FORM TWO BIOLOGY NOTES

NUTRITION -1

Is the process by which an organism provides itself or is provides itself or is provided with **materials necessary for energy release, growth and repair of body tissues and keeping the body in a good condition.**

FOOD

Is any liquid or solid which provides the body with materials for growth and repair, energy release or keeping the body in a good (healthy) condition.

KINDS OR MODES OF NUTRITION

Basically there are two kinds of nutrition

1. AUTOTROPHIC NUTRITION

2. HETEROTROPHIC NUTRITION

AUTOTROPHIC NUTRITION

This is mode of nutrition where by organisms can make their own food from simple inorganic substance, such as carbon dioxide and water using either light energy (photosynthesis) or chemical energy (chemosynthesis). Organisms which feed by this way are known as **AUTOTROPHS**

Example

1. Green plants

2. Iron bacteria and sulphur bacteria

HETEROTROPHIC NUTRITION

This is the mode of nutrition where by organisms use read manufactured food by other organisms. Organisms which feed by this way are known as **HETEROTROPHS.** They feed on already made food.

There are three types of heterotrophic nutrition

1. Saprophytic nutrition
2. Symbiotic nutrition
3. Holozoic nutrition

1. **Saprophytic nutrition**

This is the mode of nutrition where by organisms feed on dead decaying bodies parts of animals or their excrete; Organisms feeding by this way are known as **SAPROPHYTES**

2. **Holozoic nutrition**

This is mode of nutrition where by organism take food by mouth. It passes through a digestive system and broken down, finally absorbed into body tissue.

FORMS OF HOLOZOIC NUTRITION

1. **Herbivores –** Are animals which feed on plants only Example cow, goat and zebra

2**. Carnivores –** Are animals which feed on flesh only e.g. lion, tiger.

3. **Omnivores** – Are animals which feed on varieties o food (flesh, plants, insect etc) example. Man, monkey, pig.

4. **Insectivores** – Are animals that feed on insects e.g. shrews, ant

3. **Symbiotic nutrition**

This mode of nutrition in which an organism of different species exist in a nutrition relationship with other organism;

There are three kinds of symbiotic associations

1. Mutualism
2. Commensalism
3. Parasitism.

1. **Mutualism**

This is a nutritional relationship in which the two partners benefit each other by living together Example Nitrogen Fixing Bacteria in the roots of legumes.

2. Commensalism

This is an association of two group where by the host does not get any partnership. Example Epiphytes (are plants that grow on other plants) e.g. Moses and algae which grow on upper parts of big trees to get sunlight easily

3. Parasitism

This is a nutritional relationship between two organisms in which one organism live inside/on other living organism and depends on food. The parasite causes harm to the host. The host provides food and shelter for the parasite.

TYPES OF PARASITES.

Endoparasites are living inside the body of the host e.g. tapeworm, roundworm and plasmodia.

Ectoparasites;Parasite that lives on host's surface [outside the body] examples includes some mites, flea and body lice.

The importance of nutrition

1. Nutrition enables an organism to get nutrients and energy required for various life processes. These processes include growth and development of cells.
2. To protect body against diseases.

Enable in replacement of worn out tissue and dead cell

FOOD SUBSTANCES

There are several types of substances that are needed by the human body for its proper functioning. The basic food substances include proteins, carbohydrates, lipids, vitamins, minerals, roughage and water.

1. **CARBOHYDRATES**.

These are compounds which contain the following elements

1. Carbon (C)
2. Hydrogen (H)
3. Oxygen (O)

Carbohydrates are also known as **SACCHARIDES**

There are three groups of saccharides

1. Monosaccharides
2. Disaccharides
3. Polysaccharides

1. **MONOSACCHARIDES**

   These are simplest form (basic unit of carbohydrates) which are absorbed directly in the blood. These are also known as REDUCING SUGARS

   Their general formula is $C_6H_{12}O_6$

Exampleof Monosaccharide

1. **Glucose**

   Occurs freely in grapes, honey, tomato and germinating maize

2. **Fructose**

   Occurs freely in all ripe sweet fruits E.g. banana, pineapple

3. **Lactose**

It is found in mammalian milk

(B) DISACCHARIDES

These are also known as NON – REDUCING SUGARS**.** They are found when two molecules of monosaccharides condense and release molecules of water. Their general formula is C_{11} H_{22} O_{11}.Example of disaccharides.

(1) Maltose is formed when two molecules of glucose condense.

Glucose + glucose = maltose + water

(2) Sucrose is formed by condensation of glucose and that of fructose.

Glucose + fructose = sucrose + water

(3) Lactose is found by condensation of galactose molecule and glucose molecule

glucose + galactose = lactose + water

(C) POLYSACCHARDES

These are formed when several units of monosaccharides linked together.

Example of polysaccharides

1) Starch

Starch is stored in plant cell, in the muscles and liver of vertebrates as (glycogen) in exoskeleton of arthropods and fungal cell as chitin

2) Cellulose

It forms the building material of the plant cell walls.

Source of Carbohydrates

Cereals - e.g. maize, rice, wheat

Sugar – e.g. honey, sugar cane, glucose, sweet fruits.

Function of Carbohydrates in the body

1) To provide the body with energy.

2) Carbohydrates combine with proteins, glucose and lipids which are important components of cell membrane.

Carbohydrate food

2. **PROTEINS**

Proteins are compounds of carbon, Hydrogen, Oxygen and Nitrogen. Some protein also contains sulphur and phosphorus. Proteins are long chains of Amino acid formed through condensation.

Approximately there are twenty Amino acids that occur naturally. The human body makes ten of this amino acids. These are called NON – ESSENTIAL AMINO ACIDS. The other ten amino acids must be obtained from the diet they are called ESSENTIAL AMINO ACIDS. We get essential amino acids by eating food rich in protein. Food that contains all the essential amino acid is called **first class proteins**, animal protein most fall in these group. **Second class protein** lack one or one more essential amino acids, most plant proteins fall in this group.

Functions of protein

1. The body use proteins for tissue growth and repair such as healing of wounds and replacement of skin and mucus membranes.
2. Antibodies are made of proteins, Antibodies are important in offering immunity to the body
3. Enzymes which help us to digest food are protein in nature. In addition hormones, the chemical messengers in our bodies are also protein.
4. They are alternative source of energy in the body

Protein food

3**. LIPIDS**

Lipids are compounds of carbon, hydrogen and oxygen. They are insoluble in water the mean form of dietary lipids is fats and oil. Fats are solid at room temperature while oil is liquid at room temperature. Lipids are made up fatty acid and glycerol. Fatty acid can be essential or non – essential. The body can make non essential fatty acids, it is not able to produce essential fatty acids. We therefore need to eat food that contain essential fatty acid, Example of such food are oil fish, nuts oil seed (such as sunflower seeds, maize, avocados and olives.

Functions of lipids

1) Lipids are source of energy; they produce energy more than all foods substances.

2) They are important component of cell membrane.

3) Fat deposits protect delicate organs such as heart and kidney.

4) Stores of fat under the skin help to insulate the body against loss of heat.

5) Essential fatty acids are important for the formation of substances that help to control blood pressure.

4. **ROUGHAGE**

This dietary fiber that is obtained from indigestive part of plants; Roughage does not have any nutrition at value as it is not digested and absorbed in the body. However it helps in the passage of food and faeces through the gut by avoiding contraction of the gut muscle.

Source of roughage : Whole grown cereals, fruits, beans, cabbage, spinach, cassava and whole baked potatoes.

5. **WATER**

Water does not provide energy to the body but there are several ways through which it is important

(i)It used in the digestion and absorption of food.

(ii) It is a medium of transport for food and hormonies.

(iii) It acts as lubricants e.g. eyeball eyelids.

(iv)It helps in excretion of harmful by product of metabolic process e.g. urine, sweat.

(v)It helps in regulation of heat loss (evaporation of sweat on body surface causes the body to cool)

(vi)It is used in the manufacture of different secretions e.g. tears, saliva.

Water can be replaced in the body through

a) Direct drinking

b) Eating foods and fruits.

6. **VITAMINS**

Vitamins are complex organic micro nutrient that is essential for growth and survival. Lack of vitamins in the body leads to deficiency disease. Vitamins can be grouped into two categories *water- soluble* and *fat soluble vitamins*.

