinkies, Fritos corn chips, McDonald's, and KFC.

❖ Health impacts of junk foods

The health impact of junk foods can be significant or negative. Regular consumption of these highly processed, low-nutrient foods is associated with a range of health issues.

1. **Cardiovascular issues:** The excessive intake of saturated and trans fats found in many junk foods can contribute to elevated cholesterol levels and an increased risk of heart disease and other cardiovascular problems.
2. **Type 2 Diabetes:** Diets rich in refined sugars and processed carbohydrates, common in junk food, are associated with an increased risk of developing

type 2 diabetes. These foods can lead to insulin resistance and impaired glucose metabolism.

3. **High Blood Pressure:** The high sodium content in many junk foods can contribute to elevated blood pressure, increasing the risk of hypertension and cardiovascular diseases.
4. **Digestive Problems:** A lack of fiber can lead to constipation and other gastrointestinal issues.
5. **Nutrient Deficiency:** Junk foods are typically low in essential nutrients such as vitamins, minerals, and antioxidants. Relying on these foods can lead to nutrient deficiencies, affecting overall health.

3.3.4 CALORIFIC AND NUTRITIVE VALUES OF VARIOUS FOODS

Calorific value: Also known as energy content or heating value, is a measure of the amount of energy released during the combustion (burning) of a substance. It is typically expressed in terms of energy per unit mass or volume of the substance. The calorific value is an important parameter in understanding the energy content of various fuels and foods.

Table 3.4 Daily Calorific Requirements

GENDER	AGE (YEARS)	SEDENTARY	MODERATELY ACTIVE	ACTIVE
Child	2-3	1,000	1,000-1,400	1,000-1,400
Female	4-8	1,200-1,400	1,400-1,600	1,400-1,800
	9-13	1,400-1,600	1,600-2,000	1,800-2,200
	14-18	1,800	2,000	2,400
	19-30	1,800-2,000	2,000-2,200	2,400
	31-50	1,800	2,000	2,200
	51+	1,600	1,800	2,200
	Male	4-8	1,200-1,400	1,400-1,600
9-13		1,600-2,000	1,800-2,200	2,000-2,600
14-18		2,000-2,400	2,400-2,800	2,800-3,200
19-30		2,400-2,600	2,600-2,800	3,000
31-50		2,200-2,400	2,400-2,600	2,800-3,000
51+		2,000-2,200	2,200-2,400	2,400-2,800

Nutritive value: The quantitative assessment of the vital nutrients and ingredients present in food is known as "nutritive values." These values give consumers knowledge about the nutritional worth of different foods, enabling them to make well-informed dietary choices based on their objectives for wellbeing and health.

Calorie sheet: An informational document that lists the nutritional makeup and calorie amount of different foods is called a calorie sheet, also sometimes called a food calorie chart or nutritional information chart.



Table 3.5 Calorie sheet of different food items

ITEM	QUANTITY	CALORIC VALUE	ITEM	QUANTITY	CALORIC VALUE
Break fast					
Egg boiled	1	80	Egg omelette	1	120
Egg fried	1	110	Bread slice with butter	1	90
Chapati	1	60	Puri	1	75
Paratha	1	150	Sabji	1 cup	150
Idli	1	100	Dosa plain	1	120
Dosa masala	1	250	Sambhar	1 cup	150
Lunch / Dinner					
Cooked rice, plain	1 cup	120	Cooked rice, fried	1 cup	150
Nan	1	150	Dal	1 cup	150
Curd	1 cup	100	Curry, vegetable	1 cup	150
Curry, meat	1 cup	175	Salad	1 cup	100
Papad	1	45	Cutlet	1	75
Pickle	1tsp	30	Soup, clear	1 cup	75

❖ **Key food hygiene principles**

- Prevent the contamination of food with pathogens that are transferred by people, pets.

3.4.1 ADULTERATION OF FOODS

Food adulteration is a process in which the quality of food is lowered or reduced by replacing food ingredient, adding non-authenticated substances, or removing of a vital component from food for the sake of earning profit or due to other incidental reasons.



❖ Detection of Adulterants in Food

Table 3.6 Detection of Adulterants in food

FOOD	ADULTERANT	DETECTION
Arhar pulse	Kesari pulse	Kesari pulse has a characteristics wedge shape. A larger kesari resembles Arhar (Tur). It can be separated by visual examination.
Asafoetida	Resin and colour	Asafoetida burns quickly, producing a bright flame and leaving the impurities behind.
Black pepper	Papaya seeds	Adulteration of papaya seeds with black pepper may be detected by way of visual examination as well as by way of smell.
Coffee powder	Cereal starch	The formation of a blue colour in mixture by addition of a drop of 1% aqueous solution of iodine indicates adulteration with starch.
Turmeric powder	Metanil yellow colour	Add 10 drops of muratic acid or hydrochloric acid to it. The pink coloration indicates the use of the metanil yellow colour in turmeric powder.

