



# UNIT V SPORTS AND NUTRITION

## Overview

- ◆ Concept of Balanced Diet and Nutrition
- ◆ Macro and Micro Nutrients: Food sources and functions
- ◆ Nutritive and Non- Nutritive Components of Diet
- ◆ Eating for Weight control - A Healthy Weight, The Pitfalls of Dieting, Food Intolerance and Food Myths
- ◆ Importance of Diet in Sports-Pre, During and Post competition Requirements

## LEARNING OUTCOMES

*After studying this unit, students will be able to:*

- ◆ understand the concept of balanced diet and nutrition
- ◆ classify Nutritive and Non-Nutritive components of Diet
- ◆ identify the ways to maintain healthy weight
- ◆ know about foods commonly causing food intolerance
- ◆ recognize the pitfalls of dieting and food myths
- ◆ understand the importance of nutrition in sports
- ◆ comprehend the dietary requirements in pre-, during and post-competitions.

**Discussion: Find out and complete the worksheet groups.**

Vitamins	Benefits of Vitamins	Sources
A	Needed for healthy eyes, skin, nervous, respiratory, digestive systems	
B		
C		
D	Needed for bones	
E	Needed for restoration of cell membrane and body structure	
K		





## 5.1 Balanced Diet

Depending on the presence of nutrients in different food stuffs, foods have been divided into different **food groups**. These are:

1. **Cereals and Millets:** Cereals and millets include foods like wheat, rice, jowar, bajra, ragi etc. Majorly provide carbohydrates. Cereals also provide protein (protein quality can be improved by consuming it with pulses), B-vitamins, iron (bajra) and calcium (ragi).
2. **Pulses:** Pulses include all whole and washed dhals like red gram (lobia), Bengal gram (chana), lentils, green gram (moong) etc. Pulses provide protein (protein quality is improved by combining it with cereals). They are also a fair source of carbohydrates and B-vitamins especially thiamine and niacin. Whole pulses also provide iron and fibre; sprouts provide vitamin C.
3. **Milk and Milk Products:** This group includes foods like milk, curd, cheese, paneer, khoa etc. The major nutrient it gives is good quality protein, besides providing other nutrients like carbohydrates, fat (whole milk), calcium and riboflavin. Milk and milk products are generally sources of all nutrients except iron and vitamin C.
4. **Meat and Meat Products:** These include foods like meat, fish, chicken, egg and products made with these. This group is a major source of good quality protein. Other nutrients supplied by this group are B-vitamins, retinol (liver) and calcium (fish). Eggs particularly are good sources of most nutrients.
5. **Nuts and Oil Seeds:** Nuts and oil seeds eg., groundnuts, almonds, cashew nuts, til seeds, pistachio etc. are a good source of fat. They also provide protein, B-vitamins, calcium and other minerals.
6. **Green Leafy Vegetables (GLVs):** These include vegetables like mustard (sarson), bathua, fenugreek leaves (methi), spinach (palak). Green leafy vegetables are a good source of carotene (vitamin A, B-vitamins (especially riboflavin and folic acid), iron (especially sarson and bathua) and fibre. They are also a source of calcium, but presence of oxalates in GLVs bind calcium and make most of it unavailable for absorption and utilisation. Fresh GLVs provide vitamin C.
7. **Root Vegetables:** These include potato, colocasia, sweet potato, yam etc. Major nutrient supplied by root vegetables is carbohydrate. Carotene is provided only by yellow yam.
8. **Other Vegetables:** All other vegetables like brinjal, ladyfinger (okra), beans, cauliflower etc. provide fibre, vitamins, some amount of minerals.





9. **Fruits:** Wide variety of fruits is available in the market. Different fruits are sources of different nutrients; hence a combination of various fruits should be included in the balanced diet. Fruits like mangoes, apricots, oranges, papaya are rich in carotene, citrus fruits like orange, mausambi, amla and guavas are good sources of vitamin C, dried fruits like dates and raisins are rich in iron. Fibre is provided by most fruits.
10. **Sugar and Jaggery:** These are simply carbohydrates. Jaggery also has iron.
11. **Fats and Oils:** Include ghee, oil, butter etc. are a rich source of fat. Vitamin D also is provided by butter/fortified oils.

Food groups can also be classified according to their functions:

**Group 1. Energy giving foods-** This category includes foods rich in carbohydrate and fat

1. Cereals and roots and tubers
2. Sugar and jaggery
3. Fats and oils

**Group 2. Body building group** - this category includes foods rich in protein

1. Milk and milk products
2. Meat and meat products, fish, egg or poultry
3. Pulses
4. Nuts and oilseeds

**Group 3. Protective or regulatory foods** - This group include foods providing vitamins and minerals

I. Fruits-

- (a) yellow and orange fruits (mango, papaya)
- (b) citrus fruits (lemon, orange, mausambi)
- (c) others (apple, banana etc.)

II. Vegetables

- (a) Green leafy vegetables (spinach, mustard, fenugreek etc.)
- (b) Yellow and orange vegetables (carrot, pumpkin)
- (c) Others (beans, okra, cauliflower etc.)
- (d) Root vegetables- potatoes and yam (arvi) are rich in carbohydrates





It is important to consume a balanced diet in order to get all the nutrients in right amounts and right proportions. This means that in any given meal, foods from all the food groups should be included in such a manner that all the nutrients are supplied in adequate quantities. One has to ensure that each and every meal includes foods from the energy- giving, body building and protective/regulatory groups. eg., For breakfast include one source from energy giving foods (bread- 2 slices; jam), one food from body building foods (egg for non-vegetarians or paneer or sprouts for vegetarians along with milk) and any one or two foods from protective group (fruit/ fruit juice). Similarly, for lunch and dinner different foods from these food groups can be chosen in a variety of combinations. This way, the diet would provide all essential nutrients and would become balanced.

Thus, a balanced diet can be defined as one which contains different types of foods in such quantities and proportions that the need for calories, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand the period of leanness ie., when adequate food or a particular nutrient is not consumed.

Moreover, the action and interaction of the nutrients should be considered. Foods promoting absorption of certain nutrients or hindering absorption of nutrients should also be kept in mind. eg., consuming tea along with meals hampers the absorption of iron while taking sources of vitamin C with meals increases the absorption of iron. Imbalance of nutrients sometimes does not allow proper absorption and utilisation of another nutrient. eg., calcium is needed for building of bones and teeth and phosphorus is also needed for the same. Excess amount of phosphorus in the diet does not allow body to utilise calcium properly and affects bone and teeth formation. Therefore, these two nutrients should be supplied in correct proportions and adequate amounts.

### 5.1.1 NUTRITION

It is well known that food is essential for survival. Food refers to any substance that nourishes our body or in other words, it is anything that we can digest, absorb and utilize, for various physiological functions of the body including growth and development. Since the time of conception in the mother's womb, providing energy for our sustenance, regulating activities of the body and repairing day to day wear and tear, the role of food is enormous. Food provides nutrition to the body. Nutrition is, thus, the science of food and a study of the process that includes everything that happens to food from the time it is eaten until it is used for various functions in the body. It is the scientific study of foods and the nutrients therein; their action





and interaction and balance, in health and diseases. It is the study of ingestion, digestion, absorption, utilization and assimilation of nutrients present in food.

When we see any food product we recognize it as chapatti, rice, dhal, ladyfinger, apple etc. but as the food enters our mouth it starts breaking down and our body identifies it as different chemicals present therein. These chemical substances which are present in food are called nutrients. Nutrients of physiological importance are carbohydrates, proteins, fats, vitamins, minerals, water and fibre (roughage). Different food stuffs contain these nutrients in different amounts and proportions and our body needs each nutrient in a certain specific amount for various physiological functions and overall growth and development.

Nutrients, as mentioned earlier, are those chemical substances in foods that are required by the body for energy, growth and maintenance.

**I. Tick the correct option.**

1. In which of the following food groups "Sugar and jaggery" come under?
  - a. Protective or regulatory foods
  - b. **Energy giving foods**
  - c. Body building foods
  - d. Immunity boosters foods
2. Nutrition is \_\_\_\_\_ Substance.
  - a. Biological
  - b. **Chemical**
  - c. Energy
  - d. Mechanical

**II. Answer the following questions briefly.**

1. Define Nutrition.
2. Write down the importance of Balance diet.

**III. Answer the following questions in 150-200 words.**

1. What do you understand by a balanced diet?





## 5.2 Macro and Micro Nutrients: Food sources and functions

Nutrients can be broadly classified as macro- and micro-nutrients depending upon their daily requirements by the body. Some nutrients are needed in larger amounts, these are called macronutrients. Nutrients like Carbohydrates, proteins and fats along with water are macronutrients. Other nutrients like vitamins and minerals are required in small amounts and are called micronutrients. Although these are required in smaller amounts but they are all equally essential for our health. Each of these nutrients plays a significant role in the body.

