Digestive System Lab Report

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Human Anatomy and Physiology 2 Lab

Bio 2312 Course 25718

Tuesdays, 2:30pm-5:00pm

Introduction:

The digestive system is one of twelve systems that fascinates many people because they want to know how the pizza they ate yesterday came out as feces today. The function of the digestive system is to break down macromolecules, absorb nutrients and excrete waste. The digestive system consists of the gastrointestinal tract, pancreas, liver and gallbladder. The gastrointestinal tract contains the mouth, esophagus, stomach, small intestine and large intestine which are the organs that the food actually goes through while the pancreas, liver and gallbladder are accessory organs that aid in digestion. The process of digestion begins in the mouth where the teeth, tongue and saliva help break down the food mechanically into a bolus. The bolus is swallowed into the esophagus with the help of the tongue. The bolus travels down the esophagus to the stomach through peristalsis. Peristalsis is an involuntary wave like motion in the gastrointestinal tract that aids in the movement of food throughout the tract (Clinic 2018). Once the food reaches the stomach, digestive juices are released to begin the chemical breakdown of the food. The digestive juices contain stomach acid and enzymes which are produced by the lining of the stomach. Enzymes are proteins that lower the activation energy that is needed for a chemical reaction. The digestive juices mix with the bolus with the help of stomach muscles and chyme is made. The chyme is then passed to the small intestine through peristalsis.

The small intestine is where most chemical digestion is done. The liver produces bile which aids in the digestion of fat into fatty acid by emulsification. Fats can not be absorbed by the body but fatty acids can. The bile can either go to the small intestine through bile ducts or the gallbladder to be stored until it's needed. The pancreas produces a digestive juice that contains

enzymes that aid in digestion of proteins, fats and carbohydrates. The enzymes released by the pancreas are lipase which breaks down fat molecules with the aid of bile, protease which breaks down proteins and amylase which breaks down starch into sugar (Pancan 2018). All these juices and enzymes are brought to the small intestine through ducts. The small intestine absorbs the water and nutrients through its lining and into the bloodstream as the chyme passes through peristalsis. Anything that is not absorbed goes to the large intestine. In the large intestine any excess water that's left in the waste is absorbed into the bloodstream. This causes the waste from being in a liquid state into a solid. The waste then goes to the rectum and anus to be defecated when the time comes.

Objective:

This lab activity focuses on how digestive enzymes affect specific substances and how external forces like temperature have an effect on the enzymes.

Materials and Methods:

Starch Digestion

This starch digestion experiment was focused on salivary amylase. Two different experiments were conducted. One experiment focused on how temperature impacts the salivary amylase digestion. While the other experiment focused on how starch is digested by salivary amylase. For the experiment that focuses on the impact of temperature 5 beakers were filled with water and boiled to different temperatures: 20℃, 40℃, 50℃, 60℃ and 80℃. Each tube was labeled with how many degrees celsius it was boiled to before boiling so S20, S40, S50, S60 and

S80. Then 5ml of starch was added to each tube. Then 5mL of amylases was placed into 5 tubes that had been labeled A20, A40, A50, A60 and A80. All these tubes were placed in the bath with its corresponding temperatures for 5 minutes. When the timer was done each S and A tubes were put with the same numbers so S20 mixed with A20 and so on. Then a well was filled with the iodine solution and a drop of the combinations (S20 + A20) was added until the reaction stopped and no color change was present.

In the next experiment 2 test tubes were labeled 1-2 and filled with starch solution. Then equal amounts of iodine was placed in each test tube. Then amylase was added to test tube 2. Then both test tubes were placed into a beaker that contained 150mL of water. Then the beaker was placed on a hot plate until the water was warm. After being warmed the solutions were compared. Benedict's test was done on test tube 2 to observe if the amylase had been digested into simple sugars.

Lipid Digestion

For the lipid digestion experiment 4 test tubes were labeled 1-4 and filled with lipid cream. The lipid cream has a ph indicator. Lipid water and bile salts were added to test tube 1. Test tube 2 was filled with lipid and lipase. Test tube 3 was filled with lipid, lipase and bile salts. Test tube 4 was filled with lipid and amylase. After a few minutes results can be recorded.

