International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Development and Evaluation of Menthol based Antacid

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Abstract :-

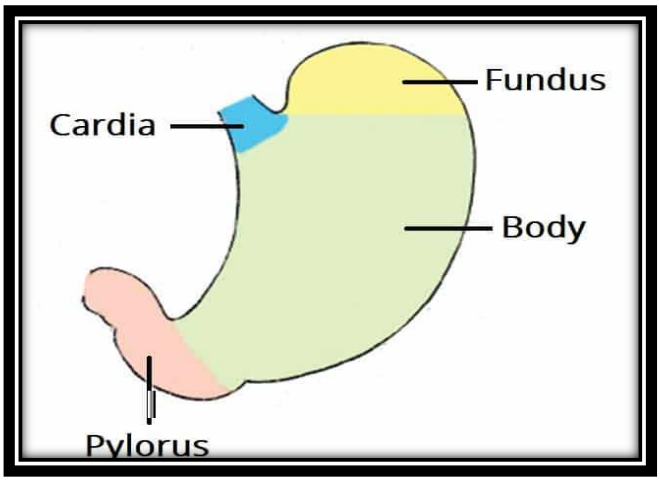
Antacids are commonly used self-prescribed medications. It consist of calcium, magnesium and aluminum salts in various combinations. The effect of antacids on the stomach is due to partial neutralization of gastric hydrochloric acid and inhibition of the photolytic enzyme, pepsin. Herbal antacids are also one of the major classes of over the counter drugs used by patient considering its safety. Hence, in present study we attempted to prepare two formulations, one is aluminum hydroxide suspension and second is combination of calcium carbonate and magnesium oxide suspension as well as compares this by marketed formulation through antacid activity using in vitro methods via- acid-Neutralizing capacity and buffering capacity. From the results of present study, it may be concluded that our both formulations possess more antacid potential than marketed formulation.

Keywords: Antacid suspension.

- **Introduction :-**
- **Stomach :-**

The most dilated part of the digestive system, the stomach, is a vital organ. It comes first in the esophagus and last in the small intestine. It is a big, hollow, muscular organ with the ability to store food. It consists of the cardia, fundus, body, and pylorus as its four primary regions. Food enters the stomach through the cardia, which is attached to the esophagus. The fundus is the superior, bulbous, dome-shaped part of the stomach that comes after the cardia. The fundus is the next largest part of the stomach, followed by the body. The pylorus, which guides food into the duodenum, or upper part of the small intestine, conically, comes after the body

Figure No.1:- Stomach



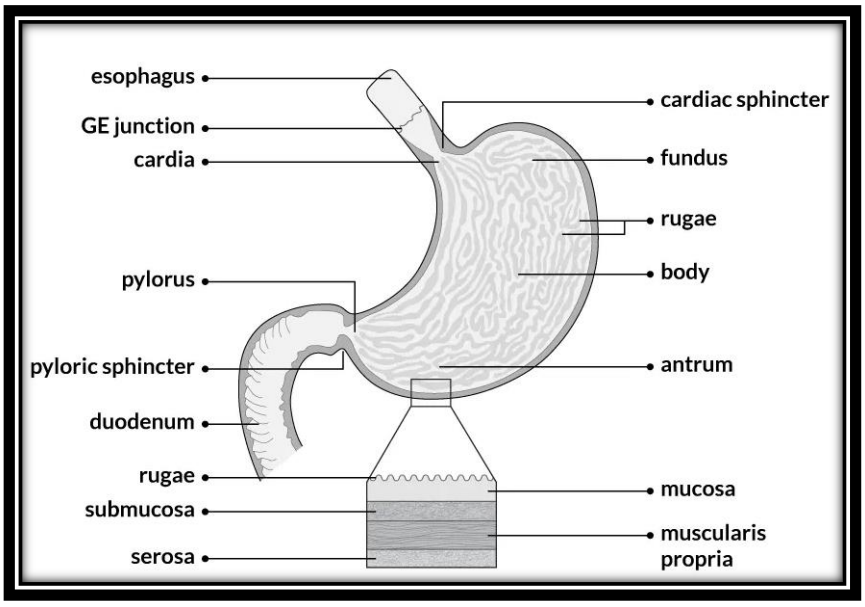
- **Structure and function :** –

The stomach primary functions include temporary food storage and partial chemical and mechanical digestion. The upper stomach relaxes to hold food, while the lower stomach contracts for mechanical digestion and mixes with stomach juices for chemical digestion. Mixing waves occur with intervals of 20 seconds, allowing small quantities of chyme to enter the small intestine. Stomach juices, including hydrochloric acid and pepsin, are secreted by the fundus portion for chemical digestion. Intrinsic factor, produced during digestion, allows for vitamin B12 absorption in the small intestine. The stomach can process food within 2 to 4 hours, depending on the type of food consumed. It can absorb substances like water, medications, amino acids, ethanol, caffeine, and water-soluble vitamins.

