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Research Article

# Analytical Study of Some Drug Brands Used to Treat Stomach Acidity

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## Abstract

This study is predicated on the assessment of the acid-neutralizing capacity of five distinct commercial brands of antacid. Antacids are prevalent substances utilized by individuals experiencing heightened gastric acidity, owing to their widespread availability in pharmacies. Consequently, this investigation concentrated on several brands of antacid medications, which function as weak bases that neutralize excess stomach acidity, thereby elevating the pH. The quantity of acid neutralized by each antacid was determined through back titration. The acid-neutralizing capacities of the brands were ranked as follows: A > B > E > D > C. The pH of the acid was measured after being heated to a temperature of 37 ℃, followed by the addition of the antacid, with a subsequent observation period of five minutes post-addition. The results regarding the impact of the antacids on acid pH were recorded as 6.95 for sample A, 6.74 for sample B, 4.58 for brand C, 1.76 for sample E, and 1.73 for sample D. An analysis of the findings indicates that sample A exhibits the highest neutralizing capacity (NC), whereas sample C demonstrates a significantly lower value of neutralizing capacity (NC).

## Keywords

Antacid, Neutralizing Capacity, Titrimetric, Tablets, pH

## 1. Introduction

The stomach plays a vital role in the digestive process as it receives, stores, and digests food that comes from the esophagus. It is influenced by various factors that contribute to what is commonly referred to as gastric digestion. Within the stomach, there are specialized glands located in the mucous membrane. These glands are responsible for producing gastric juice, which is essential for the digestive process and is responsible for stimulating the digestive process through the release of various hormones and chemicals. The composition of the stomach juice includes water, enzymes, and hydrochloric acid. This acid is produced by the acid cells located in the gastric glands, which are found in the base glands of the stomach, which secretes large amounts of hydrochloric acid. Its concentration in gastric juice is about 0.1% (PH = 2). The acid concentration in eosinophils is much higher and ranges from 0.4 to 0.5 (PH =1) [1]. Moreover, this acid plays a major role in the digestion of proteins by activating digestive enzymes that work together to break down the long chains of amino acids in proteins. The acidic nature of the stomach also converts inactive forms of digestive enzymes into active forms such as pepsinogen which converts to pepsin, and also acts as a stomach cleanser by killing bacterial pathogens.

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resulting in symptomatic relief of pain. Antacids also increase the esophageal sphincter lower tone so reduce the reflux of gastric acid or content to the esophagus and also acts as a disinfection of the stomach by killing bacterial pathogens [2].