- Fat soluble vitamin can be stored in the body and need not be consumed daily. Vitamin A, D, E and K are example of fat soluble vitamins.
- Water – soluble vitamins are not stored in the body. Therefore they should be consumed. Vitamins B and C are water – soluble. Vitamins B is named of various forms, namely vitamin B_1 B_2 B_6 and B_{12}

Source, functions and deficiency of vitamins

Vitamins	**Source**	**Function**	**Sign of deficiency**
Vitamin A (retinol)	Liver, milk, carrots, orange, and yellow vegetable	Essential for the formation of membrane of the eyes and the respiratory tract	Night blindness, increased risk of infection.
Vitamin B_1 (thiamine)	Lean meat, liver, eggs, yeast extract and brown rice	Carbohydrate metabolism, Coordinate of muscle	Beriberi, a diseases characterized by loss of appetite, muscle cramps disorder and heart failure.
Vitamin B_2 (riboflavin)	Liver, meat, whole, grain cereals, yeast extract.	Needed for metabolism of all food and release of energy to cell	Severe and cracking lips corner of the mouth.
Vitamin B_3 (niacin)	Nuts, fish, meat, yeast, extract unpolished rice.	Needed by enzyme to convert food into	Pellagra a disease characterized by skin

		energy	lesions, loss of appetite and muscle weakness
Vitamin B_6 (doxine)	meat, vegetables, yeast, extracts, whole grown cereals	Essential in protein metabolism	Nerve irritability sores in the mouth, eyes and anemia.
Vitamin B_{12} (yanocobalamin)	Fish, meat, eggs, milk, and lever.	Builds genetic material, helps to form bloods cells.	Anemia nerve damage weights loss.
Vitamin C (ascorbic acid)	Citrus fruits, fresh green vegetables and tomatoes.	Antioxidant improves absorption of iron used in synthesis of collagen in the bones and gums.	Muscle weakness, easy bruising, joint pains, scurvy (bleeding gums), poor healing of wounds and frequent infection.
Vitamin D	Egg yolk, milk oily, fish and liver	Helps to build and maintain teeth and bones.	Rickets in children, osteoporosis (soft bones) in adult
Vitamin E	Corn of sunflower oil, butter, brown, rice and peanuts	Antioxidant prevents damage of all membranes	Nerve abnormalities infertility in rats.
Vitamin K	Green vegetables and liver	Needed for normal clothing	Detective blood coagulation resulting in excessive bleeding.

7.**Minerals**

Certain mineral elements are vital for the proper functioning of the body. Some are required in relatively large quantities and are therefore called *macro minerals*. Others are required in very small quantity are referred to as *micro minerals* or *trace element*.

The following are example of minerals, their sources and their functions in the body.

a) Macro minerals

Minerals	**Source**	**Function**	**Deficiency symptoms**
Calcium	Milk, yoghurt, cheese, sardines, egg, green	Helps build strong bones and teeth,	Weak bones, bleeding easily

	vegetable	promote muscle and nerve functions, and important in clotting of blood.	
Phosphorus	Meat, milk, fish, eggs and nuts	Builds bones and teeth, help muscle and nerve activity, aids formation of genetic materials	Impaired nerve activity bone and teeth formation
Potassium	Peanut, bananas, orange juice, green beans and meat.	Help maintaining regular fluid balance needed for nerve and muscle	Poor muscle contraction
Iron	Liver, meat, beans and green vegetables	Essential formulating hemoglobin [the red pigment in blood)	anemia
Zinc	Oysters, shrimp, crab, meat, yeast extracts	Activates enzymes, helps to heal wounds necessary for a healthy immune system	Impaired teeth, poor immune response, skin problems
Sodium	Table salt	Necessary for nerve and muscle activity	Muscle cramps
Chlorine	Table salt	Maintenance of water and ionic balance, formation of hydrochloric acid in the stomach	Poor digestion of proteins
Magnesium	Spinach, pumpkin seeds, sesame seeds and black beans	Relaxation of nerves and muscle strengthening of bones.	Muscle weakness, irregular heartbeat and weaker bones

b) Micro minerals

Iodine	Iodinated table salt and sea food	Production of thyroid hormone which regulate growth, development of bones and teeth, helps prevent tooth decay	Goiter (enlarged thyroid gland)
Fluoride	Fluorinated water and fluoride tables	Development of bones and teeth, helps prevent	Poor development of bones and teeth , tooth

		tooth decay	decay
Manganese	Kidneys, liver, tea, coffee nuts and fruit	Formation of bones and activation of enzymes	Nausea, dizziness, loss of heating loss of bone mass
Copper	Meat, fish, and liver	Synthesis of bones and haemoglobin, activation of enzymes	Bleeding under skin, easy rupturing of blood vessel, bones and joint problems, anemia

A BALANCE DIET

A balanced diet refers to food containing all types of food nutrients in the correct proportion. We should eat a diet low in fats, sugar and salt but high in proteins, carbohydrates, vitamins, minerals, and roughage, more importantly we should take in large amounts of water.

However, it is recommended that we eat more fish, poultry products and legumes (such as pea, beans and peanuts)

Instead of taking red meat as protein sources. The following should be done in order to maintain a healthy body.

1. Physical activity can preserve and improve your health. Therefore, it is important to balance your food intake and exercise.

2. Minimize your intake of fats and oils by eating foods low in fats, sugars and salts. This will reduce your risk of heart attacks, tooth decay and high blood pressure respectively.

3. Include plenty of grains, fruits, and vegetables in your diet.

4. Eating a variety of food will provide the body with energy and nutrients that is required in maintaining proper health.

Nutritional requirements for different groups of people

Nutritional requirement differ for different groups of people. The ratio of nutrients varies depending state of the body. The following are some groups of people and the special nutritional needs.

1. **Expectant and lactating mothers.**

Expectant and lactating (breast feeding) mother need to get enough nutrients.

They should thus eat a balanced diet because they require nutrients for themselves and the growing foetus or babies.

Protein is needed for the build – up of the mother muscles, breast, uterus, blood supply and the baby or foetus tissue and organs.

Folic acid and vitamin B help to lower the risk of birth defects such as *spina bifida*. Spina bifida is a spinal disorder characterized by a hole in the spine.

It results from incomplete formation of the spinal cord and the bones of spine. Often the spine protrudes through the hole and sometimes a fluid filled sac may surround the protruding spinal cord.

Calcium helps in the development of the foetus or baby's bones, if the mothers' diet does not contain adequate calcium; it is derived from her bones for the foetus or baby. This weakens the mother bones.

Zinc is important for the proper progression of labour and proper growth and development of the baby.

The mother to be requires iron for her blood supply need, the foetus also needs to store iron for use during the first few months after birth.

Expectant mother requires adequate amounts of dietary fiber to reduce the likelihood constipation, which is a common complaints during pregnancy.

2. **Children**

Children require enough proteins for the growth and development of body tissues. Inadequate of proteins can lead to stunted growth.

Minerals like calcium are necessary for the formation of strong bones and teeth. Zinc is important for body growth. The zinc resources in the body can be depleted by vigorous physical exercise.

Vitamin B_{12} is required for the formation of red blood cells. Because a growing baby needs more oxygen and more blood) for growth while vitamin C helps children to build their immunity.

Children also require more energy – giving foods because they are active than adult.

3. **Adolescent**

- Need food rich in carbohydrates because of high body metabolism
- Food rich in protein and mineral salt such as calcium, iron and phosphorus
- Adolescent girl require additional supply of iron to compensate for the blood loss during menstruation.

4.**The elderly**.

Elderly people require less energy – giving foods because they are generally less active than young people. This group should eat food that is rich in fiber in order to reduce constipation and bowel problems that come with age.

They also need minerals such as iron, zinc and calcium. Iron is necessary because anemia is a frequent problem in older age; zinc is required for a healthy immune system and to increase the rate of healing of wounds.

Old age comes with the loss of calcium from bones leading to soft and weak bones that can break easily. Old people therefore require adequate amounts of calcium and vitamin D to counter the loss.

The elder often have problems of chewing tough foods because of weakened teeth and swallowing because of the decreased production of saliva. It is therefore important to ensure they get food that are nutritious as well as easy to chew and swallow. For example they can get proteins from eggs or liver instead of meat.

5. **Sedentary workers**

These are individuals who stay in one place for a long time while performing their daily occupational activities. They include workers potter's weavers, clerk, receptionists and doctors.

