ANIMAL NUTRITION

For Study videos

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ANIMAL NUTRITION

- All animals need to eat food to give them nutrients that are used in the body to provide energy.
- To repair damaged tissue and to regulate bodily processes.

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CATEGORIES OF ANIMALS

• **Herbivore**: animal that eats only plants or parts of plants

• **Omnivore**: animal that eats plants, animals or dead animal flesh

• **Carnivore**: animal that eats only other animals or the remains of other animals
<table>
<thead>
<tr>
<th>Types of teeth</th>
<th>Structure and function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>incisors</strong></td>
<td>• chisel-shaped</td>
</tr>
<tr>
<td></td>
<td>• used for biting or cutting of food</td>
</tr>
<tr>
<td><strong>canines</strong></td>
<td>• pointed</td>
</tr>
<tr>
<td></td>
<td>• used for catching, holding, tearing and/or killing prey</td>
</tr>
<tr>
<td><strong>premolars</strong></td>
<td>• flat and uneven</td>
</tr>
<tr>
<td></td>
<td>• used for grinding and crushing food</td>
</tr>
<tr>
<td><strong>molars</strong></td>
<td>• flat and uneven</td>
</tr>
<tr>
<td></td>
<td>• used for grinding and crushing food</td>
</tr>
</tbody>
</table>
HUMAN NUTRITION: The digestive system

• **Digestion**: physical and chemical breakdown of complex molecules into their simplest forms to be absorbed into the body to sustain life

• It has **five major** steps
• **Ingestion:** intake of food

• **Digestion:** physical and chemical breakdown of food into its simplest form

• **Absorption:** the products of digestion diffuse into the blood stream

• **Egestion:** the removal of undigested and unabsorbed waste from the body through the anus in the form of faeces
Parts of the digestive system

- mouth cavity
- mouth
- salivary glands
- salivary glands
- pharynx
- oesophagus
- liver
- gall bladder
- duodenum
- transverse colon
- ascending colon
- stomach
- pancreas
- jejunum
- descending colon
- ileum (small intestine)
- rectum
- anus
**Mouth**
- Breaks up food particles
- Assists in producing spoken language

**Salivary glands**
- Saliva moistens and lubricates food
- Amylase digests polysaccharides

**Pharynx**
- Swallows

**Esophagus**
- Transports food

**Liver**
- Breaks down and builds up many biological molecules
- Stores vitamins and iron
- Destroys old blood cells
- Destroys poisons
- Bile aids in digestion

**Gallbladder**
- Stores and concentrates bile

**Stomach**
- Stores and churns food
- Pepsin digests protein
- HCl activates enzymes, breaks up food, kills germs
- Mucus protects stomach wall
- Limited absorption

**Pancreas**
- Hormones regulate blood glucose levels
- Bicarbonate neutralizes stomach acid
- Trypsin and chymotrypsin digest proteins
- Amylase digests polysaccharides
- Lipase digests lipids

**Small intestine**
- Completes digestion
- Mucus protects gut wall
- Absorbs nutrients, most water
- Peptidase digests proteins
- Sucrase digests sugars
- Amylase digests polysaccharides

**Large intestine**
- Reabsorbs some water and ions
- Forms and stores feces

**Anus**
- Opening for elimination of feces

**Rectum**
- Stores and expels feces
TYPES OF DIGESTION

• 1. **Mechanical** digestion (no enzymes)
• 2. **Chemical** digestion (enzymes involved)

**Mechanical/Physical digestion**

• is the physical breakdown of **large food** particles into **smaller** particles.
• it increases the **surface area**.
• occurs during **mastication**, **churning** in the stomach and during **peristalsis** (**rhythmic contraction and relaxation of circular muscles**).
**Peristalsis** is a reflex action and is triggered by the presence of the food in the alimentary canal. It's important to transport food and water. See the mechanism below.

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**Emulsification** is the breaking down of lipids into tiny droplets. It's also a type of physical digestion.
Chemical digestion

• is the breaking down of large food compounds into smaller food compounds using digestive enzymes

• It helps in breaking down large food particles into small that can be absorbed into the blood.
<table>
<thead>
<tr>
<th>Group of enzymes</th>
<th>Carbohydrases</th>
<th>Proteases</th>
<th>Lipases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where they are produced</td>
<td>Saliva, pancreatic juices, intestinal juices</td>
<td>Stomach, pancreatic juices intestinal juices</td>
<td>Pancreatic juices, intestinal Juices</td>
</tr>
<tr>
<td>Substrate</td>
<td>Carbohydrates (starch)</td>
<td>Proteins</td>
<td>Lipids (fats and oils)</td>
</tr>
<tr>
<td>Preferred pH</td>
<td>Slightly alkaline</td>
<td>Acidic in stomach, Alkaline in small intestine</td>
<td>Slightly alkaline</td>
</tr>
<tr>
<td>End product of digestion</td>
<td>Glucose</td>
<td>Amino acids</td>
<td>Glycerol &amp; fatty acids</td>
</tr>
</tbody>
</table>

- **NOTE:** Enzymes are very sensitive to changes in **temperature** and **pH**, hence, only work in **optimal** temperatures and **pH** ranges.

