Human digestive system and functions

Tongue

The tongue is made up of muscle fibers which help in the movement of food and the teeth have different shapes; sharp and pointy, which help in chewing and to break down the food. To support the teeth, the salivary glands will produce saliva that contains enzymes called: amylase to digest starch.

The main functions of the mouth are based on chemical and mechanical digestion, these include:

- Helps break down the food so that it easy to digest.
- Assimilates starch through chewing.
- The enzymes help kill the germs and the saliva softens it before it’s swallowed.

Pharynx

- This is normally found at the back of the throat and is made up of muscle tissue which allows contractions.
- It also consists of a thin layer of epiglottis which aids the food the right way stopping it from going into the wind pipe.
- After the mouth has broken down the food, it travels down the pharynx where the food is released along the oesophagus through voluntary swallowing.

Oesophagus

- The oesophagus is made up smooth and striated muscle tissue which supports it when contracting.
- Its surface is covered with epithelial tissue to keep the oesophagus clean and smooth.

- The function of the oesophagus is to simply transport the food to the stomach through (involuntary) contractions;
- When the oesophagus contracts the food is easily pushed down towards the stomach (peristalsis).

Stomach

- The stomach is found beneath the diaphragm. It has a curved shape and consists of smooth muscle, elastic fibers and is lined with mucosa membrane.
- The cells found in the stomach secrete gastric juices with an acidic pH of 1. 5-2. 5.
- The main function of the stomach is to store up food.
- Using both mechanical and chemical digestion, the gastric juices in the stomach help kill all the microbes and the pepsin (enzyme) breaks down the protein into amino acids.
- The smooth muscle, elastic and the lining support the stomach’s movements and activities, when full or empty.

Pancreas

- The pancreas is made up of exocrine and endocrine glands and is located underneath the stomach. It is about 5-6 inches long and weighs around 2ozs (60grams). The head is broad and the body tapers off to a thin tail.
- The main function of a pancreas is to: make enzymes (exocrine) and produce hormones (endocrine) such as: insulin.
- The enzymes help to digest proteins and starch.

Liver

- The liver is regarded as a gland; it is located underneath the diaphragm and is made up of two lobes; one on the left and one on the right.
- Some of the functions of the liver include :
- Secretes bile= to help break down all the fats and lipids.
- Protects against microbes.
- Helps maintain glucose levels.
- Stores nutrients such as: iron and vitamins.

Gall bladder

- The gall bladder consists of a neck, main body which is made up of muscle tissue and a smooth base.
- The main function of the gall bladder is to store up; during stimulation, the wall of the gall bladder contracts and the bile is released to break down fats and lipids.

Small intestine

- The small intestine is made up of three functional units: the ileum, jejunum and duodenum.
- The walls of the small intestine are covered with cells and tissue: smooth muscle, columnar epithelial and goblet cells which secrete protective mucus. The villi and microvilli are also found on the surfaces of these cells.
- Most chemical digestion takes place in the small intestine;
- The villi and the microvilli increase the area which allows easy absorption of nutrients.

- Prevents infections; some microbes which are not broken down by the HCL produced in the stomach are eliminated.
- Chemical digestion of fats, carbohydrates and protein.

Large intestine

The rectum, colon, caecum and anal canal are sections found near the large intestine.

Just like the small intestine, this is arranged in layers of simple columnar tissue with lots of goblet cells and smooth muscle fibers.

Main functions include:

- Absorption of water and other substances which are released by the small intestine. (Large surface area.)
- Carries good bacteria, used to break down vitamin K and B.
- the contractions help eliminate waste

Ingestion

Ingestion is the first activity in the digestive system; it refers to eating food and drinking.

Mechanical digestion

As part of digestion, the food is broken down through the process of chewing in the mouth by the teeth.

Chemical digestion

The enzymes which are secreted by the glands and accessory organs, help break down food into smaller and manageable molecules, both in the stomach and mouth e. g: saliva.