Sedentary workers are encouraged to balance their diets with physical exercise. Due to their lifestyle and occupation obesity increasingly is common among them. Therefore, it is recommended that they limit their intake of foods rich in lipids.

6. **The sick**

Sick people require plenty for nutrients to help recover their health, those who have incurable disease such as HIV and AIDS should get food that will help them to manage their conditions.

Proper nutrition helps to keep their immune system strong and helps the body to fight opportunistic infections and disease.

Rapid weight loss is a major problem in the late stage of AIDS. It is therefore important to get enough nutrients so as that the body can compensate for this.

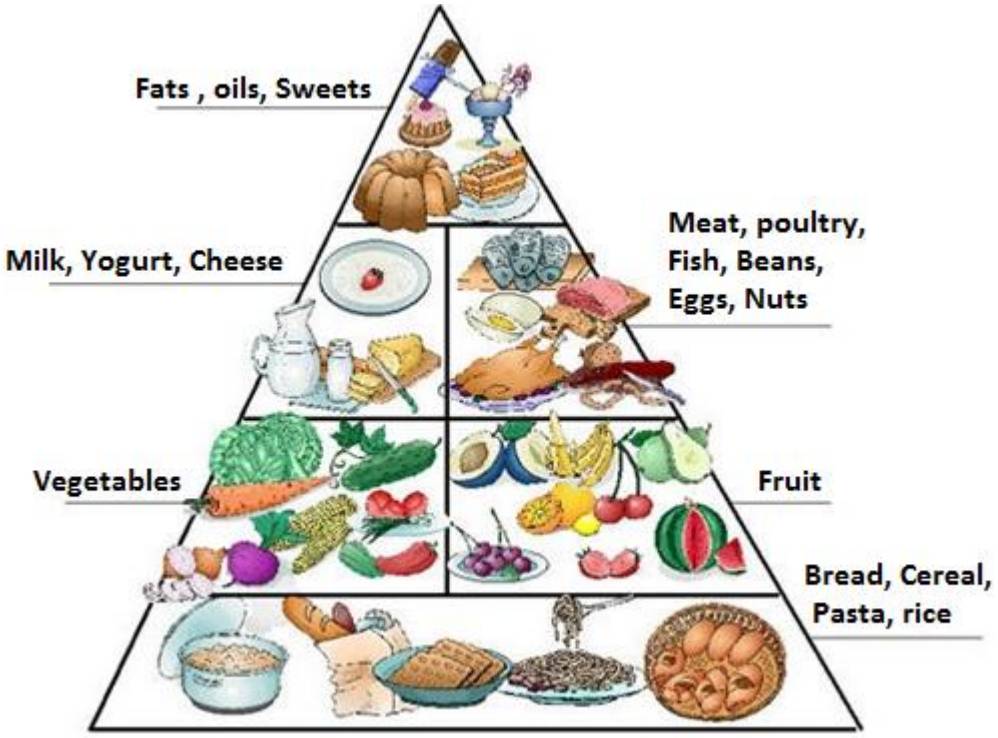
Proper nutrition helps the body to withstand heavy medication.

Proper diet and exercise helps to combat symptoms such as fatigue, nausea, diarrhea and high blood sugar.

Excess caffeine sugar, dried foods, spicy foods and alcohol should be avoided because they are harmful to a body whose immune system is already weak.

They need to take plenty of fruits and water. Fruits provide vitamins which are required to fight disease. Water replaces the amount lost through diarrhea or vomiting.

It is advisable to use food guide pyramid to know what to eat. The food guide pyramid is a chart showing the recommended amounts of different food types that dietician considers healthy eating.



Nutritional deficiencies and disorders

Malnutrition

Malnutrition (limiting the intake of one or more essential nutrients) results from eating too little from eating the wrong food. There are different types of nutritional deficiencies and disorders in human beings, these deficiencies and disorders include obesity, rickets, kwashiorkor, marasmus, anorexia nervosa and bulimia nervosa.

Nutritional disorders

Nutritional disorders are conditions of ill health in a person which arise as a result of lifestyle (poor eating habits) as discussed below.

1. **Obesity**

Obesity is where by a person has excess body fat. A person sex, age and level of activity among other factor determine his or her ideal body fat. To maintain fertility, women need more body fat. Women also store more fat in their breasts, hips and thighs.

Another important influence of body fat is a person frame size. Individuals with larger bones carry more fat.

Obesity mostly results from eating too much and not exercising enough. Body weight and health risks associated with it are correlated by the body mass index (BMI). BMI gives the relationship between the estimated body fat and the risks of certain disease or conditions.

$$\text{BMI} = \frac{\text{Body mass (in kilograms)}}{\text{persons height (in meters)}^2}$$

OR

$$\text{BMI} = \frac{\text{Body mass (kg)}}{(\text{Person's height})^2\ (\text{m}^2)}.$$

For example if your height is 1.65 meters and your body mass is 60 kilograms your BMI can be calculated as

$60/ (1.65)^2 = 60/ (2.7225) = 22.04$

If an individual's BMI falls in the range of 20 – 25, this is considered to be healthy. On the other hand if the BMI is over 30, one may be at risk of diseases associated with obesity.

The following table shows a general guide of how different values of BMI are used to define the condition of the body.

Table BMI guide

BMI	Body condition
Below 20	Underweight
20 – 25	Advisable range
25 – 30	Overweight
30 – 35	Obese
Above 35	Very obese

Obesity increases the like hood of conditions such as high blood pressure, diabetes and certain types of cancer, stroke, and respiratory problems.

Obesity can be prevented by eating properly and engage in regular exercise. The intake of calories should balance one's physical activity. It is also important to avoid eating too much fat foods such as butter, fat meat, chips, margarine, sausage and vitumbua. Avoid also unhealthy dieting.

Anorexia nervosa and Bulimia nervosa

Anorexia nervosa is also called slimmer's disease or self starvation syndrome. It occurs when a person intentionally refuses to eat enough, leading to a severe loss of body mass.

Sign and symptoms of anorexia

1. Muscle wasting (including weakening of heart muscle)

2. Excessive loss of body mass

3. Extreme fear of being fat.

4. Disturbed body image or feeling fat even when one is very thin.

Bulimia nervosa involves excessive eating followed by efforts to remove food from the body. This effort could involve self- induced vomiting, fasting, excessive exercising or taking drugs that stimulate, emptying of the bowels or excessive urination. Bulimics usually have a normal body mass and keeps their eating behavior secret. Hence it may be difficult to tell that they have a problem.

Causes of Anorexia and Bulimia

Both Bulimia and Anorexia have underlined psychological causes, such as depression, low self esteem and bottled up emotions and the need to fit contemporary standard of beauty Bulimia and Anorexia mostly affect women.

Effects of Anorexia and Bulimia

- The effects of Anorexia and Bulimia are demonstrated by heart problems due to weak cardiac muscles or an imbalance of mineral salts.
- There is an impaired mental function because the brain lacks adequate amount of glucose. Victims also exhibit dehydration. During vomiting, the acidic present in the stomach come into contact with the teeth and gums, the eventually causes, serious damage to the gum and erosion of the teeth. Other effects include anemia, stomach ulcers, abdominal cramping and inflammation of the gut, irregular or absent menstrual periods and dry skin.

Treatment for Anorexia and Bulimia

Anorexia and Bulimia can be treated by resolving the underlying psychological problems, seeing a medical practitioner who can prescribe a way of getting back one's healthy and making the necessary lifestyle and dietary change.

Nutritional deficiencies.

These deficiencies arise when the body does not have sufficient supply of a particular food or nutrient. The following are some of the common nutritional deficiencies.

1. **Marasmus**

Marasmus is a form of malnutrition in children caused by lack of adequate amount of food

Sign and symptoms of Marasmus

A child suffering from marasmus shows weight loss, slowed growth, decreased activity and lack of energy. They also have wrinkled skin, are irritable and have extreme hunger

Treatment of Marasmus

Getting adequate amount of food that contains all the nutrients in the right proportions.

2. **Kwashiorkor**

Kwashiorkor is caused by a deficiency of proteins. It affects children, mostly after stopping to breast feed.