- **The stomach is divided into 5 areas :-**

1. The cardia is the first part of the stomach, which is connected to the esophagus. It contains the cardiac sphincter, which is a thin ring of muscle that helps to prevent stomach contents from going back up into the esophagus.
2. The fundus is the top, rounded area that lies to the left of the cardia.
3. The body is the largest and main part of the stomach. This is where food is mixed and starts to break down.
4. The antrum is the lower part of the stomach. It holds the broken-down food until it is ready to move into the small intestine.
5. The pylorus is the part of the stomach that connects to the small intestine. It includes the pyloric sphincter, which is a thick ring of muscle that acts as a valve to control the emptying of stomach contents (chyme) into the duodenum (first part of the small intestine). The pyloric sphincter also prevents the contents of the duodenum from going back into the stomach.

Figure No.2 :- Stomach



- **Gastric gland :-**

Gasrici gland is a branching tubules in the stomach's inner lining that secrete mucus defense and gastric fluid.the stomach's secretions of protecting mucus and gastric juice. The location and kind of secretion differentiate the three different types of stomach glands. The pyloric glands are found at the terminal stomach region, the cardiac gastric glands at the very beginning of the stomach, and the intermediate, or true, gastric glands in the central stomach areas. Mucus, secreted by the pyloric and cardiac glands, covers the stomach and prevents it from digesting itself by assisting in the dilution of acids and enzymes The majority of the digesting chemicals

produced by the stomach are made by the intermediate gastric glands. The three main cell types that make up these glands are mucous neck, parietal, and zymogenic cells. These glands have smalltubules. The zymogenic (chief) cells, located at the base of the gland, are assumed to be the source of the pepsin and rennin enzymes. (Rennin curdles milk; pepsin digests proteins.) The gland's parietal, or oxyntic, cells are found all along its length and are in charge of producing hydrochloric acid, which is required to activate the other enzymes.
Gastric juices are normally produced in modest, continuous amounts, but there are several ways to encourage the release of these fluids. Food-related smells, tastes, or thoughts often cause an increase in enzyme secretions. When a person is sleeping, their stomach produces less than when they are awake, but when they wake up, their output increases. Food that has been consumed gives the extra stimulation needed for mucus secretion. Chemicals included in certain foods can also stimulate the synthesis of enzymes. Fear, grief, or withdrawal are psychological situations that can lower stomach secretion.

- **Digestive functions :–**

Apart from ingesting and feces, the stomach is involved in almost every aspect of digestion. Aspirin and alcohol are examples of non polar drugs that are absorbed in the stomach, despite the small intestine handling nearly all absorption.

- **Mechanical digestion :-**

Within a few moments after food enters the stomach, mixing waves begin to occur at intervals of approximately 20 seconds. A mixing wave is a unique type of peristalsis that mixes and softens the food with gastric juices to create chyme. The initial mixing waves are relatively gentle, but these are followed by more intense waves, starting at the body of the stomach and increasing in force as they reach the pylorus.

The pylorus, which holds around 30 ml of chyme, acts as a filter, permitting only liquids and small food particles to pass through the mostly, but not fully, closed pyloric sphincter. In a process called gastric emptying, rhythmic mixing waves force about 3 ml of chyme at a time through the pyloric sphincter and into the duodenum. Release of a greater amount of chyme at one time would overwhelm the capacity of the small intestine to handle it. The rest of the chyme is pushed back into the body of the stomach, where it continues mixing. This process is repeated when the next mixing waves force more chyme into the duodenum.

Gastric emptying is regulated by both the stomach and the duodenum. The presence of chyme in the duodenum activates receptors that inhibit gastric secretion. This prevents additional chyme from being released by the stomach before the duodenum is ready to process it.[28]

- **Chemical digestion :-**

1. Due to its ability to hold both undigested food and gasses generated during chemical digestion, the fundus is crucial to digestion. Food may remain in the stomach's fundus for some time before becoming combined with the chyme. Salivary amylase continues to break down food while it is in the fundus until the meal starts to combine with the acidic chyme. In the end, mixing waves combine this meal with the chyme, whose acidity causes lingual lipase to be activated and salivary amylase to be inactivated. After then, lingual lipase starts to convert triglycerides into mono and diglycerides as well as free fatty acids.
2. Pepsin and hydrochloric acid (HCL) start the breakdown of protein in the stomach. Rennin, an enzyme that aids in the digestion of milk protein, is also produced by the gastric glands throughout infancy.
3. Despite the stomach's many digestive tasks, only one is essential to life: the synthesis of intrinsic factor. Without intrinsic factor, vitamin B12 cannot be absorbed through the digestive tract, which is essential for both the maturation of red blood cells and healthy neurological function. Individuals who have a total

gastro, or removal of the stomach, for conditions like potentially fatal stomach cancer, may recover with just mild digestive problems if they have vitamin B12 injections.

