



**Government of Tamilnadu**  
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# NUTRITION AND DIETETICS

## NUTRITION

- ❖ The mode of taking food by an organism and utilizing it by the body is called **nutrition**.

### Modes of Nutrition in Plants

- ❖ There are two modes of nutrition in organisms. They are
  1. Autotrophic nutrition
  2. Heterotrophic nutrition.

#### 1. Autotrophic Nutrition (Auto = self; trophos = nourishment)

- Green plants are the only organisms which can synthesize food for themselves and also for other organisms including us.
- The mode of nutrition in which organisms make their own food is called **Autotrophic Nutrition** and such organisms are called **autotrophs**.  
**eg : Green plants, Euglena.**

#### 2. Heterotrophic nutrition: (Hetero = other; trophos = nourishment)

- Non-green plants and most animals (like us) take in ready made food from plants and other animals.
- The mode of nutrition in which organisms depend on others for their food is called **Heterotrophic Nutrition**.  
**eg : All animals, including human beings.**

### Other Modes of Nutrition in Plants

- There are some non-green plants which cannot prepare the food. They take readymade food prepared by other plants.
- They follow heterotrophic nutrition. They may be **saprophytes, parasites, insectivorous** plants etc.

### Saprophytes

- ❖ Fungi grow on dead organic matter.
- ❖ They produce digestive enzymes on the dead matter and change it into simple nutrients.
- ❖ They absorb the nutrients in dissolved form (solution) and utilize it.
- ❖ Such a mode of nutrition is called **saprotrophic** nutrition and those plants are called **saprotrophs**.  
eg: mushroom, bread mould.

### Parasites

- ❖ Cuscuta cannot synthesize food.



- ❖ As it lacks chlorophyll, it depends on the tree on which it is climbing for food.
- ❖ The plant which provides food is called **host** and the plants which consumes it is called **parasite**.

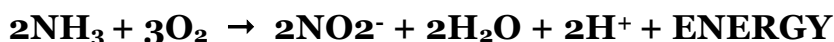
### Symbiotic Plants

- ❖ There is yet another mode of nutrition in which two different types of organisms live together and mutually help each other for nutrition.
- ❖ Lichens are organisms that consist of a fungus and alga.
- ❖ The algae gives food to the fungus and the fungus absorbs water and minerals and gives to algae. Here, both the organisms help mutually.
- ❖ The phenomenon by which two different organisms live together for mutual help is called **symbiosis**. The organisms are called **symbionts**.

### Chemosynthetic autotrophs

- ❖ Organisms which use sunlight energy for synthesis of food materials are called photosynthetic organisms or photoautotrophs.

- ❖ Those organisms which use chemical energy for the synthesis of carbon compounds are called chemosynthetic organisms.
- ❖ Examples for chemosynthetic autotrophs are Nitrosomonas, Beggiatoa. Nitrosomonas oxidizes ammonia into nitrite.
- ❖ The energy liberated during this process is used for the synthesis of carbohydrates.



- ❖ Beggiatoa oxidises  $\text{H}_2\text{S}$  to sulphur and water. During this, energy is released and used for its growth.



- ❖ Sulphur is stored as granules inside cell.

### Chemosynthetic heterotrophs

- ❖ Examples for chemosynthetic heterotrophs are fungi, most bacteria, animals and man.

### Nutrition includes five steps

#### Ingestion

- ❖ The process of taking food into the body is called **ingestion**.
- ❖ The mode of intake of food differs in different organisms. eg: Butterflies and bees suck the nectar of the flowers. Snakes (Python) and frogs swallow their food.
- ❖ Aquatic animals (Blue Whale) filter feed.

#### Digestion

- ❖ The process of breaking down of complex food into simple food with the help of enzymes is called **digestion**.

#### Absorption

- ❖ The process by which the digested food passes into the blood vessels of the wall of the intestine is called **absorption**.

#### Assimilation

- ❖ The ways in which the absorbed food is utilized in cells is called **assimilation**.

## Egestion

- ❖ The removal of undigested food through anus is called **egestion**.

## Nutrition Comprises Organic & Inorganic Components.

- ❖ Organic - Contain Carbon in their Structure.  
(eg) Carbohydrates, Proteins, Lipids, Vitamins.
- ❖ Inorganic - Don't contain Carbon.

## Carbohydrates :- [Poly-hydroxyaldehydes (or) Ketones.]



Ratio = C : H : O

1 : 2 : 1

## THREE TYPES

### Monosaccharides

- ❖ Comprised of single organic molecule. Depends upon number of Carbon atoms, they are classified into

### Trioses ( $\text{C}_3\text{H}_6\text{O}_3$ )

- ❖ Intermediary products of Carbohydrate metabolic process.
- ❖ Important role in interconversion of Biomolecules.

**Example :** glyceraldehyde.

1. Pentoses ( $\text{C}_5\text{H}_{10}\text{O}_5$ ) eg. ribose & deoxyribose
2. Hexoses ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) Each gram of Carbohydrate yields 4.1 calories

**Example :** Glucose, Fructose, Galactose.

### Disaccharides

1. Formed by Condensation of
2. Monosaccharide.  
eg. Milk & Sugar

## Mineral Nutrition

### Woodward (1699) Observation

- ❖ Plants grow better in muddy water than rain water. Characteristics of a Mineral element:-

1. Normal growth and reproduction must be dependent on particular mineral elements.
2. An essential element must have direct influence on plant.
3. Essential elements must be indispensable and their substitution by other elements must be impossible.
4. Some elements are required in very low quantities and status of essentiality (or) non-essentiality is doubtful (eg) silicon.