**Macronutrients** are required by the body in relatively large amounts. Carbohydrates, proteins and fats are macronutrients and are also called 'proximate principles' because they form the main bulk of the diet. In Indian meals, they contribute to the total energy intake in the following proportion: carbohydrates: 55-60%; protein: 10-15% and fats: 20-30%. Water does not provide energy but is a vital nutrient required in large quantity for functioning of metabolic processes in the body and various regulatory functions. Therefore, it is also considered a macronutrient.

### 5.2.1 CARBOHYDRATES

Carbohydrates are organic compounds made up of Carbon, Hydrogen and Oxygen. Carbohydrates are a major source of energy and provide 4kcal per gram. Carbohydrates are found in abundance in plant foods. There are three types of carbohydrates- monosaccharides, disaccharides and polysaccharides. Monosaccharides are simple single units of sugars like glucose, fructose and galactose.

**Disaccharides** are when two monosaccharides are combined together; these are maltose (glucose + glucose), lactose (glucose + galactose) and sucrose (glucose + fructose). Simple sugars (mono and disaccharides) are found in fruits (in the form of sucrose, glucose and fructose), milk (in the form of lactose) and sweets that are produced commercially and added to foods to sweeten, prevent spoilage, or improve structure and texture.

**Polysaccharides** are more than two units of monosaccharides joined together. These are starches and fibre (cellulose). These are also called complex sugars and are found in whole grain cereals, rice, oats, potatoes, bread, legumes, corn and flour.

All these carbohydrates have to be broken down to the smallest unit, i.e., glucose to get absorbed and utilized in the body. However, cellulose and other large carbohydrate molecules cannot be digested in the human digestive tract, and are termed as fibre or non-available carbohydrates. Sugars and starches can be digested and utilized



for various bodily functions, hence are known as available carbohydrates. Diets rich in complex carbohydrates are healthier than low-fibre diets based on refined and processed food.

Sources of carbohydrates are rice, cereal grains, breads, pasta, milk, fruit, root vegetables, sugar and products that are sweetened like jams, jellies etc., honey, and jaggery. Fibre is present in whole grain cereals (whole wheat atta), whole pulses, green leafy vegetables, peas, carrot, beans and other vegetables, fruits like guava, apple, orange, pineapple etc.

### Do you Know?

#### Carbohydrates are essential in the diet to prevent ketosis

Diets for weight-loss usually recommend avoiding carbohydrates. It is however, essential to have at least 50-100g of carbohydrate per day for complete oxidation of fat and avoidance of excessive production of ketone bodies. Therefore, according to ICMR (2020) RDA/minimum requirement for carbohydrate is 130 g/day for adults and children, based on the amount of glucose used by carbohydrate-dependent tissues, such as the brain and erythrocytes. Inadequate supply of carbohydrates causes break down of body fat reserves for energy. This not only supplies energy but also produces ketone bodies. Some ketone bodies are used by muscle and other tissues for energy, but when produced in excess they accumulate in blood and cause ketosis (disturbance of normal acid-base balance). This condition is generally seen in Diabetics and is a life-threatening situation.

#### Summary - Macronutrients, their functions and sources

Nutrient	Function	Sources
Carbohydrates	<ul style="list-style-type: none"> <li>Carbohydrates provide energy needed by the body (1g provides 4 Kcal);</li> <li>Carbohydrates are main source of energy for the nervous system, brain and red blood cells;</li> <li>These spare proteins for their important functions (if enough carbohydrates are not available, proteins are used for energy-giving);</li> <li>Carbohydrates enable proper utilization of fat by providing substrates for fat metabolism.</li> </ul>	Fruits, cereal grains, milk, sugar, rice, root vegetables, pasta, breads





Roughage	<ul style="list-style-type: none"> <li>• Dietary fibre or roughage provides feeling of fullness i.e., one does not feel hungry soon after having a meal;</li> <li>• It provides bulk to the diet, helps in smooth elimination of stool or faeces;</li> <li>• Helps prevents diseases like cancer, diabetes and heart disease, has cholesterol lowering effect;</li> <li>• It is a negligible source of energy hence, can be eaten for weight control.</li> </ul>	Whole grain cereals (whole wheat flour, dalia, oats etc.), whole pulses, Green leafy vegetables (GLVs), peas, beans and other vegetables, fruits like guava, orange, pineapple etc
Proteins	<ul style="list-style-type: none"> <li>• Proteins build and repair body cells</li> <li>• Proteins form part of various enzymes, hormones, and antibodies</li> <li>• Also provide energy (4 Kcal/g)</li> </ul>	Milk and milk products, fish, eggs, poultry, meat, legumes and grains
Fats	<ul style="list-style-type: none"> <li>• Fats provide energy (9kcal/g);</li> <li>• Fats help transporting fat-soluble vitamins;</li> <li>• Fats are part of cell membranes, membranes around nerves, hormones, bile (for fat digestion)</li> </ul>	Visible Sources- vegetable oils, desi ghee, vanaspati ghee, butter, margarine, Invisible Sources- Cheese Meat, poultry, fish, milk and milk products, nuts and seeds

### 5.2.2 PROTEINS

#### List of Essential and Non-Essential Amino Acids

Essential	Nonessential
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartate
Methionine	Cysteine
Phenylalanine	Glutamate
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine







Proteins are organic compounds containing nitrogen, besides, carbon, oxygen and hydrogen. Protein molecules have a complex structure, and are made up of nitrogen containing amino acids. Amino acids are linked together in chains to make different type of proteins in the body. From hair to nails, muscles to skin, organs to blood, hormones to enzymes, protein is a major structural and functional component of our body. There are around 20 amino acids joined together in varying sequences to form different kinds of proteins. There are nine amino acids which cannot be synthesized by the body; these are called Essential Amino Acids (EAA). These have to be supplied in the diet. Others are non- essential amino acids as these can be synthesized in the body.

Depending on the availability of these essential amino acids in foods, they are classified as complete protein foods, partially complete protein foods and incomplete protein foods. Complete protein foods are those which contain all essential amino acids in adequate amounts. These food sources include foods from animal sources like eggs, milk and milk products, meat and meat products and a plant source, soybean, that contains all essential amino acids. Protein quality is determined by the presence of complete protein foods in the diet; it improves the absorption and utilization of protein in the body. Partially complete protein foods are those which are lacking in any one essential amino acid e.g., cereals and pulses. Cereals lack lysine and pulses lack methionine. To improve the protein quality, cereals and pulses can be taken together in a meal or can be combined with sources of complete protein foods. Incomplete proteins are those which are lacking in more than one EAA. An example of this protein is maize protein.

Protein requirement for Indian adults is 0.83 g/kg body weight (according to RDA 2020; ICMR/NIN). Thus, for a man weighing 60 kg, the protein requirement would be 54 g/day and for a woman weighing 55kg the protein requirement will be 46 g/day. In terms of percentage of total energy intake, protein intake should be between 10-15% of total energy consumed. In no case, it should exceed 35% of total energy intake. Protein requirement, however, may increase to up to 2 g/ kg body weight during sports and exercise depending upon the type of sports and duration and intensity of training. Too little, or, excess intake of protein can have health implications, hence proteins should be consumed as required and recommended.





### 5.2.3 FATS (LIPIDS)

Lipids or Dietary Fats is a broader term used for both oils and fats. Oils are basically liquid at room temperature and fats are solid at room temperature. It is the presence of different types of fatty acids which make them liquid or solid.

Fatty acids are the building blocks of fats and oils. Fatty acids are classified as Saturated or Unsaturated Fats depending upon the presence of double bond in their chemical structure. Saturated fatty acids (SFA) contain no double bonds, monounsaturated fatty acids (MUFA) contain one, and polyunsaturated fatty acids (PUFA) contain more than one double bond. When the percentage of saturated fatty acids is higher, the fat is solid at room temperature and when the percentage of unsaturated fatty acids (MUFA or PUFA) is higher the lipid is liquid at room temperature and is called oil.

Saturated fats which are also called as animal fats are associated with increased health risks. They can increase risk of heart disease by increasing total and LDL (“bad”) cholesterol. It has been recommended that the intake of saturated fats be kept less than 7% of total calories. Desi ghee, butter, cheese, cream, red meats, baked products, and other full-fat dairy products are the main sources of saturated fats in most diets. Coconut and palm oils also contain saturated fats.

Monounsaturated and polyunsaturated fatty acids are unsaturated fats. When they replace saturated fats in the diet, they help to reduce blood cholesterol levels and thus lower the risk of heart disease. Canola, olive, peanut, palmolein, rice bran and til (sesame) oils and other nuts like walnuts are rich in monounsaturated fats. Sources of PUFA include vegetable oils, mustard, soybean, corn, safflower and sunflower oils and flaxseed.

