



CHAPTER 9 HUMAN NUTRITION

Making fresh produce available in urban areas

NUTRITION

- The taking in of nutrients to the body from the environment is called nutrition.
- The important nutrients are
 - a) Carbohydrates
 - b) Proteins
 - c) Fats
 - d) Vitamins and Minerals

BALANCED DIET

- A diet which contains all the nutrients in the right proportion is known as balanced diet.



- Females tend to have low energy requirements than males.
- Growing children needs more energy. As children grow the energy requirements increases because of the energy demands of the growth process and the extra energy associated with maintaining their body temperature. The energy demands tends to slow down with age due to loss of muscle tissue.

ENERGY REQUIREMENTS

- Energy can be obtained from carbohydrates, fats and proteins.
- The cheapest energy giving food is carbohydrates. The greatest amount of energy is in fats. Proteins give same energy as carbohydrates.
- The amount of energy is measured in calories or joules. 1gram of carbohydrate can give 16kj. Fat can give 37kj.

PROTEIN REQUIREMENTS

- Proteins are an essential part of a diet because they supply the amino acids needed to built up our body. An average person needs 0.57gram protein for every kilogram of body weight. A 70kg person would need $70 \times 0.57 = 39.9$ i.e. about 40gram protein per day.

SPECIAL NEEDS

- **Pregnancy:** A pregnant women needs no extra food. Her body's metabolism will adapt to the demands of the growing baby. If her diet is deficient in protein, calcium, iron, vitamin D or folic acid she has to increase her intake of these substances. The baby needs protein for making its tissues, calcium and vitamin D are needed for bone development, and iron is used to make the haemoglobin in its blood.
- **Lactation:** The production of milk for feeding the baby. If her diet is already adequate her metabolism will adjust to these demands otherwise she may need to increase her intake of proteins, vitamins and calcium to produce milk of adequate quality and quantity.

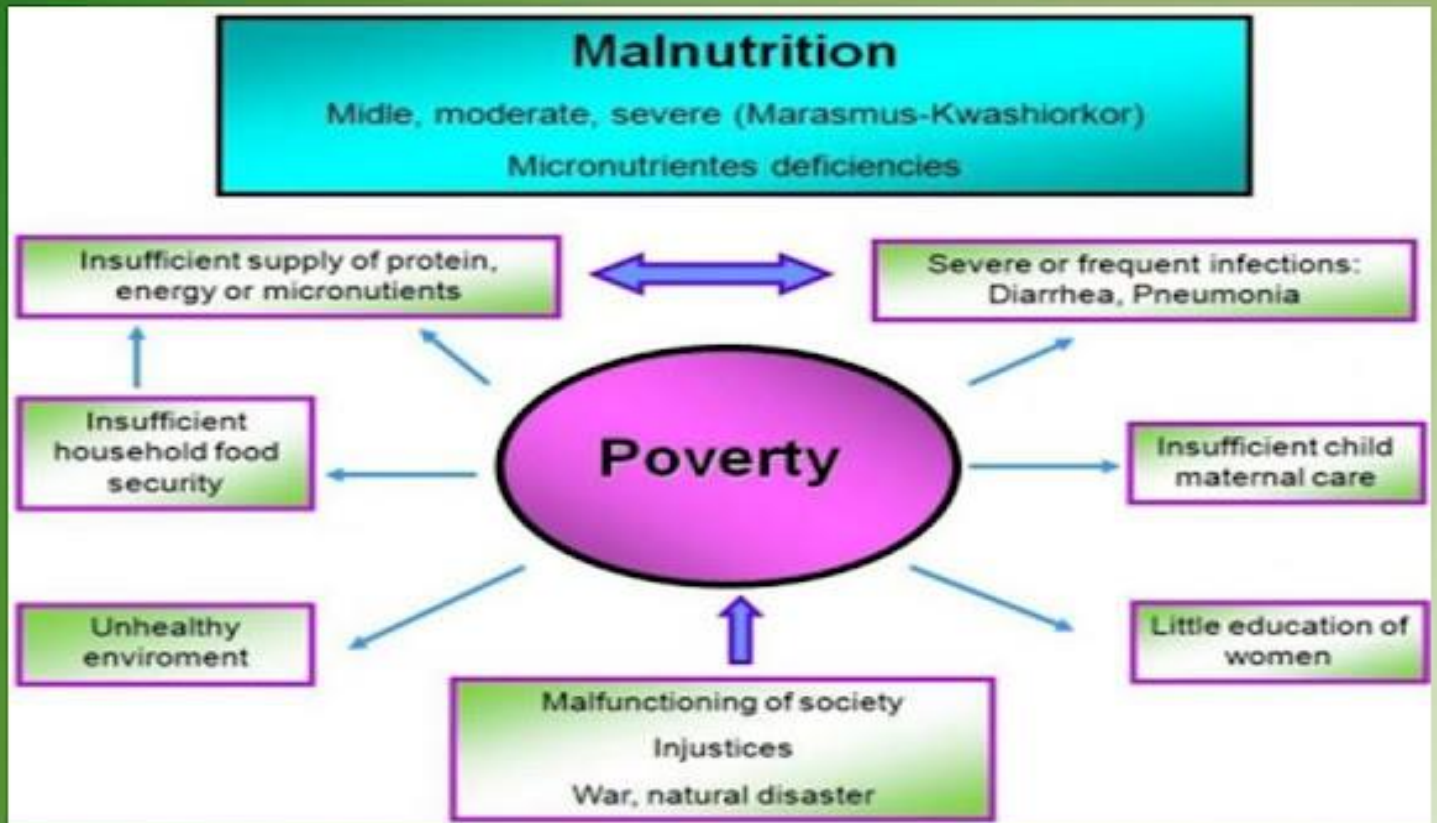
MALNUTRITION

- Malnutrition is a condition that results from eating a diet in which nutrients are either not enough or are too much such that the diet causes health problems.