However, acidity which may result from indigestion or uncontrolled increase in the intensity of hydrochloric acid within the stomach, leads to sensory symptoms of stomach incineration resulting from acid reflux and may contribute to the formation of stomach inflammation and ulceration [3, 4]. Burning sensation in the stomach is a common symptom of various health issues, including gastroesophageal reflux disease. Occasional stomach acidity can last from a few minutes to hours and is typically managed at home using over-the-counter antacids. Moreover, persistent or recurrent stomach burning may indicate an underlying health problem that requires medical attention. Stomach burning often worsens after meals, especially when the individual lies down immediately after eating. Symptoms of heartburn can include: a hot or sour taste in the mouth, a burning sensation in the throat resulting in difficulty swallowing, warmth or heat in the center of the chest, and pressure or pain behind the breastbone [5]. For limiting the production of gastric acid using Proton Pump Inhibitors (PPIs), which inhibit acid-producing cells, and $H_2$ receptor antagonists, which block excess acid production in the stomach, along with promoting the reformation of the gastric mucosal lining are the primary methods for treating peptic ulcers. This has led to the introduction of various medications over time, providing more advanced options for treating peptic ulcers and stomach acidity. Therefore, it is recommended to treat and relieve stomach acidity pain using antacids to control hyperacidity, neutralize excess acid, and stop the painful burning sensation in the stomach. Antacids are considered one of the oldest and most effective treatments for indigestion and other problems associated with stomach acid [4, 6]. Antacids work by neutralizing the hydrochloric acid (HCL) released from stomach cells and thus increasing the pH in the stomach. All antacids contain bases with a pH higher than (7) and thus work to change the stomach content to pH (4) or higher, and when the pH in the stomach rises to a pH greater than (3), the excess protease acid (HCL) of pepsin is neutralized, and thus the antacid works through several mechanisms that include direct neutralization of the acid and an increase in the pH or inhibiting the secretion of antacids that irritate stomach ulcers, and help relieve any pain associated with such ulcers [5]. Many brands of antacids are available under different brand names such as Rennie, Famotin, Malook, and others. They are found in various forms such as tablets, powders, and liquids as suspensions. While antacids as a whole are supposed to actively contribute to the antacid action, the active ingredient plays the main role of neutralization. The most common active ingredients come in the form of carbonates, bicarbonates and hydroxides, for example the majority of companies use sodium bicarbonate ($NaHCO_3$), magnesium hydroxide ($Mg(OH)_2$), aluminum hydroxide ($Al(OH)_3$) or calcium carbonate. ($CaCO_3$) as the base that neutralizes with stomach acid inside the digestive system to form salt, carbon dioxide gas, and water [4, 6]. And recently, foaming formulations containing alginate (alginic acid) have been marketed under various trade names. Including (Gaviscon), which works through a unique mechanism that differs from that used in traditional antacids. Formulations consisting of a gelatinous layer of alginate contain the form of sodium or potassium bicarbonate [7]. In the presence of stomach acid, the bicarbonate is converted to carbon dioxide, which is trapped within a precipitate. It is gelatinous and turns it into a foam that floats on the surface of the stomach contents. The strength of the alginate collar depends on several factors including the amount of carbon dioxide generated and trapped in the collar, the molecular properties of the alginate, and the presence of aluminum or calcium in the antacid components of the formulation [8]. The effectiveness of antacids depends on their ability to neutralize acid, which differ from each other according to their chemical structures, and the therapeutic effectiveness and harmful effects depend on the combination of common ions with the base, which are aluminum, magnesium, sodium, and calcium [9]. On the other hand, antacids can affect the absorption of other medications. Sometimes a person can solve this by taking antacids at a different time than other medications [10]. Regarding the study of antacids, many studies were conducted on different samples of antacids in order to determine their effectiveness and evaluate their ability to neutralize acid, including the Libyan study conducted by Adel Ahmed and others [11] in which the back titration method was used to estimate the percentage of the active substance in the studied samples. The results showed that the percentage of the active ingredient in the first sample (Rennie) was higher than the percentage of the active ingredient in the second sample (Maloox), which was 89.26% and 31.15%, respectively [11]. Also, study was conducted in Nigeria by Ahmed Muhammad and others for some different types of antacid tablets, where the acid neutralization capacity (ANC) of the samples was expressed in terms of the number of milliequivalents of acid (MEq) reacting with the base present in the antacid tablet [12]. The results of this analysis showed that all samples were effective against acid, but at different levels or degrees. Gelusil Danacid was the most active antacid and gave the highest value of milliequivalents of acid (40.5 MEq), while Cimetidine was the least active antacid among the samples studied. The lowest value of milliequivalents of acid (32.0 Meq), meaning the least ability to neutralize the acid [12]. In the year (2015), a study was also conducted in Nigeria by Abbagana Mohammad and others for different samples of antacid tablets, in which back titration was used to evaluate the acid neutralization ability. According to the results obtained, it was found that the Gaviscon tablet had the highest neutralization ability of 82.6%, while Rennietidne showed the lowest neutralization value of 36.6% [13]. Another study was conducted in Morocco by Muhammad Yaqut and others [14] to evaluate the acid-neutralizing ability of antacid drugs and other properties. The results showed that

samples containing in their composition aluminum hydroxide/magnesium hydroxide have a superior ability to neutralize acids, higher than other samples, and the oral suspensions showed Better results compared to other pharmaceutical forms [14]. In the Iraqi study, researchers conducted an experiment on various types of antacids using the back titration method to estimate their acid-neutralizing capacity. The aim was to determine the potency of these antacids by measuring their ability to neutralize excess stomach acid, which is crucial for providing symptomatic relief from indigestion and heartburn [12]. As a result, the Rennie chewable tablet had the highest ability to neutralize acid, while the suspensions showed the lowest ability to neutralize acid. This study aimed to compare different antacid formulations available in pharmacies and identify which ones are most effective in neutralizing stomach acidity and altering pH levels.