Dietary fat can be attained from visible as well as invisible sources. Visible sources are ghee, butter, cooking oil etc. while invisible sources include nuts, cereals, pulses, milk, eggs, meat etc. Invisible fat contributes significantly to the total fat and essential fatty acid content of diet depending on the food stuffs present in the diet. The total fat (visible + invisible) should provide between 15-30% of total calories required and contribution of visible fat should be restricted to 20-30g per day depending upon the physical activity levels of the individual.





### Do you know?

It has been recommended that total fat intake should be 20-30% of calories for adults to meet daily energy and nutritional needs while minimizing risk of chronic diseases. The intake of saturated fats should be less than 7% of calories, cholesterol should be less than 300 mg/day, and trans fatty acid consumption should be as low as possible. Consumption of certain fatty acids (MUFA and PUFA) are encouraged because of their positive health effects, like oils from foods such as vegetable oils, nuts, rice bran and fish because of their healthy attributes. In view of this, an ideal quality fat for good health is one which maintains a balance between SFA, MUFA and PUFA. This can be maintained by combined use of various oils for example, mustard oil with sunflower oil, or safflower oil with palm oil etc.

Cholesterol is a fat-like substance which is synthesized in the body. It is necessary in many physiological processes such as: it is a component of cell membranes, it is required in the production of bile acids (which aid in food digestion), and in the production of sex hormones. An excess of cholesterol in the blood, however, can lead to deposits in the walls of blood vessels and reduce blood flow to major arteries, which can lead to a heart attack.

Dietary cholesterol is found only in animal foods such as egg yolks, butter, organ meats, beef and chicken. Vegetable oils are cholesterol-free. Excess intake of dietary cholesterol increases blood cholesterol levels, but not as much as saturated and trans-fats do.

Trans-fatty acids are basically produced by the process called hydrogenation. It is the process of adding hydrogen molecules directly to unsaturated fatty acids such as those found in vegetable oil to make it saturated or solid. Hydrogenated oils contribute important textural and stability properties in food.

Trans-fatty acids occur naturally in beef, lamb, and dairy products. However, the main sources of trans-fats are foods such as cookies, biscuits, mixtures, namkeens, pastries and other fried foods. Trans-fatty acids are similar to saturated fats and dietary cholesterol with regard to their effect on blood low-density lipoprotein (LDL - which is a "harmful" or "bad") cholesterol. Trans-fats may also lower high-density lipoprotein (HDL - which is a good) cholesterol.

### 5.2.4 WATER

Water is essential for life. Water is an inorganic compound made up of hydrogen and oxygen. Water is a major component of our body and it makes up to 60% of the total weight of an individual. It is the medium of all body fluids including blood, saliva, digestive juices, urine, faeces, sweat and perspiration.





Water plays an important role in the regulation of body temperature. It is also a universal solvent. Water bathes the body cells and keeps them moist. Hence, it acts as a lubricant. It is also an important lubricant for the joints.

Our body gets water mainly by ingestion of water in the form of liquids; water taken as such or in the form of beverages like tea, coffee, fruit juices and aerated drinks. In other foods like vegetables, fruits, milk, cereals and pulses, water is present in invisible form. It is important that clean, safe and wholesome water is consumed in order to avoid water-borne diseases such as diarrhoea, dysentery and cholera.

### Do you know?

Each red blood cell contains haemoglobin which is the iron-containing protein that transports oxygen from the lungs to other parts of the body. In haemoglobin, each subunit contains a heme group; each heme group contains an iron atom that is able to bind to one oxygen molecules.

## 5.2.5 VITAMIN

Vitamins are the chemicals which our body needs in small amounts to function properly. They work in a variety of ways, mostly as 'helpers' eg., many of the B-vitamins help the body use protein, fats, and carbohydrates.

Vitamins are divided into two categories:

1. **Water-soluble vitamins** include all the B vitamins and vitamin C. The amount of water-soluble vitamins that body doesn't use passes through the kidneys and leaves the body as urine or stool.

The body needs water-soluble vitamins in frequent, small doses, and they are unlikely to reach toxic levels.

2. **Fat-soluble vitamins** include vitamins A, D, E, and K. Fat-soluble vitamins are stored in the body cells and are not passed out of the body as easily as water-soluble vitamins. They are more likely to reach toxic levels if a person takes in too much of these vitamins.

The table-2.i and 2.ii lists the water-soluble and fat-soluble vitamins; their functions and their sources in the foods we eat.





**Table 2.i - Water-soluble vitamins**

Nutrient	Important Functions	Sources
Thiamine (vitamin B1)	<ul style="list-style-type: none"> <li>• Works as coenzyme- (Thiamine pyrophosphate- TPP) needed for energy metabolism;</li> <li>• important for nerve function;</li> <li>• needed for DNA and RNA synthesis</li> </ul>	Whole-grain cereals, pulses, peanuts and seeds, mushrooms, green peas, beans, egg yolk and meat
Riboflavin (vitamin B2)	<ul style="list-style-type: none"> <li>• Act as two coenzymes- Flavin mononucleotide (FMN) and Flavin adenine dinucleotide (FAD) needed for energy metabolism;</li> <li>• important for normal vision and skin health</li> </ul>	Milk and milk products; animal products like eggs, liver, kidney; green leafy vegetables eg., broccoli; whole-grain cereals; legumes
Niacin (vitamin B3)	<ul style="list-style-type: none"> <li>• Part of an coenzymes- Nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) needed for energy metabolism;</li> <li>• important for nervous system, digestive system, and skin</li> </ul>	whole-grain cereals, pulses, meat, poultry, fish, vegetables (especially mushrooms). Eggs and milk and milk products lack niacin but are rich sources of EAA- tryptophan which can be converted to niacin in the body when required. 60 mg of tryptophan can be converted to provide 1 mg niacin.
Vitamin B6 (Pyridoxal, pyridoxine and pyridoxamine)	<ul style="list-style-type: none"> <li>• Part of coenzyme pyridoxal phosphate needed for protein and amino acid metabolism and also involved in activity of many enzymes required for carbohydrate, fat and protein metabolism.</li> <li>• It also helps in making white blood cells and heme in haemoglobin.</li> </ul>	Meat, Poultry, fish, Nuts, sunflower seeds, pulses, whole grains, spinach, bananas, potatoes.





Biotin	<ul style="list-style-type: none"><li>• Functions as coenzyme in metabolic reactions.</li></ul>	Widespread in foods like organ meats, such as liver or kidney; egg yolk; nuts, such as almonds, peanuts, and walnuts; soybeans and other legumes; whole grains; bananas; cauliflower, mushrooms; also produced in intestinal tract by bacteria
Pantothenic acid	<ul style="list-style-type: none"><li>• Part of co-enzyme A (CoA) needed for energy metabolism</li></ul>	Widespread in foods: milk, meat, peanuts, eggs
Folic acid / Folate	<ul style="list-style-type: none"><li>• Part of an enzyme needed for making DNA and new cells, especially red blood cells,</li><li>• formation of neurotransmitters</li><li>• needed for maintenance of normal blood pressure and reducing risk of cancer</li></ul>	Green leafy vegetables particularly spinach, pulses, oranges and orange juice, and liver. Other vegetables like cabbage, cauliflower, broccoli are also good sources
Cobalamin (vitamin B12)	<ul style="list-style-type: none"><li>• Part of two coenzymes methyl cobalamin and 5- deoxy adenosyl cobalamin, needed for making new cells;</li><li>• important to nerve function</li></ul>	Meat, poultry, fish, seafood, eggs, milk and milk products; not found in plant foods
Ascorbic acid (vitamin C)	<ul style="list-style-type: none"><li>• Antioxidant, role in collagen formation hence in wound healing, part of an enzyme needed for protein metabolism;</li><li>• important for immune system, helps in iron absorption</li></ul>	Found in fruits and vegetables, especially citrus fruits, fresh vegetables in the cabbage family, sprouts, amla and guava

### Fat-soluble vitamins

Fat-soluble vitamins are stored in the body's cells and are not excreted as easily as water-soluble vitamins. Intake of high amounts of fat-soluble vitamins could become toxic. A balanced diet usually provides enough fat-soluble vitamins.