- If the total intake of food is not sufficient to meet the body's need for energy, the body tissues breaks down which leads to the loss of weight, muscle wastage, weakness and ultimately starvation.
- Extreme slimming diet such as those that avoid carbohydrate food can result in a disease anorexia nervosa.
- When the diet contains too much fat it results in heart diseases.
- If the food intake is inadequate, it results in deficiency diseases such as anemia, rickets and scurvy.

CAUSES OF MALNUTRITION



SOURCES OF CARBOHYDRATES

Sugars	Starches	Dietary fibre
<ul style="list-style-type: none"> • Fruit (fresh and dried) • Milk • Cakes, biscuits • Soft drinks • Jam • Ice cream • Honey • Sugar 	<ul style="list-style-type: none"> • Cereals • Potatoes • Root vegetables • Pulse vegetables 	<ul style="list-style-type: none"> • Vegetables • Fruit • Brown rice • Brown bread

The importance of Carbohydrates in living things

- **Primary energy source for living things**
 - Plants- store carbohydrates as Starch
 - Animals-store carbohydrates as Glycogen
- **Provide organisms with structure**
 - Plants-Cellulose
 - Animals- Chitin

SOURCES OF FAT

Saturated fats

Mainly from animal sources

- Butter
- Meat
- Milk and cream
- Cheese
- Eggs
- Suet



Unsaturated fats

From plant and marine sources

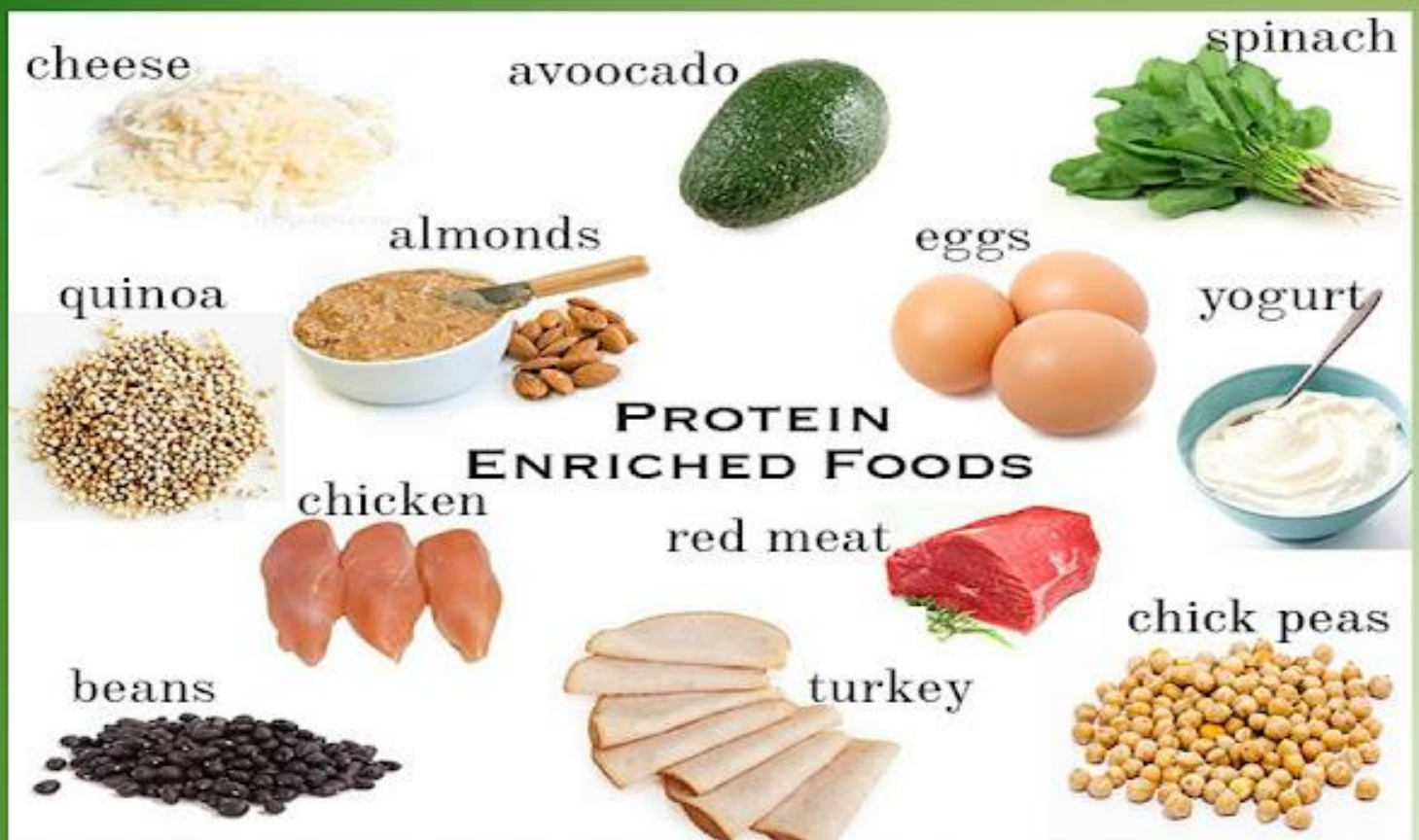
- Sunflower oil
- Olive oil
- Nuts
- Seeds
- Polyunsaturated margarine
- Fish oils
- Oily fish



IMPORTANCE OF FAT

- * Transport and absorb vitamins A, D, E and K
- * Help regulate the hormone testosterone, which is used to build body tissues
- * Enhance the flavour and texture of foods
- * Help satisfy hunger because they take longer to digest
- * Should make up 20 to 30 percent of your daily caloric intake