Absorption

The food which has been broken down may be taken into the blood, capillaries and used by the body as nutrients.

Egestion

This is also known as the process of elimination; in other words, the food which has not been digested or absorbed will be removed from the body through defecation.

C) The digestion of lipids, proteins and carbohydrates:

Mouth

The mouth uses the process of ingestion to begin the digestion; it breaks down food mechanically using the tongue and teeth when chewing food. During the chewing, the salivary glands produce the saliva which the mouth uses to further break down the food chemically. The tongue consists of muscle tissue, in particular skeletal muscle that helps with the movement of food around the mouth, the different types of teeth such as: canines and molars support with the chewing.

The saliva produced makes an enzyme called: amylase. The amylase that has a pH of 5. 6 will chemically break down and moisten the complex carbohydrates into simple sugars that can then easily travel down the pharynx and oesophagus when swallowed.

Stomach

Just like the mouth, the stomach carries out mechanical and chemical digestion to carefully break down and transport the swallowed food.

In order to chemically break down the collected food, in particular proteins, starchy carbohydrates and lipids, the stomach needs to make the enzyme known as: pepsin and other gastric juices which contain hydrochloric acid that has a pH of about 1. 5 to help destroy all the un-wanted microbes in the food.

After the food is checked and broken down chemically, the muscle fibers in the walls of the stomach enhance movement and support the mechanical digestion by making sure that all the protein (the pepsin and hydrochloric acid break the protein into large polypeptides), lipids and carbohydrates has completely mixed with the gastric juices and enzymes to make tiny balls of molecules called: chyme.

Small intestine

After the chyme has been sent through to the duodenum, the walls of the small intestine consist of both connective and epithelium tissues which help increase the surface area using the micro-villa on their surface; this allows the walls to expand and contract to allow the chyme through.

The small intestine continues to make use of the chemical digestion using different enzymes such as: trypsin, chymotrypsin and lipase.

Carbohydrates:

The starch in the carbohydrates is further broken down by the enzyme: amylase, into even smaller sugars called: maltose and sucrose which can then be changed into glucose that is easily absorbed into the blood.

Protein:

The two types of enzymes: trypsin (pH of 8) and chymotrypsin are released to enable the breakdown of protein into smaller amino acids; these are transported through specific cells surrounding the walls of the small intestine and into the blood.

Lipids:

As well as bile's emulsification of the lipids (fatty food) to smaller and more manageable molecules; the fats are quickly changed into fatty acids and glycerol which carries the enzyme: lipase. The lipase has a pH of 8 which contributes to the neutralisation of the stomach acid.

Task 3 M4

The chemical equations in this section are a demonstration of how food is broken down in the digestive system:

Carbohydrates:

Carbohydrates are made up of starch; the starch has to break down into two types of sugars: Complex and simple.

Starch + Amylase (Enzyme) Complex sugars (Oligosaccharides).

Starch + Pancreatic Amylase Simple sugars:

Sucrose= e. g. cane sugar + Sucrase (enzyme) galactose + glucose.

Lactose= e. g. Milk sugar + lactase (enzyme) fructose + glucose.

Maltose= e. g. Unlike the other two types of simple sugars, Maltose cannot be broken down further.

Protein:

Proteins use different enzymes to break down into amino acids: large polypeptides and small polypeptides.

Stomach= (enzyme) pepsin + hydrochloric acid large polypeptides.

Small intestine= (enzyme) trypsin + large polypeptides small polypeptides.

Aminopeptidase + dipeptidase (plus other enzymes) amino acids.

Lipids:

Lipids + lipase (this enzyme is normally found in the pancreas)

Fatty acids + glycerol

In order to keep healthy, a balanced diet is essential. A balanced diet refers to the intake of different foods in relative amounts, these foods carry nutrients which the body digests and absorbs to maintain its functions.