**Table 2.ii - Fat-soluble vitamins**

Nutrient	Important Functions	Sources
Vitamin A (Retinol and its precursor*, beta-carotene)  *A precursor is converted by the body to the vitamin.	<ul style="list-style-type: none"> <li>• Needed for vision in dim light, healthy skin and mucous membranes, growth of skeletal and soft tissues, immune system health</li> </ul>	Vitamin A from animal sources (retinol): milk, cheese, cream, butter, egg yolk, liver, Beta-carotene (from plant sources):, dark green leafy vegetables; red and yellow fruits and vegetables (carrots, pumpkin, mangoes, papaya)
Vitamin D	<ul style="list-style-type: none"> <li>• Needed for proper absorption of calcium and phosphorus;</li> <li>• deposition of calcium and phosphorus in bones</li> </ul>	Egg yolks, liver, fatty fish, fortified foods. When exposed to sunlight, the skin can make vitamin D.
Vitamin E	<ul style="list-style-type: none"> <li>• Antioxidant;</li> <li>• protects cell walls</li> </ul>	Polyunsaturated plant oils (soybean, corn, cottonseed, safflower); green leafy vegetables; wheat germ; whole-grain products; liver; egg yolks; nuts and seeds
Vitamin K	Needed for proper blood clotting	green leafy vegetables and cabbage; milk; also produced in intestinal tract by bacteria

### 5.2.6 MINERALS

Minerals are inorganic elements which are required by the body needs for various physiological functions. There are minerals required in larger amounts called macro-minerals and those required in smaller amounts are called micro-minerals (trace minerals).

Tables 3.i and 3.ii list important macro- and micro-minerals, their functions and their sources in the foods we eat.



**Table 3.i - Macro-minerals**

Mineral	Important Functions	Sources
Sodium	<ul style="list-style-type: none"><li>• Needed for proper fluid balance, regulating alkalinity and acidity of body fluids, nerve transmission, and muscle contraction</li></ul>	Table salt, soy sauce; large amounts in processed foods; small amounts in milk, breads, green leafy vegetables, and unprocessed meats
Chloride	<ul style="list-style-type: none"><li>• Needed for proper fluid balance, stomach acid</li></ul>	Table salt, soya sauce; large amounts in processed foods; small amounts in milk, meats, breads, and vegetables
Potassium	<ul style="list-style-type: none"><li>• Needed for proper fluid balance, nerve transmission, and muscle contraction</li></ul>	Meats, milk, fresh fruits and vegetables, whole grains, pulses
Calcium	<ul style="list-style-type: none"><li>• Important for healthy bones and teeth;</li><li>• helps muscles relax and contract;</li><li>• important in nerve functioning, blood clotting, blood pressure regulation, immune system health</li></ul>	Milk and milk products; fish with bones (eg., sardines); fortified soya milk; greens (broccoli, mustard leaves); pulses
Phosphorus	<ul style="list-style-type: none"><li>• Important for healthy bones and teeth; found in every cell;</li><li>• part of the system that maintains acid-base balance</li></ul>	Meat, fish, poultry, eggs, milk, processed foods
Magnesium	<ul style="list-style-type: none"><li>• Found in bones;</li><li>• needed for making protein, muscle contraction, nerve transmission, immune system health</li></ul>	Nuts and seeds; pulses; leafy, green vegetables; seafood; chocolate
Sulphur	Found in protein molecules	Occurs in foods as part of protein in meats, poultry, fish, eggs, milk, pulses, nuts







## Trace minerals (micro-minerals)

The body needs trace minerals in very small amounts. Although iron is considered to be a trace mineral, the amount needed is somewhat more than for other micro-minerals.

*Table 3.ii - Trace minerals*

Mineral	Important Functions	Sources
Iron	<ul style="list-style-type: none"> <li>Iron is a mineral found in every cell of the body. Iron is considered an essential mineral because it is found in red blood cells as part of haemoglobin that carries oxygen to every cell in the body;</li> <li>part of myoglobin needed for muscle contraction,</li> <li>needed for energy metabolism, hence crucial in helping perform physical work</li> </ul>	Organ meats; red meats; fish; poultry; egg yolks; whole pulses and whole grain cereals; dried fruits; dark green leafy vegetables (mustard greens, bathua); iron-enriched breads and cereals; and fortified cereals
Zinc	<ul style="list-style-type: none"> <li>Part of many enzymes needed for synthesizing protein and genetic material;</li> <li>has a function in taste perception, wound healing, normal foetal development, production of sperm, normal growth and sexual maturation,</li> <li>important for immune system</li> </ul>	Meats, fish, poultry, whole grains, vegetables
Iodine	<ul style="list-style-type: none"> <li>Found in thyroid hormone, which helps regulate growth, development, and metabolism</li> </ul>	Seafood, foods grown in iodine-rich soil, iodized salt, bread, dairy products
Selenium	<ul style="list-style-type: none"> <li>Antioxidant</li> </ul>	Meats, seafood, grains
Copper	<ul style="list-style-type: none"> <li>Part of many enzymes;</li> <li>needed for iron metabolism</li> </ul>	Pulses, nuts and seeds, whole grains, organ meats, drinking water





Manganese	<ul style="list-style-type: none"> <li>Part of many enzymes</li> </ul>	Widespread in foods, especially plant foods
Fluoride	<ul style="list-style-type: none"> <li>Involved in formation of bones and teeth;</li> <li>helps prevent tooth decay</li> </ul>	Drinking water (either fluoridated or naturally containing fluoride), fish, and most teas
Chromium	<ul style="list-style-type: none"> <li>Works closely with insulin to regulate blood sugar (glucose) levels</li> </ul>	Organ meats especially liver, whole grains, nuts, cheese
Molybdenum	<ul style="list-style-type: none"> <li>Part of some enzymes</li> </ul>	Pulses, breads and grains; green leafy vegetables, milk; liver

Other trace nutrients known to be essential in tiny amounts include nickel, silicon, vanadium, and cobalt.

### Extension Activity

Working in groups, prepare diet plans for the following:-

Name of the Activity.	
Diet plan for building muscle for a vegetarian athlete.	
Diet plan for building muscle for a non-vegetarian athlete.	
Eating strategies for a person who wants to lose 15kg.	
Eating strategies for a person who wants to gain 10kg.	

#### I. Tick the correct option.

1. Which is NOT a Micronutrient?
  - a. Macro Minerals
  - b. Trace Minerals
  - c. Vitamins
  - d. Protein





2. Which of the following is a water-soluble vitamin?
  - a. Vitamin A
  - b. **Vitamin B**
  - c. Vitamin D
  - d. Vitamin K
3. Iron is a part of
  - a. **trace minerals**
  - b. macro minerals
  - c. vitamins
  - d. carbohydrate
4. Fats and oils come under:
  - a. protective or regulatory foods
  - b. **energy giving foods**
  - c. **bodybuilding group**
  - d. routine foods
5. 1 gram of fat provides
  - a. 3 kcal
  - b. 4 Kcal
  - c. 5 Kcal
  - d. **9 Kcal**

**II. Answer the following questions briefly.**

1. What are macronutrients?
2. Explain the importance of fluid intake during a competition.
3. Write the source of 3 micro and 3 macro minerals.
4. What should be the basic nutrient in a weightlifter's diet? Why?

**III. Answer the following questions in 150-200 words.**

1. Explain different types of nutrients and their sources. List the essential nutrients, their sources and functions.
2. Critically explain the use of dietary supplements in heavy dose for longer duration. Justify your answer with suitable examples.





## 5.3 Nutritive and Non-Nutritive Components of Diet

Food is the basic requirement of every individual as it helps develop our body. It provides sufficient energy for workout and helps in the growth and development of the individual. The food which we eat contains various nutrients which are essential for our body. There are large number of nutrients required in our balanced diet. Some of them are “Nutritive components” like Carbohydrates, Fats, and Proteins, whereas some other components of diet have no nutritive value.

### 5.3.1 NON-NUTRITIVE COMPONENTS OF DIET

Foods we eat contain a wide range of organic chemical compounds some of which have nutritive value as discussed above, while some have no nutritional value. Chemical compounds in foods with no specific nutritional function are called non-nutritive components of foods. Some of these components act as anti-nutritional factors like phytate while some have various benefits like phytochemicals. Some materials with no nutritional value are added to food and beverage products to make the food smell better, taste better, last longer, and/or look better. Some of the non-nutritive components are discussed below.

### 5.3.2 NON-NUTRITIVE FACTORS THAT INTERFERE WITH NUTRIENT ABSORPTION

Non-Nutritive Factors or Anti-Nutritional Factors (ANFs), that interfere with nutrient absorption, are those biological compounds present in human or animal foods that reduce nutrient utilization or food intake, thereby contributing to impaired gastrointestinal and metabolic performance. These include:

1. **Phytates** - These are abundantly found in unrefined cereals and millets. These phytates bind iron, zinc, calcium and magnesium and make these nutrients unavailable for digestion. On germination the phytate content is reduced.
2. **Tannins**- These are present in legumes, millets like bajra, ragi, spices, tamarind, tea, turmeric and in certain vegetables and fruits. Tannins interfere with absorption of iron and protein.
3. **Trypsin Inhibitors**- These inhibit the activity of trypsin in the gut and interfere with digestibility of dietary proteins and reduce their utilisation. These are present in soya bean, and white of duck egg. Heat treatment inactivates trypsin inhibitors.