4. Within two to four hours of eating a meal, the entire contents of the stomach are discharged into the duodenum.

- **Absorption :-**

1. Although the absorption in the human digestive system is mainly a function of the small intestine, some absorption of certain small molecules nevertheless does occur in the stomach through its lining. This includes:
2. Water, if the body is dehydrated
3. Medication, such as aspirin
4. Amino acids[29]10–20% of ingested ethanol (e.g. from alcoholic beverages)[30]
5. Caffeine[31]
6. To a small extent water-soluble vitamins (most are absorbed in the small intestine)[32]
7. The parietal cells of the human stomach are responsible for producing intrinsic factor, which is necessary for the absorption of vitamin B12. B12 is used in cellular metabolism and is necessary for the production of red blood cells, and the functioning of the nervous system.

- **Conditions and Disorders :-**
- **What conditions and disorders affect your stomach?**

1. Gastrointestinal diseases: may affect your stomach. You may have gastrointestinal symptoms only under specific circumstances, such as getting heartburn during pregnancy or you may have a chronic (long-lasting) condition.
2. Common conditions that affect your stomach include:
3. Gastric ulcers**:** Erosion in your stomach's lining that can lead to pain and bleeding.
4. Gastritis **:** Stomach inflammation.
5. Gastroesophageal reflux disease (GERD) **:** When stomach contents travel up to your esophagus, causing heartburn or coughing
6. Gastroparesis **:** Nerve damage that affects your stomach's muscle contractions.
7. Indigestion (dyspepsia) **:** Discomfort, pain or burning in your upper stomach.
8. Peptic ulcer disease **:** Ulcers (sores) in either your stomach or the first portion of your small intestine (duodenum).
9. Stomach cancer **:** When cancerous cells grow uncontrollably in your stomach.

- **Acidity :-**

1. The body part are involved in a acidity are –
    - Esophagus, stomach, intestine
2. In simple terms, it is a condition that causes excess acid production in stomach .This not only cause discomfort in the stomach but also lead to other symptoms, such as sour taste in mouth difficult in swallowing, and indigestion .
3. These numerous cause of acidity, right from poor eating habits and excessive stress to the use of certain medication .moreover, lifestyle factor, such as smoking and consuming food loaded with oil, fat, and spices can also up your risk of acidity .
4. The secretion of acid, it start affecting the inner lining of the stomach . This causes acid in stomach.
5. If not treated on time the Acidity is said to have occurred when a person suffer from heartburn and also when information of gas takes place in the stomach.

6. It is a common problem which many suffer from, and occurs mainly due to excess secretion of hydrochloric acid in stomach.
7. Person might suffer from severe indigestion, gout, arthritis and formation of ulcer in mouth and stomach .
8. When acidity takes place, the gastric juice move from the stomach to the lower esophagus or food pipe, in turn making it dysfunctional .
9. You can fight acidity with simple lifestyle changes and effective home remedies, such as tulsi, fennel, seeds and cold milk . In most cases, over –the-counter medication to reduce or neutralize the acidity.

Figure No. 3:- Acidity

- **Causes of acidity :–**
- The stomach produces gastric acid that helps in digesting food .However ,due to some causes ,there are times when gastric acid are produced in excess, leading to acidity .Factor affecting the function of the lower esophageal sphincter are also responsible for acid reflux .
- Some common causes of acidity include :

1. **Food and dietary factors :-**
   Eating food containing excessive amount of chilies, pepper, vinegar, paprika. Deep fried and oily food containing excessive intake of caffeine in form of tea, coffee, and chocolate .
   - High intake of table salt
   - Diet low in fiber
   - Overeating or eating at irregular interval
   - Unhealthy habit ,like lying down just after eating
   - Eating just before strenuous physical exercise
   - Frequent smocking
   - Excessive intake of alcohol ,soda ,carbonated drink
   - Lack of sleep
   - Lack of physical activity

2. **Ailment and medication:-**
   - Excessive stress, anxiety or depression
   - Stomach diseases like peptic ulcer, gastroesophageal reflux disease ,and stomach cancer
   - Medication like painkillers, antibiotic ,chemotherapy ,medications ,and anti depressants

Figure No. 4 :- Dietary factor

Figure No. 5 :- food and diet

- **Symptoms of Acidity : –**

When some of the stomach's acid refluxes up into the esophagus or the food pipe, which joins the mouth and stomach, it can cause symptoms of acidity. The lower esophageal sphincter (LES), a ring of muscle, normally functions as a valve to let food pass into the stomach but prevent it from going back up the esophagus. The following signs of acidity can occur when this valve malfunctions, causing stomach contents to reflux into the esophagus and cause symptoms to appear.

- **Heartburn :-**
  Heartburn is unrelated to the heart, despite the name. A burning feeling in the chest is a typical sign of acidity, which is brought on by extra stomach acid seeping into the esophagus. This sensation may linger for several hours or just a few minutes.
- **Regurgitation :-**

It is possible for some acidic individuals to regurgitate. It's a sensation where the person feels stomach acid, bile, or liquid undigested food going up and down in their throat. This feeling, which resembles feeling sick to some extent, frequently happens after eating, after exercising, or when you bend immediately after eating.

