Review Article

"Implications of Low Stomach Acid: An Update"

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ABSTRACT : Hydrochloric acid (HCL) is the primary gastric acid secreted by our stomach. Its role in digestion and the regulation of pH in the stomach is critical for maintaining our health in a number of ways. Hydrochloric acid (HCl) secretion assists protein digestion by activating pepsinogen to pepsin, renders the stomach sterile against orally-ingested pathogens,prevents bacterial or fungal overgrowth of the small intestine, encourages the flow ofbile and pancreatic enzymes, and facilitates the absorption of a variety of nutrients, including folic acid, ascorbic acid, beta-carotene, non-heme iron, and some forms of calcium, magnesium, and zinc. Numerous studies have shown acid secretion declines with advancing age and impaired HCl production and secretion is seen in a variety of clinical conditions. While the underlying etiological factors leading to impaired or complete lack of HCl secretion are not well understood, long term supplementation is safe and may be effective in certain patient populations and clinical conditions.

Key Words: Achlorhydria, Hydrochloric Acid, Pathogens.

INTRODUCTION.

Hydrochloric acid (HCl) is an important gastric secretion that enables the body to break down proteins, activate important enzymes and hormones, and protect against bacterial overgrowth in the gut. *Achlorhydria* (the complete absence of stomach acid) and *hypochlorhydria* (low stomach acid) are common digestive problems.[1] Numerous studies have shown acid secretion declines with advancing age and impaired HCl production and secretion is seen in a variety of clinical conditions.

HCl's important functions include:

Breaking down proteins into the essential amino acids and nutrients

our body needs in order to stay healthy.

- **Stimulating our pancreas and small intestines to produce the digestive enzymes** and bile necessary to further breakdown the carbohydrates, proteins and fats we eat.

- **Preventing disease** by killing pathogenic bacteria and yeast normally present in food.[2]

HCL and Digestion.

Digestion is a complex body function that starts when food enters the mouth and continues as material is processed and passed on to the stomach, small intestine and large intestine. In the stomach, digestion begins with the release of a number of gastric secretions, including HCl, pepsinogen and a protective mucus coating. Secretion of hydrochloric acid and pepsin is a prerequisite for healthy digestion. Normally the stomach contains enough free hydrochloric acid (HCl) to maintain a constant stomach acidity of between pH 1 and 2.[3] The autonomic nervous system profusely innervates the digestive system with parasympathetic fibers (vagus nerve) which function largely to increase gastric secretion and motility, thus enhancing digestion. Sympathetic fibers, on the other hand, tend to indirectly reduce secretion and motility by constricting blood supply to digestive organs. Locally in the stomach, the submucosal plexus acts in a reflex manner to increase stomach acid secretion. Gastric secretion is also responsive to hormonal control. The hormone, gastrin, is secreted by the stomach into the blood in response to ingestion of food, particularly dietary peptides. Gastrin has a dual effect on digestion: it stimulates the parietal cells to secrete HCl and promotes contraction of the smooth muscles responsible for stomach motility. Excessive amounts of gastrin have been associated with ulcer formation (Zollinger-Ellison syndrome). Gastric secretions in the stomach consist of protective mucus, pepsinogen, and HCl. [2]

Direct & Indirect Physiological Functions of HCl

Stomach

• Converts pepsinogen to pepsin
• Stimulates gastrin secretion
• Maintains sterile environment
• Cleaves protein into peptides

Gall Bladder

• Stimulates gall bladder to contract

(modulated by CCK)

• Enhances bile flow

Small Intestine

• Stimulates GIP

• Stimulates Secretin

• Stimulates CCK

(modulated by peptides & fats)

• Prevents pathogens from colonizing

• Stimulates peristalsis

• Enhances fat emulsification (due to bile flow)

Pancreas

• Stimulates bicarbonate

(modulated by secretin)

• Stimulates secretion of digestive enzymes.

HCl and Nutrient Interactions

Hydrochloric acid aids in the liberation of iron from food and facilitates its conversion to the ferrous form. In patients with iron deficiency anemia, optimal absorption of iron has been found to be related to maximal HCl output. [4] Zinc solubility is dependent on pH, with increasing solubility occurring as the pH becomes more acidic. Magnesium oxide is virtually insoluble in water and only 43% soluble in simulated peak acid secretion. Folic acid absorption in the small intestine has been shown to be influenced by gastric acidity. In patients with gastric atrophy, folic acid absorption is depressed [5] Plasma vitamin C concentrations are significantly lower in individuals with hypochlorhydria when compared with individuals who have a pH less than or equal to 4. A significant reduction in plasma response to beta-carotene supplementation has been demonstrated with pharmacologically induced achlorhydria. Experimental evidence suggests a component of a B-complex vitamin may be needed to maintain adequate HCl secretion.