SOURCES OF PROTEIN



IMPORTANCE OF PROTEIN

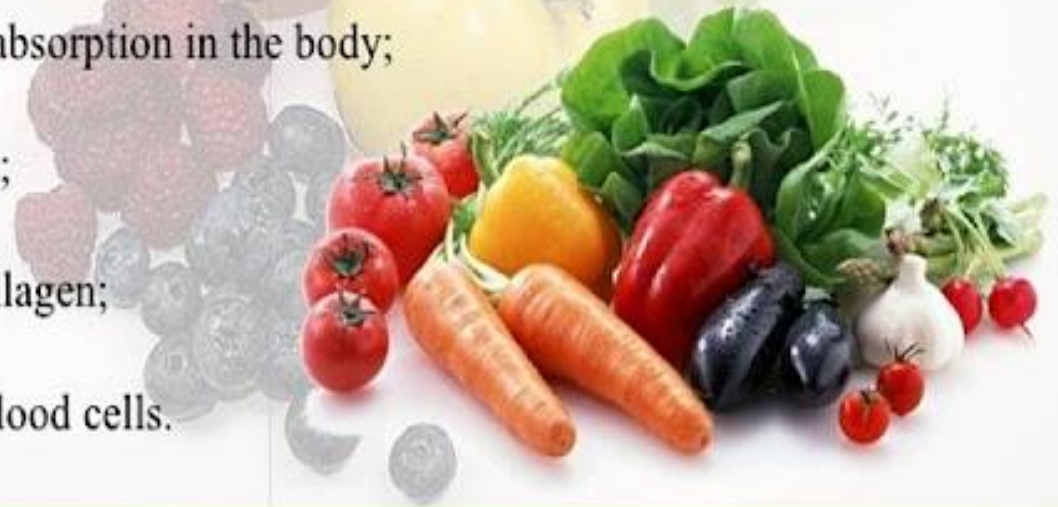
- 1. Nutritional role:** Provide the body with essential amino acids, nitrogen and sulfur.
- 2. Catalytic role:** All enzymes are proteins in nature.
- 3. Hormonal role:** Most of hormones and all receptors are protein in nature.
- 4. Defensive role:** The antibodies (immunoglobulins) that play an important role in the body's defensive mechanisms are proteins in nature.

SOURCES OF VITAMIN C



IMPORTANCE OF VITAMIN C

- Maintaining healthy gums, teeth and skin;
- Acting as an antioxidant to fight signs of aging;
- Building the body's immunity against viruses;
- Increasing iron absorption in the body;
- Healing wounds;
- Synthesising collagen;
- Producing red blood cells.



SOURCES OF VITAMIN D

Vitamin **D**



The body itself makes vitamin D when it is exposed to the sun

Cheese, butter, margarine, fortified milk, fish and fortified cereals are food sources of vitamin D



ADAM.

The complex block features the word 'Vitamin' in a grey, sans-serif font and a large, stylized 'D' in red. To the left of the text is a square image of a bright sun. Below the text is a photograph of various food items: a wedge of orange cheddar cheese, a block of butter, two pieces of salmon, a glass of white milk, a silver pitcher of milk, and a pile of round, brown cereal flakes. The logo 'ADAM.' is located in the bottom right corner.

