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Comparative Study of Anti acidity Medication: An Analysis of Neutralisation Capacity

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***Abstract*— This study aimed to analyse the effectiveness of different commercial medicines when reducing stomach acidity. The primary goal of the procedure was to compare the efficiency of different anti acidity brands when it comes to neutralising HCl, and to spot any significant differences.**

An experiment was conducted using an HCl solution of molarity replicating stomach conditions, and a standardised solution of NaOH. Four different samples were tested. Powdered samples were added to separate acidic solutions, and were actively monitored through titration. Data was expressed in table and graph form.

The experiment revealed varying degrees of effectiveness amongst the Anti acidity samples. Rabesil demonstrated the highest neutralising capacity. Gelusil and Opera showed moderate performance, while Esomesil was the least effective. Data plotting confirmed these differences between the brands.

The study concluded that medicinal effectiveness varies significantly among different brands. Unusual results of PPIs Rabesil, Esomesil and Opera show that a more detailed analysis can be performed. The results highlight the importance of evaluating antacid products and PPIs based on their inhibition capacity rather than branding alone. This contributes well to the amount of relief customers can expect when trying such medicines.

***Index Terms*— Commercial Medicines, Stomach Acidity, Anti Acidity Brands, Neutralising HCl**

I. INTRODUCTION

Antacids are over-the-counter medications designed to neutralise stomach acid, providing rapid relief from heartburn and indigestion. They work by directly counteracting excess hydrochloric acid in the stomach, thus raising the pH to reduce acidity. Commonly available in tablet, liquid, or chewable forms, antacids contain active ingredients such as magnesium hydroxide, calcium carbonate, etc. These compounds react in the stomach to produce neutral substances, easing the burning sensation of discomfort. Antacids are typically used for short-term relief and are a popular choice for managing acidity related conditions.

PPIs (proton pump inhibitors) are similar medications which significantly help in easing stomach acidity, by preventing the stomach lining from releasing gastric acid. They may also contain inactive substances which contribute to acid neutralisation.

Testing commercial brands of anti acidity medicines is crucial to ensure their efficiency and safety for consumers. They vary significantly in their composition and thus effectiveness. Previous research has demonstrated that not all antacids provide consistent relief or have the same duration of action. *(Studies such as those conducted by the American Journal of Gastroenterology have highlighted that among different brands, some may not meet their labelled claims. Moreover, research published in the Journal of Clinical Pharmacology has raised concerns about potential interactions between antacids and other medications)* Ensuring that such medicines are properly examined helps maintain safety standards, ensures proper dosage, and protects consumers from ineffective or potentially harmful products.

Our experiment was performed solely to compare the activity of four different commercially sold pills. The procedure replicates the conditions that could be found in the body, specifically the acid concentrations. Our aim is to show how different products and their formulation can evidently affect their neutralising capacity, as well as to see if the products which function through proton pump inhibition can still affect HCl concentration.

This study is conducted from a perspective of academic curiosity and does not wish to criticise or condone the pharmaceutical companies involved, due to a lack of extensively reliable data.

II. THEORY

- **Gelusil:** Gelusil tablets are composed of ingredients such as aluminium and magnesium hydroxide, Silicate (for neutralisation), as well as simethicone (an anti-foaming agent which reduces bloating)
- **Rabesil:** while Rabesil does not primarily work by neutralisation, it contains active substances such as simethicone and rabeprazole sodium (a proton pump inhibitor/PPI). Tablets do include inactive ingredients which could possibly counteract HCl.
- **Esomesil:** of almost a similar composition as that of Rabesil, except the active PPI present is esomeprazole magnesium. Again, tablets do include inactive ingredients which could possibly counteract HCl.
- **Opera:** it is in the form of a capsule, due to the nature and density of ingredients such as ozemprazole. It also works through PPI.

All medications except for Gelusil are manufactured by Vassil Pharma. Dosages vary

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III. METHOD

- **Independent variable:** Type of medicine used (0.2g of Gelusil, Opera, Rabesil and Esomesil each)
- **Dependant variable:** Amount of HCl (at 0.1 M) neutralised
- **Controlled variables:** Concentration of NaOH and HCl stock solutions, mass of medicine used. Identical, clean apparatus was used in each experiment, performed at a constant room temperature.
- **Materials:** leaflets, burette, conical/erlenmeyer flasks, pipette, measuring cylinders, weighing balance

The indicator phenolphthalein (col.less to pale purple) was used.