Signs and symptoms of kwashiorkor

The signs and symptoms of kwashiorkor include extremely thin arms and legs, poor growth, swollen thin arms and legs, swollen abdomen due to enlargement of the liver and reddish or yellowish thin and weak hair. Other symptoms are weakened immunity, diarrhea, anemia, and dry skin that cracks easily

Treatment for kwashiorkor

Kwashiorkor is treated by providing a child with a diet that has adequate amounts of proteins.

3. **Rickets**

Rickets is a condition where by the bones of a child soften, leading to fractures and deformities. The cause of rickets is lack of vitamin D, phosphorous and calcium.

Sign and symptoms of Rickets

A child suffering from rickets can be identified by observable skeletal deformities such as bow legs, knock knees, an odd – shaped skull and a deformed spine. A child feels bone pain, experiences dental problems such as weak teeth or delayed formation of teeth and develops weak muscles. The child’s bones are easily fractured, shows slow growth and gets muscle spasms and muscle cramps.

Prevention of Rickets

Rickets is prevented by increasing the amount of vitamin D, phosphates and calcium in the diet and by ensuring exposure to sufficient amount of sunlight.

FOOD TEST

Food test is used to determine which nutrients are present in a food specimen. At this level we will learn how to test for carbohydrates, proteins and lipids.

1. **Test for carbohydrates**

	Procedure	**Observation**	**Conclusion**
	Test for reducing sugar		
	Dissolve food sample in water	colour changes from blues to green to yellow then orange	Reducing sugar is present
	Add an equal amount of Benedict's solution to the solution		
	Boil the mixture		
	Test for non reducing sugar		
1. 3. 5.	Dissolved the food sample in water Put 2cm^3 of the solution in a test tube. Add 1cm^3 of(dilute hydrochloric acid neutralizes disaccharides to monosaccharide's) Boil the mixture Allow the mixture to cool Add small amounts of sodium hydroxide at a time (sodium addition) Continue until fizzing stops. Add 2cm^3 of Benedict's solution, then boil the mixture	Colour changes from blue, green to yellow to orange.	Non – reducing sugar is present
	Test for starch		
	Add a few drops of iodine solution to the food sample	Colour changes to blue - black	Starch is present

Test for Protein

Procedure	observation	Conclusion
Biuret test		
The food sample should be in solution form	Color changes to purple	Proteins are present
Pour $2cm^3$ of food sample in a test tube		
Add $1cm^3$ of sodium hydroxide solution then a drop of copper sulphate solution shaking the mixture after each addition		

Test for lipids

	Procedure	observation	Conclusion
	Grease spottiest		
	Rub the food sample on a piece of dry filter paper	a translucent mark is formed	Specimen contain lipids
	Hold the paper against the light		
	Sudan III test		
	The food sample should be in solution form	Droplets of oil turn red	Specimen contains lipids
	Add some drops of Sudan III test		
	Emulsion test		
	Ensure the food sample is in solution form	The clear mixture turns cloudy forming a milky suspension	Specimen contains lipids are present.
	Put the food sample in a test tube along with an equal amount of acetone, benzene or ethyl alcohol.		
	Shake the mixture		
	Add an equal volume of water		

DIGESTIVE SYSTEM IN HUMAN

Some common terms concerned with the movement of food along the alimentary canal.

INGESTION – This is taking in a food to the mouth.

DIGESTION – This is the process by which food is broken down to small particles which are absorbed and assimilated in the body.

ABSORPTION – This is the process by which soluble end products of digestion diffuse into the blood stream.

ASSIMILATION – This is the incorporation of products of digestion into the cell metabolism.

EGESTION –This is the process by which indigested food particles are removed from the body through the anus.

The digestive system is made up of alimentary canal (gut) and associated organs such as the pancreas and liver

PARTS OF ALIMENTARY CANAL

The alimentary canal is a long hollow tube that runs from the mouth to the anus. It is also known as digestive tract.

- It consists of the mouth, pharynx, gullet, stomach, duodenum, ileum, caecum, colon and rectum

DIGESTION

Digestion is a process by which food is broken down into form that can be absorbed and used by the body. It involves both mechanical and chemical breakdown of food. Mechanical take place in the mouth; the teeth chew the food to reduce it to small piece that can be swallowed easily

The small pieces have a large surface area to facilitate the action of digestive juice called enzymes

Chemical breakdown is achieved by digestive enzymes. The digested food is absorbed and assimilated in the body. The undigested and indigestible materials are egested as faeces.

THE DIGESTIVE SYSTEM AND DIGESTION PROCESS

The major regions where digestion occur in the alimentary canal are mouth, stomach, duodenum and ileum

DIGESTION IN THE MOUTH

In the mouth, food is chewed by teeth and mixed with saliva to form a ball like to break down food into small particles thus increase the surface area for enzymatic activities.

-Saliva is alkaline in nature, so it makes the food alkaline when in the mouth.

- Secretion of saliva is controlled by the nervous system. These smell, taste, sight or thoughts of food cause saliva to flow from the gland.

-Saliva is a mixture of mucus water, a variety of salts and the enzymes known as salivary amylase.

FUNCTION OF SALIVA

1. Water acts as solvent for dissolving food substance

2. Mucus lubricates thus food for easy swallowing.

3. Salivary amylase turns starch to maltose.

- The tongue rolls the food in the round mass known as bolus(plural is boli)

- The boli are pushed down the oesophagus by the tongue

THE PHARYNX

- The region which crosses the air passage is known as glottis
- There is a structure known as epiglottis which prevent food from entering the wind pipe or trachea.
- There is no digestive enzymes

THE OESOPHAGUS (GULLET)

- This is the tube which connects the pharynx and the stomach.
- The food passes the gullet rapidly by contraction and relaxation of the gullet mode this is known as PERISTALSIS
- Peristalsis is the process by which food substances move down the alimentary canal in the form of bolus through muscle valve known as sphincter
- There is no digestive enzymes.

DIGESTION IN THE STOMACH

- The food is mixed with hydrochloric acid and gastric juice to produce a semi – solid mass known as chyme.
- The wall of the stomach contains gastric glands which secrete gastric juices.
- The gastric juices contain water, hydrochloric acid, mucus and enzymes(pepsin and rennin).

FUNCTION OF THE HYDROCHLORIC ACID

1) Provides suitable acidic medium for enzymes to work best

2) Hydrolyses or breaks down food to simple particles

3) Kills bacteria present in food

- The function of pepsin is to breakdown proteins into peptides.

- The function of rennin is to coagulate (solidifies) soluble milk protein (casein) into an insoluble form which is then acted on by the enzymes pepsin. This enzyme is mostly found in young mammals during sucking period.

The function of mucus is to protect the stomach against corrosion by the hydrochloric acid.

GENERAL FUNCTIONS OF THE STOMACH

- It is a temporary storage of food
- Digestion of proteins starts in the stomach
- Helps in mixing food during churning, also absorb water alcohol and some vitamins.

There is a muscle valve between the stomach and the duodenum known as **pyloric sphincter**

The chyme (liquid food) passes periodically from the stomach through the pyloric sphincter to the duodenum.

DIGESTION IN THE DUODENUM

- Duodenum is the first part of the small intestine
- It is associated with the liver and pancreas.

THE LIVER

- The liver has cells which secrete bile.
- Bile is stored in the gall bladder and is released through the bile duct. It is greenish yellow in colour and contains bile salts.

FUNCTION OF THE BILE

i) It emulsifies fats (lipids) i.e. break down fats into tiny fat droplets to increase the surface area for enzymatic activities.

ii) Provides an alkaline medium for enzymes to work best.

iii) It neutralizes the acidic food from the stomach.

THE PANCREASE

The pancreas secretes digestive juices known as pancreatic juice. The juice contains the following.

1. Pancreatic amylase – it breaks down the starch into maltose.

2. Pancreatic lipase – digest the fat droplets into fatty acids and glycerol.

3. Sodium hydrogen carbonates ($NaHCO_3$) provides basic medium for pancreatic enzymes to work best i.e. neutralize the acidic chyme from the stomach. The resulting food mixture in the duodenum is known as chyme.