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The chemical digestion of large compounds into smaller compounds: representation

A protein molecule is made up of many different amino acids.

A starch molecule is made up of many glucose molecules.

A fat molecule is made up of fatty acid and glycerol molecules.

Protease breaks down protein molecules.

Carbohydrase breaks down carbohydrate molecules.

Lipase breaks down fat molecules.

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ABSORPTION

- It takes place mostly in the **small intestine** because food particles here are small enough to be absorbed.

- **Small intestine is suitable for absorption due to the characteristics below**

  - It is approximately *6 m long*.
  - The walls contain **transverse folds**
  - The inner wall has **millions of finger-like** projections called **villi**
  - Each villus contains **microvilli** to further increase the **surface area**.

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Simple structure of villus
ADAPTATION OF THE VILLUS FOR ABSORPTION

• The **epithelium** is only **one-cell layer thick** allowing **nutrients** to pass through **quickly**.

• **Goblet cells** secrete **mucus** to ensure the absorptive surface is **moist** and nutrients to be **dissolved** and **absorbed**.

• It has many **mitochondria** to supply **energy** for **active absorption** of nutrients.

• **Microvilli** further **increase** the **surface area**.

• There is a **lymph vessel** called a lacteal in each villus which **absorbs** and **transports lipids**.
Transport of amino acids and glucose

Amino acids & glucose are absorbed into blood capillaries of the villi in the small intestine.

Capillaries join together to form large venules to form the hepatic portal vein transports amino acids and glucose to the liver.

Glucose and amino acids flow through hepatic vein to the heart.

The liver converts excess glucose to glycogen and stores it.

Excess amino acids are deaminated by the liver to form urea (waste product) and are removed from the body.
Assimilation

• is the incorporation of absorbed nutrients into the cells of the body.

• For example, muscle cells will absorb amino acids to be converted to proteins and glucose will be absorbed by cells to provide energy.

• The liver plays a vital role in the assimilation of nutrients.

• The liver is responsible for the metabolism of glucose, deamination of amino acids, the breakdown of alcohol, drugs and hormones.
Egestion

• All **undigested** materials are transported through the **colon** where most water and mineral salts are **absorbed**.

• The **undigested** material is **temporarily stored** in the **rectum** until it is **excreted** through the **anus**.

• The **undigested** waste is then referred to as **faeces**.

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Homeostatic control of blood glucose levels

• **homeostasis**, the ability of an organism to **maintain stability** of internal conditions (e.g. temperature, chemical balance) despite changes in its **environment**

• **negative feedback mechanisms**, mechanisms in the human body that **detect changes or imbalances** in the internal conditions and **restore** homeostasis
The following is a general sequence of events in a negative feedback mechanism:

- Step 1: An imbalance is detected
- Step 2: A control centre is stimulated
- Step 3: Control centre responds
- Step 4: Message is sent to target organ/s
- Step 5: The target organ responds
- Step 6: It opposes / reverses the imbalance
- Step 7: Balance is restored.
The influence of insulin and glucagon on blood glucose levels

- Glucose converted to glycogen in liver
- Cells stimulated to take up glucose
- Blood glucose levels lowered
- Normal blood glucose level
- Blood glucose level increases
- Blood glucose level drops
- Glycogen converted to glucose in liver
- Pancreas secretes glucagon
- Pancreas secretes insulin
- High blood glucose level (after eating)
Blood glucose levels are maintained at a constant level (homeostasis).

When blood glucose levels are too high, insulin is released from the pancreas to stimulate the liver and muscles convert blood glucose into glycogen to return the blood glucose level to normal.

When blood glucose levels are too low, glucagon is released from the pancreas stimulates the liver and muscles to convert glycogen to glucose, which enters the blood and returns glucose levels to normal.
• **Diabetes mellitus** is a disorder characterized by **high blood glucose** levels resulting in increased fatigue (tiredness), dehydration and lack of energy.