- **Sour taste in the mouth :-**

A sour taste in the mouth is often a sign of acidity and is another prevalent symptom of stomach problems. It occurs when bile and stomach acid ascend to the back of your throat from eating, leaving behind an unpleasant taste. Usually, regurgitation occurs concurrently with this.

- **Difficulty in swallowing :-**

Dysphasia, another name for difficulty swallowing, is the result of too much stomach acid creating a feeling of fullness. Additionally, it slows down the food's passage through the food pipe and makes digestion more difficult.

- **Sore throat :-**

The inability to swallow is known as dysphagia, which is caused by an excess of stomach acid producing a sense of fullness. It also makes digestion more challenging by slowing down the meal's journey through the food pipe

Figure No.6:- Sore throat

- **Indigestion :-**

Dyspepsia, another name for indigestion, is a crucial indicator of acidity and other digestive issues. It may cause discomfort and a burning sensation in the middle of the upper abdominal

- **Risk Factor of Acidity :** –

1. Condition that can increase your risk of acidity include;
2. Obesity
3. Bulging of top of stomach up into the diaphragm
4. Pregnancy
5. Smoking
6. Dry mouth
7. Asthma
8. Diabetes
9. Delayed stomach emptying
10. Connective tissue disorder ,such as scleroderma.

- **Prevention of acidity : –**

1. Eat healthy
2. Change your eating pattern
3. Eat slowly
4. Avoid sleeping with a full stomach
5. Stay fit
6. Increase water intake
7. Avoid tea and coffee
8. Quit smoking
9. Change your sleeping posture
10. Limit alcohol intake

- **Diagnosis :-**

1. Usually, acidity is self-diagnosable by paying attention to one's symptom and lifestyle habits. If medication and lifestyle change do not provide relief from acidity symptoms, it usually indicate its complication such as gastro esophageal reflux disease can be diagnosed with the help of following examination .
2. Upper GI endoscopy and biopsy:
3. This help to examine the lining of the esophagus, stomach and duodenum . They may help in diagnosing the complication associated with the GERD such as Barrett's esophagus, strinctures and esophagitis.

- **Radiology Imaging :-**

1. Moreover , X-ray can help visualize any problem associated with the upper gastrointestinal tract.
2. Esophageal manometry:
3. This test determines the ability of the esophageal valve and muscles to help food pass from the esophagus to the stomach .
4. Esophageal PH monitoring :
5. The acid amount the refluxes back from the stomach to the esophagus is determined using this test . Serology and histology for H. pylori infection

- **Treatment of Acidity :-**

If you experienced any Symptom like burning sensation in chest pain in upper abdomen you should visit gastroenterologist immediately before matter get worse severe stomach acidity curse are available in market as well as in your home there are antacid also you get in the market.

The drug which are use in a treatment of acidity-

1. Antacid : Aluminum hydroxide ,Magnesium trisilicate and calcium carbonate
2. H2 receptor blocker : Famotidine
3. Proton pump inhibitor : Omeprazole, Pentaprazole, and Rabeprazole
4. Prokinetic drug : Domperidone, metoclopramide and levosulpiride
5. Coating drugs : sucralfate and colloidal bismuth [CBS]

- **Complication of Acidity :-**

If proper attention is not paid to acidity and it is left untreated, it can lead to complication such as gastric ulcer, gastric esophagal reflux diseases [GERD], duodenitis, irritable bowel syndrome, peptic strictures .

- **Gastroesophageal reflux disease :-**

GERD is suspected if acid reflux symptoms persist for more than three times a week or if it continue for several weeks .Proper medical attention is required for GERD or it can lead to more severe health condition.

- **Gastric ulcer :-**

When the excess acid damage the stomach or duodenum's lining ,it leads to gastric ulcers .Surgery may be required if ulcer do not heal with medication

- **Oesophageal strinctures :-**

Over time, the backflow of acid from the stomach can damage the lining of the oesophagus thus leading to strictures .Such stricture are known as peptic stricture ,which can both cancerous and non-cancerous .Stricture do not allow food and liquid to enter the stomach.

- **Oesophageal cancers :-**

Adenocarcinoma and squamous cell carcinoma are the two type of cancer that occur in the oesophagus.

- **Duodenitis :**

Duodenitis is the inflammation of the first part of the small intestine

- **Antacid:**

Antacids are a medicine used to treat heartburn and indigestion. You can get antacids over-the-counter without a prescription. Antacids work quickly to reduce the amount of acid in your stomach to relieve symptoms. Antacids don't treat the underlying causes of heartburn and in digestion antacids work quickly to neutralize the acid in your stomach. They can also inhibit the activity of pepsin, an enzyme that creates acid that breaks down food for digestion.