4. Trypsin – break down proteins into peptide.

DIGESTION IN THE ILEUM (SMALL INTESTINE)

- The ileum is the largest section in the alimentary canal.
- The intestine contains secretory cells which secrete mucus and digestive juice known as intestinal juice or succus entericus.
- The juice has 4 enzymes

1. Erepsin or peptidase digests peptides to amino acids.

2. Maltase – breaks down maltose to glucose.

3. Lipase – breaks down fat droplets to fatty acids and glycerol.

4. Sucrase – breaks down sucrose (cane sugar) to glucose and fructose.

5. Lactase digest lactose to glucose and galactose

- The ileum has two main functions

  a) Digests all types of food.

  b) Absorption of end products of digestion into the blood stream

  NOTES: The walls of the alimentary canal secrete mucus which performs two major functions.

  a) Allows smooth movement of food materials along the alimentary, absorption of the end product of digestion into the blood of stream

  b) Protect the wall of the alimentary canal against corrosion (digestion) by digestive enzymes.

  -End products are:

- Amino acids – simple form of proteins.
- Glucose – simple form of carbohydrates.
- Fatty acids and glycogen – simplest forms of lipids.

ABSORPTION

Absorption is the process by which the soluble end products e.g. glucose diffuses into the blood stream.

- Absorption takes place mainly in the small intestine however; absorption of some water, soluble vitamins B and C, and soluble salts take place into the stomach.

PROCESS OF ABSORPTION

1. Amino acids and glucose. These materials are absorbed into the blood stream through the process of active transport

- These materials diffuse into the blood with the dissolved materials to the HEPATIC PORTAL VEIN

- The hepatic portal vein takes the blood with the dissolved materials to the river and then joins the general body circulation.

2. Fatty acids and glycerol.

- They are absorbed by the villi

- They can drain into lymphatic vessel and finally join the body circulation at the vena cava.

NOTE: The wall of the small intestine has numerous fingers – like structure called villi: (singular villus) which increase the surface area for digestion and absorption of food to take place.

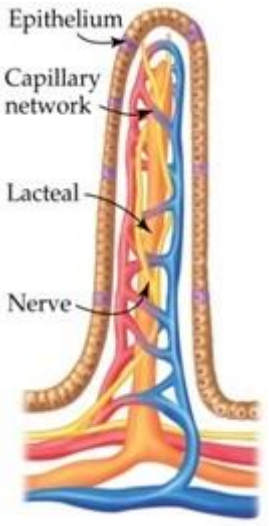


Diagram of villi

Adaption of ileum to its functions

1) It is long to provide large surface area for digestion and absorption.

2) It is highly coiled to increase the surface area for digestion and absorption.

3) It has villi and micro – villi which increase the surface area for absorption.

4) It has dense network of blood capillaries which facilitate easy diffusion of digested materials.

ASSIMILATION

- This is the process by which the end products of digestion are incorporated in the cell metabolism. Assimilation occurs as follows:

  Glucose: some is oxidized during respiration to produce energy (ATP) some is stored as glycogen in muscle some is converted to fats and stored as tissue beneath the skin.

  AMINO ACIDS

  Some are used in the synthesis (formation) of proteins, some are used in growth and repair of worn out cells. In absence of glucose and fats they may be oxidized to release energy during respiration.

  FATTY ACID AND GRYCELOR

- Are oxidized to release energy during respiration.
- Stored as a dispose tissue beneath the skin. This helps in insulating the body.

  THE CAECUM AND THE APPENDIX

- These have no function in man.
- In herbivores the caecum and appendix contain bacteria that secrete an enzyme known as cellulose.

THE LARGE INTESTINE (COLON)

- The large intestine has four functions.

1. Absorb water from the undigested materials
2. Absorb small amount of digested food.
3. Glandular lining of the colon produces mucus which lubricate the passage of faeces
4. It is a temporary storage of faeces up to the time of defecation (egestion).

EGESTION: The undigested and indigested materials are known as faeces. The faeces are removed from the body through anus by the process of egestion.

SUMMARY OF DIGESTION

Part of alimentary canal	Enzymes secreted	Substance digested	Product of digestion
Mouth	Salivary amylase	Carbohydrates	Maltose
Stomach	Pepsin	Protein	Peptides
	Rennin	Soluble milk protein (caseinogens)	Insoluble milk protein e
	Trypsin	Protein	Peptides
Duodenum	Pancreatic amylase	Starch	Maltose
Ileum	Pancreatic juice	lipase	Fattys acids and glycerol
		Maltase	Glucose
		Sucrase	Glucose and fructose
		Lactose	Glucose and galactose

NUTRITION -2

The ruminant digestive system

A ruminant is an animal that chews food, swallows it then returns it to the mouth later for further chewing. This is called **chewing cud.** Examples of ruminants are cows, goats, sheep, antelopes and giraffes.

The digestive system of a ruminant is different from that of a human being. Ruminants have a more elaborate system to enable cellulose digestion.

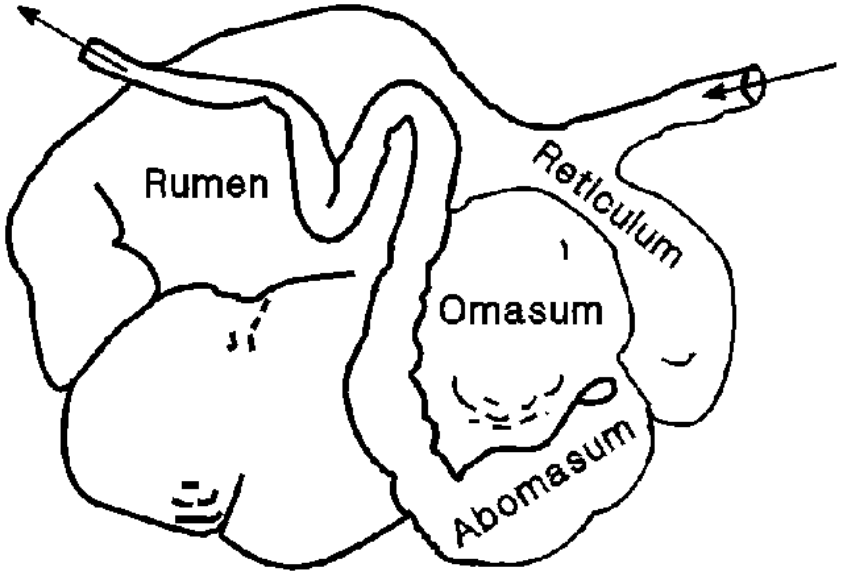
The stomach of a ruminant has four chambers: rumen, reticulum, omasum and abomasum.

When a ruminant first chews and swallows a mouthful of plant matter, the food enters the rumen. Bacteria in the rumen immediately start digesting the cellulose present in the material. Chewing cud softens and helps down plant fibres, making them more access to digestion by the bacteria. When the food in the rumen, it is coarse and very green. The food then regurgitated and chewed again. It passes the reticulum. The reticulum has a 'honeycomb" appearance. In the reticulum, the food is mixed thoroughly with water. The food coarse, more watery, less green and very small compared to the food in the rumen.

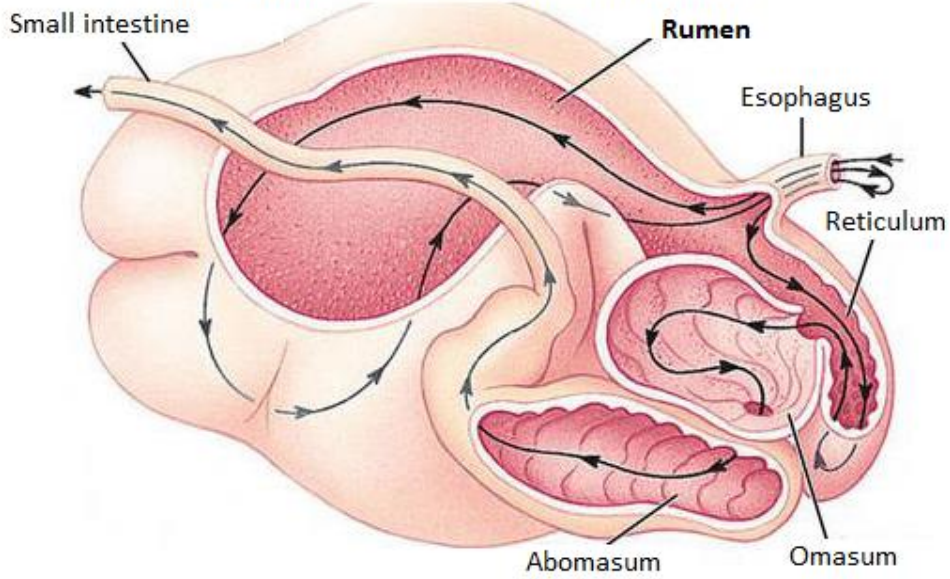
The food is regurgitated, chewed again and passed to the omasum. The abomasum has longitudinal folds like the leaves of a book. *The* folds help to remove water from the food. The food in the omasum is in form of fine particle and has very little water.