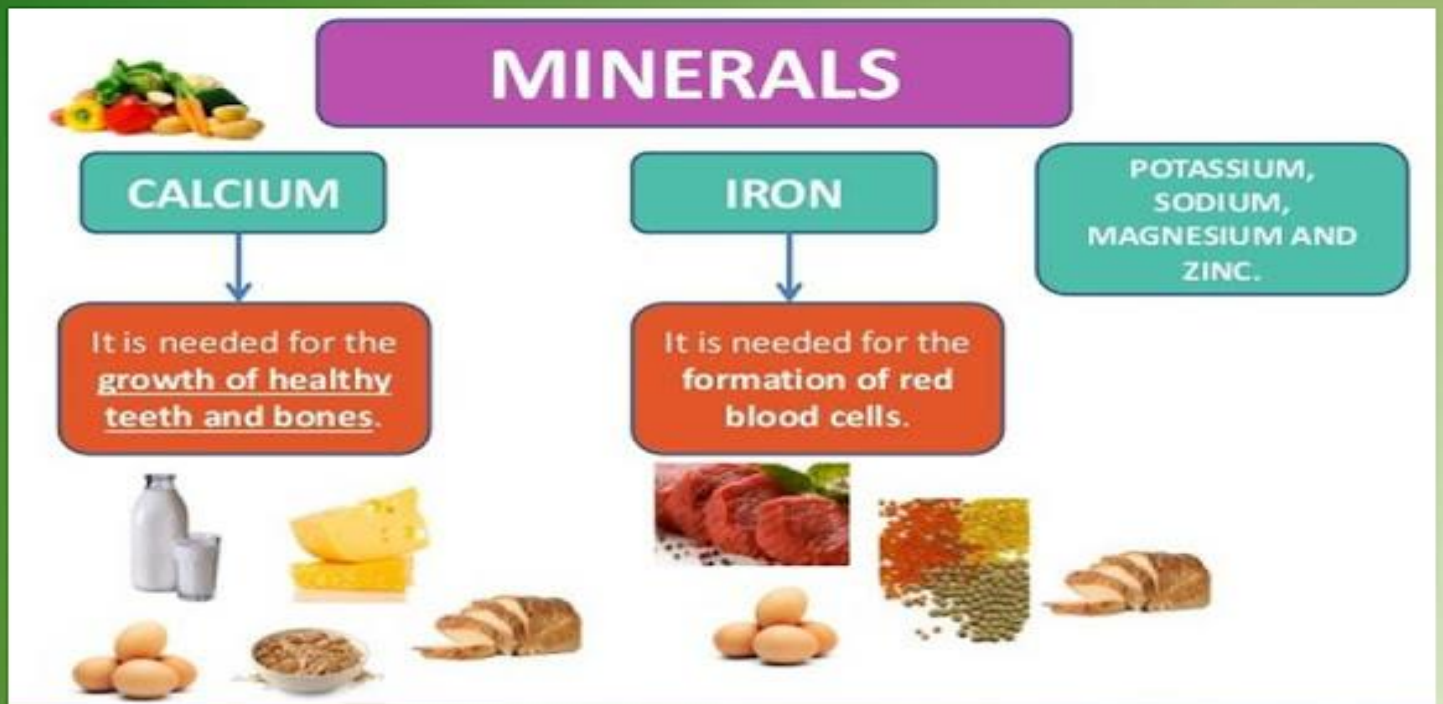
IMPORTANCE OF VITAMIN D

- Vitamin D helps in the absorption of calcium from the intestine and the deposition of calcium salts in the bones.
- Natural fats in the skin are converted to a form of vitamin D by sunlight.

SOURCES OF IRON & CALCIUM



IMPORTANCE OF IRON & CALCIUM



SOURCES OF FIBRE



IMPORTANCE OF FIBRE

- ▶ Helps maintain bowel integrity and health. A high-fiber diet may lower your risk of developing hemorrhoids, and small pouches in your colon.
- ▶ Lowers blood cholesterol levels. Soluble fiber found in beans, oats, flaxseed and oat bran may help lower total blood cholesterol levels by lowering low-density lipoprotein, or "bad," cholesterol levels.
- ▶ Helps control blood sugar levels. Fiber, particularly soluble fiber, can slow the absorption of sugar, which for people with diabetes can help improve blood sugar levels
- ▶ Aids in weight loss. High-fiber foods generally require more chewing time, which gives your body time to register when you're no longer hungry, so you're less likely to overeat.

IMPORTANCE OF WATER

WATER



Causes of Vitamin D Deficiency

1. Not consuming the recommended levels of the vitamin over time.
2. Exposure to sunlight is limited
3. Having dark skin
4. Kidneys cannot convert vitamin d to its active form
5. Digestive tract cannot adequately absorb vitamin d
6. Obese

The most accurate way to measure how much vitamin D is in your body is the 25-hydroxy vitamin D blood test. A level of 20 ng/milliliter to 50 ng/mL is considered adequate for healthy people. A level less than 12 ng/mL indicates vitamin D deficiency.



PROTEIN ENERGY MALNUTRITION

- **KWASHIORKOR:** Is a condition found in young children in area where there is very little protein diet.

Symptoms include swelling of feet and abdomen, wasting muscles, thinning hair and loss of teeth.



- **Marasmus:** Is a condition due to very poor diet with inadequate carbohydrate intake as well as lack of protein.
- Symptoms include reduced fat and muscle tissue, the skin becomes thin and hangs in folds.



DEFINE THE TERMS

- **Ingestion:** The taking of substances such as food and drink into the body through the mouth.
- **Mechanical Digestion:** The breakdown of food into smaller pieces without chemical change to the food molecules.
- **Chemical Digestion:** The breakdown of large insoluble molecules into small soluble molecules.

- **Absorption:** The movement of small food molecules and ions through the wall of the intestine into the blood.
- **Assimilation:** The movement of digested food molecules into the cells of the body where they are used, becoming part of the cells.
- **Egestion:** The passing out of food that has not been digested or absorbed, as faeces, through the anus.





FUNCTIONS OF MAIN PARTS OF THE ALIMENTARY CANAL

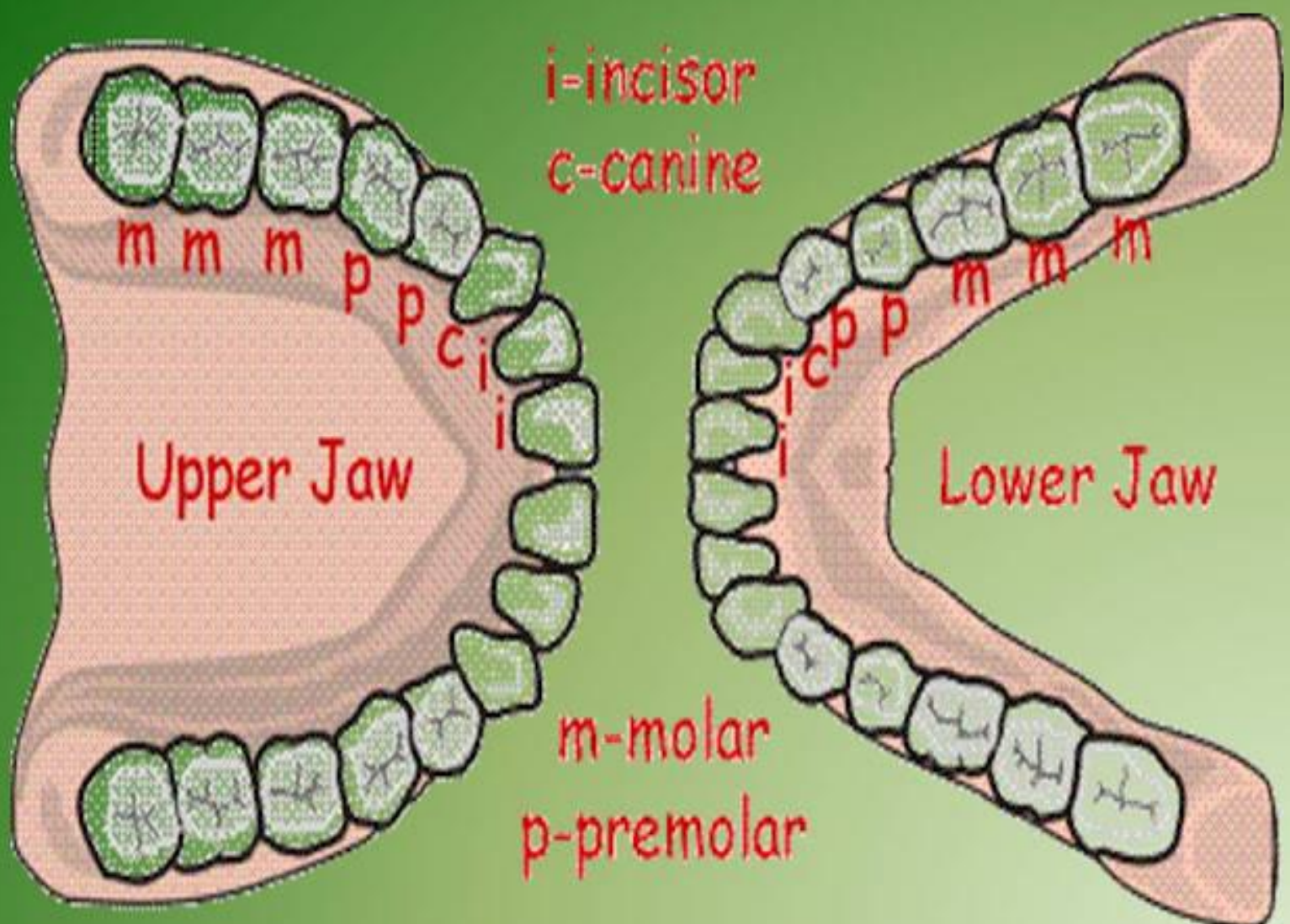
REGION OF ALIMENTARY CANAL	FUNCTION
Mouth	Ingestion of food. Mechanical digestion by teeth, chemical digestion of starch by amylase and formation of bolus for swallowing.
Salivary glands	Saliva contains amylase for chemical digestion of starch in food; also liquid to lubricate food and make small pieces stick together.
Oesophagus (Gullet)	Transfers food from the mouth to the stomach, by peristalsis.
Stomach	Produces gastric juice containing pepsin, for chemical digestion of protein; also hydrochloric acid to kill bacteria; peristalsis churns food up into a liquid.

