

BIO LAB: Investigating Antacid Medication



LEVEL:
Year 11&12



TOPIC:
Physiology



TIME REQUIREMENT:
55 mins

CURRICULUM ALIGNMENT

- *Multicellular organisms have a hierarchical structural organisation of cells, tissues, organs and systems (ACSBLO54)*
- *The specialised structure and function of tissues, organs and systems can be related to cell differentiation and cell specialisation (ACSBLO55)*
- *In animals, the exchange of nutrients and wastes between the internal and external environments of the organism is facilitated by the structure and function of the cells and tissues of the digestive system (for example, villi structure and function), and the excretory system (for example, nephron structure and function) (ACSBLO57)*

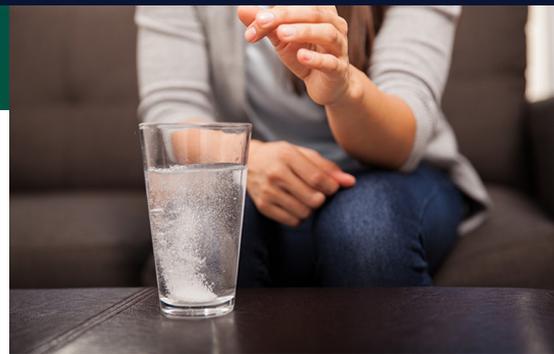
BACKGROUND

In a relaxed state, the average volume of the human stomach is 50 mL; however, it is capable of expanding to 400 litres. The lowest pH of secreted acid is roughly 0.8, which is then diluted within the stomach to produce an ideal pH of around 1.4. Pepsin is a digestive enzyme produced in the cells of the stomach lining that breaks proteins down into smaller peptides. To enable the action of Pepsin, the stomach secretes acid to produce the optimum pH. In the short term, excessive acid production result in acid indigestion. Prolonged and persistent levels of excess acid can cause ulceration in the stomach lining. In the short term, antacids may provide temporary relief. For the treatment of long-term imbalances, other medications are required.

In this practical, students use dilute Hydrochloric Acid to model the volume and concentration of our stomach contents. Students test the effectiveness of an assortment of over the counter antacid powders, tablets and liquids on their 'model' stomach. Students monitor changing pH in their stomach model using a Universal Indicator Solution (or a pH probe). Students observe how different antacids at recommended doses react to the "stomach" contents. This practical is a comparison of the effects of different antacids and prompts discussion into the consequences of prolonged usage.

PREPARATION - BY LAB TECHNICIAN

- 1 To make the Hydrochloric Acid Solution, add 1 mL of 1 M Hydrochloric Acid to 9mL of distilled water to make a 0.1M dilution. Collect 1 mL of this dilution using a pipette and dilute in 9 mL of distilled water to make a 0.01M dilution.
- 2 Record the details of the antacid medications and dosage information located on the packaging. Make enough copies for each group to refer to.
- 3 Prepare 2 beakers. Fill them with 50 mL of water and indicator, to show what a neutral pH would look like.
- 4 Measure 50 mL of dilute acid into two beakers. Add Universal indicator until the colour is clearly visible.
- 5 Reserve one of the beakers as a comparison (Control) as minor differences the acid pH range can be difficult to identify.



MATERIALS

- 0.01M Hydrochloric Acid
- Cold Ethanol/91% Isopropyl Alcohol
- Universal Indicator
- Selection of over the counter Antacids
- Dropping Bottles
- Beakers (250 mL)
- Measuring Cylinder (100 mL)
- Morter and Pestle



SAFETY PRECAUTIONS

- Wear appropriate personal protective equipment (PPE).
- Handle Hydrochloric acid with care as it is a hazardous chemical
- Keep the Universal indicator away from open flames as it is flammable



METHOD - STUDENT PRACTICAL

- 1 Crush the antacids in tablet form by grinding with a mortar and pestle.
- 2 Add antacid to the other beaker according to the standard dose recorded earlier, and observe the colour change. Note down these changes.
- 3 Observe which antacid has the biggest or fastest impact on the solution. Identify and record any other changes, such as effervescence.
- 4 Using a pH probe, plot a graph of the pH over 10-15 minutes.



OBSERVATION AND RESULTS

- Note how the pH levels alter only very slightly as a result of the addition of the antacid.
- Compare how liquids with powders react and the speed of their reaction, and why.



INVESTIGATIONS

- To delve into a more comprehensive exploration of the stomach and its structures, you may investigate other over-the-counter medications which can influence indigestion, such as those with a mucilaginous component. Mucilaginous components coat the stomach lining, and prevent lining tissue damage from acid.
- Discuss with your students the potentially negative impacts that can result from long-term use of antacids, including regular use of antacids raising the normal pH of the stomach
- Discuss the possibility that the gastric lining is stimulated into producing even more acid, as the body's natural mechanisms for maintaining balance are disturbed.



EXTENSION EXERCISE

- Before commencing the practical, get students to brainstorm all of the 'brands' of antacids that they know.
- Discuss the 'promises' made in the advertisements.
- After the practical, discuss whether the promises made in the advertisements are realistic or not.