Marketed antacids contain salts of aluminum, calcium, magnesium sodium. Contain a combination of two salt such as magnesium carbonate and aluminum hydroxide. You can buy many antacids without a prescription. Liquid forms work faster, but you may prefer tablets because they are easy to use. All antacids work equally well, but they can cause different side effects. If you use antacids often and have problems with side effects, talk with your health care provider.

Antacid are available in various form in the market .The forms are tablet, powder , liquid . Tablet antacid are slow acting and have less neutralizing power than a liquid form of antacid . Tablet must be chewed, and may not interact well with gastric acid . The average therapeutic dose of an antacid is 10 to 15 ml of liquid or one to two tablet three to four times a day. These drugs have slow volume of distribution undergo minimal hepatatic metabolism are excreted in faeces . For most the convenience of tablet far outweigh these slight disadvantage . It consist of calcium, magnesium and aluminum salt in various combination.

Herbal antacid are also one of the major classes over the counter drug used by patient considering it's safety .In a herbal antacid formulation mint, fennel, catnip, marshmallow root , papaya ,are used.

Figure No. 8 :- Antacid tablet

Figure No.9 :- Antacid

- **Work of antacid –**

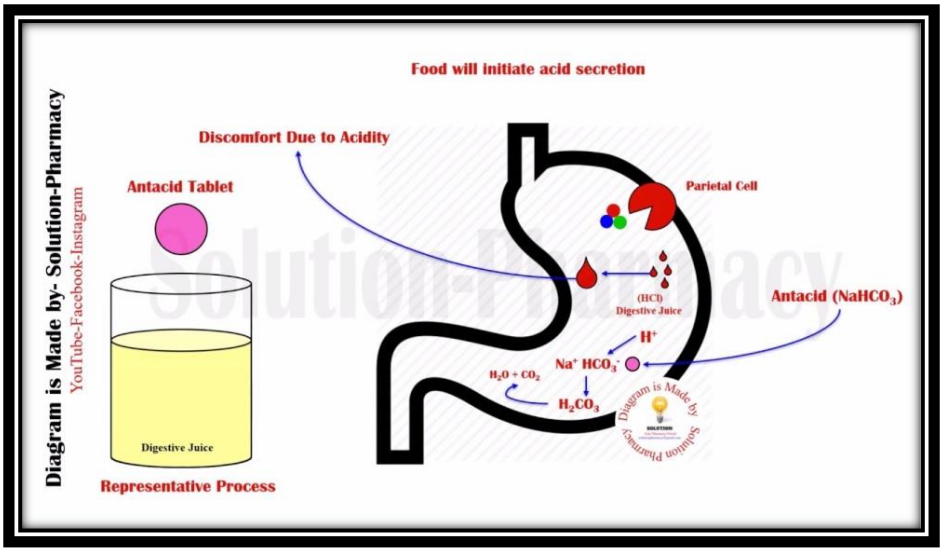
Antacids function by neutralizing, or counteracting, the acid in the stomach. Metallic salts that are basic (alkaline) in nature are found in antacids. The pH is neutralized when they react with gastric acid. The result of an acid and base reaction is called neutralization. The stomach contents' corrosiveness is reduced by this neutralization. This could alleviate the pain caused by ulcers and the burning feeling caused by acid reflux. Their mode of action demonstrates that they don't treat the underlying cause of indigestion or heartburn.

Suppose that despite taking antacids, your symptoms of stomach acid persist. In that instance, it is preferable to speak with a physician and use more sophisticated medications, such as proton pump inhibitors or histamine H2-receptor antagonists.

- **Mechanism of antacid :–**

Gastric acid is neutralized by antacids. If taken after meals, their effects last longer. Because of the quick emptying of the stomach, the effects wear off after about an hour if taken without food. Large dosages of antacids are necessary to repair ulcers, but they quickly reduce the symptoms of peptic ulcer disease. Tablets are easier to use, while liquid treatments operate faster. The majority of antacids are not well absorbed from the stomach. Simeticone is occasionally used as an antifoaming agent in antacids.

Figure No. 9:- Mechanism of antacid



- **Pharmacokinetic of antacid : –**

Absorbable antacids dissolve quickly and react with hydrochloric acid in the stomach to produce water and carbon dioxide right away. Gastric distention brought on by carbon dioxide increases gastric output and induces reflux esophagi is. While the majority of antacids are non -adsorbable, sodium carbonate functions differently since it enters the bloodstream and alters the pH of the organism as a whole. Absolute renal failure patients quickly eliminate the extra bicarbonate, whereas individuals with kidney paralysis may collect some of this bicarbonate and develop systemic alkalosis. The majority of antacids prescribed in medicine are not systemically pharmacokinetic and are not absorbable.

How to take antacid : –

1. You should take antacids when you have symptoms of heartburn or indigestion. You can also take an antacid one hour after eating, which is when you might experience symptoms of heartburn.
2. Always follow instructions on how much and how frequently you should take antacids according to the label of each antacid brand, since they may vary.
3. If you experience symptoms at night and take an antacid before bed, don't eat food with an antacid at that time.
4. If you take antacids regularly, contact your healthcare provider about your symptoms to examine any underlying causes of frequent heartburn.