This section highlights the uses and examples of the main substances needed for a balanced diet:

Carbohydrates

Carbohydrates are made up of: hydrogen, carbon and oxygen. They can either be complex or simple depending on how fast they are digested and absorbed in the body. The simple carbohydrates which are quickly digested are made up of sugary foods such as: cakes, chocolates and pastries.

Those which take longer to digest are the complex carbohydrates which are found in starchy foods such as: potatoes, rice, bread and pasta. These

healthy foods, convert the starch into glucose which supplies the body with energy and heat.

Lipids

Lipids are split up into saturated and unsaturated fats and oils.

The saturated (single carbon bond) fats and oils are found in foods such as: milk, butter, cookies and cheese. Whereas, the unsaturated (double carbon bonds) are either poly-unsaturated or monounsaturated found in: nuts, vegetable and olive oils.

These essential fats and oils are not only stored up as energy in cells and tissue, but they also enhance insulation by building up a thick layer which reduces heat loss underneath the skin.

Protein

Proteins are made up of long chained amino acids that are building blocks of: carbon, hydrogen, nitrogen and oxygen. Those which are essential cannot be synthesised or kept in the body and therefore need to be replaced by the intake of foods such as: meat, nuts, eggs and fish.

When the body has received these foods, it stores them up as energy which it the uses for growth and repair of cells and tissue in daily activities.

Vitamins

Vitamins are described as chemical compounds that support and encourage the normal metabolic processes which take place daily in the body. Some of these vitamins include:

A

Vitamin A is a fat soluble vitamin which comes from foods such as: milk, carrots, meat, cheese and broccoli.

Vitamin A encourages: cell growth, bone growth, clear vision, immunity (helps the defence system) and healthy teeth and skin.

C

Vitamin C, a water soluble vitamin can be found in all types of fruit such as oranges and vegetables.

Through oxidation reactions, this vitamin maintains the production collagen fibers in connective tissue and therefore protects the body from a deficiency called: scurvy.

D

Just like vitamin A, this vitamin is also a fat soluble vitamin that can be found in fatty foods such as: cheese, butter, eggs and fish oil. It is also received naturally from the sun.

Vitamin D manages the absorption of calcium and phosphate in the digestive system, which are both essential for healthy bones and teeth. Without this, a deficiency called rickets can occur.

Minerals

Minerals are described as inorganic compounds in particular salts, which are simply important to the body’s general processes.

Iron

Iron is very important because it makes up the haemoglobin in red blood cells which the body uses to store up oxygen. It can be found in foods such as: pulses, dried fruit, green vegetables and wholemeal bread.

A common deficiency called: anaemia is developed if there is not enough intake of iron in diet.

Calcium

Calcium is essential because it gives the body its structure; the intake of calcium ensures healthy teeth and growth of bones, at the same time encouraging the clotting of blood and movement of muscles, joints and bones.

It is commonly found in foods such as: milk, cheese, eggs, yogurt and vegetables.

Fibre

Fibre can be seen in the category of carbohydrates, but the only difference between the two is that fibre does not contain starch and it is not absorbed or in some cases digested like other nutrients so, they call it: cellulose.

The foods which make up fibre are either soluble or insoluble. The insoluble foods include: bran, wholemeal flour, bread, brown rice, cereals and nuts. Soluble fibre is found in foods like: fruits, vegetables, peas, beans, oats and milk.

The role which fibre plays in the body is mainly centred towards the digestive system; fibre in the digestive system, enhances the process of

elimination so that the waste products are quickly and carefully removed from the body to stop any damage to the intestines which, if left to endure inside could cause diseases.

Water

Water is made up of the two most important elements: hydrogen and oxygen. Without water, our bodies would not function properly; the cells, tissues and organs need to continuously take in water to do the following:

- Prevent dehydration which could lead to diseases.
- Keeps the cells of the body moist.
- Normal metabolism; body temperature needs to be regulated.
- Help eliminate waste products.