1. Standardisation of NaOH solution:

- Done in order to determine the concentration of the NaOH stock solution.
- Prepare and keep an HCl stock solution with a concentration of 0.1 mol/l (this replicates the molarity of stomach acid fluid)
- Pipette 25ml of the HCl solution into a conical flask. Add a few drops of indicator
- Fill a burette with the NaOH solution of unknown conc. Place it with a clamp stand over the conical flask.
- Start the titration, swirling the flask regularly, and note the amount of NaOH needed to reach the end point (colour change).
- Repeat until at least two concordant readings are obtained
- Use the reading to calculate the molarity of NaOH needed using this formula: **C1V1 = C2V2** as (NaOH+ HCl is a balanced reaction with a molar ratio 1:1). Record the concentration of your stock solution.

Step 1 can be considered a control experiment, showing that NaOH is evidently neutralising and raising the pH of the solution. The reaction taking place is: NaOH+ HCl → NaCl+ H2O

The standardised solution for this experiment had a concentration of 0.1 moles NaOH per litre

2. Preparation of a sample:

- In order to create a sample, take the medicinal pill and grind it into a fine powder with a mortar and pestle. Transfer the powder onto a thin leaflet/filter paper.
- Rinse the mortar and pestle with distilled water, dry, and repeat for the other brands.
- If the medicine is in the form of a capsule, there is no need to crush it, instead directly transfer the powder onto a paper.
- Using a machine, weigh out 0.2g of a sample and transfer into a 250ml Erlenmeyer flask. Repeat for the other tablets.
- At the end, there should be four flasks with a known amount of medicine in each.

3. Titration:

- Pipette 25 ml of HCl stock solution (at 0.1M) into each Erlenmeyer flask, and swirl until dissolved. Add a few drops of indicator. **The antacids are hence prepared for analysis.**
- Prepare a clean burette and fill it with NaOH stock solution. Make sure there are no air bubbles at the jet. Record an initial reading.
- Titrate against one of the antacid solutions until you reach an endpoint/colour change. Record the final reading.
- Note the volume of NaOH required to neutralise the rest of the HCl (final reading – initial reading).
- Repeat with the other 3 samples.

Repeat steps 2 and 3 until you have at least two concordant titre readings for each medicine sample.

4. Recording your results:

- Record the results in a table, with appropriate units and a mean final value
- Readings can also be plotted on a bar graph
- Note any anomalous results.

5. Reaching a conclusion:

- **In general, the solution which requires the least amount of NaOH contains the most effective sample, as the sample would have already neutralised most of the HCl added.**
- This is in assumption that the 25 ml of HCl added is in excess
- It is also possible to convert the volumes into mole values by calculation. However, the reading should be enough to draw a conclusion.

6. Precautions:

- This is a medium risk experiment, as the diluted NaOH and HCl solutions can be corrosive/harmful for the skin
- Wear chemically resistant gloves and safety goggles, including a lab coat

IV. DATA ANALYSIS AND CONCLUSION

	Change in Reading/ml			
SAMPLE	TRIAL 1	TRIAL 2	TRIAL 3	FINAL
GELUSIL	16.0	16.4	16.1	16.1
Esomesil	22.2	22.5	22.2	22.2
Rabesil	15.3	15.3	15.5	15.3
Opera	19.9	19.7	19.9	19.9

Table 1

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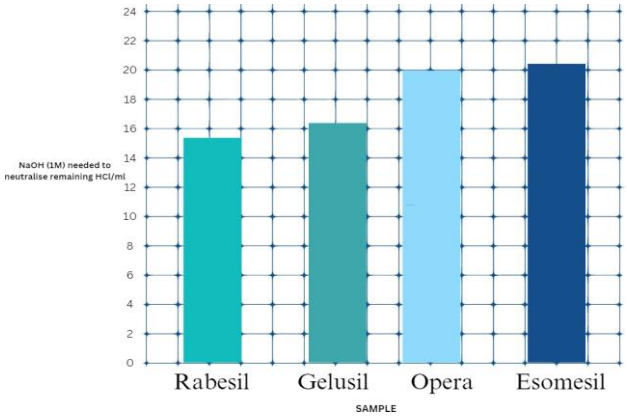
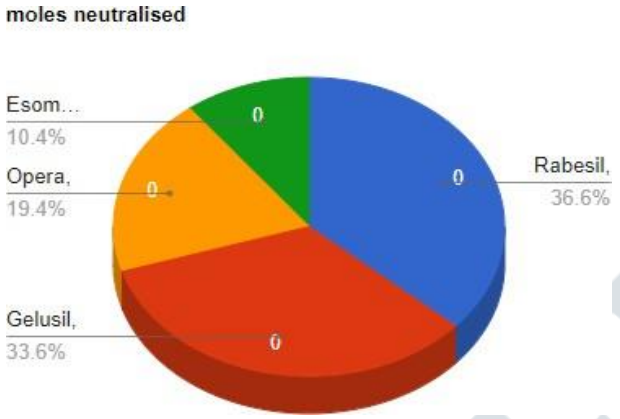
Volume 11 Issue 8 August 2024



