

Biopharmaceutics and pharmacokinetics

Biopharmacy LAB 3

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Lab 2. In vitro evaluation of antacids



Introduction

- The Gastro-intestinal (GI) tract generates and maintains different pH environments along its length.
- pH is very important for controlling activity of digestive enzymes.

ACIDITY IN THE STOMACH

- Acidity in the stomach is normal, but excess acidity is potentially harmful.
- It is unusual compared to other organs as its pH is as low as 1-2 due to production of hydrochloric acid from structures in lining of walls.
- Acid environment kills bacteria that comes in with food, is optimum for activity of digestive enzymes

EXCESS ACID

Factors that cause excess production of gastric juice (acidic secretion)

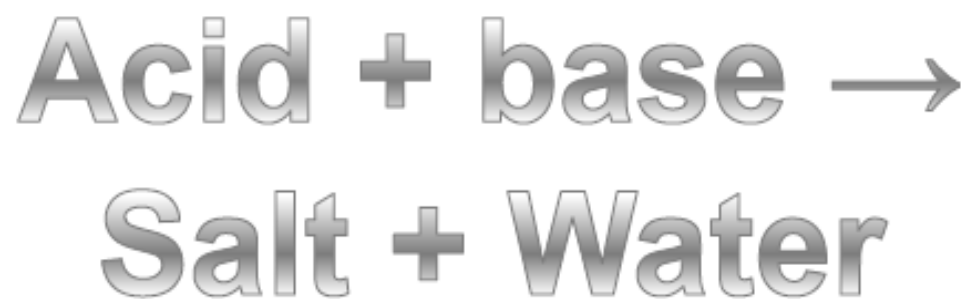
- Excess alcohol
- Smoking
- Stress
- Some anti-inflammatory drugs



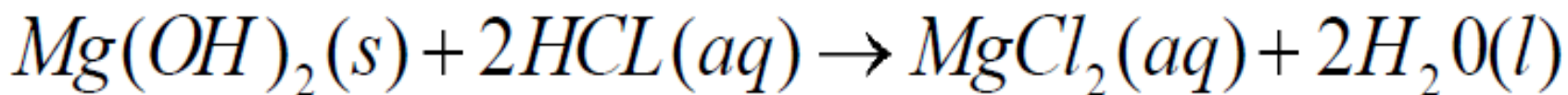
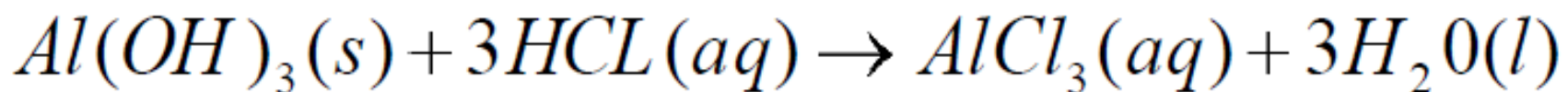
- Acid indigestion or dyspepsia is an illness commonly treated by self-medication.
- Antacids are drugs which on ingestion **react with the hydrochloric acid** of gastric content to lower the acidity.
- Antacids are **alkalis**, such as aluminium hydroxide, magnesium salts (magnesium hydroxide and magnesium trisilicate), sodium bicarbonate, and calcium hydroxide.
- **The finished product must raise the pH of gastric secretions to 3.5 or greater within 10 minutes.**

- They are simple ,often effective treatment for many dyspepsia's (impairment of the power or function of digestion),and provide symptomatic relief in conditions such as peptic ulcer, gastritis (inflammation of the lining of the stomach) ,and esophageal reflux with heartburn.

Typical Neutralization Reaction



Example Antacid Reactions:



They are generally formulated in combinations ,for example:

- magnesium hydroxide +aluminium hydroxide

Or with other components, such as:

- Simeticone (activated dimeticone, an anti-foaming agent),
- Alginates (anti-reflux agents).

Antacids may be divided into two main groups according to their water solubility:

Water insoluble and have slow prolonged action

- e.g. aluminium hydroxide, magnesium carbonate, hydroxide and trisilicate.

Water soluble and act quickly but its effect is transient and prolonged use may cause systemic alkalosis and renal damage

