**Antacid**

Antacids are weak alkaline compounds which neutralized stomach acidity. It is used to relive heart burn, and [indigestion](https://en.wikipedia.org/wiki/Indigestion) or an upset stomach. Antacids are available [over the counter](https://en.wikipedia.org/wiki/Over_the_counter) and are taken by mouth to quickly relieve occasional [heartburn](https://en.wikipedia.org/wiki/Heartburn).

Indications

* Gastroesophageal reflux disease( GERD)
* Gastric and duodenal ulcers
* Acute/chronic gastritis and gastroduodenitis
* Gastropathy secondary to non-steroidal anti-inflammatory drugs (NSAIDs)
* Pain and dyspeptic syndromes

Criteria of an ideal antacid preparation:

* The antacid should not be absorbable or cause systemic alkalosis
* The antacid should not be a laxative or causes constipation
* The antacid should exert its effect rapidly and over a long period of time
* The antacid should buffer in the pH 4-6 range
* The reaction of the antacid with gastric HCl acid should not cause a large evolution of gas
* The antacid should probably inhibit pepsin

### Antacids Classification

1. **Systemic** (absorbable) **antacids:**These antacids are soluble and resorbable and produce systemic alkalosis.

Their anionic group neutralizes the H+ ions in gastric acid. This releases their cationic group which combines with HCO3 – from the pancreas to form a soluble basic compound that can be absorbed producing metabolic alkalosis.

Examples: Sodium bicarbonate.

1. **Non-systemic** (non-absorbable) **antacids:** These antacids are not absorbed into the systemic circulation and do not produce systemic alkalosis. However small amounts that are absorbed have the same alkalinizing effect as Sodium bicarbonate.

Their anionic group neutralizes the H+ ions in gastric acid. This releases their cationic group which combines with HCO3 – from the pancreas to form an insoluble basic compound that is excreted in feces.

 Examples, Aluminum hydroxide, Calcium carbonate, magnesium Trisilicate, etc.

Mechanism of action

* Antacids are weak base that act similar to when an acid reacts with a hydroxide; a salt and water are produced as in the following equation:

 **HCl + NaOH → NaCl + H2O**

* Probably decreases pepsin activity

**Types:**

# Sodium bicarbonate NaHCO3 (backing soda)

* Systemic antacid.
* It is highly water soluble antacid.
* Has very rapid onset and short duration of action.
* Sodium bicarbonate can cause flatulence, because of the evolution of carbon dioxide in the presence of acid.
* It is readily absorbed and sodium retention can result with continued use. With large doses, it will induce systemic alkalosis, or may worsen edema and CHF.
* Sodium bicarbonate reacts with gastric HCl to produce sodium chloride, carbon dioxide, and water.

 **NaHCO3 + HCl → NaCl + CO2↑ + H2O**

# Aluminium hydroxide and carbonate

* Non-systemic antacid
* Has slower onset of action.
* It causes constipation (because of liberation of astringent aluminium cation.
* Most cause increased faecal phosphate excretion due to formation of insoluble aluminium phosphate in the intestinal tract. Hypophosphatemia occurs on regular use leading to osteomalacia. It is used in hyperphosphatemia and phosphate stones.
* Aluminum hydroxide reacts with gastric HCl to produce aluminum chloride and water.

 **Al(OH)3 + 3HCl → AlCl3 + 3H2O**

* Aluminum carbonate reacts with gastric HCl to produce aluminum chloride, carbon dioxide, and water.

 **Al2(CO3)3 + 6HCl → 2AlCl3 + 3CO2↑ + 3H2O**

* Aluminum hydroxide may inhibit the action of pepsin and stimulate stomach mucus secretion.
* Note: Sucralfate is a complex of aluminium hydroxide and sulfated sucrose which forms a barrier to protect the mucosa from acid, pepsin. It adheres to ulcer in acidic gastric juice. It must be taken 1 hour before meals.

# Calcium carbonate CaCO3

* **Rapid acting** and largely nonsystemic(partly absorbed).
* They do not cause systemic alkalosis.
* The librated **calcium cation** can be absorbed; causing increased serum calcium levels, renal failure due to hypercalcemia has been reported.
* They cause an uncommon but very serious S.E, milk-alkali syndrome(burnett syndrome).→hypercalcemia, metabolic alkalosis and acute renal injury.
* The calcium antacids tend to be constipating and are usually found in combination with magnesium antacids.
* It can cause flatulence, because of the evolution of carbon dioxide in the presence of acid.
* It forms insoluble compounds with dietary phosphate and prevent its absorption.
* Used as calcium replenisher.
* Calcium ions decrease heartburn symptoms by stimulating peristalsis in the esophagus and moving the acid into the stomach.
* Calcium carbonate reacts rapidly with gastric HCl to produce calcium chloride , carbon dioxide and water.

 **CaCO3 + 2HCl → CaCl2 + H2O + CO2↑.**

# Magnesium hydroxide , carbonate, oxide and trisilicate

* Non-systemic antacid
* Has slower onset of action.
* The magnesium cation causes this group of antacids to be **laxatives**. For this reason, they are usually found in combination with aluminium and calcium antacids in an attempt to equalize the constipative and laxative actions.
* Magnesium hydroxide reacts rapidly with gastric HCl to produce magnesium chloride and water.

  **Mg (OH)2 + 2HCl→ MgCl2 + 2H2O**

* Magnesium carbonate reacts with gastric HCl to produce magnesium chloride, carbon dioxide, and water.

 **MgCO3 + 2HCl → MgCl2 + H2O +CO2↑**

* Magnesium oxide is converted to the hydroxide and therefore, the chemistry and pharmacology are the same as those of magnesium hydroxide.

 **MgO + H2O → Mg (OH)2**

 **Mg (OH)2 + 2HCl→ MgCl2 + 2H2O**

* Magnesium trisilicate dissolves slowly, and reacts with gastric HCl to produce magnesium chloride, silicon dioxide( colloidal silica, which can coat gastrointestinal mucosa conferring further protection) and water.

 **Mg2Si3O8+ 4HCl →2MgCl2 +3SiO2 + 2H2O**

# Combination antacid

 Because no single antacid meet all the criteria for an ideal antacid, several products are on the market containing mixtures of antacids. Most of these combination products are

1. An attempt to balance the constipated effect of calcium and aluminum with laxative effect of magnesium.
2. Some of these products are also a mixture of an antacid with rapid onset of action and one with a supposedly longer duration of action.

**Products**

1. Rennie® chewable tablet: calcium carbonate 680mg; magnesium carbonate 80mg
2. Maalox®susp.: magnesium hydroxide 3.65; aluminum hydroxide 3.25
3. Gaviscon® chewable tablet and susp.: sodium alginate???; sodium hydrogen carbonate; calcium carbonate

**Side effects of long term antacid therapy:**

* If pH raises too high rebound acidity to neutralize the alkali occurs.
* Antacids which absorbed systemically exert alkaline effect on body’s buffer system.
* Some antacids cause constipation (Aluminium containing antacid) while others have laxative effect (Magnesium containing antacid).
* Sodium containing antacids are problem for patients on sodium restricted diet (for hypertension patient).
* Antacids containing calcium may cause hypercalcemia, which promotes kidney stones formation and reduces parathormone production