



Evaluation of Neutralizing Capacity of Different Commercial Brands of Antacid Tablets

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ABSTRACT

This study is based on the evaluation of acid neutralizing capacity of five different commercial brands of antacid tablets. Five different but widely used commercial antacid tablets were selected for the purpose of this study. Each of the sample tablets was purchased, crushed, weighed and kept at room temperature before being analyzed using titrimetric method. Titration of each sample tablet (0.5 g) dissolved in 20 cm³ of 0.1 M HCl with 0.1 M NaOH was carried out and the average titer values of different runs were recorded. The titre value for Gaviscon was 9.20 cm³, 13.04 cm³ for Gestid, 10.02 cm³ for Danacid, 10.10 cm³ for Cimetidine and 10.05 cm³ for Rennietidine. The neutralizing capacity (NC) of Gaviscon was found to be 82.6%, 53.4% for Gestid, 64.8% for Danacid, 49.8% for Cimetidine and 36.6% for Rennietidine. Analysis of the results shows that Gaviscon tablet has the highest NC, while Rennietidine shows lower NC value.

Keywords: Antacid, Neutralizing capacity, Titrimetric, Tablets, Ulcer

INTRODUCTION

Antacid is any substance, generally a base or basic salt, which neutralizes stomach acidity. Antacids are pharmaceutical drugs being basic in nature and having a characteristic ability to neutralize an acid of the gastric content (such as stomach) and thus lower the acidity of the content (van Riet-Nales *et al.*, 2002). Antacid works on the basis of different mechanism including directly neutralising acidity, increasing the pH or reversibly reducing or blocking the secretion of acid by the gastric cell to reduce acidity in the stomach (Pali, *et al.*, 2011). They are generally used to relieve acid indigestion, stomach upset, sour stomach and heartburn. Antacids also prevent irritation of the stomach ulcer and help relieve any pain which is associated with such ulcer. In addition antacid are known to reduce peptic activity by acting as pepsins. All antacids contain bases with a net pH above 7 and have a buffer (substances that help minimize changes in the concentrations of hydrogen (H⁺) and hydroxyl (OH⁻) ions). Changing of the gastric content to pH 4.0 and 4.2, antacids prevent irritation of the ulcer and relieve pain (van Riet-Nales *et al.*, 2002). They also reduce peptic activity as pepsin is inactive at this pH 4.0 and above. However, they do not affect the rate of healing of peptic ulcer but are used to relieve ulcer pain and encourage healing (Farzaei *et al.*, 2013). It is also reported that antacids promote the healing in duodenal ulcer (Zajac *et al.*, 2013). Different brands of antacids are now available for the relieve

of heartburn and peptic ulcer pain. Commercial antacid comes in two forms, either as liquids or as solid tablets. The principal constituents of antacids are magnesium and aluminum as hydroxides alone or in combination (Smith *et al.*, 1976). Some contains salt of calcium, sodium, carbon or bismuth. The effectiveness of each antacid depends on its neutralizing capacity and the transit time in the stomach. Liquid preparations of antacids are more effective than the solid ones (tablets) because the constituents are already in their form (Duffy *et al.*, 1982).

This research work is aimed at evaluating the acid neutralizing capacity of five different commercial brands of antacid tablets using titrimetric method of analysis.

MATERIALS AND METHODS

Pharmaceutical drugs used

The five different brands of commercial antacids tablet used in this research work were purchased in Damaturu at Gidantu Patient medicine store, along Maiduguri road opposite Government House Damaturu, Yobe state. These are Danacid, Cimetidine, Gaviscon, Gestid and Rennietidine all in form of tablets.

PREPARATION OF SAMPLES AND REAGENTS

0.1 M Hydrochloric Acid Solution

0.1 M HCl was prepared by diluting 8.6 cm³ of 12 M HCl with deionized water in 1litre

volumetric flask. After the addition of the acid the volume of the flask was made to the mark using deionised water.

0.1M Sodium Hydroxide Solution

0.1 M NaOH was prepared by dissolving 4.0 g of NaOH with deionized water in 1litre volumetric flask. After the dissolution process, the volume was made to the mark.

0.1 M Potassium Hydrogen Phthalate (KHP) Solution

2.04 g of KHP was weighed and properly dissolved with deionized water in 100 cm³ volumetric flask. After the dissolution process, the volume was made to the mark with the deionized water.

Standardization of Sodium Hydroxide Solution

20 cm³ of 0.1 M KHP was measured into a 250 cm³ Erlenmeyer flask followed by the addition of 3 drops of phenolphthalein indicator. The solution was titrated with 0.1 M sodium hydroxide solution until it turns pink which persisted for at least 30 seconds. The volume of 0.1 M NaOH solution used was recorded. The titration procedure was repeated 3 more times, and the average titre value was recorded.

Standardization of Hydrochloric Acid Solution

20 cm³ of the 0.1 M HCl solution was measured into a 250 cm³ Erlenmeyer flask followed by the addition of 3 drops of phenolphthalein indicator. The solution was then

titrated with 0.1 M NaOH until the solution turns pink which persisted for 30 seconds without fading. The titration procedure was repeated 3 times, and the average titre value was recorded.