Duodenum	First part of the small intestine; receives pancreatic juice for chemical digestion of proteins, fats and starch as well as neutralizing the acid from the stomach; receives bile to emulsify fats.
Ileum	Second part of the small intestine; enzymes in the epithelial lining carry out chemical digestion of maltose and peptides; very long and has villi to increase surface area for absorption of digested molecules.
Pancreas	Secretes pancreatic juice into the duodenum via pancreatic duct for chemical digestion of proteins, fats and starch.
Liver	Makes bile, containing salts to emulsify fats (physical digestion); assimilation of digested food such as glucose; Deamination of excess amino acids.

Gall bladder	Stores bile, made in the liver, to be secreted into the duodenum via the bile duct.
Colon	First part of the large intestine; absorption of water from undigested food; absorption of bile salts to pass back to the liver.
Rectum	Second part of the large intestine; stores faeces.
Anus	Egestion of faeces.

Types of human teeth

	Incisor	Canine	Premolar	Molar
				
Position in mouth	Front	Either side of incisors	Behind canine	Back
Description	Chisel-shaped (sharp edge)	Slightly more pointed than incisors	2 points (cusps), 1 or 2 roots	4 or 5 cusps 2 or 3 roots
Function	Biting of pieces of food	Similar function to incisors	Tearing and grinding food	Chewing and grinding food



Dental formula is a shorthand method to indicate the type, number and position of teeth in the mouth. Each line forms one quarter of your mouth (i.e. upper L teeth, lower right teeth)

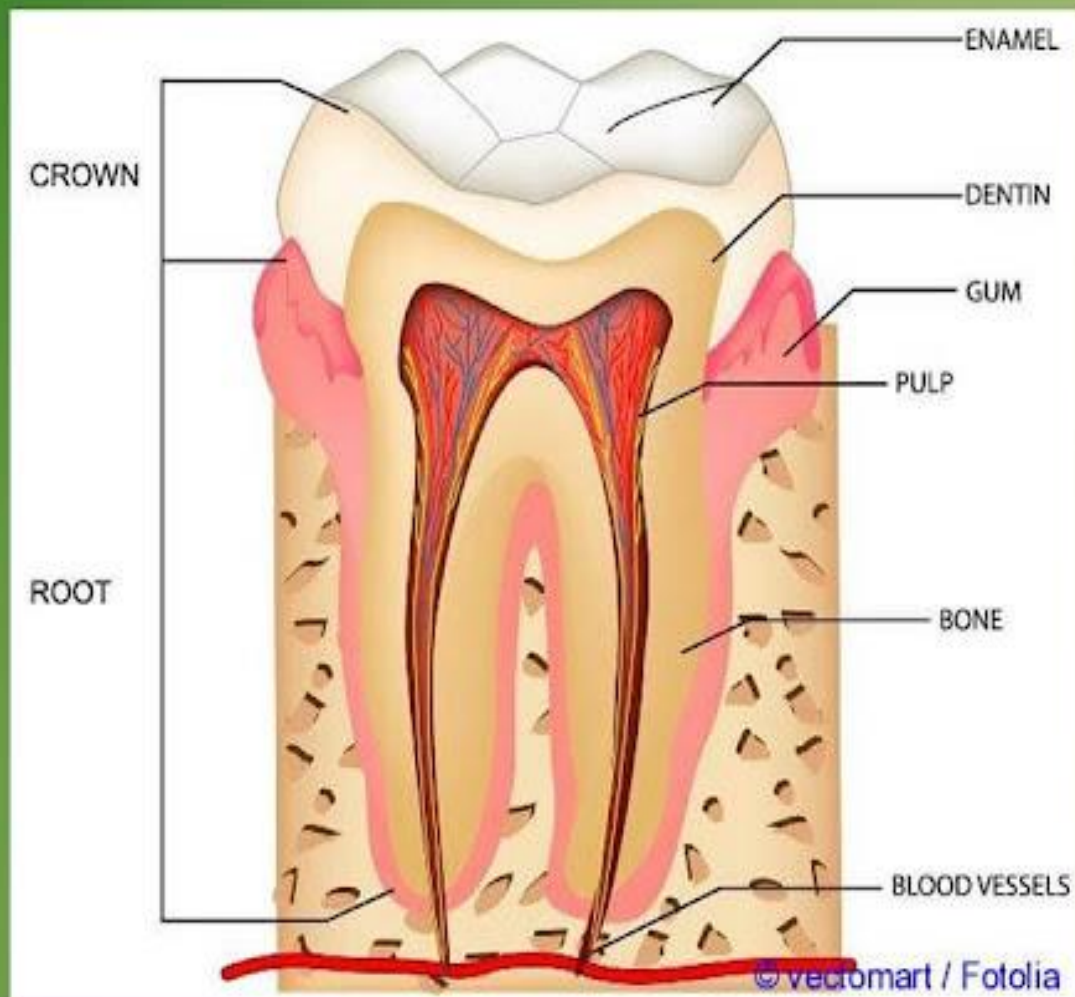
I = incisor **C** = canine **P** = premolar **M** = molar