The abomasum is the ruminant's stomach. The abomasum has gastric acid facilitates the digestion of proteins. It also has microorganisms that may have spilled over the rumen.

OUTER SIDE OF RUMINANT STOMACH



Four-Chambered Stomach of Ruminant



Differences between the ruminant System and the human digestive system are:

- Ruminant digestive system has four chambers. Human beings have one stomach chamber.
- Ruminants have no upper incisors. Instead, they have a horny pad. This helps in the chewing of food. They also have a gap on the lower jaw called diastema. –*humans* have upper incisors and no diastema. Ruminants chew cud. They regurgitate what they had swallowed and chew it again. Human beings do not chew cud.
- Ruminant's digestive system has organisms(bacteria) that help to digest fibre and synthesize vitamin B. Human beings cannot digest fibre.

Diseases and disorders of the digestive system

This includes diseases and disorders that affect; the oesphagus, the stomach and the

large intestines. Examples include dental caries heartburn, stomach ulcers, constipation flatulence and cancer.

1. **ULCERS**

1. These occur as a result of the action of enzymes and acid on the epithelial membrane lining of the stomach and duodenum walls. The mucus coating can be broken by bacteria called *Hericobacter pylori*

Cause

- Ulcers can be caused by stress which stimulates acid production
- Ulcers can also be inherited.
- Certain medication like aspirin
- Smoking and taking alcohol
- Caffeine

Sign and symptoms of ulcers

1. Burning pain in stomach or the middle of thorax
2. Nausea and vomiting
3. Tiredness and weakness
4. Blood in vomiting or stool (a symptom of breeding ulcer)

CONTROL OF ULCERS

Ulcers can be controlled as follows

1) Have stress reduction programs

2) Eliminate smoking and drinking alcohol

3) Changing diet and taking meals on time

- The ulcers can be corrected or reduced by the following treatment

1. Drinking milk

2. Taking magnesium trisilicate tablet

3. Surgery which include

- Cutting the vestigial part

- Gastrectomy removal of the duodenum and the stomach.

2. **CONSTIPATION**

- This is the frequent passage of hard faeces

Constipation is caused by the following:

(i) Abnormally slow movement of faeces matter through colon. As a result maximum absorption of water takes place leaving very dry hard faeces.

(ii) A diet low in fibre such as roughages

(iii) Failure of the sensory cells to signal the presence of faecial matter in rectum.

CONTROL

Constipation can be controlled by

(i) Eating high fibre rich food.

(ii) Drinking a lot of water.

3. **HEART BURNS**

This is the burning sensation along the alimentary canal or in the chest cavity as a result of accumulation of too much acid in the stomach.

- An individual with this problem feels uncomfortable all the time
- Prolonged heart burn can lead to oesophagus ulcers

CONTROL

Heart burn can be reduced by drinking milk or taking tablets which neutralize the acid of the chyme.

4. **FLATULENCE**

This is a condition caused by excessive gas in the digestive track it causes pain and embarrassment to many individuals.

- The intestinal gas such as oxygen and nitrogen are gulped in while breathing and at the same time eating
- Other gases such as methane, carbon dioxide and hydrogen are produced from fermented undigested food
- The gases in the intestine can be minimized by

  (i) Eating slowly

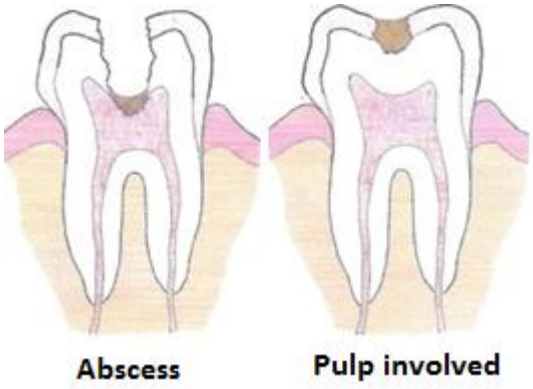
  (ii) Avoid milk if you are lactose intolerant

  (iii) Not eating gas – inducing food such as beans, cabbage, onions

  (iv) Using antacids

1. DENTAL CARIES

This is commonly referred to as tooth decay. It occurs when bacteria destroy the outer part of the tooth.



Development of dental caries

There are always bacteria present in the mouth. The bacteria combine with acid, saliva and remains of food to form **plaque.** Plaque is the sticky substance often found between teeth. Plaque begins to form within 20 minutes after we eat. The bacteria in plaque convert the remains of food (especially sugar and starch) into acids.

The acid dissolves the enamel in the tooth, forming **a cavity.** If this cavity is left untreated, it reache**s** the pulp cavity and nerve endings inside the tooth causing an infection.

This disease is caused by a number of factors including:

(i) Lack of hard food

(ii) Too much sweet food

- Sweet food tends to encourage growth of bacteria

  (iii)Lack of calcium in the diet

  (iv)Lack of vitamin D

  (v) General ill health

6. **CANCER**

- Cancer is a disease which affects the digestive tract include

1. Cancer of oesophagus
2. Cancer of the colon

- **There are various causative agents of cancer**, Their common ones include

i) Mutation of genes

ii) Cancer inducing foods we eat. They affect the colon when they come in contact over a long direction of time

TREATMENT

- It has not been up to date easy to treat or prevent cancer. The following methods are applied in treating it.

1) Chemotherapy – During treatment to supplement surgery

2) Radiation – Bombardment using radioactive particles to eliminate the cancerous cells

3) Surgery – Removal of all cancerous cells

NOTE: The outlined treatment are not 100% perfects, they will affect other cells or induce other cells to become cancerous

CONTROL

Taking the fibre food in the food to come into contact with the cells leaving the colon wall

NUTRITION IN PLANTS

AUTOTROPHISM

This is the mode of nutrition used by green plants to manufacture their own food.

- The process is used by green plants to manufacture their food is known as ***photosynthesis***.

Definition – photosynthesis is the process in which green plants manufacture complex food substances from simple inorganic substances such as carbon dioxide and water in the process of sunlight and chlorophyll

- This process of photosynthesis occurs in the green parts of the plants mostly in leaves

STRUCTURE OF THE LEAF

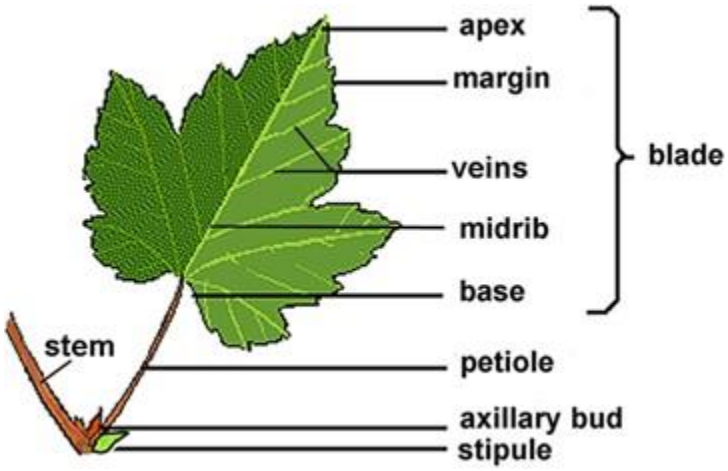
A) EXTERNAL PARTS OF THE LEAF

1) Petiole – attaches the leaf to stem or branch.

2) Veins – Transport materials within the leaf

3) Midrib – gives rise to veins. Transport materials to the leaf

4) Lamina- photosynthesis takes place in it.



