

ISEF RESEARCH PLAN/PROJECT SUMMARY

Form #3

Research Plan

RATIONALE:

Proteins are digested in the body by a stomach enzyme called pepsin. Gastric chief cells secrete pepsin which is usually activated by lower pH levels in the stomach. I wanted to test how different pH levels affected the digestion of the protein albumin (egg white) to better understand the digestive system.

RESEARCH QUESTION(S):

How Does the pH Level Affect the Digestion of Protein?

HYPOTHESES:

Null: The pH level will not affect the digestion of protein.

Alternate: The pH level will affect the process of digesting the protein albumin.

Independent Variables:

pH level: 3; 4; 5; 6; 7 (control: pH 3 because it is the normal pH of stomach acid)

Constants: same temperature, light, amount of protein

Dependent Variable:

Analyze the number of proteins digested based on:
% of egg white dissolved after 30 minutes at 37 C.

Expected Outcome:

Lower pH levels will digest protein faster than higher pH levels.

RESEARCH METHODOLOGY:

Materials:

Egg white (hard-boiled), Test tubes or cups (6), Test tube rack, Dietary supplement containing pepsin, Vinegar, Sodium bicarbonate (baking soda), Distilled water, pepsin, Metric ruler, nitrile gloves, safety goggles,

Procedure:

To make 1% pepsin solution: Mix 4 g pepsin + 200 mL of distilled water. The solution must be made on the day of the experiment.

Label test tubes pH 3; pH 4; pH 5; pH 6; pH 7 and place them into the test tube rack. Make 5 mL solutions of vinegar + water to make 5 different solutions with pH 3, 4, 5, 6, and 7. Add 2 mL of pepsin to each test tube. Add 2 mL of each pH solution to the labeled pH test tube. Incubate all test tubes at 37 degrees Celsius for 30 minutes.

After 30 minutes, shake the tubes by inverting up and down for 3 minutes. Observe suspensions to determine if any small pieces of egg white are visible in the suspension (which means it has been digested from the solid cube of egg white). If there is no digestion (pieces of egg white in the suspension) then that means that no digestion took place. Analyze the amount of proteins digested based on % of egg white dissolved after 30 minutes at 37 C.

Repeat experiment with new solutions and egg whites for 5 more times. Average the results for each pH level and analyze data to determine if pH affected the breakdown of protein.

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How will you collect/measure data?

I will analyze the amount of proteins digested based on visually estimating the % of egg white dissolved after 30 minutes at 37 C.

RISK AND SAFETY:

Safety goggles will be worn to avoid splashing liquids into the eyes. Nitrile gloves will be worn when conducting experiments to protect the skin.

DATA ANALYSIS:

I will analyze the amount of proteins digested based on visually estimating the % of egg white dissolved after 30 minutes at 37 C.

Works Cited/BIBLIOGRAPHY:

- Bruso, Jessica. "Healthfully." *Healthfully*, 5 Dec. 2018, healthfully.com/effect-of-ph-on-digestion-7668606.html. Accessed 22 Oct. 2021.
- Cullen, Allison. "Why Is Your PH Balance so Important?" *www.avogel.co.uk*, 2 June 2017, www.avogel.co.uk/health/digestive-system/why-is-your-ph-balance-so-important/.
- Loomis Jr., Howard. "Digestion in the Stomach - Food Enzyme Institute." *Foodenzymeinstitute.com*, 2019, www.foodenzymeinstitute.com/content/Digestion-in-the-Stomach.aspx.
- Pick, Marcelle, et al. "Digestion & GI Health - the Truth about PH Balance." *Marcelle Pick, OB/GYN NP*, 4 Apr. 2017, marcellepick.com/digestion-gi-health-truth-ph-balance/.
- Schwalfenberg, Gerry K. "The Alkaline Diet: Is There Evidence That an Alkaline PH Diet Benefits Health?" *Journal of Environmental and Public Health*, vol. 2012, 2012, pp. 1-7, www.ncbi.nlm.nih.gov/pmc/articles/PMC3195546/, 10.1155/2012/727630.