- **Role of antacid :-**

1. higher doses given continuously can promote ulcer healing
2. superior to H2 blocker in bleeding peptic ulcer
3. primarily in pain relief

- **Classification of antacid :**

1. Systemic [absorbable] antacid –

2. Non-Systemic [non-absorbable] antacid-

- **Systemic antacid :-** Systemic antacids are antacids which get systemically absorbed e.g. sodium carbonate is water soluble and potent neutralizer, but it is not suitable for the treatment of peptic ulcer because of risk of ulcer perforation due to production of carbon dioxide in the stomach. Systemic absorption leads to alkalosis ,may worsen edema and congestive heart failure because of sodium ion load .Example- sodium bicarbonate ,sodium citrate.

- **Non-systematic antacid:-** They are insoluble and poorly absorbed systemically. In Magnesium salt, Magnesium carbonate is most water soluble and reacts with HCl at a slow rate, while Magnesium hydroxide has low solubility and has the power to absorb and inactivate pepsin and to protect the ulcer base.

1. Aluminium containing antacid – aluminium hydroxide, aluminium phosphate

2. Calcium containing antacid – Calcium carbonate , tribasic calcium phosphate

3. Magnesium containing antacid - Magnessium carbonate ,magnesium oxide

4. combination antacid preparation- simethicone

- **Clinical applications :-**

Non-systemic antacids are probably most frequently used in the management of uremia as aluminum hydroxide binds phosphate, thus reducing hyper phosphatema as well as having an antacid effect.

Mechanism of action :-

- Non systemic antacids work to bind bile acids, neutralize hydrochloric acid, reduce pepsin activity, and maybe increase the synthesis of local prostaglandins (PGE1). Aluminum hydroxide and magnesium hydroxide are typically combined in preparations to optimize each compound's buffering properties. Another reason the two are typically mixed is because magnesium increases intestinal motility while aluminum decreases it. Aluminum hydroxide has a sluggish, long-lasting action, while magnesium hydroxide and calcium carbonate both have brief, quick effects.
- The administration of antacid medicines to veterinary patients presents challenges due to the high dosage and frequent dosing necessary to minimize rebound acid secretion. However, a recent study revealed that the clinical effectiveness of antacid tablets is comparable to that of cimetidine or larger dosages of antacid liquids in humans.

- **Adverse effects :-**

1. Calcium-containing antacids tend to promote constipation; magnesium promotes looser feces and aluminum reduces gastric motility and delays gastric emptying.
2. If antacids are administered infrequently they may actually result in increased gastric acid production.
3. Administration of excessive calcium-containing antacids may predispose to renal calculi.

- **Types of antacid :-**

1. Aluminium hydroxide.
2. Magnesium carbonate.
3. Magnesium trisilicate.
4. Magnesium hydroxide.
5. Calcium carbonate.
6. Sodium bicarbonate.

- **Aluminium Hydroxide :-**

The formulation of aluminum hydrochloride and water results in the neutralization of the acid in the stomach. It is also known to inhibit pepsin activity . Aluminum hydroxide is complexed with a sulfated polysaccharide sucrose oct sulfate to form saculfate. This complex does not have a significant buffering action against the acid or has no effect on the pepsin secretion, and does not alter the gastric acid production in any was nevertheless, it is known to heal chronic ulcers and prevent acute mucosal damage induced chemically by reducing access to pepsin and acid. Sucralfate like its aluminum hydroxide component, is known to stimulate angiogenesis and granulation tissue formation. Aluminum hydroxide is also useful in hyper phosphatemia due to its ability to bind phosphate in the gastrointestinal (GI) tract and subsequently prevent the absorption of phosphate .

- **Calcium salt : –**

1. Calcium salts neutralize gastric acidity, resulting in increased gastric and duodenal bulb pH; they also inhibit pepsin's proteolytic activity if the pH is greater than 4 and increase lower esophageal sphincter tone. The calcium released from calcium carbonate is known to increase peristalsis in the esophagus, pushing the acid into the stomach and providing relief from heartburn symptoms. The calcium salts also form combined insoluble compounds with dietary phosphate and prevent the absorption of the latter.

- **Bicarbonate sodium :-**

Sodium bicarbonate is a weak, short-acting antacid. While generally a safe household remedy, its high sodium content is a disadvantage. Unlikely to be recommended by doctors, “bicarb” or “baking soda” is still a common component of many patent medicines. Bicarbonate has an effervescent property that explains the commercial survival of antacid/pain-killer combinations such as Alka-Seltzer™ and Bromo-Seltzer™. Bicarbonate reacts with stomach hydrochloric acid to release carbon dioxide gas (CO2) that is quickly absorbed, but sometimes elicits a satisfying belch .An imbalance of the body’s normal pH level (systemic alkalosis) can result from overuse of bicarbonate. Those who require sodium restriction for high blood pressure or heart disease should avoid bicarbonate.