B) **INTERNAL PARTS OF THE LEAF**

The internal parts of the leaf consist of

1) Cuticle

2) Epidermis

3) Guard cell

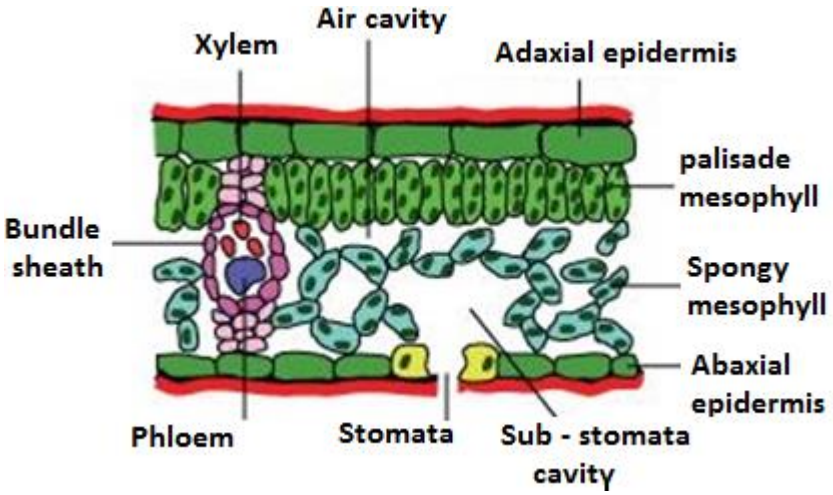
4) Palisade layer

5) Spongy mesophyll layer

6) Leaf veins

7) Chloroplast

Diagram showing the internal parts of a leaf



FUNCTION OF THE INTERNAL PARTS OF LEAF

a) **CUTILE** – This is a thin wax transparent and water proof

- It is found on both sides of the leaf

Functions

(i) Reduce excessive water loss

(ii) Protects inner tissue from damage

(iii) Prevents entry of pathogens

b) EPIDERMIS – This is a thin layer found on both sides

Functions

i) secretes (makes) the cuticle

ii) Protects inner tissue from damage

c) **GUARD CELLS**

Are bean shaped epidermal cells mostly found on the lower surface.

Functions

i) Control opening and closing of stomata

ii) Control water loss

iii) Allow gaseous exchange

iv) Contain chloroplasts with chlorophyll used to trap sunlight for the process of photosynthesis.

d) PALISADE LAYER

This is the layer between the upper epidermis and the spongy mesophyll layer

- It is made up of palisade cells

Functions - trap sunlight by using chlorophyll for the process of photosynthesis

e) SPONGY MESOPHYLL LAYER

This is found between the palisade layer and the lower epidermis

Function

i) Used for gaseous exchange

ii) Photosynthesis takes place in it

f) LEAF VEINS

Consist of both xylem and phloem

Functions:

1. Xylem transport water and mineral salts from the root to the rest parts of the plants.
2. ii) Phloem transport manufactured food from the leaves to the rest parts of the plant.

g) CHLOROPLAST

These are disc shaped organelles that contain chlorophyll

Functions:

1. Chlorophyll absorbs (traps) sunlight for photosynthesis

REQUIREMENTS AND CONDITIONS NECESSARY FOR PHOTOSYNTHESIS

The raw materials of photosynthesis are:

a) Carbon dioxide

b) Water

- Carbon dioxide is obtained from the atmosphere and water is absorbed by the roots from the soil.
- The conditions necessary for photosynthesis to take place are

  (i) Chlorophyll

  (ii) Sunlight

- Chlorophyll is used to absorb light energy needed during photosynthesis and sunlight (solar energy) is converted to chemical energy (ATP) needed by all living organisms

PROCESS OF PHOTOSYNTHESIS

The process of photosynthesis occurs in two stages which are:

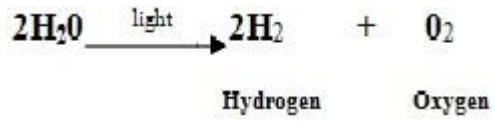
(i) The light stage.

(ii) The dark stage.

THE LIGHT STAGE

- It occurs in the chloroplasts
- The chlorophyll absorbs light energy from the sun
- The light energy is used to split the water molecules to oxygen and hydrogen

  The process is known as photolysis

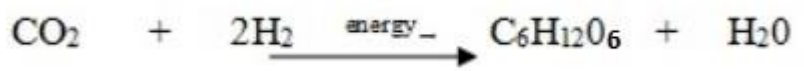


Oxygen is released to the atmosphere while some is used in respiration

- Hydrogen enters the dark reactions
- Some of the solar energy absorbed by the chlorophyll molecules is used in the formation of energy rich compound known as Adenosine triphosphate (ATP) which later is used in the dark stage of photosynthesis

THE DARK STAGE

- It occurs in the stomata and it doesn't need a light
- Carbon – dioxide combines with hydrogen to form sugar such as glucose
- This process is called **carbon dioxide fixation**
- This process requires energy (ATP) and enzymes i.e.



END PRODUCTS OF PHOTOSYNTHESIS

The end products of photosynthesis are:

i) Glucose

ii) Oxygen

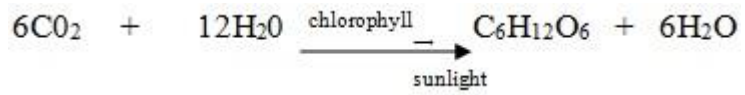
iii) Water

Glucose – is used in respiration to release energy. Some is stored as starch or oils during exchange.

Oxygen – Some oxygen is used during respiration while the rest is released into the atmosphere during exchange.

Water – some water is used in various chemical reactions within the cells, some water is released to the atmosphere during transpiration

The overall chemical equation representing the process of photosynthesis



ADAPTATION OF THE LEAF IN THE PROCESS OF PHOTOSYNTHESIS

(i) Cuticle and epidermis are transparent to allow easy penetration of light

(ii) Presence of stomata on the leaf allows easy diffusion of carbon dioxide

(iii)The network of veins allows movement of materials in and out of the leaf

(iv)The air spaces in the spongy mesophyll layer allow gases to circulate easily.

(v) Presence of large numbers of chloroplasts in the palisade layer enables maximum sunlight absorption.

(vi) The leaves are well arranged to avoid overlapping and overshadowing

(vii) Broad and flat lamina allows maximum absorption of sunlight and carbon dioxide.

FACTORS AFFECTING THE RATE OF PHOTOSYNTHESIS PROCESS

1. **LIGHT INTENSITY**: A good quality of light enhances the rate of photosynthesis.

- Very bright light damages the plant due to strong sun rays

- Plants under shade receive poor quality of light

2. **CARBON – DIOXIDE CONCENTRATION:** An increase in carbon dioxide concentration results to an increase in the rate of photosynthesis up to a certain level

- Any further increase in the carbon dioxide concentration after the maximum point induce the stomata to close and therefore cutoff the supply of carbon dioxide.

3. **TEMPERATURE**: Photosynthesis is controlled by enzymes. Enzymes are affected by changes in temperature.

- High temperature destroys the enzymes, very low temperature inactivate them.

- The rate of photosynthesis increase as the temperature increase up to maximum point i.e. 40^0c.

4**. WATER**: Plants require water for the various chemical reactions of the cells.

-Water is also a raw material for photosynthesis.

5**. MINERAL SALTS:** Some minerals such as magnesium and iron are responsible in the formation of chlorophyll.

- The availability of these minerals results in the chlorophyll synthesis and the rate of photosynthesis increases.

6**. LEAF AGE**: As the leaf ages chlorophyll breaks down hence the rate of photosynthesis is reduced.

7. **PRESENCE OF MANUFACTURED CARBOHYDRATES**: This will reduce the rate of photosynthesis since carbohydrates are product of photosynthesis

IMPORTANCE OF PHOTOSYNTHESIS

(i) Food substance like glucose is formed. Plants and animals use these food substances.

(ii) Release oxygen in the atmosphere for respiration of organisms

(iii) Purify the atmosphere by removing carbon dioxide.

(iv) Light energy is converted into a form that can be used by all other organisms. This energy is known as **ATP**.

STORAGE ORGANS

Plants store food for future use

Foods in plants can be stored in:

(a) Leaves e.g. Onions, cabbage

(b) Fruits e.g. Mango, pineapple, pawpaw

(c) Seeds e.g. Beans, peas, rice, maize

(d) Stems e.g. Irish potato, ginger, sugar cane

(e) Roots e.g. Sweet potato, cassava, carrots

ADVANTAGE OF FOOD STORAGE ORGANS

i) Some organs give rise to new plants e.g. Seeds, stem, tubes

ii) Permits the survival of plants over dry seasons.

iii) Some are used as source of food by man and other animals e.g. Rice, wheat, potatoes etc.

iv) The stored food is used during germination before the leaves form.

v) Some are used for commercial purpose by man e.g. Sugar cane

MINERAL REQUIREMENTS IN PLANTS

- The mineral elements required by plants are grouped into two;

1. Macro elements or Macro nutrients

These are elements required in large quantities by the plants.

