

# **Digestive System Lab Report**

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Bio Human Anatomy and Physiology II 2312

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## **Chemical Breakdown of Food**

What is digestion? As we all know that digestion is how your body turns food you eat into nutrients it uses for energy, growth, and cell repair. Food and drink must be changed into smaller molecules of nutrients before the blood absorbs them and carries them to cells throughout the body. Digestive system is important because your body needs nutrients from food and drink to work properly and stay healthy. Your digestive system breaks nutrients into parts small enough for your body to absorb and use for energy. Each part of your digestive system helps to move food and liquid through your GI tract, break food and liquid into smaller parts, or both. Once foods are broken into small enough parts, your body can absorb and move the nutrients to where they are needed.

### **Organs and functions**

Food moves through your GI tract by a process called peristalsis. The large, hollow organs of your GI tract contain a layer of muscle that enables their walls to move. The movement pushes food and liquid through your GI tract and mixes the contents within each organ. The muscle behind the food contracts and squeezes the food forward, while the muscle in front of the food relaxes to allow the food to move. The main organs that make up the digestive system in order of their function are the mouth, esophagus, stomach, small intestine, large intestine, rectum. Helping them along the way are the pancreas, gallbladder and liver.

## Processes involved

Here's how these organs work together in your digestive system. The digestive process starts in your mouth when you chew. Your salivary glands make saliva, a digestive juice, which moistens food so it moves more easily through your esophagus into your stomach. Saliva also has an enzyme that begins to break down starches in your food. Food starts to move through your GI tract when you eat. When you swallow, your tongue pushes the food into your throat. A small flap of tissue, called the epiglottis, folds over your windpipe to prevent choking and the food passes into your esophagus. Once you begin swallowing, the process becomes automatic. Your brain signals the muscles of the esophagus and peristalsis begins. After you swallow, peristalsis pushes the food down your esophagus into your stomach. When food reaches the end of your esophagus, a ring like muscle called the lower esophageal sphincter relaxes and lets food pass into your stomach. This sphincter usually stays closed to keep what's in your stomach from flowing back into your esophagus. Glands in your stomach lining make stomach acid and enzymes that break down food. Muscles of your stomach mix the food with these digestive juices. Your pancreas makes a digestive juice that has enzymes that break down carbohydrates, fats, and proteins. The pancreas delivers the digestive juice to the small intestine through small tubes called ducts. Your liver makes a digestive juice called bile that helps digest fats and some vitamins. Bile ducts carry bile from your liver to your gallbladder for storage, or to the small intestine for use. Your gallbladder stores bile between meals. When you eat, your gallbladder squeezes bile through the bile ducts into your small intestine. The muscles of the small intestine mix food with digestive juices from the pancreas, liver, and gallbladder, and push the

mixture forward for further digestion. The walls of the small intestine absorb water and the digested nutrients into your bloodstream. As peristalsis continues, the waste products of the digestive process move into the large intestine. Waste products from the digestive process include undigested parts of food, fluid, and older cells from the lining of your GI tract. The large intestine absorbs water and changes the waste from liquid into stool. Peristalsis helps move the stool into your rectum. The lower end of your large intestine, the rectum, stores stool until it pushes stool out of your anus during a bowel movement.

## **Major Enzymes involved in digestion**

Your digestive system breaks down nutrients you consume in food, converting them into small molecules that your cells, tissues and organs use as fuel and for hundreds of metabolic functions. It takes hours to complete this complex process, which results in simple sugars, fatty acids, glycerol and amino acids. After you break food into small pieces by chewing it, specialized enzymes made in different parts of your digestive tract act on it to finalize the process. The 3 major enzymes involved in digestion is lipase, amylase and pepsin. Lipase is an enzyme that breaks down dietary fats into smaller molecules called fatty acids and glycerol. A small amount of lipase, called gastric lipase, is made by cells in your stomach. This enzyme specifically digests butter fat in your food. Amylase is a digestive enzyme that acts on starch in food, breaking it down into smaller carbohydrate molecules. The enzyme is made in two places. First, salivary glands in your mouth make salivary amylase, which begins the

digestive process by breaking down starch when you chew your food, converting it into maltose, a smaller carbohydrate. Special cells in your stomach produce an inactive enzyme, pepsinogen, which changes into pepsin when it contacts the acid environment in your stomach. Pepsin breaks certain chemical bonds in proteins, producing smaller molecules called peptides and beginning protein digestion.

## **Some health conditions associated with some common malfunctions of the digestive system**

Some common malfunctions of the digestive system is heartburn, cancer, irritable bowel syndrome, and lactose intolerance. Other digestive health conditions include Gallstones, cholecystitis, and cholangitis. Rectal problems, such as anal fissure, hemorrhoids, proctitis, and rectal prolapse.