It has been demonstrated that a diet inadequate in the entire B-complex impaired gastric secretion in experimental animals. This effect was reversible upon administration of a diet supplemented with B vitamins.[6] Gastric secretions may be influenced by food constituents. When five grams of lysine monohydrochloride (95% L-lysine) is added to a test meal consisting of toasted white bread, the amount of HCl in the gastric contents increases.[7] Cholinergic drugs stimulate and anticholinergic drugs inhibit it. HCl production is usually increased by caffeine, alcohol, histamine, and hypoglycemia. The production of pepsin is actively stimulated by any stimulant that increases HCl.

HCL and clinical implications.

Improvement in general health and skin condition was observed following treatment with HCl and B-complex in virtually all patients with impaired HCl production. In a correlation between eczema and psoriasis and reduced gastric secretions, it was found 8 of 11 patients with eczema and 10 of 19 patients with psoriasis had functional hypoacidity. Francis reported that four patients with vitiligo and achlorhydria experienced disappearance of vitiligo after starting HCl supplementation with each meal.[8] Patients of Osteoporosis ,Arthritis , Diabetes, Asthama after receiving HCl supplementation, also experienced marked improvement.[9]

Protection from Pathogens

HCl plays an important role in maintaining a sterile environment in the stomach. HCl does this by protecting against orally ingested pathogens and acting as a barrier to prevent bacterial or fungal overgrowth of the small intestine. Researchers have shown that a common pathogen, E. coli (*Escherichia coli*) is inactivated when stomach acidity is high, with a pH ranging between 1.5 and 4.0.[10]

Experiments have shown that low acidity is associated with the rapid invasion of microorganisms from the colon, leading to gastric and intestinal bacterial colonization and overgrowth [11] An additional finding of a Japanese team was a strong correlation between low stomach acidity and increased infection by *Helicobacter pylori* (H. pylori), (one of the most common chronic bacterial infections of humans and recognized as a major cause of gastritis, gastric ulcer disease, gastric carcinoma and B-cell gastric lymphoma.

HCL and advancing age.

The human requirement for vitamins, minerals and other nutrients remains relatively constant throughout adult life. Unfortunately our ability to properly digest food and absorb vital nutrients declines with advancing age. Surprisingly, one of the most common age-related causes of impaired digestive function is the reduction of hydrochloric acid produced by the stomach.[12] Numerous studies have shown acid secretion declines with advancing age. The resultant rise in stomach pH can have a detrimental impact on nutrient absorption and may increase the risk of a variety of clinical conditions. It has been estimated 30% of U.S. men and women older than age 60 have atrophic gastritis, a condition in which little or no acid is secreted by the

What Causes HCL Deficiency?