## 2. Materials

Hydrochloric acid (HCl 0.1 M), Sodium hydroxide (NaOH 0.1 M), phenolnaphthalene indicator (ph.ph), distilled water. Sensitive balance, 250 ml conical flasks, 10ml and 5ml pipette, 25 ml burette, PH meter made by (CG 818), Water bath, Stirrer motor (JENWay 1002) and Pestle and mortar.

## 3. Experimental

### 3.1. Sample Collection

Five different types of antacid drugs were collected in Al-Khums city. The following Table 1 shows the name of the samples and the active ingredient in their composition.

***Table 1.*** *The number of samples and the active ingredient for each sample.*

| Sample number | The active ingredient (active substance) of the sample |
|---|---|
| Brand A | Calcium carbonate $CaCO_3$, magnesium carbonate $MgCO_3$ |
| Brand B | Sodium alginate, magnesium bicarbonate $MgHCO_3$ |
| Brand C | Magnesium hydroxide $Mg(OH)_2$ – Aluminum hydroxide $Al(OH)_3$ |
| Brand D | 1,3-thiazole, a sulfonamide and a member of guanidine |
| Brand E | L-Methoxy 2-[(5)-(4-methoxy3,5-dimethylpyridin-2-yl)methyl]sulfinyl]1-benzimidazole |

### 3.2. Sample Preparation

Solid samples were prepared by taking a sample from each antacid tablet and crushing it separately using a mortar and pestle. 0.5 g of the crushed tablet was weighed and transferred to a conical flask.

### 3.3. Measurement of the Acid Neutralization Capacity of Antacid Samples by Volumetric Titrations (Neutralization Titrations) by the Back Titration Method

The prepared sample was dissolving in 25 ml of 0.1 M hydrochloric acid (HCl) and placed in titration flask. The contents of the flask were shaken using a magnetic stirrer to help dissolve the sample, and the solution was heated for three minutes, then was cooled to room temperature. 2-3 drops of ph. ph indicator were added to the sample solution. Then the sample was titrated with 0.1N NaOH. For the liquid sample, an amount of 0.5 grams was weighed and performed as in the case of solid samples [14, 15].

### 3.4. Measuring the Effect of Some Samples of Antacids on the pH of the Acid (HCl) Using pH Meter

The pH of the acid (HCl) was measured after adding the antacid according to the following 25 ml of hydrochloric acid (HCl) was measured using a pipette and placed in a 100 ml beaker and the pH of the acid was measured using a pH meter, then acid solution was heated using a water bath. A whole tablet powder of the sample was added to the hot acid solution (37 ℃). After 5 minutes, pH electrode was placed in the sample solution and the device reading was recorded. The previous steps were repeated with the rest of the samples (in the case of the liquid sample, a dose of 5 ml was taken from the sample and performed as in the case of solid samples) [16].

### 3.5. Calculating the Results of the Acid Neutralization Capacity of Samples Using the Back Titration Method

When an antacid is dissolved in an excess amount of acid (HCl), part of the added acid is neutralized by the base present

in the antacid, and when titrated with a base such as (NaOH), the remaining acid (excess acid) is neutralized, and at the equivalence point the number of moles of (NaOH) is equal. Additive is the number of moles of hydrochloric acid remaining after reacting with the base in the antacid.

The following is a table showing the consumed volumes of (NaOH) required to calibrate each sample, noting that the consumed volume of (NaOH) recorded in the table is the average after 3 readings for each sample.