camelet@lmc

Formula for permanent dentition

$$\begin{array}{l} \underline{\mathbf{I.C.P.M}} \\ \underline{\mathbf{I.C.P.M}} \end{array} = \begin{array}{l} \underline{\mathbf{2.1.2.3}} \\ \underline{\mathbf{2.1.2.3}} \end{array} = \frac{16 \text{ teeth upper jaw}}{16 \text{ teeth lower jaw}} = 32 \text{ total}$$

TOOTH STRUCTURE



- **Crown:** The part of the tooth that is visible above the gum line.
- **Gum:** Tissue that overlays the jaws.
- **Enamel:** The hard layer which covers the surface of the crown.
- **Cement:** Enables the tooth to grip to its bony socket in the jaw.
- **Dentine:** Softer than enamel. Inside the dentine is a pulp cavity, containing nerves and blood vessels.

CARE OF TEETH

- The best way to prevent tooth decay is to avoid eating sugar, sweet drinks or fizzy drinks.
- Brushing teeth is very important in the prevention of gum disease.
- Use of fluoride toothpaste helps to reduce bacteria.

PROPER CARE OF TEETH

1



BRUSH YOUR TEETH
at least twice daily

2



FLOSS YOUR TEETH
to remove plaque
in between teeth

3

LIMIT SUGARY FOODS
to avoid tooth decay



4

QUIT SMOKING & DRINKING
to avoid yellowing of teeth



5

USE MOUTHWASH
to keep gums healthy



Mechanical Digestion

Mechanical digestion involves the physical breakdown of food. Mechanical digestion occurs in the following locations:

- Mouth – teeth, tongue, and palates
- Esophagus - peristalsis
- Stomach – muscular churning action of stomach
- SI – bile and peristalsis

CHEMICAL DIGESTION

- Digestion is mainly a chemical process and consist of breaking down large molecules to small molecules. The large molecules are usually not soluble in water while the smaller ones are. The small molecules can be absorbed through the alimentary canal, blood vessel and into the blood.

ENZYMES WHICH HELPS IN DIGESTION

Enzyme	Site of action	Substrate digested	End products
Amylase	- mouth - duodenum	starch	- maltose - glucose
Protease	- stomach - duodenum	protein	- amino acids
Lipase	- duodenum	fat	- fatty acids - glycerol