4. **Oxalates-** These are present in green leafy vegetables and some legumes. These interfere with calcium absorption.
5. **Goitrogens-** These are also known as anti-thyroid substances as these interfere with iodine uptake by thyroid gland and may contribute to development of iodine deficiency disorders when iodine intakes are marginal. These are present in cabbage, cauliflower, turnips, soybean, bajra, peanuts, lentils.

### 5.3.3 BENEFICIAL NON-NUTRITIVE FACTORS OF FOODS

1. **Phytochemicals-** Phytochemicals are chemical compounds produced by plants, generally to help them thrive or thwart competitors, predators, or pathogens. The name comes from Greek phyton, meaning 'plant'. They are found in fruits, vegetables, grains, beans, and other plants. Some of these phytochemicals are believed to act as antioxidants and protect cells from damage that could lead to cancer.

Risk of cancer can be reduced by eating more colourful vegetables, fruits, and other plant foods that have certain phytochemicals in them. Some of these phytochemicals are Beta carotene and other carotenoids in yellow, red, green vegetables and fruits, flavonoids in green tea, isothiocyanates in cruciferous vegetables (cabbage, broccoli, kale, mustard greens, turnip greens, and cauliflower).



2. **Anthocyanins:** Anthocyanins give grapes, blueberries, cranberries, and raspberries their dark colour. They have been shown in the laboratory to have anti-inflammatory and anti- tumour properties.
3. **Flavonoids or isoflavones:** These are found in vegetables, fruits and grains like soybeans, chickpeas and may act a little bit like oestrogen. The oestrogen-like





compounds in these plants are called phytoestrogens. These help in lowering the risk of osteoporosis, heart disease, breast cancer and symptoms of menopause

4. **Artificial Sweeteners:** These are synthetic compounds that duplicate the taste of sugar, but contain less energy, and, therefore, are often added to diet foods and beverages. The reason is to maintain the desired taste, but reduce the caloric value. Because artificial sweeteners are considered additives, they are often regulated. Therefore, their identifications and concentrations must be determined.
5. **Preservatives:** These are compounds that have the ability to inhibit microbial growth and are often added to food and beverage products to prolong shelf life. Preservatives are considered additives, and are typically regulated. Therefore, their identification and concentration levels must be determined.
6. **Spices:** A spice is a dried seed, fruit, root, bark or vegetable substance primarily used for flavouring, colouring or preserving food. Sometimes a spice is used to hide other flavours. Spices are distinguished from herbs, which are parts of leafy green plants also used for flavouring or as garnish. A spice may have other uses, including medicinal, religious ritual, cosmetics or perfume production, or as a vegetable. For example, turmeric roots are also consumed as a vegetable and garlic as an antibiotic.
7. **Coffee:** Coffee is a brewed beverage prepared from the roasted or baked seeds of several species of *Coffea*. The two most common sources of coffee beans are *Coffea arabica*, and *Coffea canephora*. Once ripe, coffee berries are picked, processed and dried to yield the seeds inside. The seeds are then roasted to varying degrees, depending on the desired flavour, before being ground and brewed to create coffee. Coffee can have a stimulating effect on humans because of its caffeine content. It is one of the most popular drinks in the world. It can be prepared and presented in a variety of ways.

I. **Tick the correct option.**

1. Anthocyanins give colour to
  - a. roots
  - b. coffee
  - c. wheat
  - d. grapes





2. Oxalates are presents in
  - a. green leafy vegetables
  - b. bajara
  - c. nuts
  - d. spices

**II. Answer the following questions briefly.**

1. Define Non-Nutritive components of food.
2. Explain the beneficial factors of Non-Nutritive foods.

**III. Answer the following questions in 150-200 words.**

1. Explain Non-Nutritive components of Diet

## 5.4 Healthy Weight

There are numerous advantages of maintaining healthy weight. Overweight or obese people can gain these health benefits by losing some weight. For most obese or overweight people, health benefits can come with losing the first 5-10% of weight. Conditions such as Type 2 diabetes are less likely to develop if an obese person loses even 10% of their weight. With a healthy body weight there is less likelihood of having heart disease, stroke, or obesity related cancers all of which can be life-threatening and the chances of living a long and healthier life increase.

### Do you Know

Body Mass Index (BMI) is used to broadly categorize a person as underweight, normal weight, overweight, or obese based on tissue mass (muscle, fat, and bone) and height. Overweight or Obesity can lead to a variety of health conditions, such as type 2 diabetes, high blood pressure, and cardiovascular problems. On the other hand, a weight that is too low can increase the risk of malnutrition, osteoporosis, and anaemia.

Waist-to-Hip Ratio (WHR) - or the ratio between the circumference of the waist and the circumference of the hip indicates risk of obesity. Greater circumference of trunk is an indicator of high risk of hypertension and type 2 diabetes.

Girth Circumferences or circumferences of different segments of the body help to document body size and to estimate the percentage of body fat. Skinfolds determine body fat quite accurately. The skinfold technique can only be performed by a trained technician using skinfold callipers.





Bioelectrical Impedance Analysis is a commonly used method for estimating body composition, in particular body fat and muscle mass. A weak electric current is allowed to flow through the body and the voltage is measured in order to calculate impedance (resistance) of the body. It is done using a portable machine, is easy to administer and gives reliable results of body composition. Hydrostatic Weighing or Underwater weighing is known as the gold standard method to measure mass per unit volume of a living person's body.

There are various ways of assessing healthy body weight that include weight for height charts or Body Mass Index (BMI) or assessment of body fat percentage. Body Mass Index (BMI) Quetelet's Index is a key index for relating weight to height. BMI is derived by taking a person's weight in kilograms (kg) divided by his or her height in meters squared. Now-a-days, BMI is used to define normal weight, overweight, and obesity rather than the traditional height/weight charts. BMI of 30 or more for either sex indicates obesity. BMI however, does not measure how much fat mass or muscle mass is there. A very muscular person might get a high BMI without health risks. It is, therefore, less accurate in people such as body builders and pregnant women.

BMI	Classification
< 18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Grade I obesity
35.0-39.9	Grade II obesity
≥ 40.0	Grade III obesity

Intra-abdominal or visceral fat has a particularly strong correlation with cardiovascular disease. Women with abdominal obesity have a cardiovascular risk similar to that of men. This can be evaluated by measuring waist circumference or by calculating waist to hip ratio. A waist circumference of >102 cm (>40 inches) in men and >88 cm (>35 inches) in women or the waist-hip ratio (the circumference of the waist divided by that of the hips of >1.0 for men and >0.85 for women) are used to define central obesity. In those with a BMI under 35, intra- abdominal body fat is related to negative health outcomes independent of total body fat. Body fat percentage is total body fat expressed as a percentage of total body weight that can be assessed by methods like skinfold measurements, bioelectrical impedance, dual X-ray absorptiometry (DEXA) etc. but to measure body fat percentage,

special equipment and technical expertise is needed. There is no generally accepted definition of obesity based on total body fat. Most researchers have used >25% in men, and >32% in women, as cut-points to define obesity and higher health risks.







### 5.4.1 EATING FOR WEIGHT CONTROL

Eating right is important to stay at a healthy weight. Maintaining body weight is a balancing act, meaning that the amount of energy we consume should be expended. If we eat more calories than we burn, we gain weight. And if we eat fewer calories than we burn, we lose weight. The balance between calorie intake and calories used or expended is essential to keep the weight maintained. The best way to have energy balance is to make better choices, thus, choosing foods that are lower in fat and have fewer calories and increasing physical activity are the best ways to reduce body weight.

We can lose weight by making smart choices every day, we can develop new eating habits and preferences that will leave us feeling satisfied and winning the battle of weight loss. Remember, slow and steady wins the race. So, aim to lose one to two kilos a week to ensure healthy weight loss. Losing weight too fast can take a toll on the mind and body, making one feel sluggish, drained, and sick. Caloric restriction for weight reduction is essential to get results. Dietary modification must be accompanied by moderate amounts of exercise to get effective results in weight loss or weight maintenance. Aerobic exercise increases the daily energy expenditure and is particularly useful for long-term weight maintenance. Exercise also preserves lean body mass and partially prevents decrease in basal metabolic rate which comes when caloric intake is restricted. Additionally, most of the benefits of exercise come from improvements in body composition, overall fitness and metabolic health, not just weight loss. Risk of cardiovascular diseases, diabetes and other obesity related health problems also lower. Once stress is reduced, stress related intake of food is also curtailed. The person should be put in negative energy balance to upto 500-1000 kcal to get ideal reduction in weight of 500g - 1 kg / week. To lose weight, we have to eat fewer calories than what we expend. But that doesn't necessarily mean we have to eat less food. We can fill up our stomach while on a diet, as long as we choose foods wisely.