***Table 2.*** *The consumed volume of (NaOH).*

| Sample number | Volume of acid used (HCl) ml | Consumed volume of (NaOH) ml |
|---|---|---|
| Brand A | 25 | 0.7 |
| Brand B | 25 | 12.8 |
| Brand C | 25 | 15.3 |
| Brand D | 25 | 16.3 |
| Brand E | 25 | 15 |

Calibration results are calculated by following the following steps:

Number of moles of acid = molarity (M) x volume in liters (V)

$= 0.1 \times 25 \times 10^{-3} = 0.0025$ mol

Calculate the number of moles of acid neutralized by the base (NaOH) using the following law:

Number of moles of acid neutralized by (NaOH) = molar concentration (NaOH) x titrated volume in liters

Substituting in the law for sample (A) we find that:

0.1 x 0.7 x 10-3 = 0.00007 mol

Calculate the number of moles of acid reacting with the antacid using the following law:

Number of moles of acid reacting with the antacid = number of moles of acid – number of moles of acid neutralized by (NaOH)

0.0025 – 0.00007 = 0.00243 mol

Calculate the percentage of acid that was neutralized by the antacid using the following rule:

$$\text{Percentage of neutralization} = \frac{The\ number\ of\ moles\ of\ acid\ reacting\ with\ the\ antiacidcxMolecular\ weight\ of\ the\ sample}{Weight\ of\ the\ sample} x\ 100$$

The weight of each sample was (0.5 grams).

$$\text{The percentage of neutralization for sample (A)} = \frac{0.00243x184.08}{0.5} x\ 100 = 89.46\%$$

In the same way, the percentage of neutralization was found in all antacid samples, as shown in the following Table 3:

***Table 3.*** *The results of the percentage of acid neutralization for the studied samples.*

| Sample | Percentage of acid neutralization % |
|---|---|
| Brand A | 89.46 |
| Brand B | 77.30 |
| Brand C | 26.33 |
| Brand D | 58.61 |
| Brand E | 69.08 |

From these data shown in Table 3, a graph was drawn that shows the percentage of neutralization for each sample as shown:

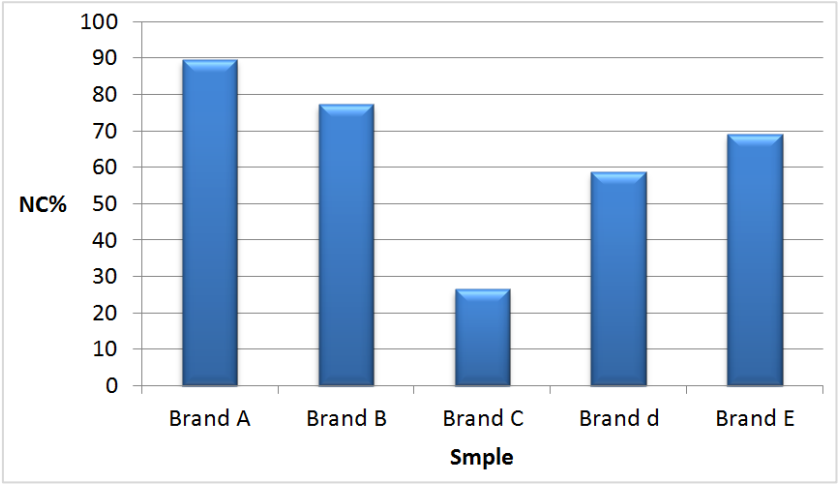


***Figure 1.*** *The percentage of acid neutralization for the studied samples.*

## 3.6. The Effect of Antacid Samples on the pH of Acid (HCl) During a Time Period of 5 Minutes

The pH of the acid was measured after heating it to a temperature of 37 ℃, adding the antacid, and passing a time period of 5 minutes after the addition. The results of the readings were as shown in the table below, noting that the pH of the acid (HCl) before the addition was (1.57).

