



Nutrition & Diet Therapy

Third Stage

First Semester 2022-2023

Lecture Five: Digestion, Absorption & Metabolism

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Digestion

Digestion is the process whereby food is broken down into smaller parts, chemically changed, and moved through the gastrointestinal system. The gastrointestinal (GI) tract consists of the body structures that participate in digestion. Digestion begins in the mouth and ends at the anus. Along the entire GI tract secretions of mucus lubricate and protect the mucosal tissues. Digestion occurs through two types of action:

mechanical & chemical.

During **mechanical digestion**, food is broken into smaller pieces by the teeth. It is then moved along the gastrointestinal tract through the esophagus, stomach, and intestines. This movement is caused by a rhythmic contraction of the muscular walls of the tract called peristalsis. Mechanical digestion helps to prepare food for chemical digestion by breaking it into smaller pieces.

During **chemical digestion**, the composition of carbohydrates, proteins, and fats is changed. Chemical changes occur through the addition of water and the resulting splitting, or breaking down of the food molecules. This process is called **hydrolysis**. Hydrolysis also involves digestive enzymes that act on food substances, causing them to break down into simple compounds. **An enzyme act as a catalyst, which speeds up the chemical reactions without itself being changed in the process. An enzyme is often named for the substance on which it acts. For example, the enzyme sucrase acts on sucrose, the enzyme maltase acts on maltose.**

Table 3-1 Enzymes and Foods Acted Upon

SOURCE	ENZYME	FOOD ACTED UPON	
Mouth	Salivary amylase	Starch	
Stomach	Pepsin	Proteins	
	Rennin	Proteins in milk	
Small intestine	Gastric lipase	Emulsified fat	
	Pancreatic amylase	Starch	
	Pancreatic proteases (trypsin) (chymotrypsin) (carboxypeptidases)	Proteins	
		Pancreatic lipase (steapsin)	Fats
			Lactase
	Maltase	Maltose	
	Sucrase	Sucrose	
	Peptidases	Proteins	

- ❖ **Saliva:** secretion of the salivary glands.
- ❖ **Salivary amylase:** also called ptyalin; the enzyme secreted by the salivary glands to act on starch.
- ❖ **Esophagus:** tube leading from the mouth to the stomach; part of the gastrointestinal system.
- ❖ **Cardiac sphincter:** the muscle at the base of the esophagus that prevents gastric reflux from moving into the esophagus.
- ❖ **Fundus (of the stomach):** upper part of the stomach.
- ❖ **Pylorus:** the end of the stomach nearest the intestine.

- ❖ **Chyme:** the food mass as it has been mixed with gastric juices.
- ❖ **Gastrin:** hormone released by the stomach.
- ❖ **Gastric juices:** the digestive secretions of the stomach.
- ❖ **Pepsin:** an enzyme secreted by the stomach that is essential for the digestion of proteins.
- ❖ **Duodenum:** first (and smallest) section of the small intestine.
- ❖ **Jejunum:** middle section comprising about two fifths of the small intestine.

- ❖ **Ileum:** last part of the small intestine.
- ❖ **Secretin:** hormone causing the pancreas to release sodium bicarbonate to neutralize acidity of the chyme.
- ❖ **Cholecystokinin (CKK):** hormone that triggers the gallbladder to release bile.
- ❖ **Bile:** secretion of the liver, stored in the gallbladder, essential for the digestion of fats.
- ❖ **Pancreas:** gland that secretes enzymes essential for digestion and insulin, which is essential for glucose metabolism.