#### *Modifications in the diet to be made*

1. Diet should consist of foods from all food groups including, milk and milk products, meat and meat products, cereals, pulses, fruits and vegetables.
2. High-fibre foods are higher in volume and take longer to digest, which makes them filling. High-fibre foods include:
  - **Fruits and vegetables** - Eat whole fruits, salads, and green leafy vegetables of all kinds. Soups and salads can be liberally eaten. The high water and fibre content in most fresh fruits and vegetables makes them hard to overeat. Eat vegetables raw or steamed, not fried or breaded.





- **Beans** - Select beans of any kind. Add them to soups, salads, and meals.
  - **Whole grains** - High-fibre cereals, oatmeal, brown rice, whole-wheat pasta, whole-wheat or multigrain bread.
3. Add nuts to the daily diet but only in moderation.
  4. Switch to fat-free or low-fat milk and milk products. Use low-fat milk in place of cream thereby reducing the overall caloric intake of the day.
  5. Baking or grilling foods rather than frying them reduces the calorie count of foods
  6. Limit intake of high sugar foods like jams, jellies, sweetened curd etc.
  7. Cut on high cholesterol and saturated fat foods like mixtures, mathris, namkeens and bakery products. Instead choose on high fibre biscuits, or khakhra type snacks.
  8. Eat low-fat proteins like egg whites, fish, lean meats, nuts, and poultry.
  9. Serve smaller portions. One easy way to control portion size is by using small plates, bowls, and cups. This will make portions appear larger. Don't eat out of large bowls or directly from the food container or package, which makes it difficult to assess how much has been eaten. Using smaller utensils, like a teaspoon instead of tablespoon, can slow eating and help feel full sooner.
  10. Cooking meals at home allows controlling both portion size and what goes in to the food. Restaurant and packaged foods generally contain a lot more sodium, sugar, fat and calories than food cooked at home—plus the portion sizes tend to be larger.
  11. Avoid consuming high salt foods like pickles, papad etc. as these foods induce water retention.
  12. Be especially careful to avoid high-calorie snacks and convenience foods.
  13. Soft drinks (including soda, energy drinks, and coffee drinks) are a huge source of calories in many people's diets. One can of soft drink contains between 10-12 teaspoons of sugar and around 150 calories, so a few soft drinks can quickly add up to a good portion of your daily calorie intake. Instead homemade lemon water, coconut water, lassi or chachh are better replacements of commercially available juices and soft drinks.
  14. Reduce daily calorie intake by replacing soda, alcohol, or coffee with water. Thirst can also be confused with hunger, so by drinking water, one can avoid consuming extra calories.





15. Eating frequently throughout the day (3 small meals and 2-3 snacks) will stimulate metabolism. Skipping meals (including breakfast) can decrease metabolism. Skipping meals usually turns into eating more at the end of the day.

Reducing portion sizes, changing ways of cooking, right food selection would go long way in helping weight management.

### 5.4.2 THE PITFALLS OF DIETING

Maintaining a calorie deficit always leads to weight loss. Without exercise, a calorie deficit must be created through a lower calorie intake. The main problem with dieting alone is the sacrifice needed to sustain a very low-calorie intake for a long period of time, which is too much for most people to handle. On a very low-calorie diet, most people tend to breakdown and go back to their old habits causing any weight loss to return quickly.

The body's reaction to dieting is also different. In case of a sudden and drastic reduction in calorie intake, the body adjusts its metabolism accordingly. Eating very little calories for a long time would turn body into starvation mode means slowing down metabolic processes which is the body's way of protecting itself against long periods with little or no food. This starvation mode causes body to drastically cut its energy requirements and the person stops losing weight.

#### Do you Know

Anorexia nervosa is an eating disorder characterized by an abnormally low body weight, an intense fear of gaining weight and a distorted perception of weight. People with anorexia place a high value on controlling their weight and shape, using extreme efforts that tend to significantly interfere with their lives.

To prevent weight gain or to continue losing weight, people with anorexia usually severely restrict the amount of food they eat. They may control calorie intake by vomiting after eating or by misusing laxatives, diet aids, diuretics or enemas. They may also try to lose weight by exercising excessively. No matter how much weight is lost, the person continues to fear weight gain.

Diets, especially fad diets or "quick-fix" pills and plans, often lead to failure because diets that cut out entire groups of food, such as carbohydrates or fat, are simply impractical and unhealthy. The key is moderation. Diets that severely cut calories, restrict certain foods, or rely on ready-made meals might work in the short term but don't include a plan for maintaining weight, so the weight quickly comes back.





Severely restricted diet also lead to deficiency of various other nutrients. Once we start eating normally, we will gain weight until our metabolism bounces back. Special shakes, meals, and programmes are not only expensive, but they aren't practical for long-term weight loss. Hence, instead of dieting alone and looking for miraculous foods to reduce or maintain weight, regular exercise and good eating habits are crucial to health and well-being.

### 5.4.3 FOOD INTOLERANCE

Food intolerance is the non-IgE mediated food hypersensitivity or non-allergic food hypersensitivity, which is characterized by difficulty in digesting certain foods. Food intolerance is different from food allergy. Food allergies trigger the immune system, while food intolerance does not. The symptoms of food intolerance generally take longer to emerge, compared to food allergies. In food intolerance, some people suffer digestive problems after eating certain foods. Foods most commonly associated with food intolerance include dairy products, grains that contain gluten, and foods that cause intestinal gas build-up, such as beans and cabbage. Gluten in wheat is one of the most common causes of food intolerance. Some people are intolerant to several groups of foods, making it harder to determine whether it might be a chronic illness or food intolerance. Identifying which foods are the reasons can take a long time.

The symptoms to food intolerance are varied and can include stomach-ache, bloating, nausea, irritable bowel, hives, migraine, mild fever, cough etc. Some types of food intolerance are given below:

**Absence of an enzyme:** Enzymes are needed to digest foods fully. If some of these enzymes are missing, or are insufficient for digesting a particular foodstuff, proper digestion may be affected. Some food intolerance is caused by the lack of a particular enzyme like lactose intolerance which is caused due to deficiency of lactase enzyme in the body. Hence, the person is unable to digest lactose from milk and gets intolerant to milk and all milk products. People who are lactose intolerant do not have enough lactase, an enzyme that breaks down milk sugar (lactose) into smaller molecules and absorb through the intestine. If lactose remains in the digestive tract, it can cause stomach-ache, spasms, bloating, gas and diarrhoea.

**Chemical causes of food intolerance:** Certain chemicals in foods and drinks can cause intolerance, including amines in some cheeses, and caffeine in coffee, tea, and chocolates. Some people are more susceptible to these chemicals than others.

**Toxins due to Food poisoning:** Some foods have naturally-occurring chemicals that can have a toxic effect on humans, causing diarrhoea, nausea, and vomiting. Peanuts or undercooked beans have aflatoxins that can cause extremely unpleasant digestive problems.





**Salicylates:** Salicylates are derivatives of salicylic acid, which occurs naturally in plants as a defence mechanism against harmful bacteria, fungi, insects, and diseases. Salicylates are present in most plant-sourced foods, including the majority of fruits and vegetables, spices, herbs, tea, and flavour additives. Mint-flavouring, tomato sauce, berries, and citrus fruits have particularly high levels of salicylates. Salicylate intolerance, also known as salicylate sensitivity, occurs when somebody reacts to normal amounts of ingested salicylate. These chemicals are found in many foods and most people can consume salicylate-containing foods without any adverse effects. However, some people suffer symptoms after eating large amounts. Salicylate intolerant individuals should avoid foods that contain high levels. Processed foods with flavour additives are usually high in salicylates as well.

**Gluten intolerance:** Gluten is a protein found primarily in wheat, barley and rye. If a person has a gluten intolerance, this protein can cause digestive problems such as gas, abdominal pain or diarrhoea. Gluten intolerance is sometimes confused with Celiac disease, or thought of as a food allergy. Anyone who suspects they may have a gluten intolerance should see a doctor before giving up gluten, as cereals can be an important source of various nutrients.

**Food additives and intolerance:** Additives are used to enhance flavours, make foods look more appealing, and to increase their shelf life. Food additive intolerance has been a steadily- growing problem over the last many years because more and more foods contain additives. Nitrates are known to cause itching and skin rashes. Processed meats are generally high in nitrates and nitrites. MSG (monosodium glutamate) is used as a flavour enhancer known to cause headaches. Some colourings - especially carmine (red) and annatto (yellow) also cause food intolerance.

