Digestive Enzymes

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Do you have indigestion, heartburn, bloating or gassiness? If so, rather than blocking the digestive process with antacids, you may wish to try the natural approach which focuses on aiding digestion. Digestive enzymes and hydrochloric acid supplements are often recommended by practitioners of natural medicine to help improve digestion and prevent reflux.[1]

Low digestive enzyme and hydrochloric acid secretion

The rationale for this approach is that a more likely cause of indigestion is a lack of digestive enzyme secretion as well as a lack of hydrochloric acid secretion, or hypochlorhydria, rather than hyperacidity.[2] In fact, both human and animal research has demonstrated that digestive enzymes produced by the pancreas reduce with age.[3] [4] In addition, suboptimal pancreatic function may occur for other reasons, including pancreatic and non-pancreatic disorders—both of which may cause an impaired production of pancreatic digestive enzymes, resulting in poor digestion. At least in part, this is there is also an age-related decline in bile acid synthesis by the liver[5]—bile acids help digest fats. Furthermore, insufficient amounts of digestive enzymes can cause or exacerbate abnormal digestive conditions, such as maldigestion, food allergies or sensitivities, intestinal fermentation, putrefaction and peroxidation, and the phenomenon known as intestinal hyperpermiability, or "leaky gut."[6]

Likewise, several studies have shown that the ability to secrete hydrochloric acid decreases with age[7] [8] [9], with low stomach acidity in more than half of the subjects older than 60 years in some cases. In addition some research suggests that people with a wide variety of chronic disorders do not produce adequate amounts of stomach acid. These disorders include allergies[10] [11] [12], asthma[13] [14], gallstones[15] [16], rosacea[17], dermatitis herpetiformis[18], rheumatoid arthritis[19], and vitiligo.[20]

Inadequate secretion of digestive enzymes and hydrochloric acid can be addressed through the use of a multi-digestive enzyme (MDE) supplement. Such supplements may contain pancreatin or pancrealipase, pancreas extracts from pork (porcine) or beef (bovine) sources that contain lipase, protease, and amylase.[21] The may also contain microbial/fungal sources of enzymes, as well as betaine hydrochloride as a source of hydrochloric acid, and ox bile as a source of bile.

Digestive enzymes

Many, though not all, of digestive enzymes are produced by the pancreas, and each has specific functions. *Lipase* is a digestive enzyme that is widely distributed in the plant world, in milk, milk products, bacteria, molds, and animal tissues.[22] Lipase enzymes aid in fat digestion by hydrolyzing fat in the small intestine. *Amylase* is an enzyme that breaks starch down into sugar. *Protease* is any enzyme that conducts proteolysis, that is, begins protein catabolism by hydrolysis of the peptide bonds that link amino acids together in the polypeptide chain, which form a molecule of protein.

Using Pancreatin or Pancrealipase

Pancreatin or pancrealipase (a more concentrated form of pancreatin) has been successful in improving digestion function. In one study, previously housebound patients with suboptimal pancreatic function who used pancreatin were able to return to a near-normal social and work life-style.[23] In another study, patients with impaired digestion due to severe, suboptimal pancreatic function also experienced impaired secretion of cholecystokinin (CCK)[24]—an intestinal hormone that stimulates bile secretion and

consequent fat digestion. Supplementation with pancreatin caused these patients to experience a significant increase in their CCK levels.[25]

A number of studies have shown that patients with impaired digestion due to suboptimal pancreatic function experienced improved digestion after supplementation with pancreatin.[26] [27] [28] Research has also shown that individuals with chronic suboptimal pancreas function also experienced digestive improvement with pancreatin.[29] [30] In addition, several studies have shown that inadequate digestive enzyme production can be caused by various non-pancreatic disorders, and responds well to digestive enzyme supplementation.[31]

Since pancreatin is a good source of lipase, it is no surprise that a pancreatin supplement reduced fat in the stools and improved nutritional status in patients with suboptimal pancreatic function.[32] [33] [34] Likewise, in a double-blind study lipase from pancreatin was shown to significantly reduce gas, bloating, and fullness after a high-fat meal.[35] Participants in this study took one capsule immediately before the meal and two capsules immediately after the meal.