Graph 1



Pie Chart 1

V. ANALYSIS

Multiple readings from Table 1.0 were taken into consideration, and anomalous results (such as 22.5ml and 16.4ml) were excluded in the calculation of the mean, final result.

According to the readings:

- 0.1g of Rabesil neutralised 0.00049 mols of HCl
- 0.1g of Gelusil neutralised 0.00045 mols of HCl
- 0.1g of Opera neutralised 0.00026 mols of HCl
- 0.1g of Esomesil neutralised 0.00014 mols of HCl

VI. CONCLUSION

The study aimed to analyse the Neutralising capacity of different commercial medicines for stomach acidity. The primary goal of the procedure was to compare the efficiency of when it comes to neutralising HCl. The experiment was conducted using an HCl solution of molarity

same as stomach conditions, and a standardised solution of NaOH. Four different samples were tested. Powdered samples were reacted with HCl and the solution was monitored through titration. Data was expressed in table and graph form.

The graph clearly illustrates the variations in the neutralising capacities of the different samples tested, and helps reach the conclusion that:

- Rabesil demonstrates the most effective performance, as it requires the smallest volume of NaOH solution to neutralise the remaining hydrochloric acid (HCl). This suggests that Rabesil is particularly good at inhibiting the activity of HCl.
- Following Rabesil, Gelusil and Opera also show moderate results, with Gelusil showing a notably higher neutralising capacity compared to Opera. Specifically, Gelusil necessitates an average of 3.8 millilitres less NaOH to achieve the same effect against HCl.
- In contrast, Esomesil emerges as the least effective option among the samples tested. The significantly higher volume of NaOH required for neutralisation indicates that Esomesil neutralises only a minimal amount of HCl, highlighting a lower efficiency in neutralising the acid.

VII. REFLECTIONS

- Experiments could evolve a judgement error involving determining the end point.
- Despite maintaining clean apparatuses, contamination can occur in a school laboratory
- Different anti acidity tablets are also composed of many binding agents and lubricants (such as Magnesium stearate, Magnesium cellulose, etc) which can affect the accuracy of the procedure.
- A more detailed analysis of PPIs like Rabesil could give rise to more accurate experimental procedures, keeping in mind the composition of the medicines.

REFERENCES

[1]. Levine, Jeffrey G., M.D., Amanda Murakami, B.S., Christine Furtek, B.S., Robert Tipping, M.S., and Scott Korn, M.D. “Famotidine/Antacid Combination Tablets Are More Effective for the Treatment of Heartburn Than Either Component Alone.” *American Journal of Gastroenterology* 99, no. 10 (October 2004): S2.

[2]. Salisbury, B. H., and J. M. Terrell. “Antacids.” PubMed ID 30252305.

[3]. Brindle, Harry. “The Chemical Evaluation of Antacids.” *Journal of Pharmacy and Pharmacology* 5, no. 1 (August-September 1953): 15-22.

[4]. Heidelbaugh, Joel J., M.D., Kathleen L. Goldberg, Pharm D, and John M. Inadomi, M.D. “Overutilization of Proton Pump Inhibitors: A Review of Cost-Effectiveness and Risk in PPI.” *American Journal of Gastroenterology* 104, no. 3 (March 2009): S27-S32.

[5]. Breuhaus, Herbert C., and James B. Eyerly. “Antacids: Their Effect by Titration and within the Human Stomach.” *Annals of Internal Medicine* 14 (1941): 2285-2291.