## **Material and Method**

**Amylase** is a protein made by your pancreas and by glands in and around your mouth and throat. It helps you break down carbohydrates and starches into sugar. It's normal to have some amylase in your blood. But too much of it could mean one of the ducts (tubes) in your pancreas is blocked or injured.

**Cellulose** is the main substance in the walls of plant cells, helping plants to remain stiff and upright. Humans cannot digest cellulose, but it is important in the diet as fibre. Fibre assists your digestive system keeping food moving through the gut and pushing waste out of the body.

**Water** and other liquids help break down food so that your body can absorb the nutrients. Water also softens stool, which helps prevent constipation.

In many ways, your gut bacteria are as vast and mysterious as the Milky Way. About 100 trillion bacteria, both good and bad, live inside your digestive system.

Peptidase breaks protein compounds down into amino acids by leaving the peptide bonds within proteins by hydrolysis. This means that water is used to break the bonds of protein structures.

## **Assessing Pepsin Digestion of Proteins**

To examine the effect of amylase substrate specificity, six tubes were prepared with different combinations of amylase, starch, cellulose, peptidase, bacteria and deionized water. Pepsin, BAPNA and pH 2.0 were added to Tube 1. Tube 2 had pepsin and BAPNA and pH 2.0 buffer added to it. In Tube 3 pepsin, deionized water and pH 2.0 were added to it. Deionized water, pH 2.0 buffer and BAPNA were added to Tube 4, while in Tube 5 pepsin, BAPNA and pH 7.0 buffer were added. Finally, pepsin, BAPNA and pH 9.0 were added to the Tube 6. From Tube 1-4 same amount of each reagent was added in all tubes except Tube 5-6 was different but all Tubes were incubated at 37° C for 60 minutes.

## Results

### Assessing Pepsin Digestion of Protein

You can tell because the protein was not digested in tube #1.

To test for the specificity of the enzyme pepsin, BAPNA, deionized water were used.

Tubes 1-2 and 5-6 had pepsin and BAPNA while 3 had deionized water and pepsin and 4 had BAPNA and deionized water. After 60 minutes incubation at 37 C, only tube 5 was positive if the incubation time was reduced to 30 min for Tube 5, I think there would be no digestion of protein. There was no color change & a density of 0.

### Assessing Starch Digestion of Salivary Amylase

What effect did boiling and freezing have on enzyme activity? Boiling caused amylase to be denatured, thus inactivating the enzyme. Freezing has no effect.

Amylase is most active in neutral areas pH 7.0, such as the mouth and the small intestine (duodenum).

To examine the effect of amylase substrate specificity, six tubes were prepared with different combinations of amylase, starch, cellulose, peptidase, bacteria and deionized water. Amylase, starch and pH 7.0 were added to Tube 1. In Tube 1 the amylase is hydrolyzing the starch to glucose. In Tube 2 the glucose is already present in the hydrolyzed form. Amylase cannot digest cellulose, so tube #3 is not positive for Benedict's test. pH 7.0 Amylase is most active in neutral areas, such as the mouth and the small intestine (duodenum). 37°C simulates an environment of normal body temperature. Tube 2 had amylase, glucose and pH7.0 buffer added to it. In Tube 3,

amylase, cellulose and pH7.0 were added to it. Cellulose, pH7.0 buffer and deionized water were added to Tube 4, while in Tube 5 peptidase, starch and pH7.0 buffer were added. Finally, bacteria, cellulose and pH 7.0 buffer were added to tube six. The same amount of each reagent was added in all tubes. All tubes were incubated at 37° C for 60 minutes.

### **Assessing Lipase Digestion of Fat**

Fat globules are separated into droplets by bile salts through an emulsification process, which is physical not chemical and promotes lipase activity. Pancreatic lipase is most active at pH 7.0 the pH of the mouth is 7.0 & the pH of the small intestine is close to 8.0 so the enzyme would function in both places. Measurement of lipase activity uses a decrease in pH. Because the pH in Tube #5 is already very low, it is hard to tell if fatty acids are released. Test tube #1 should have the highest activity because the pH is closest to that of the small intestine.

### **Discussion and Conclusion**

Amylase is an enzyme that breaks down starch into maltose disaccharide consisting of two glucose molecules. It is used for digestive purposes in humans. When amylase is present the starch sprayed on the paper towel will be converted to sugar. IKI turns starch purple. When all the starch has been converted to sugar by the enzyme amylase you will get a white spot on the paper where the sample containing



amylase was applied, if this spot has the same purple color as the surrounding area we can conclude that the sample did not contain amylase, at least not enough to significantly change the amount of starch on the paper.

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