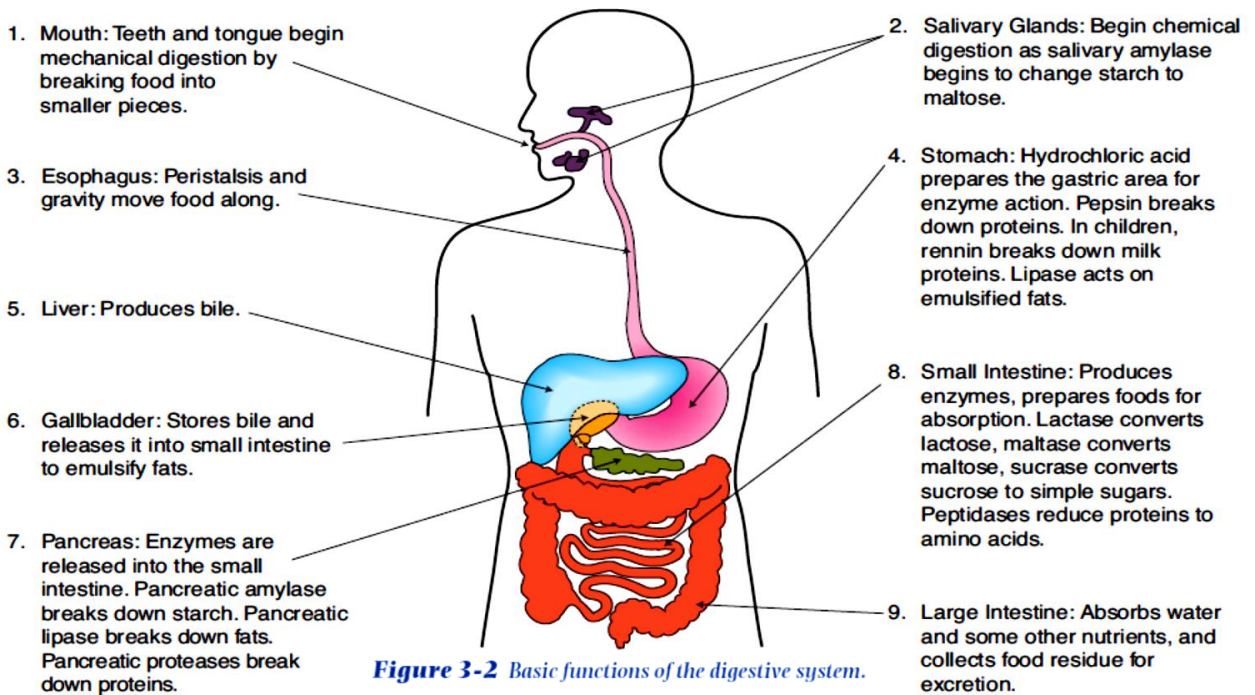


Figure 3-2 Basic functions of the digestive system.

Absorption

After digestion, the next major step in the body's use of its food is absorption. Absorption is the passage of nutrients into the blood or lymphatic system (the lymphatic vessels carry fat-soluble particles and molecules that are too large to pass through the capillaries into the bloodstream). To be absorbed, nutrients must be in their simplest forms. Carbohydrates must be broken down to the simple sugars (glucose, fructose, and galactose), proteins to amino acids, and fats to fatty acids and glycerol. Most absorption of nutrients occurs in the small intestine, although some occurs in the large intestine. Water is absorbed in the stomach, small intestine, and large intestine.

Absorption in the Small Intestine

The small intestine is approximately 22 feet long. Its inner surface has **mucosal folds, villi, and microvilli** to increase the surface area for maximum absorption. The fingerlike projections called **villi** have hundreds of microscopic, hair like projections called microvilli. The microvilli are very sensitive to the nutrient needs of our bodies. Each villus contains numerous **blood capillaries (tiny blood vessels connecting veins and arteries)** and **lacteals (lymphatic vessels in the small intestine that absorb fatty acids and glycerol)**.

Absorption in the Large Intestine

The **colon walls** secrete mucus as a protection from the **acidic digestive juices** in the chyme, which is coming from the small intestine through the ileocecal valve. **The major tasks of the large intestine are to absorb water, to synthesize some B vitamins and vitamin K (essential for blood clotting), and to collect food residue. Food residue is the part of food that the body's enzyme action cannot digest and consequently the body cannot absorb. Such residue is commonly called dietary fiber.**

Metabolism

As nutrients are oxidized, energy is released. When this released energy is used to build new substances from simpler ones, the process is called **anabolism**. An example of anabolism is the formation of new body tissues. When released energy is used to reduce substances to simpler ones, the process is called **catabolism**. This building up (anabolism) and breaking down (catabolism) of substances is a continuous process (**metabolism**) within the body and requires a continuous supply of nutrients.