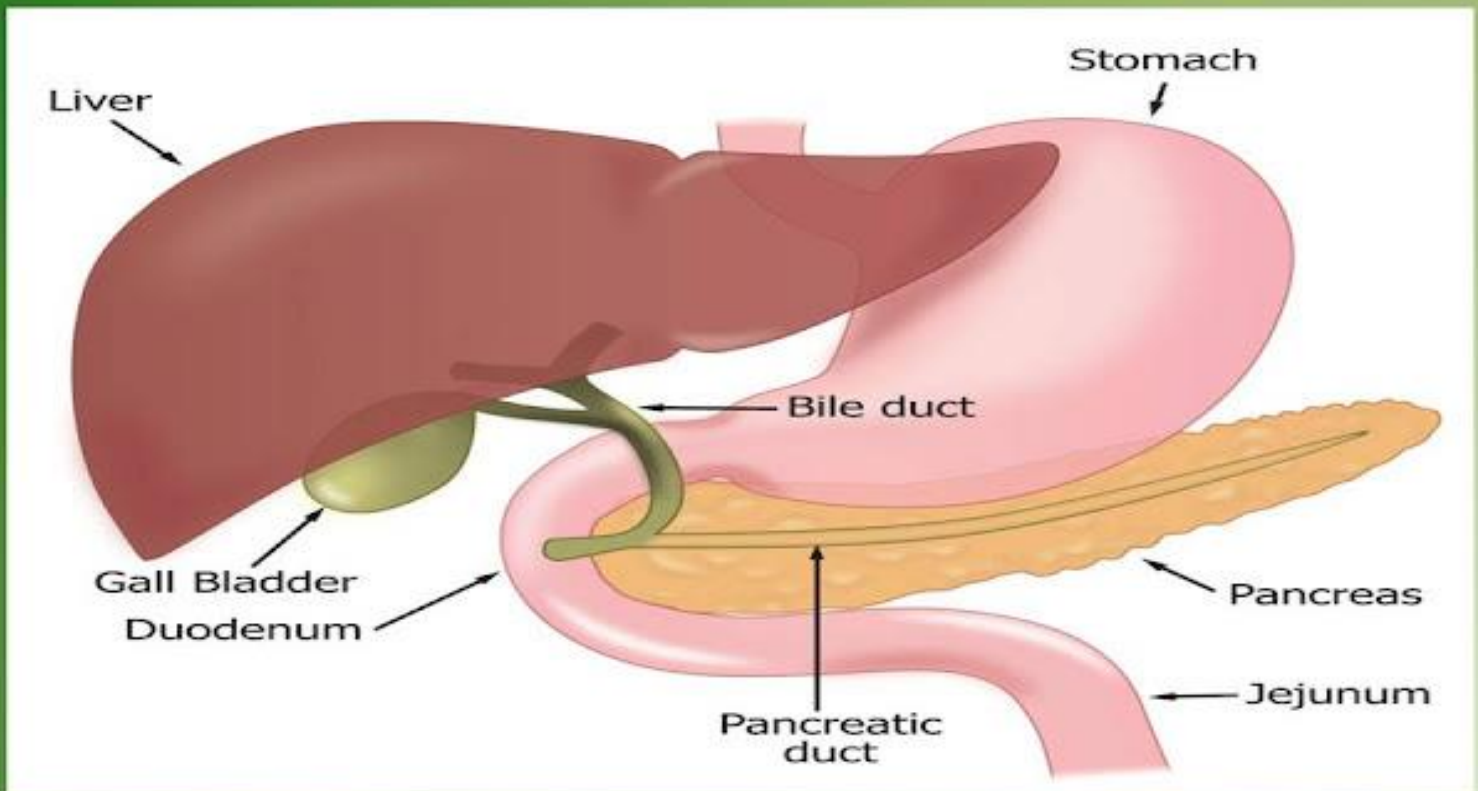
FUNCTIONS OF HYDROCHLORIC ACID

- The hydrochloric acid makes a weak solution in the gastric juice.
- It creates acidic medium for pepsin to act.
- It kills the bacteria taken in with the food.s

ROLE OF BILE

- Bile is a green watery fluid made in the liver, stored in the gall-bladder and released to the duodenum through the bile duct.
- The bile emulsifies the fat- they breakdown large molecules of fat into smaller molecules.
- Bile is slightly alkaline which neutralizes the acidic food from the stomach.

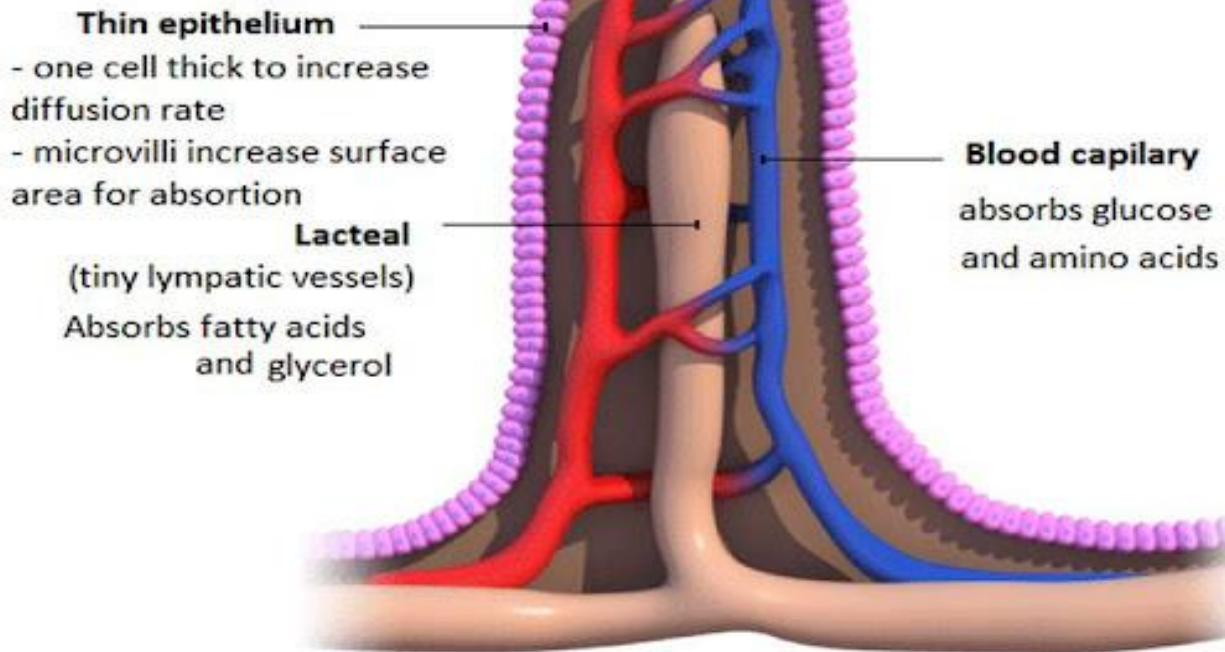
RELATIONSHIP BETWEEN STOMACH, LIVER AND PANCREAS



HOW SMALL INTESTINE IS ADAPTED FOR ITS FUNCTION

Features	How this helps absorption take place
It is very long, about 5 m in an adult human	This gives plenty of time for digestion to be completed, and for digested food to be absorbed as it slowly passes through.
It has villi, each villus is covered with cells which have even smaller projections on them, called microvilli.	This gives the inner surface of the small intestine a very large surface area. The larger the surface area, the faster nutrients can be absorbed.
Villi contain blood capillaries	Monosaccharides, amino acids, water, minerals and vitamins, and some fats, pass into the blood, to be taken to the liver and then round the body.
Villi contain lacteals, which are part of the lymphatic system.	Fats are absorbed into lacteals.
Villi have walls only one cell thick	The digested nutrients can easily cross the wall to reach the blood capillaries and lacteals.