3.4.2 ARTIFICIAL RIPENING

Artificial Ripening: The process of artificially ripening fruits involves subjecting them to certain chemicals or controlled environmental conditions in order to induce ripening in an unripe fruit.

Chemical agents used for artificial ripening

Ethylene is the major ripening agent produced naturally within the fruits, which initiates the process of ripening. Chemicals like ethanol, methanol, ethylene glycol, ethephon, and calcium carbide are used to ripen fruits and vegetables artificially.

1. **Ethylene:** A very small concentration of ethylene in the air is sufficient to promote the fruit ripening process. Externally ethylene is likely to trigger or initiate the natural applied ripening process of apple, avocado, banana, mango, papaya, pineapple and guava, and therefore, can be marketed before the predicted time.
2. **Calcium Carbide:** Calcium carbide is widely used in different parts of the world. Once applied on the fruits, calcium carbide comes into contact with moisture and releases acetylene, which has fruit ripening characteristics similar to ethylene.
3. **Ethephon:** Ethephon is another agent that is used to artificially ripen fruits. Ethephon is often considered better than calcium carbide because pineapple, banana, and tomato treated with 1000 ppm of ethephon required less time for ripening than other treated fruits as well as compared with the non-treated fruits.



3.4.3 USE OF PESTICIDES

INTRODUCTION

A pesticide is a substance intended for destroying, repelling, or mitigating any animal, microorganism, or plant pest. While pesticides are commonly chemical agents, biological or physical agents can also be pesticides. Many people equate the term pesticide with insecticide. Insects, weeds, fungi, and other pests are all prevented from damaging crops by the application of pesticides.

Use of pesticides

1. Crop Protection:

- (a) **Insecticides:** Control and eliminate insect pests that damage crops and reduce yields.
- (b) **Fungicides:** Prevent and manage fungal infections that can harm crops.

2. Livestock Protection:

- (a) **Insecticides and acaricides:** Protect livestock such as cattle, sheep, and poultry from external parasites like ticks, mites, and lice.
- (b) **Antiparasitic Drugs:** Used as veterinary pharmaceuticals to control internal parasites in livestock.

3.4.4 GENETICALLY MODIFIED FOOD (GMF)

INTRODUCTION

Genetically modified food (GMF) has been a prevalent topic ever since we started witnessing advancements in DNA modification technology. WHO has defined GMF as a category of a foods that are developed via the insertion of new genes from another organism.

Advantages of Genetically Modified Food

- Have a desirably better taste and quality.
- Better production in less time, thereby providing food for more people.

Disadvantages of Genetically Modified Food

- The production imposes high risks to the disruption of ecosystems and biodiversity because the “better” traits produced from engineering genes can result in the favouring of one organism.
- It increases the cost of cultivation and makes farmers more inclined towards the marketization of farming that works on immoral profits.

3.5 DIETARY SUPPLEMENTS

INTRODUCTION

Dietary supplements contain one or more dietary compounds such as vitamins, minerals, amino acids, or other substances with a nutritional or physiological effect.

1. Reduced Risk of Birth Defects:

- (a) **Folic Acid:** Supplementation of folic acid during pregnancy has been associated with a reduced risk of neural tube defects in newborns. This is well-established and supported by numerous studies.

2. Bone Health in the Elderly:

- (a) **Calcium and Vitamin D:** For older adults, particularly postmenopausal women, supplementation with calcium and vitamin D has been shown to support bone health and reduce the risk of fractures.

3. Iron Supplementation for Anaemia:

- (a) **Iron Supplements:** Iron supplementation is effective in treating iron-deficiency anaemia, especially in populations with documented iron deficiency.

3.5.1 NUTRACEUTICALS

The term nutraceutical is largely used to indicate the usage and effectiveness of a variety of herbal products. The “nutritional elements” products are herbs, vitamins, proteins, minerals, fat, fiber, and amino acids.