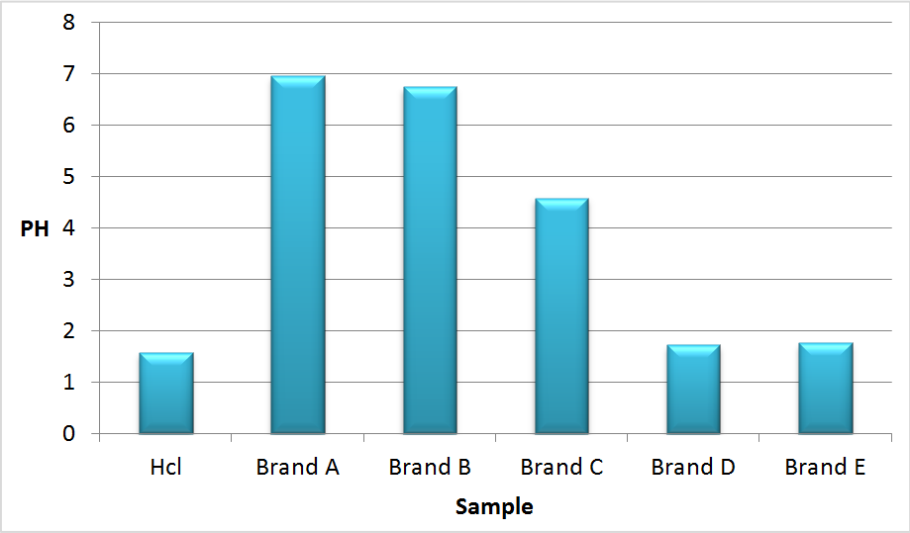


***Figure 2.*** *The effect of samples on the pH of the acid (HCL).*

***Table 4.*** *The effect of antacid samples on the pH of acid (HCl).*

| Sample | pH (HCl) in a time period of 5 minutes |
|---|---|
| Brand A | 6.95 |
| Brand B | 6.74 |
| Brand C | 4.58 |
| Brand D | 1.73 |
| Brand E | 1.76 |

## 4. Discussion

The results of volumetric titrations conducted on antacid samples, in which the reverse (indirect) titration method was used instead of direct titration in order to avoid the problem of dissolution of some samples that contain poorly soluble substances such as carbonates, showed that all samples were effective against the acid, but to degrees or different levels, as recorded in Table 4. Sample (A) consumed the smallest amount of the titrated volume (NaOH), and this indicates that sample neutralized a large amount of the acid, leaving only a small portion to react with the titrated base (NaOH), and this is contrary to what was shown. Sample (D) neutralized a smaller portion of the acid present in the beaker and thus consumed a large amount of the base (NaOH) for the titration. As for sample (E), it showed a result similar to sample (C), and the titration result for sample (E) was similar to a previous study conducted in Nigeria [12, 16]. The neutralization capacity of antibiotics varies from one light to another, depending on the clear composition and its active ingredient. Through Table 3 and Figure 1, it was noted that sample (A) may have the highest acid neutralization capacity of (89.46%) as it contains calcium and magnesium carbonate. As an active ingredient in its composition, sample (C) has a lower acid neutralization capacity of (26.33%), and these results are directly from the forensic study that was previously tested [11, 15]. As for sample (B), it showed a high neutralization capacity of (77.30%) as it contains bicarbonate and alginates that work to form a gelatinous layer within a few seconds. Therefore, these formulations consisting of alginates can provide long-term relief compared to traditional antacids. Because the collar can be kept in the stomach for hours [8].

The effect of the samples on the pH of the acid (HCl) showed that sample (A) had the highest effect because after a period of 5 minutes, the average pH of the hydrochloric acid was (6.95), which was close to the neutralization degree (7), due to the high concentration of the carbonate component. Calcium, which makes it have a rapid effect. Sample (B) also showed a significant effect on the pH of the acid (6.7) followed by sample (C), which gave an effect with an average pH (4.58). While, sample (D) and sample (E) had a weak effect on the pH of the acid, with an average of (1.73) and (1.76), respectively. The reason may be due to its chemical composition and active ingredient, or it requires a longer time than the specified time period to have an effect on the pH for acid.

## 5. Recommendations

1) It is recommended to conduct further studies on other types of antacids to estimate their effectiveness and ability to neutralize acid and to study their physical and chemical properties.
2) Antacids with a higher percentage of acid neutralization should be used to obtain faster relief from indigestion symptoms and other problems related to high stomach acidity and acid reflux.
3) When taking antacids, it is preferable not to take them with other medications so as not to cause side interactions that affect the extent to which the medication is well absorbed.
4) We recommend conducting comparative analyzes between local medicines and medicines from neighboring countries in order to estimate the extent of effectiveness and the percentage of the active substance they contain.