Longitudinal section through a villus



SIGNIFICANCE OF VILLI

- The small intestine contains small finger-like projections called villi which increase the surface area of the intestine and contain specialized cells that transport substances into the bloodstream. Although these villi do not aid in the digestion of nutrients, they do help with nutrient absorption.

ROLE OF CAPILLARIES AND LACTEALS IN VILLI

- Villi are well supplied with blood capillaries, taking absorbed food molecules from the small intestine to the rest of the body.
- Villi also contains lacteals, which carry fat droplets separate from the rest of the food molecules because fat does not dissolve well in blood.

PROCES OF EGESTION

- Egestion – the process where indigestible and unabsorbed material are removed from the alimentary canal through the anus.

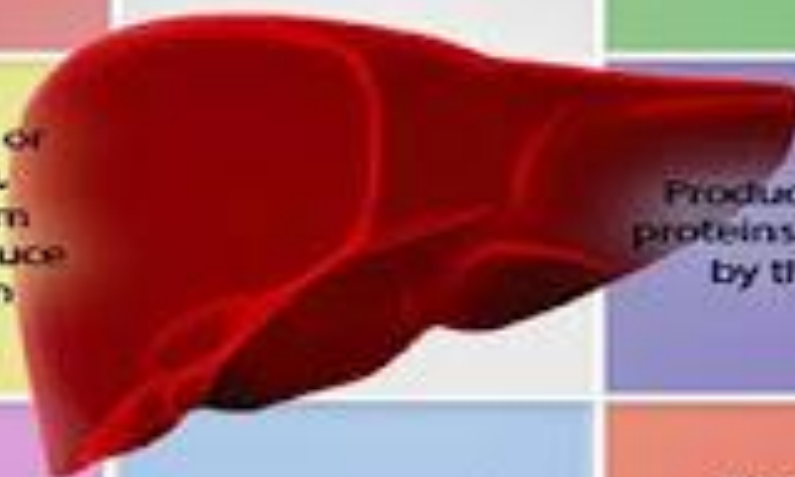
WATER ABSORPTION IN SMALL INTESTINE AND COLON

- 80% of the water in the contents of the small intestine is absorbed into the blood. This includes water in the food and drink plus water in all the secretions that have been added.
- Some water is absorbed as the remaining food pass through the colon.
- About 70 liters of digestive juices are poured into the alimentary canal each day. If the water is not absorbed by ileum and colon the body would become dehydrated.

ASSIMILATION

- Assimilation is the movement of digested food molecules into the cells of the body where they are used becoming part of the cells.
- The liver carries out a number of function as a part of assimilation.
 1. Converts glucose into glycogen and regulates the concentration of glucose in the blood.
 2. Breaks down excess amino acids
 3. Produces cholesterol from fat.
 4. Converts fatty acids and glycerol into fat and stored around the body.
 5. Uses amino acids to make proteins such as those involved with blood clotting

Liver Functions



Removes potentially toxic byproducts of certain medications.

Prevents shortages of nutrients by storing vitamins, minerals and sugar.

Metabolizes, or breaks down, nutrients from food to produce energy, when needed.

Produces most proteins needed by the body.

Helps your body fight infection by removing bacteria from the blood.

Produces most of the substances that regulate blood clotting.

Produces bile, a compound needed to digest fat and to absorb vitamins A, D, E and K.

Quiz time



- What is a balanced diet?
- What are the effects of malnutrition on heart disease?
- What are the health risk associated with a diet high in starch?
- Describe the role of fiber in the diet.
- What are the symptoms of Kwashiorkor and Marasmus?
- What are the main causes of starvation?
- State the function of amylase, protease and lipase listing their substrate and the end product.

Quiz time



- How the condition in the stomach different from the condition in the small intestine?
- Write two ways in which bile aids the digestion of fat.
- Describe how the small intestine is adapted for the absorption of food?
- Differentiate between absorption and assimilation.
- Describe the role of capillaries and lacteal in the villus.
- What are the functions of hydrochloric acid present in the stomach?

Quiz time



- People who have a diet rich in protein may have an excess of amino acids in their bodies. Describe what happens to these amino acids?
- What are the functions of liver?
- Describe how liver controls blood sugar level?
- Describe the structure of teeth.

Quiz time



- 1.The breaking down of insoluble food molecules into soluble molecules
- 2.Name the enzyme which has fat as substrate
- 3.Name the enzyme which has protein as substrate
- 4.Name the enzyme which has carbohydrate as substrate
- 5.Secretion of bile
- 6.Bile is stored in
- 7.The muscular contraction that squeezes food down the oesophagus
- 8.The acid present in stomach
- 9.Vitamin needed for absorption of calcium
- 10.No.of temporary teeth
- 11.No. of permanent teeth

Quiz time



- 12.The end product of protein digestion
- 13.The end product of fat digestion
- 14.The end product of carbohydrate digestion
- 15.Malnutrition caused lack of carbohydrate
- 16.Protein energy malnutrition
- 17.Stored form of carbohydrate in plants
- 18.Stored form of carbohydrate in animals
- 19.Hardest substance in our body
- 20.First part of large intestine
- 21.First part of small intestine
- 22.Second part of small intestine
- 23.Enzyme which work in the acidic medium
- 24.Fat that comes from animals
- 25.The organ which can regenerate

DID YOU KNOW



Your liver is the only organ in your body capable of regeneration!

After a 75% ablation of its total mass, your liver only needs 4 months to regain its initial weight.

A liver in good health works as efficiently at 80 years of age as it did at the age of 20.

For further references:

https://en.wikipedia.org/wiki/Animal_nutrition

<http://animalscience.tamu.edu/academics/nutrition/>

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