Classification of Nutraceuticals

Depending upon various characteristics, nutraceuticals can be classified by several methods:

1. Nutraceuticals from food source

Vegetable: Allicin, α -Limonene

Animals: Choline, conjugated linoleic acid (CLA)

Microbial: Lactobacillus acidophilus, Streptococcus salvaricus

2. Nutraceuticals indicating their pharmacological activities

Anti-oxidant: Ascorbic acid, Catechins

Anti-inflammatory: Curcumin, Quercetin

Anti-cancer: Genestein, Limonene

Bone protectives: Soy protein, Daidzein

Antibacterial: Garlic, Curcumin



3. Nutraceuticals according to their chemical nature:

Phenolic compound: Tannins, Anthocyanins

Protein based: Choline, Indole

Isoprenoids: Carotenoids, Saponines

Carbohydrate derivative: Ascorbic acid, Oligosaccharides

Fatty acids and structural lipids: Sphingolipids, Lecithin

Microbial: Prebiotics, Probiotics

Minerals: Ca, Se

4. Nutraceuticals according to their higher content in specific food items

Nutraceuticals: EPA and DHA, Lycopene

Name of the specific food: Fish oils, Tomatoes, and tomato products

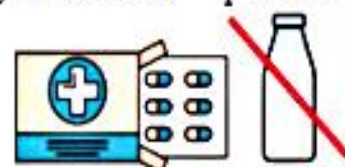
3.5.2 FOOD SUPPLEMENTS

INTRODUCTION

Food supplements aim to maintain an appropriate intake of specific nutrients, address nutritional deficiencies, or promote particular physiological processes. They can't have a pharmacological, immunological, or metabolic effect as they aren't therapeutic items.

Benefits of food supplements

- Improved cognitive function
- Reduce the risk of cardiovascular
- Increase bone mineral density
- Improve obesity-induced penile dysfunction



3.5.3 DRUG FOOD INTERACTION

INTRODUCTION

When a medication's absorption, metabolism, distribution, or excretion are impacted by the consumption of specific meals or nutritional nutrients, this is known as in drug-food interactions. Adverse effects or altered therapeutic outcomes may result from these interactions, which can also affect the safety and efficacy of medications. To maximise treatment regimens and reduce the chances of problems, patients and healthcare providers must be aware of drug-food interactions.

Table 3.7 Examples of Food/Drug Interactions:

DRUG CLASS	FOOD THAT INTERACTS	WHAT TO DO	EFFECT OF THE FOOD
Analgesic			
Acetaminophen (Tylenol)	Alcohol	Increases risk for liver toxicity	Avoid alcohol
Antibiotic			
Tetracyclines	Dairy products; iron supplements	Decreases drug absorption	Do not take with milk. Take 1 hour before or 2 hours after food/milk.
Amoxicillin, penicillin, zithromax, erythromycin	Food	Decreases drug absorption	Take 1 hour before or 2 hours after meals.

Anticoagulant

Warfarin (Coumadin)	Foods rich in Vitamin K	Decreases drug effectiveness	Limit foods high in Vitamin K: liver, broccoli, spinach, kale, cauliflower, and Brussels sprouts
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Anticonvulsant

Phenobarbital, primidone	Alcohol	Causes increased drowsiness	Avoid alcohol
	Vitamin C	Decrease in drug effectiveness	Avoid excess vitamin C

Antifungal

Griseofulvin (Fulvicin)	High-fat meal	Increases drug absorption	Take with high- fat meal
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Antihyperlipidemic

Lovastatin (Mevacor)	Food	Enhances drug absorption	Take with food
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Antihypertensive

Felodipine (Plendil), nifedipine	Grapefruit juice	Increases drug absorption	Consult your physician or Pharmacist before changing diet.
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Anti-inflammatory

Naproxen (Naprosyn), ibuprofen (Motrin)	Food or milk	Decreases GI irritation	Take with food or milk
	Alcohol	Increases risk for liver Damage or stomach bleeding	Avoid alcohol

Diuretic

Spirolactone (Aldactone)	Food	Decreases GI irritation	Take with food
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Psychotherapeutic

MAO inhibitors: isocarboxazid (Marplan), tranylcypromine (Parnate), phenelzine (Nardil)	Foods high in tyramine: aged cheeses, Chianti wine, pickled herring, Brewer's yeast, fava beans	Risk for hypertensive crisis	Avoid foods high in tyramine
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Acid Blocker

Ranitidine (Zantac), Cimetidine (Tagamet), Famotidine (Pepcid), Nizatidine (Axid)	Vitamin B ₁₂	Decrease vitamin absorption	Consult your physician regarding B ₁₂ supplementatio n
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Antineoplastic

Methotrexate	Folic acid, vitamin B ₁₂	Decreases vitamin absorption	Consult your physician regarding supplementation
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Laxative

Fibercon, Mitrolan	Vitamins and minerals	Decreases nutrient absorption	Consult your physician regarding supplementation
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