Digestive System Lab Report

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Introduction:

The digestive system is a group of organs working together to convert food into energy and basic nutrients to feed the entire body. Food passes through a long tube inside the body known as the alimentary canal or the gastrointestinal tract (GI tract). The alimentary canal is made up of the oral cavity, pharynx, esophagus, stomach, small intestine, and large intestine(Taylor, 2020). In addition to the alimentary canal, there are several important accessory organs that help your body to digest food but do not have food pass through them. Accessory organs of the digestive system include the teeth, tongue, salivary glands, liver, gallbladder, and pancreas. There are six key processes of the digestive system. The first key process is ingestion, where food enters the mouth. Then mechanical digestion occurs, chewing the food and mixing it with the first digestive enzyme, salivary amylase, which breaks down carbohydrates. Next is propulsion, which is the act of swallowing, refers to the movement of food through the digestive tract(Lang, 2013). After that, through chemical digestion, food is broken down into "small organic and inorganic molecules suitable for absorption by the digestive epithelium" (Martini et al., 886). Secretion occurs next where acids, water, enzymes, buffers, and salts are released. Then comes absorption, where the absorbed materials enter the interstitial fluid. Lastly, defecation is where waste is eliminated from the body.

Digestion is important because your body needs nutrients from food and drink to work properly and stay healthy. Enzymes play an important role in the digestive system by breaking down food into molecules for a wide range of bodily functions and are essential for healthy digestion. Digestion first occurs in the mouth, where we see the first enzyme, amylase, come into play. Amylase is secreted by both the salivary glands and the pancreas and is essential for the digestion of carbohydrates; it breaks down starches into sugars. The next enzyme, pepsin, is

secreted by the stomach and breaks down proteins into peptides, or smaller groupings of amino acids, that are either absorbed or broken down further in the small intestine(Bolen, 2020). Lipase is also produced in the stomach and is responsible for the breakdown of fats into fatty acids and glycerol (simple sugar alcohol).

Sometimes the digestive system can malfunction and cause some health conditions. One health condition is called gastroesophageal reflux disease(GERD). GERD is a long-term condition where acid from the stomach comes up into the esophagus. Another common condition is known as gallstones. Gallstones are hard deposits that form in your gallbladder — a small, pear-shaped sac that stores and secretes bile for digestion. Gallstones can form when there's too much cholesterol or waste in your bile, or if your gallbladder doesn't empty properly. Gallstones block the ducts leading from your gallbladder to your small intestine, which causes infection or sharp pain in your upper-right abdomen(Orenstein,2020).

Objective:

The purpose of this lab activity was to examine the effects of digestive enzymes on their specific substances and observe the effects of environmental influences on digestion.

Materials and Methods:

Starch Digestion Experiment:

The starch digestion experiment was done in two parts. The first part of the experiment tested the digestion of starch by salivary amylase. The second part of the experiment tested how temperature affects the amount of time it takes for starch to become salivary amylase. In the first

part, 2 test tubes were filled with a starch solution using a dropper. Equal amounts of iodine were then added to both test tubes to show that they contained starch. A spoon of amylase was then added to test tube 2. Both test tube 1 and 2 were set into a beaker with 150 mL of water on top of a hot plate to warm up. After warming, both tubes were compared. To check if the starch in test tube 2 had been digested by the amylase into simple sugars, a Benedict's test was performed. Some of the digested solution in test tube 2 was put into a test tube containing Benedict's Solution and heated using a Bunsen burner. For the second part of this experiment, 5 beakers with water were set up and heated to the temperatures: 20°C, 40°C, 50°C, 60°C, and 80°C using a thermometer. Then, 5mL of starch was added to 5 different test tubes each labeled S20, S40, S50, S60, and S80. After that, 5mL of amylase was added to 5 different test tubes labeled A20, A40, A50, A60, A80. Each test tube was then added to its respective water bath depending on its corresponding number. All of the test tubes were allowed to equilibrate for 5 minutes in their water baths. After equilibrating, S20 was mixed with A20 and then a timer was set. Every 30 seconds, a drop of the new mixture would be added to a well filled with iodine until the reaction stopped and there was no color change anymore. The results were recorded and the same procedure was then conducted for all of the remaining test tubes.