- **Magnesium hydroxide : -**

Magnesium hydroxide is best known as milk of magnesia. Like magnesium citrate or magnesium sulfate, it is an effective laxative. Were it not for its tendency to cause diarrhea, magnesium hydroxide would be the most ideal antacid. To counter the diarrhea effect, most manufacturers add aluminum hydroxide, which is constipating. The

combination substantially raises the price, and the addition of the less-effective aluminum hydroxide reduces the antacid benefit

Calcium carbonate : -

1. Calcium Carbonate (chalk) is the most potent usable antacid. It can completely neutralize stomach acid. Nonetheless, it is not always the best choice for regular use.

2. About one-third of the administered calcium is absorbed, and high blood calcium or calcium-containing kidney stones are slight risks.

3. Phosphate bound by calcium in the gut or bone may deplete the serum phosphorus in some kidney failure patients.

4. A systemic alkalosis from prolonged and aggressive use infrequently produces metabolic consequences. [Alkalosis is excess base (alkali) in the body fluids. This is the opposite of excess acid

- **There are two form of antacid :-**

- **Liquid :–**

1. Several liquid antacid preparations are marketed . Common liquid preparations include milk of magnesia and magnesium/aluminum combination a potential advantage of using a liquid preparation over a tablet is that liquids may provide quicker relief, however this may coincide with a shorter duration of action Example –digene suspenstion

Figure No.9 :- Digene liquid

- **Tablet :–**

Chewable tablets are one of the most common forms of antacids, and are readily available over the counter. Upon reaching the stomach , the tablet powder will dissolve in the stomach acid, allowing the cations to be released and neutralize excess stomach acid. Common salts available in tablet form include those of calcium,

magnesium, aluminum, and sodium. Some common American brand are tums, Gaviscon chewable tablets, and Maalox chewable tablets

Example – Dynacid tablet

Fig.9:-Dynacid

Figure No.10 :- Antacid Powder

Evaluation parameter :-

1] Particle size control: -

Any suspension's particle size is vital and needs to be kept within a certain range. Particles that are too big or too small should be avoided. Larger particles may clog the needle and cause irritation if injected or implanted into the eye. They will also settle faster at the bottom of the container and give the product a grittier texture.

2] Theory of sedimentation:
Sedimentation is the process by which particles or floccules settle in liquid dosage form due to gravity. Velocity of sedimentation in cm/sec

3] Sedimentation parameters: -
The ratio of the final volume of sediment (Vu) to the initial volume of sediment (VO) prior to settling is known as the sedimentation volume.

- V u / VO = F
- where ,Vu is the sediment's final or ultimate volume.
- VO is the initial suspension volume prior to settling.

- The values of F vary from less than one to more than

- **Methodology and material : –**

Ingredients are use in formulation of suspension :–

1. Magnesium oxide
2. Calcium carbonate
3. Sorbitol
4. Sodium saccharin
5. Methyl Paraben
6. Propyl Paraben
7. Peppermint oil
8. Alcohol
9. Purified Water

- **Magnesium Oxide : -**

Magnesium oxide serves as a laxative by pulling water into the intestines, an antacid by neutralizing stomach acid, and a dietary supplement by supplying needed magnesium. Magnessium oxide is active agent in formulation of antacid .

- **Calcium carbonate : –**

An inorganic salt that is used as an antacid is calcium carbonate. It is a simple substance that works by balancing the acidic effects of hydrochloric acid in stomach secretions. The action of pepsin may be inhibited by subsequent pH increases. The presence of prostaglandins and bicarbonate ions may also have cyto protective effects .The aforementioned effects stem from the chemical reaction $CaCO3 + 2HCl \rightarrow CaCl2 + H2O + CO2$, wherein the base component, calcium carbonate, and hydrochloric acid combine to generate carbon dioxide, water, and calcium chloride. This process neutralizes the acid by scavenging the $H+$ radicals.

- **Sorbitol :-**

One substance called Sorbitol has two uses: it can be used as an irrigating fluid for urology and as a laxative to alleviate constipation. Possibly utilized as a medicinal sweetener as well .a polyhydric alcohol that has half the sucrose's sweetness. Sorbitol is used as a stabilizer for medication, vitamin, and antacid suspensions as well as in sugar-free liquid solutions. It prevents crystallization around bottle tops when added to syrups. Additionally utilized in topical and injectable formulations, sorbitol is a therapeutic osmotic laxative.

- **Sodium saccharin** -

It can sweeten food between 300 and 600 times more effectively than sucrose. Saccharin sodium improves taste receptors and can be used to cover up some bad tastes. The Strong sweetener saccharin sodium is used in food items, drinks, tabletop sweeteners, and pharmaceutical formulations like mouthwashes, gels, suspensions, pills, powders, and medicated candies.

