Lisette Lindao

BIO 2312 OL57: Human Anatomy and Physiology II Lab

Tuesday, 2:30pm-5:00pm

Chemical Breakdown of Foodstuff Lab

Professor Niloufar Haque

Introduction:

Nutrients are needed for growth, survival, and reproduction of the human body. The nutrients given to the human body are mechanically broken down and chemically digested into molecules that are absorbed. The digestive system is used to break down larger molecules into smaller ones, so it can be absorbed into the blood, where cells can use the nutrients. The large protein molecules are known as enzymes that are produced by body cells and are biological catalysts (Marieb, 2019, p590). They increase the rate of reaction without being a part of it. Depending on which enzyme you are working with, they either hydrolyze one or more molecules and catalyze chemical reactions involving the substrate. Assessing starch digestion by salivary amylase is important because in order to know that your body is getting the nutrients it needs, you need the right enzymes to break them down. Amylase helps break down carbohydrates, so you can get the nutrients you need. The carbohydrate digestion begins at the mouth with salivary amylase and ends at the colon. Amylase has no effect on proteins and lipids which show how each enzyme works with its own substrate. Another enzyme is named trypsin which is produced by the pancreas. Trypsin hydrolyzes proteins into small peptides (Marieb, 2019, p593). Protein digestion begins at the stomach and ends in the small intestine. BAPNA is a dye used to determine if the amino acid is hydrolyzed by trypsin. This dye is used to test which additive hydrolysis. Pancreatic lipase digestion has two reactions. Bile is crucial to fat digestion because it emulsifies the fat. The first reaction that occurs is that fats and oils will use bile to emulsify into microscopic fat and oil droplets. Then the fats and oil droplets will use lipase to break down the fats into fatty acids and monoglycerides. Testing pH makes a great way to notice if digestion is working because of how acidic fatty acids are. The pH would decrease if digestion has been done.

In the digestive process food must be broken down by the mechanical action of chewing and by the chemical action of digestive enzymes which happens at the stomach. Saliva has enzymes that help digest the starches in food, amylase breaks down the starch into sugars (HealthCare, 1997). The process of amylase breaking down starch into sugar makes it easier to absorb into the blood and transport for energy use throughout the body. Based on this lab activity, you will see that temperature also affects enzyme activity along with pH. The ideal temperature for enzymes is 37℃, if the temperature is lower than this the enzymes will move slower causing a decrease in enzyme activity.

The purpose of this lab was to test how enzymes would react to a substrate, along with how temperature and pH affects the enzyme.

Hypothesis: Test tube 2A, 4A, and 6A will have a color change resulting in a positive starch test.

Materials & Methods:

For activity 1, assessing starch digestion by salivary amylase, each test tube was labeled from 1A-6A. In each test tube, 3 drops of each indicated substance was added. Tube 1A contained amylase and water, tube 2A contained starch and water tube 3A contained maltose and water, tube 4A contained amylase and was then boiled for 4 minutes then starch was added, 5A and 6A contained amylase and starch. Test tubes 1A-5A were incubated in 37℃ water for about an hour. A pipet was used to transfer a drop of a sample of each test tube 1A-6A into a labeled spot plate. A drop of Lugol's iodine solution was placed in each sample to test the presence of starch. The results were recorded for each tube. 3 drops of benedict's solution were placed into the remaining mixtures of test tubes and were boiled for 5 minutes. This was to test if maltose was present based on color change and results were recorded in the chart.

Activity 2 was to test protein digestion by trypsin. Each test tube was labeled as 1T-5T and had 3 drops of an indicated substance. 1T contained trypsin and water, 2T contained BPNA

and water, 3T contained trypsin and was boiled for 4 minutes then BAPNA was added, 4T and 5T contained trypsin and BAPNA. Test tubes 1T-4T were incubated in 37℃ water for about an hour. After the hour passed the tubes were examined and recorded for results of positive or negative hydrolysis based on color change.