It is very difficult to determine whether somebody has a food intolerance or allergy because the signs and symptoms often overlap. Patients are advised to keep a diary and write down which foods are eaten, what the symptoms were like, and when they appeared. The data in the diary can help a dietician or doctor identify which foods are causing adverse reactions, and what steps to take. Apart from lactose intolerance and celiac disease, there is no accurate, reliable, and validated test to identify food intolerance. The best diagnostic tool is an exclusion diet, also known as an elimination or diagnostic diet. Exclusion diets are extremely useful in isolating the causative foods. In a typical exclusion diet, the suspected food is removed from the diet for a period of 2 weeks to 2 months. If during this period the adverse reactions do not appear, it becomes more likely that the cause has been recognized. The best current treatment for food intolerance is to either avoid certain foods or eat them less often and in smaller amounts.





#### 5.4.4 FOOD MYTHS

**The fewer the carbohydrates, healthier you are-** Choosing the healthiest carbohydrates, especially whole grains, is important for health and well-being. Refined carbohydrates should be avoided however, choosing whole grains is associated with a decreased risk of chronic diseases and premature mortality.

**Oils/Margarine have fewer calories than Ghee/butter-** Ghee/Butter and Oils/Margarine have about the same amount of calories. Margarine, which is made from vegetable oils, was seen as a healthier alternative to butter (which contains cholesterol and saturated fat), but later it was found that some margarines are actually unhealthier because they contain trans-fats, which have even more adverse effects on cholesterol and heart health.

**Apples and brinjals are rich in iron because they turn brown when cut-** One of the greatest myths about apples and brinjals is that they are good sources of iron. They are an excellent source of fibre but not of iron. This change in colour is an enzymatic reaction and has nothing to do with iron.

**Milk should be avoided after eating fish-** A lot of Indians think that drinking milk right after consuming fish causes skin disease like leukoderma, or white patches on skin. This is not true.

**Drinking water in between meals affects digestion-** Most people think that drinking water during meals will affect the capacity to digest food. The truth is that drinking water simply fills up stomach and as a result one tends to eat less which is especially good when someone is trying to lose weight.

Similarly, you may come across many such beliefs, but for any belief try to learn the science behind to understand the fact.

#### Art Integration

Start an awareness campaign in your school regarding importance of nutrition in our life.

You could include the following activities:

- Poster making Competition on the benefits of
  - ◆ Healthy Eating
  - ◆ Healthy Lifestyle
- Talk Show by inviting a Dietician.
- Making and screening a video film on dietary imbalances.
- Cooking competition for cooking healthy.
- If possible, develop a school vegetable garden to increase awareness about various vegetables.



**I. Tick the correct option.**

1. What is an ideal weight to be reduced in one week?
  - a. 250 gms to 500gms
  - b. 500 gms to 1 kg
  - c. 1kg to 1.5 kg
  - d. kg to 2 kgs
2. BMI between 25.0-29.9 is \_\_\_\_\_
  - a. under weight
  - b. normal
  - c. overweight
  - d. obese

**II. Answer the following questions briefly.**

1. List the points to be considered for weight maintenance.
2. Point out the pit falls of dieting

**III. Answer the following questions in 150-200 words.**

1. What is food Intolerance? Enlist the foods which are commonly associated with food intolerance.
2. How you can modify your diet for weight control
3. Enumerate any five food myths and the related facts.

### 5.5. Importance Of Diet In Sports And Pre, During And Post Requirement

Nutrition is an important aspect of training and performance. Athletes should make appropriate dietary manipulations for better performances and long-term health benefits by choosing right foods and a diet including variety of foods. The concepts of nutrition and basic principles of balanced diet are applicable to the field of sports as well. A sports person needs to increase or decrease his energy intake and proportions of macronutrients and micronutrients depending upon the nature of her/his sport or game. Diet of sportspersons should aim at maintaining body weight and body composition desired for their specific sport, maintaining adequate pool of nutrient levels in the body, adopting healthy nutritional practices during





training and competition and carrying on with healthy nutritional practices during off-season as well i.e., when competitions are not taking place. Any imbalances in nutritional intake, both deficiency or excess of certain nutrients, can be detrimental to the performance of athletes and may reduce their ability to play up to maximum potential. A nutritious diet meeting nutritional demands of athletes not only helps in better performance but will also support good health.

### 5.5.1 IMPORTANCE OF DIET IN SPORTS

1. The body needs nutrition to repair and recover. Sports persons have greater demands on their body. If these are not met through proper diet, outcome will suffer and post training recovery process will be affected.
2. For different games, there are different body composition requirements which can be manipulated to certain extent by nutrient composition of diet besides training, thus helping in achieving body composition goals.
3. Right kind of nutritional composition in pre-competition meals, during competition and post competition meals can help improve performance, delay fatigue and speed up recovery.
4. Knowledge of nutrition is essential to make fitness, weight loss and weight gain programmes successful in athletes. Those sports persons who play in weight categories can achieve body weight goals with appropriate diets. During off-season or no practice period, the diet should be such that it does not alter too much of body composition and prevents excessive weight gain.
5. Certain nutrients are taken as ergogenic aids, their ergogenic potential and psychological and physiological effects can help sports persons in their performance.
6. Dehydration can impair athletic performance. Therefore, sufficient intake of fluids and electrolytes ensures maximum hydration before, during and after exercise
7. Adequate diet enhances physiological adaptations during training.

### 5.5.2 CARBOHYDRATES IN SPORTS AND EXERCISE

As we all know that carbohydrates are the major source of energy for any activity. For athletes engaging in strength-sports (wrestling, boxing, judo etc.) 55% of total calories should be provided by carbohydrate sources. While in endurance sports like running, swimming, football, hockey and other similar type of sports 60-70% of calories should be derived from carbohydrates in the diet. Besides the total







amount of carbohydrates in the diet, the type and time of carbohydrate intake is also important. Appropriate type and time of carbohydrate intake prior to, during and post exercise can improve exercise performance.

Before competition, complex carbohydrates should be taken and consuming simple sugars prior to exercise (<1 hour) should be discouraged as it may increase insulin levels which in turn increases carbohydrate metabolism resulting in low blood glucose levels during exercise. This induces early fatigue and light-headedness due to hypoglycaemia. Excessive intake of highly concentrated sugars, such as candy and soft drinks in a short period of time can also result in cramps and bloating. However, simple carbohydrate foods are the best sources of energy replacement after strenuous exercises; complex carbohydrate foods are preferred as pre-exercise carbohydrate sources.

It takes about 4 hours for carbohydrates to be digested and begin to be stored as muscle and liver glycogen. Therefore, pre-exercise meals should be consumed about 4 to 6 hours before exercise. A light carbohydrate and protein snack 30 to 60 min prior to exercise (e.g., 50 g of carbohydrate and 5 to 10 g of protein) serves to increase carbohydrate availability toward the end of an intense exercise bout. This also serves to increase availability of amino acids and decrease exercise-induced breakdown of protein.

### 5.5.3 PROTEINS FOR EXERCISE AND TRAINING

During exercise and training, muscle bulk is increased and also there is breakdown of muscle tissues. During prolonged exercises, protein is oxidised to provide energy. For these purposes, increased amount of protein is recommended in sports persons. ICMR (1985) has recommended protein intake of 12-14% of total caloric intake and range of protein intake as 1g/kg body weight to 2 g/kg body weight; lower limit for endurance sports and sports of light weight category and upper limit for strength sports.

Eating sufficient calories from a well-balanced diet generally provides adequate proteins. However, sources of good quality protein should be included. Milk and milk products, meat and meat products should be incorporated. Low fat protein sources like skim milk, egg white, fish, and chicken are more helpful in enhancing performance as well as maintaining long term health. Cereal pulse combination or supplements with complete protein also improves the quality of protein.

Protein and amino acid supplementation is becoming widely popular in athletes. Markets are flooded with protein and amino acid supplements. However, additional





supplementation of protein is not necessary as long as athletes maintain energy balance and take 15% of their total caloric intake in the form of proteins.

The protein intake in excess of twice the recommended (i.e. >2g/kg BW) could increase the risk of renal degeneration and bone porosity. When protein intake is increased, urea production increases and more water is drawn in urine to eliminate metabolic products putting athlete into a dehydrated state. High protein intake also leads to urinary calcium loss, which in long term would affect calcium status particularly of women athletes.

#### 5.5.4 FAT INTAKE IN SPORTS AND TRAINING

Fat intake in athletes contributes to energy density and offers other protective roles, however, higher than recommended could pose health problems. Hence athletes, like other population, should restrict dietary fat intake within the suggested amounts i.e. 25-30% of total calories.

Within this limit, dietary fat choices also make a difference. A diet that includes polyunsaturated fatty acids (PUFA; vegetable oils, nuts and oil seeds) and monounsaturated fatty acids (MUFA ground nut oil, fish oil etc) has definite advantages over a diet rich in saturated fatty acids (animal fat/ desi ghee; butter etc) in terms of improving total cholesterol, LDL, HDL and triglyceride levels. Thus, these healthy fats should account for the majority of fat in athlete's diet. Invisible fat sources should also be chosen wisely. Like inclusion of egg whites, fish and skimmed milk in place of high fat animal foods would be helpful in keeping the total cholesterol levels below 200mg/day.