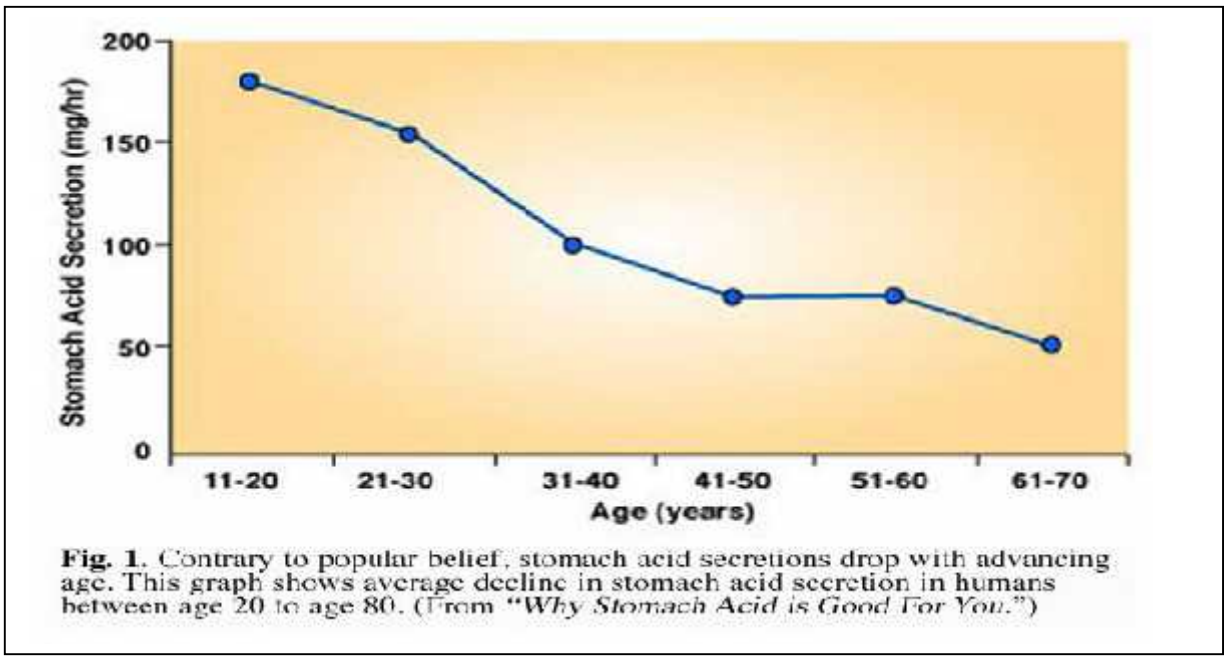

Fig. 1. Contrary to popular belief, stomach acid secretions drop with advancing age. This graph shows average decline in stomach acid secretion in humans between age 20 to age 80. (From "*Why Stomach Acid is Good For You.*")

Stomach [13], and 40% of postmenopausal women have no basal gastric acid secretion.Sharp et al tested 3,484 patients and found 27% to have achlorhydria.[14] The greatest incidence (39.8%) occurred in females age 80-89. Among males, an increase in incidence was observed for each decade (except 50-59) until the age of 70. Over age 60, there was a significant increase in the incidence of achlorhydria in both males and females. [15]

In a second study involving 3,484 subjects, researchers found that among both males and females, 27% suffered from achlorhydria, with the greatest incidence (39.8%) occurring in females aged 80 to 89 years.

- Older than 45 years of age
- Antacid
- H-Pylori and other harmful bacteria
- Proton Pump Inhibitors
- H1/H2 Blockers
- Gastric Bypass Surgery
- Chicken Pox
- Intestinal Dysbiosis

Runaway antacid use is a primary cause of HCL deficiency. This causes metabolic alkalosis, and the excess of bicarbonate in the stomach and blood, altering the ph balance. The bacteria helicobacter pylori (H-Pylori) is a bacteria that is present in approximately 50-90% of people. Most people who have H-Pylori have no symptoms of it! H-Pylori shuts down the

production of HCL. An important and interesting discovery made by Jonathon Wright, MD is that people who had the chicken pox virus, often have low HCL later in life. This may or may not be due to the chicken pox.

There are two main consequences of low stomach acid:

1. **We become protein malnourished.** When our stomach acid is low, we are not able to digest protein.
    - Improper digestion of protein creates toxins in our intestines that can set the stage for illness and disease.
    - Improper digestion of protein also creates acidic blood, since protein is by nature acidic.
2. **We become mineral deficient.** As our blood becomes more acidic, it will look for minerals from anywhere in our body, in order to get our blood to its more ideal alkaline state. Acidic blood robs our body of minerals, even taking minerals from our bones (which is important to know if we want to prevent osteoporosis).

Low stomach acid eventually creates a vicious cycle: low stomach acid = low minerals =acidic blood. This cycle continues because acidic blood further creates low minerals and low stomach acid. Listed in table 1 are some of the common symptoms and disorders caused by low stomach acid [15]

Table 1. Symptoms of poor stomach acid production.
(Alt Med Rev 1997; 2(2):116-127)

Additionally, a number of chronic health conditions are correlated with impaired acid secretion, including allergies, asthma and gallstones (Table 2).[15]

• Addison's Disease	• Lupus
• Asthma	• Osteoporosis
• Celiac Disease	• Pernicious Anemia
• Chronic Autoimmune Disorders	• Psoriasis
• Diabetes	• Acne rosacea
• Eczema	• Thyrotoxicosis
• Food Allergies	• Urticaria
• Gall Bladder Disease	• Vitiligo
• Gastric Cancer	• Colitis (Ulcerative)
• Gastritis	• Hair Loss
• Graves Disease	• Multiple Sclerosis (MS)
• Hepatitis	• Rheumatoid Arthritis

Table 2. Disorders associated with poor stomach acid output. (*Alt Med Rev* 1997; 2(2):116-127)

Supplemental Hydrochloric Acid

Hydrochloric acid was routinely prescribed for many symptoms and clinical conditions for over 100 years. Use of HCl by the medical establishment began to decline in the late 1920s. The decline in HCl replacement therapy, according to Jonathan Wright, was due to poorly designed and misinterpreted research that convinced medical practitioners that HCl and pepsin replacement therapy was not necessary.