<table>
<thead>
<tr>
<th>Types of diabetes mellitus</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type 1 diabetes</strong></td>
<td><strong>Type 2 diabetes</strong></td>
</tr>
<tr>
<td><strong>Cause:</strong> Usually an inherited disorder or a loss of insulin-producing cells in the pancreas</td>
<td><strong>Cause:</strong> Insulin resistance where body does not produce or react to insulin, usually as a result of poor lifestyle choices</td>
</tr>
<tr>
<td><strong>Treatment:</strong> Lifelong disorder that requires daily injections of insulin and specially adapted diet</td>
<td><strong>Treatment:</strong> Maintaining a balanced diet, regular exercise and medication</td>
</tr>
</tbody>
</table>
Balanced diet

• is required to maintain **good health**.

• A **balanced diet** should consist of all the **necessary nutrients** in their **correct quantities**.

• **Carbohydrates** and **fats** provide the body with energy,

• **protein** is used for **building** and **repair** of cells

• **vitamins** and **minerals** for maintenance of **immune** system and bodily **processes**.
The amount of nutrients required is dependent on:

- Age
- gender
- level of activity.

- **For example,**
- growing children need more protein to build and repair cells;
- active people require more energy foods
- men need more energy foods than women
Different diets

- **vegan** Do not eat any **animal products** such as meat, eggs and milk.

- **vegetarian** Do not **eat meat** but do **eat dairy products** and eggs.

- **halaal** Followers of **Islamic faith** do not consume pork, alcohol, carnivorous animals or any food that comes into contact with carnivorous animals. The slaughter of animals must follow strict rules.

- **kosher** Followers of **Jewish faith** do not eat pork, shellfish, fish without fins or scales, no predatory birds etc.
Malnutrition

It occurs when a person does not follow a balanced diet.

It can result in under-nourishment (eating too little food) or over-nourishment (eating too much food).

This can lead to a number of different disorders or diseases

- **kwashiorkor**
- **lack of protein** occurs mainly in children.
- swollen stomach and liver; sores on skin; stunted growth
- **marasmus**
- **lack of energy** foods such as carbohydrates and fats.
- thin muscles; no fat deposits; lack of energy; sunken eyes
• **anorexia nervosa**
• psychological condition where a person **refuses to eat** in fear of gaining weight.
• excessive weight loss; can be fatal
• **bulimia**
• psychological condition where a person regularly **overeats and induces vomiting** to avoid weight gain.
• dehydration; tooth decay; tears in the oesophagus; electrolyte imbalance
• **coronary heart disease**

• a **diet too high** in fats and sugars; obesity; high blood pressure; smoking; lack of exercise

• plaque and cholesterol build up in blood vessels going to heart; heart failure; heart attack

• **diabetes**

• poor diet (**high in sugar**) and **lack of exercise**

• tiredness; heart attack; stroke; kidney disease; blindness; numbness in fingers and toes; toe and/or leg amputations
• **obesity**

• a diet **too high in energy** foods such as sugars and fats

• excessive deposits of body fat; increased risk of heart disease; type 2 diabetes; hypertension; arthritis
Food allergies

• Some people have food allergies which are triggered when they consume or come into contact with a particular food or group of food types.

• The body considers the food item to be a pathogen and the immune system attacks the compounds of the food item.

• **Symptoms** of a food allergy usually include swelling, itching and shortness of breath or wheezing.

• Common foods that people are allergic to include milk, peanuts, shellfish, egg and gluten.
Food supplements

• When a diet is deficient in certain nutrients, Additional supplements are often taken for health, sport or beauty reasons and should only be taken on the advice of health professionals.

• Calcium and Vitamin D are often added to a diet to maintain strong bones and prevent osteoporosis particularly in pregnancy and old age.

• Body builders and extreme sportsmen and women add protein supplements to their diets to build and repair muscle tissue.
Tooth decay

• Tooth decay occurs when the outer tooth layer or tooth enamel is damaged.

• Plaque consisting of a sticky film of bacteria, forms on your teeth after eating.

• When you eat or drink foods containing a high percentage of sugars, the bacteria in plaque produce acids that attack tooth enamel.

• Fluoride helps to make teeth stronger and prevent cavities. Fluoride can be added to drinking water, salt and toothpaste to reduce tooth decay in a population.
Dietary information on packaging

- a list of ingredients
- the amount of carbohydrates, proteins, fats and oils etc.
- allergens
- recommended serving size
- kilojoules
Alcohol and drug abuse

negative consequences

• anxiety
• paranoia
• tremors
• sleeplessness
• mood swings
• depression
• changes in appetite
• death if overdosed
Some of the effects of drug abuse

• anxiety
• paranoia
• tremors
• sleeplessness
• mood swings
• depression
• changes in appetite
• death if overdosed
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