

NEW YORK CITY COLLEGE OF TECHNOLOGY

A&P II, BIO 2312L Summer Term 2

LAB REPORT

**CHEMICAL BREAKDOWN OF FOODSTUFF**

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## **Introduction**

According to the textbook “Fundamentals of Anatomy & Physiology 11th ed.,” digestion is very important because our body needs nutrients from food and drink to stay healthy. Proteins, fats, carbohydrates, vitamins, minerals, and water are nutrients. Digestion is the process of turning the food we eat into nutrients, which the body uses for energy, growth and cell repair needed to survive. The main function of the digestive system is digestion and absorption. Digestion is the breakdown of food into small pieces, which are then absorbed into the body. Alimentary canal or the digestive tract is a tube with two openings: the mouth and the anus. It includes the mouth, pharynx, esophagus, stomach, small intestine, and large intestine. Accessory organs include the teeth and tongue, salivary glands, liver, gallbladder, and pancreas (F.Martini., Prentice-Hall Pub. 2011).

The small intestine has three parts and the first part is called the duodenum. The jejunum is the middle part and the ileum is the end. The large intestine includes the appendix, cecum, colon, and rectum. The appendix is a finger-shaped pouch attached to the cecum. The cecum is the first part of the large intestine, then colon is next. The rectum is the end of the large intestine.

The liver is an organ that has multiple functions. Its main digestive function is producing and secreting a bile, which gets to the small intestine through bile duct. Bile breaks down large globules of lipids into smaller ones that are easier for enzymes to chemically digest. Bile is also needed to reduce the acidity of food entering the small intestine from the very acidic stomach because enzymes in the small intestine require a less acidic environment in order to work (NIH, 2017).

The gallbladder is a small sac below the liver that stores some of the bile from the liver. The gallbladder also concentrates the bile by removing some of the water from it. It then secretes the concentrated bile into the small intestine as needed for fat digestion following a meal.

The pancreas secretes many digestive enzymes and releases them into the small intestine for the chemical digestion of carbohydrates, proteins, and lipids. The pancreas also helps to lessen the acidity of the small intestine by secreting bicarbonate, a basic substance that neutralizes the acid. The enzymes in our body help to perform a very important job. These include building muscle, destroying toxins, and breaking down food particles during digestion (NIH, 2017).

### **Objective**

The objective of this lab experiment is to observe the effects of digestive enzymes on starch, protein, and fat. Activity one will use amylase to hydrolyze starch into sugar; activity 2 will use trypsin to break down protein into short chains of amino acids and activity 3 will consist of lipase that will break down fat into glycerol and fatty acids. Salivary amylase changes starch into the sugar maltose, which is soluble in water. The IKI test detects the presence of starch and the Benedict's assay test for the presence of reducing sugars. Trypsin is an enzyme, used to break proteins down into a short chain of peptides. BAPNA, is to determine if there is hydrolysis by trypsin. The enzyme and substrate combinations were amylase on starch and trypsin on proteins.

## **Materials and Methods**

**Activity 1:** to test for the activity of salivary amylase digestion of starch, a total of six tubes 3 gtt of water were added to tubes labeled 1A, 2A and 3A. 3gtts of starch were added to tubes labeled 4A, 5A and 6A. 4A amylase was boiled for four minutes, then added starch. 6A temperature was 0 °C, whilst the rest of the tubes at 37 C.

**Activity 2:** to test for the activity of trypsin, 3 gtt of water were added to tubes labeled 1T and 2T. 3 gtt of trypsin were to tubes 1T, 3T, 4T and 5T. BAPNA synthetic color-producing substrates were added to tubes 2T, 3T after boiled trypsin, 4T and 5T. 5T temperature was 0°C, whilst the rest were 37°C .

**Activity 3:** to test for the activity of lipids. 5 gtt of water were added to tubes labeled 1L and 2L. 5ggtts of litmus cream were to tubes 3L,4L,5L,4B and 5B. Bile salt added to 4B and 5B. 3L was boiled for four minutes, then added litmus cream. Tubes 5L and 5B temperature was 0 C,whilst the rest are at 37 C.

## Results/Data

### Activity 1: Salivary Amylase Digestion of Starch

Tube #	1A	2A	3A	4A	5A	6A
Additives (3gtt ea)	Amylase + water	Starch + water	Maltose + water	Boil amylase 4 min, then add starch	Amylase + starch	Amylase + starch
Incubation condition	37 C	37 C	37 C	37 C	37 C	0 C
IKI test (color change)	Yellow	black	yellow	Dark purple	Yellow	black
Result (+) or (-)	-	+	-	+	-	+
Benedict's test (color change)	Blue	blue	orange	blue	red	red
Result (+) or (-)	-	-	+	-	+	+

**IKI test:** A blue-black color indicates the presence of starch as referred to a positive starch test, if starch is not present the mixture will not turn blue which is referred to as a negative starch test.

**Benedict's test:** green to orange is maltose is present and this is a positive sugar test. A negative sugar test is indicated by no color change.

### Activity 2: Trypsin Digestion of Protein

Tube #	1T	2T	3T	4T	5T
Additives (3gtt ea)	Trypsin + water	BAPNA + water	Boil trypsin 4 min then add BAPNA	Trypsin + BAPNA	Trypsin + BAPNA
Incubation condition	37 C	37 C	37 C	37 C	0 C
Color change	No change	No change	No change	yellow	Light yellow
Result (+) or (-)	-	-	-	+	+

The presence of yellow color indicates a positive hydrolysis test, if the sample stays clear then it will be a negative hydrolysis test.

### Activity 3: Pancreatic Lipase Digestion of Fats

Tube no.	1L	2L	3L	4L	5L	4B	5B
Additives ( 5gtt ea)	Pancreatin, water	Litmus cream, Water	Boil pancreatic 4 min, then add 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	0 C	0 C
Color change	blue/purple	blue/ purple	blue/pink	pink	purple	Bright pink	pink/purple
Results: (+) or (-)	-	-	-	+	+	+	+

If digestion occurs, the fatty acids produced will turn the litmus cream from blue to pink. The presence of pink indicates a positive test, and blue indicates no change.

### **Discussion/Conclusion**

The digestive system plays a very crucial part in our body function to help digest and absorb the food that we eat. All three experiments went as planned, the overall outcome of the test results gave an idea how enzymes break down certain substances. The results of experiment indicate that amylase does breakdown starch. However, specific temperature does affect the results of each of every experiment. For activity one, tube 5A and 6A had the same substance but 5A was at 37°C whereas 6A was at 0°C, resulting in the IKI color change being black in 6A and yellow in 5A. The digestion of protein is a process of hydrolysis. The presence of yellow in tubes 4T and 5T indicated a positive hydrolysis test but temperature did not affect these results, in this activity. 4T was at 37°C and 5T was at 0°C but both show a positive result. In Activity 3, the pink indicates digestion being occurred. A pH indicator called litmus blue is used in the test tubes, it changes the test tube from blue to pink as the test tube contents becomes acidic. In conclusion, the results were satisfied and all three tests showed the objective of the experiments can be accepted. In order for the experiments to be even more accurate, I would like the test tubes to be in more different temperatures and do the experiments a couple more times.

## References

Martini, F., Prentice-Hall Pub. (2011). The Digestive System. Fundamentals of Anatomy & Physiology 11th ed., Chapter 24, 578-589.

( 2017). NIH, National Institute for Diabetes and Digestive and Kidney Diseases. Your Digestive System & How it Works

<https://www.niddk.nih.gov/health-information/digestive-diseases/digestive-system-how-it-works>