Evaluation of the Neutralizing Capacity of Antacids Tablets

Sample of each antacids tablet was separately weighed and crushed using a mortar and pestle. 0.5 g of the crushed tablet was weight and transferred into a 250 cm³ Erlenmeyer flask. This is followed by the addition 20 cm³ of the standardized HCl solution and swirled gently to dissolve the crush tablet as completely as possible. 3 drops of bromophenol blue indicator were added to the solution which then turns yellow (if the solution is still blue, then additional 10 cm³ of HCl is required until the solution is yellow). The solution was titrated with the standardized NaOH until it turns blue (van Dop, *et al.*, 1976 and Lin, *et al.*, 1998). The titration procedure was repeated 3 times, and the average titre value was recorded.

The same procedure was repeated on all the other brands of antacid tablets and the average titre value of the NaOH solution required to neutralize the excess acid (HCl) for each brand of the antacid was recorded.

RESULTS AND DISCUSSION

Analysis of Antacid Tablets

Analysis of the different commercial brand of antacids tablet was carried out to evaluate their acid neutralizing capacity and results was given in Table 1.

TABLE 1: Results of antacid tablets analysis

	Danacid	Cimetidine	Gaviscon	Gestid	Rennietidine
Titre value (cm ³)	10.02	10.10	9.20	13.04	10.05
Total amount of HCl used (mol.) x 10 ⁻³	2.0	2.0	2.0	2.0	2.0
Amount HCl neutralized by NaOH (mol.) x 10 ⁻³	1.002	1.010	0.920	1.304	1.005
Excess HCl neutralized by Antacid (mol.) x 10 ⁻⁴	9.98	9.90	10.80	6.96	9.95
Mass of Antacid used (g)	0.5	0.5	0.5	0.5	0.5
Molar mass of the antacid (g/mol)	325	252	382	383	184
Excess HCl neutralized by a molar mass unit of Antacid (g/mol)	0.324	0.249	0.413	0.267	0.183
NC or % of Excess HCl neutralized	64.8	49.8	82.6	53.4	36.6

According to the results obtained in the analysis of different brands of antacid tablets (Table 1), it was clear that Gaviscon tablet shows lower average titer value of 9.20 cm³, while Gestid tablet has the highest average titer value of 13.04 cm³. This indicate that Gaviscon with the lower average titre value records the highest value of the excess HCl neutralized, while Gestid with the highest titre value records the lowest value of the excess HCl neutralized. This means more amount Gestid is needed to neutralize same amount of HCl

compared to other antacids used in the study. Similarly, less amount of Gaviscon is needed to neutralize same amount of HCl compared to the rest of the antacids used in the study.

The total amount of HCl (mole) used was determined using the equation (1), while the amount of HCl (mole) neutralized by NaOH was determined using the expression (2). The amount of excess HCl neutralized by antacid was determined by subtracting the amount of HCl neutralized by

$$\text{Total amount of HCl (mole) used} = \frac{\text{molrity of HCl} \times \text{vol. (cm}^3\text{) of HCl}}{1000\text{cm}^3} \dots\dots (1)$$

$$\text{Amount of HCl neutralised by NaOH} = \frac{\text{molarity of HCl} \times \text{Titre value (cm}^3\text{)}}{1000\text{cm}^3} \dots\dots(2)$$

$$\text{Excess HCl neutralized by antacid} = M_{(\text{HCl})} - M_{(\text{HCl neutralized by NaOH})} \dots\dots\dots (3)$$

The moles of excess HCl neutralized was multiplied by the molar mass of the antacid and in order to get the moles of excess HCl per molar mass unit of the antacid.

Each antacid tablet has different active ingredient, so for Gaviscon contains NaHCO_3 , CaCO_3 and $\text{NaC}_6\text{H}_7\text{O}_6$; Gestid has $\text{Mg}_2\text{O}_8\text{Si}_3$, Al(OH)_3 and

Mg(OH)_2 ; Danacid has $\text{Mg}_2\text{O}_8\text{Si}_3$ and Al(OH)_3 ; Rennietidine has CaCO_3 and MgCO_3 ; while Cimetidine has $\text{C}_{10}\text{H}_{16}\text{N}_6\text{S}$.

Percentage of the excess HCl neutralized or the neutralizing capacity was calculated for each brand of antacids as follows;

$$\text{NC or \% of Excess HCl Neutralised} = \frac{\text{Amount of excess HCl neutralised per molar mass unit of antiacid}}{\text{mass of antiacid}} \times 100$$

Therefore, it was clear from the results that Gaviscon gives the highest neutralizing capacity of 82.6% while, Rennietidine represent the tablet with lowest neutralizing capacity of 36.6%.

CONCLUSION

From the results shown it was clear that Gaviscon tablet is more active, because it neutralized more amount of acid than the rest. It is recommended that further work should be carried out on other antacid drugs particularly on the enzymatic assay, cytotoxicity and tissue absorption to fully ascertain their neutralizing capacity.

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