### **Functions of Minerals**

1. Calcium - found in middle lamella
2. Nitrogen and Sulphur - in Proteins
3. Phosphorous - in nucleic acids.
4. Minerals influence Osmotic pressure of plant cell.
5. It absorbed from soil, affects pH of cell sap.
6. Elements like Fe, Cu, Mn and Zn acts as catalyst.
7. Elements like Ca, Mg, Na, K - Neutralize the toxic effects of other elements.
8. Elements like As, Cu, Hg show toxic effects at plants.
9. Deposition of ions like  $K^+$  and  $Ca^{++}$  on cell membrane changes its permeability.

### **Hydroponics**

- ❖ Growth of plants in water and sand culture.
- ❖ Also known as soil-less agriculture, test-tube farming, tank farming (or) chemical gardening.

### **Uses**

- ❖ To know which mineral essential for growth and development of plant.
- ❖ Increase yield of ornamentals such as gladioli, snapdragon, roses and vegetables such as carrot, radish, potatoes, tomatoes & lettuce.

### **Advantages**

1. Provide desired nutrient environment.
2. Acid-base balance can easily maintained.
3. Mulching, changing of soil and weeding are eliminated.
4. Proper aeration of nutrition solution is possible.
5. Labour for watering of plants can be avoided
6. Tilling is not necessary.

### Disadvantages

1. Production is limited.
2. Technical skill is required to design equipment.

### Macro Nutrients

Elements	Physiological Role	Deficiency Symptoms
C, H, O	General metabolism of plants	Affects normal growth of plants.
Nitrogen	Constituent of Protein, Nucleic Acids, Vitamins, <b>Chlorophyll</b> , ATP	<ol style="list-style-type: none"> <li>1. Stunted growth.</li> <li>2. Chlorosis</li> <li>3. Reduction in fruit size and flowering and protein contents.</li> <li>4. Change in Pigmentation pattern.</li> </ol>
Phosphorous	<ol style="list-style-type: none"> <li>1. Constituent of Plasma membrane, nucleic acids, nucleotides.</li> <li>2. Promotes root growth and fruit ripening</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase in Phosphatase enzyme activity.</li> <li>2. Reduction in growth.</li> </ol>
Potassium	<ol style="list-style-type: none"> <li>1. Required in region of cell differentiation</li> <li>2. Involved in stomatal opening and closing.</li> <li>3. Protein and Carbohydrate metabolism</li> </ol>	<ol style="list-style-type: none"> <li>1. Causes mottled chlorosis</li> <li>2. Shortening of internodes.</li> </ol>
Sulphur	<ol style="list-style-type: none"> <li>1. Constituent of thiamine and Biotin and Co-enzyme A - important role in respiration</li> <li>2. Constituent of amino acids such as cystine, cysteine and methionie</li> </ol>	<ol style="list-style-type: none"> <li>1. inhibition of protein synthesis</li> <li>2. Chlorosis.</li> </ol>
Magnesium	<ol style="list-style-type: none"> <li>1. Chorophyll can't formed without magnesium</li> <li>2. activates enzymes PEP carboxylase and RuBP carboxylase</li> </ol>	<ol style="list-style-type: none"> <li>1. Interveinal chlorosis.</li> <li>2. Appearance of Necrotic spots</li> </ol>
Calcium	<ol style="list-style-type: none"> <li>1. Formation of Plasmamembrane</li> <li>2. Constituent of enzymes like phospholipase and adenyl kinase</li> </ol>	<ol style="list-style-type: none"> <li>1. Affects respiration</li> <li>2. Cell wall become brittle.</li> </ol>



## Micronutrients

Iron	<ol style="list-style-type: none"> <li>1. constituent of enzymes such as catalases, peroxidases and cytochromes</li> <li>2. Important role in electron - transport system of Photosynthesis.</li> </ol>	Impairs aerobic respiration.
Boron	<p>Necessary for Pollen germination, cell differentiation and translocation of <b>Carbohydrates</b>.</p>	<ol style="list-style-type: none"> <li>1. Brown rot disease in beetroots.</li> <li>2. Premature fall of fruits and flowers.</li> </ol>
Manganese	<p>activator of enzymes like carboxylase, oxidases, dehydrogenases, kinases.</p>	Grey Spot disease in Oats.
Copper	<ol style="list-style-type: none"> <li>1. Constituent of Plastocyanin plays a role in Photophosphorylation</li> <li>2. Maintains Carbohydrate - nitrogen balance</li> </ol>	<ol style="list-style-type: none"> <li>1. die back of shoots in citrus.</li> <li>2. exanthema disease - Producing gums on bark.</li> <li>3. Reclamation disease - affecting seed formation.</li> </ol>
Zinc	<ol style="list-style-type: none"> <li>1. Synthesis of Indole-Acetic Acid (IAA) by activating enzyme <b>tryptophan Synthetase</b>.</li> <li>2. Important role in Protein Synthesis.</li> </ol>	little leaf disease.
Molybdenum	<ol style="list-style-type: none"> <li>1. role in nitrogen metabolism.</li> <li>2. Affects Synthesis of ascorbic acid.</li> </ol>	<ol style="list-style-type: none"> <li>1. Yellow spot disease of citrus.</li> <li>2. Whiptail disease in cauliflower.</li> </ol>