Protein Digestion

For the protein digestion experiment 5 test tubes were labeled 1-5. Each test tube had 5 cubes of egge white in it. Then 2mL of water was added to test tube 1. Then test tubes 2, 3 and 4 received 2mL of a pepsin solution. Next test tubes 2 and 4 had 2 drops of hydraulic acid added. Test tube 5 had 2mL of amylase solution added. Then test tubes 1, 3, 4 and 5 were placed in a

warm water bath for about 30 minutes. After the 30 minutes all the test tubes were slightly shaken to observe any changes.

Results/Data

Table 1- Effect of temperature during digestion of starch

Test Tube	**Contents**	**Temperature**	**Time until reaction ended**
1	Amylase and Starch	20℃	2 minutes
2	Amylase and Starch	40℃	1 min and 30 seconds
3	Amylase and Starch	50℃	1 minute
4	Amylase and Starch	60℃	30 seconds
5	Amylase and Starch	80℃	Less than 30 seconds

Table 2- Salivary Amylase Digestion of Starch

Test tube	**Starch present?**	**Iodine present?**	**Amylase present?**	**Color of solution after being heated?**	**Mixed with bendicts?**
1	yes	yes	no	Dark purple almost black	no
2	yes	yes	yes	clear	yes

Table 3- Lipid digestion

Test tube	Contents	Color change
1	Lipid cream, water and bile salts	no
2	Lipid cream and lipase	Light pink
3	Lipid cream, lipase and bile salts	Light yellow
4	Lipid cream and amylase	no

Table 4- Protein Digestion

Test tubes	Contents	Temperature	Observations
1	Egg whites and wate	Warm	No visible suspensions
2	Egg whites, pepsin and HCL	Cold	A few visible suspensions
3	Egg whites and pepsin	Warm	A few visible suspensions
4	Egg whites, pepsin and HCL	Warm	A great amount of visible suspensions

5	Egg whites and amylase	Warm	No visible suspensions

Discussion/Conclusion

The effect of temperature on salivary amylase digestion of starch is visible from the experiment. The higher the temperature the quicker the reaction time ended. This tells us that the higher the temperature the quicker the digestion of starch by salivary amylase. The next starch test was testing the presence of starch. When iodine is added to a starch solution the solution becomes a dark purple almost black color. This color is seen in test tube 1 indicating that starch was present in the solution. In test test tube 2 the solution did not turn dark purple when iodine solution was added. This is because the starch was digested by amylase. The starch had become a simple sugar that why when Benedict's reagent was added the solution reacted.

The lipid experiment had a lipid cream that was also a ph indicator. Only test tubes 2 and 3 had color change because they both contain lipase which is necessary in the digestion of lipids. Although test tube 2 had some color change indicating some digestion of lipids, test tube 3 had the most significant color change because it had both lipase and bile salts, the bile salts further the digestion of lipids. Test tube 1 had bile salts but no lipase so the lipid was not digested. Test tube 4 had amylase which digests starch so the lipid was not digested.

The protein experiment used egg white cubes as the protein that needed to be digested. Only test tubes 2, 3 and 4 had any form of visible suspension because pepsin was present in all three. Test tube 1 had no visible suspensions because only water was added and water can not digest proteins. Test tube 5 had amylase which digest starch so no visible suspensions were seen. Test tube 4 had the most visible amount of suspension. Even though test tube 2 had the same

contents as test tube 4, test tube 4 had more visible suspensions due the temperature. This indicates that the digestion of protein happens faster the higher the temperature. Test tube 3 did not have as many visible suspensions as test tube 4 because HCL was not present. This indicated that the presence of HCL aid in the digestion of protein alongside pepsin.

Works Cited

Clinic, Cleveland. "Structure & Function of the Digestive System: How It Works." *Cleveland Clinic*, 2018, my.clevelandclinic.org/health/articles/7041-the-structure-and-function-of-the-digestive-system.

Pancan. "Pancreatic Enzymes and Supplements." *Pancreatic Cancer Action Network*, PanCAN, 6 Apr. 2018,

www.pancan.org/facing-pancreatic-cancer/living-with-pancreatic-cancer/diet-and-nutrition/pancreatic-enzymes/.