## Abbreviations

| | |
|---|---|
| M | Molarity |
| ANC | Acid Neutralizing Capacity |
| Mqe | Milliequivalents of Acid |
| ph.ph | Phenonphathalin Indecator |
| NaOH | Soduim Hydroxid |
| HCl | Hydrochloride Acid |

## Conflicts of Interest

The authors declare that there is no conflict of interest.

## References

[1] Book of Organology by Dr. Sabah Nasser Al-Alouji, 1st ed., (2002) Thinking House for Printing, Publishing and Distribution.

[2] Jwan Mohammed Ahmed. "Comparison of Acid-neutralizing capacity of antacids in Erbil City". Zanco J. Med. Sci., (2021): Vol. 25(2).

[3] Xiaoxiao Yang 1, Yueyue Li, Yiyuan Sun, Mingming Zhang, Chuanguo Guo, Iqtida Ahmed Mirza, Yan-Qing Li "Vonoprazan: A Novel and Potent Alternative in the Treatment of Acid-Related Diseases". (2018) 63(2): 302.

[4] David A. Johnson, Philip O. Katz, David Armstrong, Henry Cohen, Brendan C. Delaney, Colin W. Howden, Peter Katelaris, Radu I. Tutuian, Donald O. Castell" The Safety of Appropriate Use of Over-the-Counter Proton Pump Inhibitors: An Evidence-Based Review and Delphi Consensus. Drugs. (2017): 77: P. 547–561.

[5] Malfertheiner P, Megraud F, O'Morain C A, Gisbert J P, Kuipers E J, Axon A T, Bazzoli F, Gasbarrini A, Atherton J, Graham D Y, Hunt R, Moayyedi P, Rokkas T, Rugge M, Selgrad M, Suerbaum S, Sugano K, El-Omar E M; European Helicobacter and Microbiota Study Group and Consensus panel. (2017); 66(1): 6-30.

[6] Tripathi D. "Essentials of medical pharmacology". 6th ed. New Delhi: Jeyapee; (2008): P. 627–38.

[7] Bhoir S, Bhagwath M. "Comparison of seven oxethazine containing antacids available in Indian market". JAPI. (2013): 61: 400–3.

[8] Mandel, Daggy, Brodie, jacoby Alimet any pharma Cology Thera peuties. (2001). Vol.(14): 669-690.

[9] Jagadesh, Kandk and chidandg, K, N. "Study of Acid Neutralizing Copacity of varions Antacid Formulations". Asian Journal of pharma ceutical Technology and Iunovation, (2015) 3(12): 1-6.

[10] Ph-D MSN, R, N, CNE, Col-By. Medically reviewed by Oebra Sullivan". Louisa Richards on juty, 2020.

[11] Adel Amhamed Al-Ajtal, et al "analytical study of some medications used to treat stomach acidity". Faculty of Science - Misrata University, Al-Satel Scientific Journal, (2021): 25. 35-44.

[12] Ahmed M. H., Momoh M. K "Determination of Effectiveness and Acid Neutralization Capacities (ANC) of some commercial Antacids Tablets". Iconic Research Engineering Journals. (2021): vol. 5(1).

[13] Abdu, K. and Abbagana, M. "Evaluation of Neutralizing Capacity of Different Commercial Brands of Antacid Tablets". ChemSearch Journal, (2015): 6(2): 32 – 34.

[14] Mohamed Yafout, Hicham Elhorr, Ibrahim Sbai El Otmani, and Youssef Khayati. "Evaluation of the acid-neutralizing capacity and other properties of antacids marketed in Morocco". Med Pharm Rep. (2022): Vol. 95(1).

[15] May Mohammed Jawad Al-Mudhafar, Shayma L. Abdulhadi and Ali Basim Talib. "Evaluation of Commercial Antacid Tablets in Iraq". Der Pharma Chemica, (2016): 8(19): 283-288.

[16] Alalor C. A, Avbunudiogba J. A, Builders F. P, Okpara LO. "Evaluation of the Acid Neutralizing Capacity of Some Commercially Available Brands of Antacid Tablets in Nigeria". East African Scholars Journal of Medical Sciences. (2019): Vol. 2, Iss-(1) 12-16.