"Encouraged by the legal drug industry, medical students are not taught that hypochlorhydria (inadequate stomach acid production) is treatable only with unpatentable, natural replacement therapies. Instead, their education concentrates on hyperchlorhydria (excess stomach acid production) and its treatment with patentable acid blocker drugs and highly profitable over-the-counter antacids." [12,13]

Hydrochloric acid has been shown to be effective in relieving symptoms associated with achlorhydria and hypochlorhydria. Substances shown to support healthy acid secretion and digestion include:

Betaine hydrochloride

Betaine hydrochloride (HCl) is a nutritional supplement that has been used for over 100 years to safely restore normal gastric acidity and to support healthy gut function.

Pepsin

Pepsin has a long history of medicinal use and is considered very safe when administered to assist digestion, typically in conjunction with hydrochloric acid.

Peppermint

Peppermint is used to aid the various processes of digestion due to its antibacterial and gastric-acid-promoting effects. Peppermint also aids digestive function by combating gas, increasing the flow of bile, and healing the stomach and liver. The spasmolytic property of peppermint has been found to decrease the tone of the lower esophagus sphincter so that the escape of air is made easier, which is particularly useful for relieving discomfort caused by spasms in the upper digestive tract. [16]

Gentian (Gentiana lutea)

The bitter principles of the dried root of Gentiana lutea have been used in Europe as a digestive aid for centuries, especially in Swedish bitters. Gentian roots were historically used topically to treat skin tumors, and internally to treat fever and diarrhea. [17] Modern research has shown that gentian, which contains two of the most bitter substances known, the glycosides gentiopicrin and amarogentin, acts on taste bud receptors to stimulate the secretion of saliva in the mouth and hydrochloric acid in the stomach. [18]

Conclusion

The normal sequence of digestion and absorption is dependent upon the anatomic andphysiologic integrity of the upper gastrointestinal tract. When this system is disrupted, disorders of digestion and absorption can occur. Because of inadequate breakdown and assimilation, impaired gastric secretions are likely to result in nutritional deficiencies not withstanding adequate ingestion of nutrients. Secretion of gastric acid is required to destroy orally-ingested pathogens and to prevent their overgrowth in the stomach and small intestine. Additionally, the dumping of acidic chyme into the small intestine is necessary to stimulate the release of hormones, pancreatic enzymes, and bile. In order to have optimal absorption of several nutrients, including folic acid, ascorbic acid, beta-carotene, non-heme iron, and some forms of calcium, magnesium and zinc, adequate HCl production is required.

It is quite probable the absorption of other nutrients are dependent on HCl secretion. HCl administration seems to be most indicated in aging people notresponding to nutrients which seem indicated, particularly B vitamins and minerals. Childhood asthma, alcoholism, chronic skin conditions, digestive disturbances, intestinal permeability, overgrowth by pathogenic bacteria or fungi, and evidence of parasites are conditions which may indicate impaired

ability to secrete adequate HCl and which may benefit from supplementation. Diseases associated with the pancreas or gallbladder, since these organs indirectly require stomach HCl production to function optimally, may also benefit from HCl administration. While the etiologic factors leading to impaired or complete lack of HCl secretion are not well understood, long term supplementation is safe and warranted in certain populations and clinical conditions

However, we conclude from this review that indigestion could be caused by low stomach acid, which affects over 50% of the population. Using over-the-counter antacids counter antacids can neutralize stomach acid and actually make our digestion worse, leaving us at risk for malnutrition and mineral deficiencies.

The key to improving our digestion is in increasing our stomach acid by reducing sugar in our diet, eating healthy fermented foods and beverages, and cutting out processed foods. When we couple that with Body Ecology's digestive enzymes, we'll be able to kick indigestion to the curb and finally have the health and energy we have been hoping for.

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