#### 5.5.5 VITAMINS AND MINERALS

Vitamins and minerals perform functions for athletes and non-athletes alike. Athletes, however, have high energy needs and high production of free radicals. Therefore, they require higher amounts of B-vitamins and vitamins with anti-oxidant properties. The required amount can be obtained by eating a variety of foods especially fruits and vegetables. Taking more than required vitamins and minerals does not improve performance, if there are no deficiencies of any vitamin or mineral in the body.

The key to obtain the adequate vitamins and minerals is to eat a wide variety of nutrient-dense foods in amounts that will maintain energy balance. Fruits and vegetables are particularly rich in vitamins and antioxidants as well. Supplements are not replacements for food.





### 5.5.6 PRE-EXERCISE OR PRE-EVENT MEAL

For pre-exercise or pre-event meal, fuelling up of glycogen stores to obtain energy and proper hydration are the primary goals. This would control hunger, fatigue, weakness, light-headedness which could interfere in the sports performance. Pre-exercise meal should also provide a comfortable gastrointestinal state for sports performance. During night, our blood glucose levels and storage levels of glycogen go down and therefore, eating carbohydrate-containing foods before exercise refills liver glycogen stores and can replenish muscle glycogen stores. In pre-exercise meal our main considerations should be as follows:

- A meal comprising high-carbohydrate, moderate protein and low fibre and low-fat foods providing 500-1000 kcal should be consumed. Examples of good pre-event meal would be banana milk shake or pasta and fruits with curd or potato sandwich with fruit juice.
- High sugar foods must be avoided to prevent insulin rush that results in early fatigue, cramping, dehydration, nausea and diarrhoea.
- On regular training days, instead of large meals, small meals or a snack every 2-3 hours should be taken.
- Meals should be taken about 2-4 hours before exercise.
- If eating within two hours of exercise eat less and take semi-solid or liquid meals.
- Dinner on the previous night of the competition is also important. The meal should be such that it ensures proper sleep and adequate fuelling up.
- Familiar and easily digestible foods should be consumed. Any newer food or foods with known allergies or known to cause gastrointestinal upsets should be avoided.
- Foods heavy on stomach like fried foods or high fibre foods should be avoided on the day prior to competition.
- Too much of protein intake should also be avoided as it increases water excretion leading to a state of dehydration. Moreover, proteins are digested slower.
- Take sufficient liquids or a small snack an hour (or less) before exercise.

Maintaining optimal hydration status along with sufficient muscle glycogen stores delays the onset of fatigue and enables the athletes to exercise longer before getting exhausted. High intensity games lead to heavy sweat loss resulting in fluid and electrolyte (sodium, potassium, chloride) imbalance. Hence, sufficient





amounts of fluids to maintain water and electrolyte balance need to be consumed at regular intervals. The best fluid for this purpose is always water. Water intake at a level of 150-250 ml every 15 minutes depending upon the exercise intensity and environmental conditions, would prevent dehydration. Commercially available sports drinks particularly having sugar levels up to 2% could be taken. Signs of dehydration include dark urine, decreased amount of urine, reduced frequency of urination, rapid heart rate, headache, irritability, and confusion. In sports of weight category, athletes dehydrate themselves for the purpose of reducing weight in order to get placed into lower weight categories, this practice may affect their performance, hence, it should be discouraged.

### 5.5.7 DURING EXERCISE

Dealing with nutritional needs during training is crucial for optimal performance. The main aim during exercise and training should be to maintain water balance, control body temperature, sustain normal blood sugar levels and delay fatigue. In order to maintain fluid balance and normal body temperature during exercise, water that is lost through sweating during exercise needs to be replaced. Even slight dehydration brings in mental and physical fatigue and weakens the performance. During small breaks in the events like in tennis, boxing etc. the consumption of adequate carbohydrate and fluids may be taken care of. In shorter breaks, carbohydrate rich foods like banana, juices, carbohydrate-based drinks (less than 2% concentration) or simply water may be taken. Carbonated beverages, fizzy drinks and drinks that contain caffeine are not recommended.

If exercising for more than 60 minutes, carbohydrate-electrolyte beverages like diluted fruit juices containing 5 percent to 8 percent carbohydrates can be ingested. As the duration of high intensity events continues, muscle glycogen levels diminish. Therefore, for endurance athletes, in events lasting longer than two hours, carbohydrate rich solids or liquid meals are recommended during exercise.

### 5.5.8 POST-TRAINING/COMPETITION

Post training or sports competition, recovery of the best body state is required to play or to train the next day to the maximum potential and reduce the chances of injury. The main emphasis during recovery phase must be on the following:

- To replace fluids lost during exercise.
- To refill carbohydrate stores (muscle and liver glycogen)
- To replace electrolytes (sodium, potassium, chloride)





First of all, the fluids lost during exercise must be replaced to restore fluid balance. Because restoration of normal fluid levels takes time, re-hydration needs to begin during exercise and continue after exercise ends. It is recommended that athlete should drink more fluid than is lost because some of the fluid that is taken during recovery is eliminated as urine. Achieving adequate re-hydration before the next training session is crucial for quality training. After exercise fluids should be taken until body returns to its pre-exercise weight or urine is clear or pale colour.

Athletes benefit from consuming high carbohydrate foods immediately after ending repeated intervals of intense exercise or prolonged exercise. The body replaces the glycogen energy stores in the muscle within first few hours of exercising. Immediately after an event, refuelling body with some carbohydrates such as juice, fruit, sweet curd or cereal is required. Eating a balanced meal is recommended that includes carbohydrates and good quality protein within two hours after the event.

**I. Tick the correct option.**

1. Range of protein intake is
  - a. 5g/kg body weight to 1 g/kg body weight
  - b. **1g/kg body weight to 2 g/kg body weight**
  - c. 2g/kg body weight to 3 g/kg body weight
  - d. 3g/kg body weight to 4 g/kg body weight
2. Approximately, how much carbohydrate is required for strength dominant sports?
  - a. 40%
  - b. **55%**
  - c. 70%
  - d. 80%

**II. Answer the following questions briefly.**

1. Discuss the importance of Protein in regard to sportsperson.
2. Which diet should a sportsperson take during the competition?

**III. Answer the following questions in 150-200 words.**

1. Elaborate the importance of food during and after competition.





IV. Complete the following Graphic Organiser giving the Macro- and Micro-nutrients present in the following food groups.



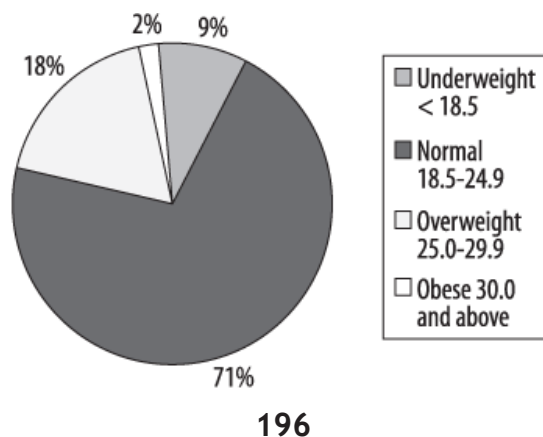
### I. Sports Integration

Start an awareness campaign in your school regarding importance of nutrition in our life.

You could include the following activities:

- Poster making Competition on the benefits of Healthy Eating and Healthy Lifestyle
- Talk Show by inviting a Dietician.
- Making and screening a video film on dietary imbalances.
- Survey on sportsperson's diet
- If possible, develop a school vegetable garden to increase awareness about various vegetables.

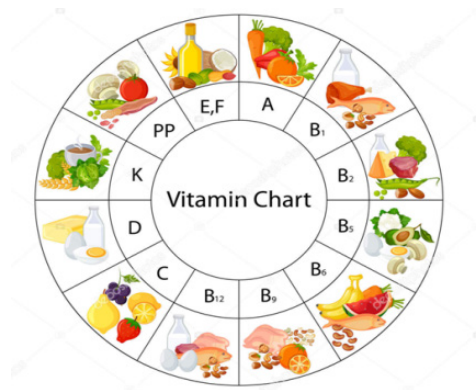
### II. Sports and Nutrition





Picture Reference: <https://www.oreilly.com/library/view/statistics-in-a/9780596510497/ch04.html>

1. Based on the above pie chart
  - a. The major category of students fall in \_\_\_\_\_
  - b. Which category is overweight?
  - c. 25-29.9 is \_\_\_\_\_ category.
- 2.



In reference to the picture answer the following questions

- a. What is the other name of Vitamin B1?
- b. Deficiencies of B9 can cause\_\_\_\_\_.
- c. Vitamin \_\_\_\_\_ helps in maintaining hair colour.

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