Activity 3 was used to assess the fat digestion by lipase. 5 test tubes were labeled 1L-5L and 2 test tubes were labeled 4B and 5B. Test tube 1L contained pancreatin and water, 2L contained litmus cream and water, 3L contained pancreatin and was boiled for 4 minutes then litmus cream was added, 4L and 5L contained pancreatin and litmus cream, 4B and 5B contained a pinch of bile salt, pancreatin, and litmus cream. Each tube was covered with a small square of parafilm so the contents wouldn't fall out while mixing it. Once it was mixed the parafilms were removed and test tubes 1L-4L and 4B were incubated in 37℃ water for about an hour. After an hour, litmus powder was added to make litmus cream. In order to prepare a color control, 0.1 of N HCI was added to test tubes 1L and 2L and mixed. To test the change in pH, the color will change and results will be recorded.

Results/Data:

Activity 1: Salivary Amylase Digestion of Starch						
Tube #	1A	2A	3A	4A	5A	6A
Additives (3 gtt ea)	Amylase, water	Starch, water	Maltose, water	Boiled amylase, starch	Amylase, starch	Amylase, starch
Incubation condition	37°C	37°C	37°C	37°C	37°C	0°C
IKI test (color change)	No color change	blue/black	No color change	blue/black	No color change	blue/black
Result:(+) or (-)	-	+	-	+	-	+
Benedict's test (color change)	No color change	No color change	orange	No color change	orange	No color change
Result:(+) or (-)	-	-	+	-	+	-

Activity 2: Trypsin Digestion of Protein					
Tube #	1T	2T	3T	4T	5T
Additives (3 gtt ea)	Trypsin, water	BAPNA, water	Boiled trypsin, BAPNA	Trypsin, BAPNA	Trypsin, BAPNA
Incubation condition	37°C	37°C	37°C	37°C	0°C
Color change	No color change	No color change	No color change	yellow/ brownish	No color change
Result: (+) or (-)	-	-	-	+	-

Activity 3: Pancreatic Lipase Digestion of Fats							
Tube #	1L	2L	3L	4L	5L	4B	5B
Additives (5 gtt ea)	Pancreatin, water	Litmus cream, water	Boiled pancreatin, litmus cream	Pancreatin, litmus cream	Pancreatin, litmus cream	Pancreatin, litmus cream, bile salts	Pancreatin, litmus cream, bile salts
Incubation condition	37°C	37°C	37°C	37°C	0°C	37°C	0°C
Color change	No color change	No color change	No color change	Color change	No color change	Color change	Some color change
Result: (+) or (-)	-	-	-	+	-	+	+

Discussion/ Conclusion:

Activity 1 was used to test for the presence of starch and maltose. The lab experiment was successful in the sense that I predicted 2A, 4A, and 6A would result in positive starch tests. The positive test was identified by the blue/black color change in the test tubes which meant starch was present. The benedict's test determined whether maltose was present due to a color change of orange. In this lab 3A and 5A tested positive for sugar. Although test tube 5A and 6A contained the same things, they were incubated at different temperatures causing the difference in test results. In activity 2, I successfully predicted that 4T would be the only positive result because of the color change to yellow, hydrolysis of trypsin. When it is a positive result, it means

the dye molecule was divided from the amino acid. As a result of activity 3, the pH had an effect on the combination of pancreatin, litmus cream, and bile salts as predicted. The color change of the litmus cream will be pink meaning fats are being digested. The outcome of the entire lab wasn't what I expected due to virtual circumstances, but it was still do-able and a great learning experience. This activity helped get out of the routine of lecture learning and brought light to a different way of retaining the information learned throughout this lab. Overall it was a great way to learn a new topic.

References:

Marieb, E. N., Smith, L. A., & Zao, P. Z. (2019). Digestive System Processes: Chemical and Physical. In *Human Anatomy & Physiology Laboratory Manual* (12th ed.). essay, Pearson.

HealthCare, B. J. C. (1997). *The Digestive Process: Digestion Begins in the Mouth*. Alton Memorial Hospital. https://www.altonmemorialhospital.org/Health-Library/View-Content?contentTypeId=134&contentId=193#:~:text=Saliva%20contains%20special%20enzymes%20that,lipase%2C%20which%20breaks%20down%20fats.