They include; manganese, carbon, calcium, oxygen, phosphorus, sulphur, hydrogen, potassium and nitrogen.

2. Micro element or micro nutrients
   These are elements required in small quantities by the plants.

They include; manganese, zinc, sodium, boron, chlorine, copper, cobalt and silicon.

NOTE: Nitrogen, iron and magnesium are used to synthesize carbohydrates

- Lacking of these elements cause yellowing of leaves
- Carbon, Hydrogen and oxygen are used to synthesize carbohydrates
- Lack of these elements show stunted growth in plants.

FOOD PROCESSING, PRESERVING AND STORAGE

Food processing: This refers to all the ways in which food is treated in order to make it edible, appetizing and safe to eat or keep it fresh for a long time

- Some of the activities involved in food processing are:

  (i) Picking, sorting and washing fruits and vegetables

  (ii) Converting raw material into other products

  Examples – Making cheese from milk

  - Making sugar from sugar cane

FOOD PROCESSING TECHNIQUES

Common food processing techniques include

i) Removing unwanted outer layers e.g. peeling potato

ii) Chopping or slicing e.g. Bananas, mangoes and cassava

iii) Liquefaction e.g. producing juice by squeezing fruits

iv) Fermentation e.g. making wine from banana and grapes and beer brewing

v) Cooking e.g. boiling, frying, steaming or grilling

vi) Deep freezing

vii) Baking

FOOD PRESERVING

This is a method that involve special methods of food processing that are used to prevent food from getting spoiled or going bad. These methods include:

1. Canning or bottling; this is used for getting rid of micro – organisms.

2. Pasteurization and boiling; this involves using high temperature to kill micro – organisms that cause spoilage

3. Refrigeration – using very low temperature to slow down the growth of micro – organisms

4. Irradiation – this involves using radiations to kill micro – organism that might make food go bad.

5. Drying salting, applying honey or smoking eliminate the moisture that is needed for growth of micro organisms.

6. Adding chemicals such as salt, sugar and carbon monoxide to prevent physical changes in food.

IMPORTANCE OF FOOD PROCESSING, PRESERVING AND STORAGE

1) Prevents wastage of food

2) Saves money by preventing spoilage of food

3) Maintains the quality of food.

4) Prevents growth of micro – organisms that can cause illness and improves the flavor of food.

5) Removes harmful toxins and micro – organisms from food

6) Makes food available even when they are not in season

7) Enables transportation of delicate and perishable food such as milk and fruits over long distance

TRADITIONAL METHODS OF FOOD PROCESSING AND PRESERVING

1. **CURING:** This involves the addition of substances such as sugar, salt, spices and vinegar to animal foods e.g. Meat and fish.

- Curing binds or removes water making it unsuitable for the growth of micro – organism

- It also improves the taste of food. Example sausage and canned beef are made by curing meat.

2**. DRYING IN THE SUN**

The food is left in the sun for long periods of time in order to reduce its moisture content.

- Removing the amount of water in the food discourage the growth of micro – organism This method is used to reserve rice, maize, cloves, bananas, beans, peas, meat, fish, cassava and green vegetables.

  NOTE: Dried grain or cassava can be pounded or ground into flour and dry cloves are used for making spices.

3**. SMOKING**

Smoke reduce the moisture content of food to prevent the growth of micro – organisms

Example: Grains, meat and fish can be dried slowly over a smoking wood fire.

4**. COOKING:** This includes boiling, steaming, baking in hot ash, grilling and roasting.

- These processes help to soften food, improve flavor and preserve food. Examples: potatoes, banana, and maize can be boiled before being dried

- Meat can be grilled or deep fried.

5**. SALTING**: Salt removes water from the food and kills micro – organisms that would otherwise spoil the food.

6**. FERMENTATION**

Fermentation is the conversion of carbohydrates such as sugars into acids and alcohol

Fermentation can occur naturally or can be induced

Example: Milk can be fermented into yoghurt by keeping in a container for some time.

Picking foods such as cucumbers and mangoes can be fermented by putting them in salty water for some time, bacteria produce lactic acid that gives the food its distinctive flavor and helps to preserve it.

MODERN METHODS OF FOOD PRESERVATION AND PROCESSING

1. PASTEURIZATION: This is the method of heating food to very high temperature for a short while in order to kill micro – organism that can cause food spoilage

Pasteurizations maintain the nutrients content and flavor of food. Example: Food which can be pasteurized is milk and fruit juice

2. LIQUEFICATION; this is the making of liquids from solid food

- It is mostly applied to fruits where by juice is made out of them.

- The juice is then pasteurized and post into cans or containers.

3. CANNING AND BOTTLING

This is the method where by food is preserved by heating it in air tight vacuum – sealed bottles or cans.

- First the container is filled with food then the air is pumped out to form a vacuum.
- The container is sealed and heated to kill micro – organisms and enzymes fruits and fruits juices, beef, fish and baked beans.

  NOTE: Bottled and canned foods can be kept for months or even years.

4. USING ADDITIVES – This is the addition of chemicals such as sodium benzoate, sodium chloride and vinegar to slow down the growth of micro – organisms. Examples the food can be preserved by this process are fish and meat.

5. DRYING OR DEHYDRATION: This is where food is dried by using either hot blasts of air from vacuum dryer or a freezer (freeze drying).

- After drying, the food is then sealed in moisture proof containers

6. IRRADIATION – This is the use of ray's energy to stop growth of micro – organism in stored food stuff.

- This makes food last longer

- Also prevents spoiling.

Examples: the foods that can be preserved by this method are onions, beans and potatoes

FOOD STORAGE

Food storage is a method used to keep reserves of food for future use

- Food storage can be done on a small side at the family level. Examples in the food storage, or on a large scale for populations. Example in government sides for grains

TRADITIONAL METHODS OF FOOD STORAGE

1) Storage in granaries and pits

- Dry grains are stored in granaries which are usually raised above the ground.

The gains are sometimes mixed with neem leaf ash or groundnuts to further prevent attack by micro – organisms.

- Granaries keep grains safe from insects, rodents and birds
- Harvested yams, potatoes and cassava can be stored in large the ground after drying.

2) Storage in pots and tins

- Preserved foods such as flour, dried vegetables and cassava can be in large dry puts or tightly covered for future use.

- Foods can be stored for months by using this method.

ADVANTAGE OF TRADITIONAL METHODS OF FOOD PROCESSING, PRESERVATION STORAGE

i) They are simple and can be done by most people

ii) They use locally available materials and simple technology, the keeping costs low.

iii) No harmful chemicals are added to the food.

iv) Curing and smoking add a distinctive flavor to the food

v) Most methods do not destroy nutrients

DISADVANTAGES OF TRADITIONAL METHODS OF FOOD STORAGE, PROCESSING AND PRESERVATION

i) Food can be preserved and stored for only limited periods of time

ii) Traditional method is difficult to do on a large scale.Traditional methods are highly limited in the variety of foods that can be processed, preserved and stored

MODERN METHODS OF FOOD STORAGE

1**. Refrigeration**

- This is the temporary storage of food at temperature of up to 4^0c in order to slow down the growth of micro – organism

- Refrigeration can be done in refrigerators or cold rooms

Example: The foods that can be refrigerated are milk, fresh fruit, fresh vegetable, juice and bottler.

2. Freezing: This is the strong food at very low temperature i.e. below -10^0c in order to stop the growth of micro – organisms

Food is frozen in freezers. Example the foods that can be frozen are: poultry, fish and meat.

ADVANTAGES OF MODERN METHODS OF FOOD PROCESSING, PRESERVATION AND STORAGE

(i). Food can last for many months or even years

(ii). Modern methods can process, preserve and store a large variety of foods.

(iii). The advanced technology used is fast and can handle large quantities of food

DISADVANTAGES OF MODERN METHOD OF FOOD PROCESSING, PRESERVATION AND STORAGE

- The chemicals used can be harmful if eaten in excess.
- These methods can only be used in a certain area. Example – refrigeration and freezing require electricity.
- The process used for example radiation; canning and pasteurizing require special skills.
- Sometimes nutrients are lost thus lowering the nutritional value of food.