Lipid Digestion:

To test the activity of lipase on lipids, 4 test tubes were filled with lipid cream, which had a pink pH indicator. Test tube 1 was filled with water and bile salts. After that, lipase was poured into test tube 2. Test tube 3 was given lipase enzymes and bile salts. Amylase was added to test tube 4. After a few minutes of allowing the solutions to sit, all observations were recorded.

Protein Digestion:

To test the digestion of lipids by pepsin, 5 test tubes were given 5 cubes of egg whites that were about the same size. Test tube 1 then received 2mL of water. Only test tubes 2, 3, and 4 received 2mL of pepsin solution. Test tubes 2 and 4 were additionally given 2 drops of hydrochloric acid. Only test tube 5 received 2mL of an amylase solution. Test tubes 1, 3, 4, and 5 were incubated for about half an hour in warm water for 30 min, while test tube 2 was kept at room temperature. After the half an hour was up, the tubes were shaken to observe any visible suspensions left by the egg white. All observations were then recorded.

Results/Data:

Table 1: Results of Salivary Amylase Digestion of Starch

Test tube	**Starch present ?**	**Iodine present ?**	**Amylase present?**	**Color of solution after being heated?**	**Mixed with benedict?**
Test tube-1	yes	yes	No	Very dark purple, almost black	no
Test tube-2	yes	yes	yes	Clear	Yes

Table 2: Results for the Effect of Temperature on Salivary Amylase Digestion of Starch

Test Tube	Contents	Temperature	Time Until Reaction Ends
1	Amylase Starch	20°C	2 minutes
2	Amylase Starch	40°C	1 minute, 30 second
3	Amylase Starch	50°C	1 minute
4	Amylase Starch	60°C	30 seconds
5	Amylase Starch	80°C	Less than 30 seconds

Table 3: Results of Lipid Digestion

Test Tube	Contents	Reaction Observed
1	Lipid Cream Water Bile Salts	-No color change, remained dark pink in color -Water and Bile Salts did not digest the lipids
2	Lipid Cream Lipase	-Color changed to light pink -Lipase digested the lipids
3	Lipid Cream Lipase Bile Salts	-Color changed to light yellow -Lipase digested the lipids
4	Lipid Cream Amylase	-No color change, remained dark pink in color -Amylase did not digest the lipids

Table 4: Results of Protein Digestion

Test Tube	Contents	Temperature	Reaction Observed After ½ Hour
1	Egg Water	Warm	-No visible suspensions -Water did not digest the egg white
2	Egg Pepsin Hydrochloric Acid	Cold	-Some visible suspensions are found -Pepsin is an enzyme that can digest egg white
3	Egg Pepsin	Warm	-Some visible suspensions are found -Pepsin is an enzyme that can digest egg white
4	Egg Pepsin Hydrochloric Acid	Warm	-A great amount of visible suspensions is found -Pepsin is an enzyme that can digest egg white
5	Egg Amylase	Warm	-No visible suspensions -Amylase did not digest the egg white

Discussion/Conclusion:

The digestion of starch experiment showed that the enzyme amylase does indeed digest starch. When starch and iodine was present, the solution turned a dark purple- black color. If amylase digested starch, then the solution would turn clear as it did. Starch is a complex carbohydrate that is broken down into its simplest form through amylase., as shown by the benedict test. The solution precipitated once it was heated and was found at the very bottom, which was an indicator that it was broken down into simple sugars. The effect of temperature also plays a role when amylase and starch is present for digestion. The temperature of water caused quicker results. The color changed from black to a brown every time but, some test tubes were quicker than others, depending on the temperature. The lipid digestion showed chemical reaction through the change of pH. Only test tube 2 and 3 had a chemical reaction, where it changed the original color pink, to a lighter pink and yellow. Test tube 3 digested lipid better because it was in a warmer environment. In the pepsin digestion of protein, amylase did not play a role in the digestion as expected. Amylase is an enzyme that breaks down carbohydrates into glucose, not proteins. Pepsin was needed to break down proteins. The visible suspension was the result in test tubes 2,3, and 4 that showed digestion and in all those tubes, pepsin was present. Overall, this lab experiment shows how the enzymes in our body play an important role in our digestive system to absorb nutrients.

Works Cited

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