Because pancreatin is rapidly emptied from the stomach during digestion, people taking digestive enzyme product may obtain better results by spreading out supplementation throughout the meal.[36]

Microbial enzymes
Inadequate digestive enzyme function can be addressed through the use of microbial and fungal enzymes with activities similar to pancreatin. Microbial enzymes have been the subject of various studies evaluating their effects on lactose intolerance, impaired pancreatic enzyme production, excess fat in the feces, celiac disorder and a variety of other digestive issues, with positive results.[37] [38] [39] [40] [41] [42] In addition, a number of studies have shown that microbial enzymes have anti-inflammatory activity as well as fibrinolytic properties, as demonstrated by their ability to hydrolyze fibrin and fibrinogen[43] [44] (found in scar tissue).

One of the most functionally valuable attributes related to microbial enzymes is that they appear to possess unusually high stability and activity throughout a wide range of pH conditions (from a pH of 2-10).[45] This enables them to be more consistently active and functional for a longer distance as they are transported through the digestive tract.

Betaine hydrochloride
To address hypochlorhydria, the use of betaine hydrochloride as a supplemental source of hydrochloric acid is indicated. Based upon clinical experience[46], this supplemental source of hydrochloric acid often relieves the symptoms of heartburn and improve digestion in people who have hypochlorhydria.

Furthermore, the importance of maintaining healthy levels of hydrocholoric acid is underscored by other key roles that this digestive aid plays in the body. For example, hydrochloric-acid secretion from the stomach, pancreatic enzymes, and bile all inhibit the overgrowth of Candida and prevent its penetration into the absorptive surfaces of the small intestine.[47] [48] [49] Likewise, many minerals and vitamins require adequate concentrations of stomach acid to be optimally absorbed from food or supplements.[50] [51] [52] [53] [54] [55]

In addition, clinical improvements have been noted in the case of individuals with disorders associated with hypochlorhydria. In a preliminary trial, supplemental hydrochloric acid, along with B-complex improved some cases of rosacea[56] and hives[57] in people with low stomach-acid production. Supplementation with hydrochloric acid in combination with avoidance of known food allergens led to clinical improvement in children with asthma.[58] Also, supplementation with hydrochloric acid resulted in gradual repigmentation of the skin in some patients with vitiligo after one year or more.[59]

Pepsin
Pepsin is an enzyme that degrades food proteins into peptides. In the stomach, chief cells release pepsinogen, a pro-form zymogen. Hydrochloric acid activates pepsinogen to convert to pepsin. Pepsin is stored as pepsinogen so it will only be released when needed, and does not digest the body's own proteins in the stomach's lining. Pepsin plays a complementary role to hydrochloric acid in digestion by facilitating the breakdown of proteins[60], and rendering calcium and iron more absorbable.[61]

What are Bile Acids?
Bile acids are the main active components of bile. Bile refers to the fluid produced by the liver and secreted into the small intestine from the gall bladder via the bile duct. Bile salt is a synonymous term for bile acid, and the two are often used interchangeably.[62] In a healthy person, bile acid synthesis is about 400 mg/day. However, bile acid secretion, is about 12,000 mg (12 grams) per day. The difference comes from bile acids which have been reabsorbed and reused within the small intestine.[63] As a consequence of this active reabsorption, a bile acid “pool” is formed that circulates multiple times daily. This gives an idea of how important bile acids are in the normal metabolism of the gastrointestinal tract.

In the small intestine, bile acids solubilize fats to aid their absorption. Deficiencies of bile acids cause fat malabsorption and fatty stools (steatorrhea) as indicated by diarrhea. In addition, bile acid

deficiency jeopardizes a person's nutritional status by reducing the absorption of fat and fat-soluble nutrients.[64] Bile acids have been shown in clinical trials to be effective in improving fat absorption and the nutritional status of individuals.[65] [66]

Regularity, Fatty Stool, Parasites

Bile acids have other roles besides the digestion of fats and fat-soluble nutrients. For instance, it softens the stool and encourages peristalsis, thus improving the movement of the digested food mass through the gastrointestinal tract. Diets that are high in soluble and semi- soluble fibers work with the liver to trap the bile in a form which will not be too quickly reabsorbed by the system. Furthermore, bile is one of the body's chief weapons against the colonization of parasites in the intestines. [67]

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