- **Methyl Paraben** -

Methyl paraben is primarily used as an antibacterial preservative in medicinal products. Similar applications can be found in food, industrial, and cosmetic products. The fact that parabens are cheap, colorless, odorless, and harmless makes them widely used. Manufacturers frequently employ methyl parabens as a kind of preservative. To extend the shelf life of food, cosmetics, and medications while preventing bacterial and fungal growth, people can add them.

- **Propyl Paraben–**

Propyl paraben is the benzoate ester that is the propyl ester of 4-hydroxybenzoic acid. Preservative typically found in many water-based cosmetics, such as creams, lotions, shampoos and bath products. Also used as a food additive. It has a role as an antifungal agent and an antimicrobial agent. is a stable, non-volatile compound used as an antimicrobial preservative in foods, drugs and cosmetics for over 50 years. It is an ester of p-hydroxybenzoate. Propyl paraben is readily absorbed via the gastrointestinal tract and dermis.

- **Peppermint oil –**

Is use as a flavouring agent .peppermint is an aromatic herb in the mint family. It's a hybrid mint that's a cross between spearmint and watermint . It can be found naturally in North America and Europe .Peppermint essential oil can be extracted from the leaves of the peppermint plant and is used for a variety of purposes. It has a sharp odor that's cool and refreshing, and the taste is similar. You may be familiar with the coolness in your mouth after you consume something with a peppermint flavor .The main chemical components of peppermint oil are menthol and menthone.

Table No.1 Ingredient and their uses

Sr.no.	Ingredients	Uses
1.	Magnesium oxide	Suspending agent
2.	Calcium Carbonate	Suspending agent
3.	Sorbitol/Mannitol	Sweetners
4.	Sodium Saccharin	Preservtive
5.	Methyl Paraben	Preservative
6.	Propyl Paraben	Preservative
7.	Peppermint oil	Cooling and flavoring agent
8.	Alcohol	Co solvent
9.	Purified water	Solvent

Table No.2 Formulation Table-

Sr.No.	Ingredients	Quantity
1.	Magnessium oxide	9 gm
2.	Calcium Carbonate	10 gm
3.	Sorbitol/ Mannitol	2.5 gm
4.	Sodium saccharin	0.1gm
5.	Methyl paraben	0.01gm
6.	Propyl paraben	0.03gm
7.	Peppermint oil	0.003gm
8.	Alcohol	0.5ml
9.	Purified Water	q.s.

Procedure :-

1. Firstly use clean glassware for the formulation .
2. Take a beaker and add magnesium oxide and calcium carbonate is a suspending agent .and sorbitol dissolve in purified water .
3. Take another beaker and methyl paraben ,propylparben [preservative], peppermint oil [flavouring agent],and sodium saccharin are dissolve in alcohol
4. Finally alcohol phase dissolved in water phase and make up to volume with purified water upto 50 ml

- **Antacid activity: -**

1. **Acid-Neutralizing Capacity (ANC):-**

3 ml of each formulation were transferred to 250 ml beaker and 70 ml distilled water was added to solutions with continuous stirring for 15 min. Excess HCl was titrated with 0.5 N NaOH to attain a stable pH of 3.5. The number 0f mEq of acid consumed was calculated by formula;

Total mEq= (30 X N HCl) - (V NaoH X N NaoH)

Where, N HCl and N NaOH are normality of hydrochloric acid and sodium hydroxide respectively and V NaOH is volume of sodium hydroxide and the result were expressed as total mEq per gm of substance.

2. Buffering Capacity (BC) :-

5 ml of each formulation was added to 100 ml of 0.1N HCI a kept at 37oC with constant stirring. The pH of the mixture was determined after the intervals of 0,1,4,8 and 10 minutes. A quantity of 20 ml of the mixture was then removed by a pipette and replaced by 20 ml fresh 0.1N HCI. The process was repeated at 10 minutes interval until a pH below 2.75 was reached which shows that the buffering

- **Result and discussion -**

1. Above table present the computed and tabulated acid neutralizing capacity and buffering capacity of the chosen preparation, respectively. In the test of acid neutralizing capacity, Formulations 1 through 4 used a notably higher quantity of acid than the others. These goods are classified F 4> F3 > F 1> F2 for their acid neutralizing capacity based on ANC. The buffering capacity test measured the amount of time that the pH goes below 2.75; F3 and F4 both displayed pH values below 2.75 at intervals of 10 to 15 minutes.

PH at time interval of minutes	**Formulation**			
	F1	F2	F3	F4
01 min.	01	01	2.5	03
04min	01	01	2.5	03
08min.	01	01	2.5	03
10min	01	01	2.5	03
15min	-	1	2	2.5
20min	-	-	-	-

- **Conclusion:-**

Thus, it can be said that formulations F3 and F4 have greater potential as antacids than formulations F1 and F2, even though the latter two have shown inconsistent results in tests of buffering and acid neutralizing capacity. This could be because of the composition of the formulations, some of which may work antagonistically while others may work synergistically. When it comes to quality control and determining the effectiveness of herbal medication, biological standardization is crucial.

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