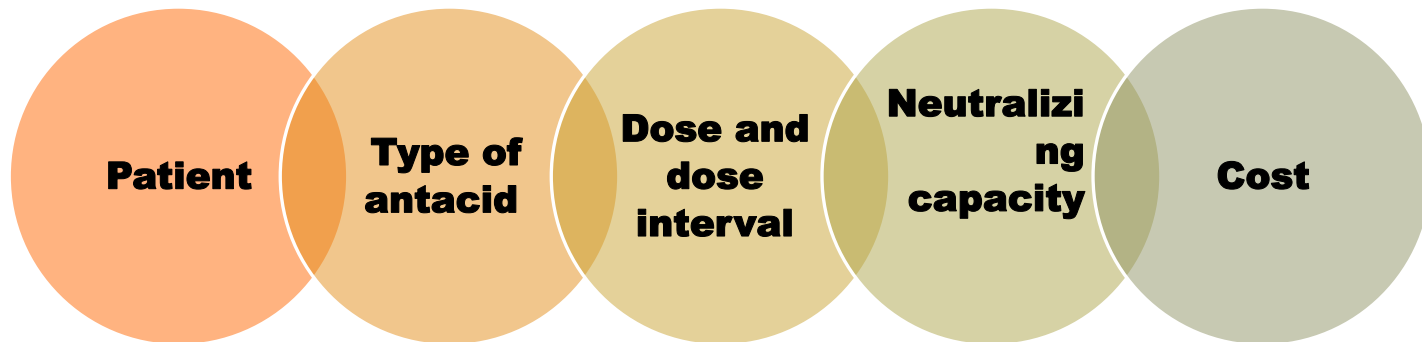
- e.g. sodium bicarbonate and sodium citrate

Antacids ,by altering gastric pH, may interfere with drug absorption in number of ways:

1. Altered drug ionization :e.g. carbenoxolone (an ulcer healing drug),its absorption is completely inhibited above pH 2 and therefore ,it should not be given with antacids.
2. Alteration of gastric emptying : The stomach empties more readily when pH increaeses.

3. Drug dissolution may be affected by pH changes.
 4. Drug interaction: calcium , aluminium and magnesium decrease the gastric absorption of tetracyclines due to complex formation with it.
 5. Systemic effect : Systemic antacids may accelerate the excretion of drugs(salicylates) and inhibit the urinary excretion of basic drugs ,e.g. amphetamines.
- ✓ It seems advisable to administer other drugs at least one half to one hour before antacids ingestion in order to assure consistent absorption and effect.

Several factors must be considered when selecting an antacid product



The patient : Whether he has impaired renal function ,edema , high blood pressure , allergic to milk or milk products.

Type of antacid(systemic or nonsystemic):
A systemic antacid,such as sodium bicarbonate is soluble, readily absorbed,and capable of producing systemic electrolyte disturbance

Non systemic such as calcium carbonate or basic aluminum substances ,form compounds that are not appreciably absorbed and thus do not exert any systemic effect.

Neutralizing capacity

- Antacids differ in their ability to neutralize gastric secretions

Dose and dose interval

- An ideal antacid should be rapid in onset and provide a continuous buffering action

- Mg (OH)₂ and CaCO₃ have rapid onset of action.
- MgCO₃ : Intermediate onset
- Mg trisilicate and aluminium compounds have slow onset.

Aim of the experiment:

The objective of this experiment is to

- evaluate in vitro , a number of antacid marketed products and compare their buffering capacity .

Principle

- A simple procedure is used, to imitate the physiological conditions in the stomach . Techniques of alternate addition and removal of (0.1N HCl)solution are used to mimic the release of HCL from the oxyntic cells and the periodic emptying of the stomach.

Practical work:-

The aim of experiment:-

To evaluate antacid activity of Maalox susp. (15ml), citrogran granules (5gm), Eno&Gaviscon.

Procedure:-

To simulate the physiological conditions in the stomach, artificial gastric juice (A.G.J.) is used & the techniques of alternate addition & removal of solutions are used to stimulate the release of Hcl from oxyntic cell & the periodic emptying of the stomach.

Artificial Gastric Juice (AGJ 0.1 N Hcl) :-

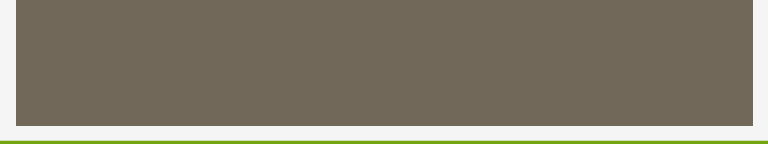
Hcl $\boxed{8.5}$ ml
D.W ad 1000ml
pH = 1.2-1.4

Equipment:-

Beaker (250ml), pipette (10ml), burette (50ml), stirring glass rod, artificial gastric juice(0.1N Hcl).

Method:-

- 1-place 150 ml of the (A.G.J.) in 250ml beaker.
- 2-arrange the pH – meter so that the electrode are in the solution.
- 3- fill 50ml burette with A.G.J. & position it so that the solution may be added to the beaker as desired.
- 4- record the initial PH of the juice(at zero time).
- 5- add the antacid and stir the juice.
- 6-record the PH at 5 min. interval.
- 7-to stimulate stomach condition, add 2ml of fresh juice from the burette each 2min. and at the end of each 10 min. withdraw 10ml from the beaker using a pipette and discard.
- 8-continue recording until the PH has reached to maximum and then dropped significantly, record for 50min.



Enter your results in a table and plot a graph against time as you conduct the experiment.

Time in minutes	PH of the mixture
0.5	
2	
4	
6	
8	
10	
20	
40	
50	