DigestMAX HCl

ADVANCED Naturals

PRODUCT MONOGRAPH

Product composition
Medicinal Ingredients:
Each capsule contains:

Protease	20,000 HUT
Amylase	9,000 DU
Lipase	900 LU
Lactase	250 ALU
Cellulase	250 CU
Invertase (sucrase)	50 SU
Malt Diatase	125 DP
Pectinase	150 ADJU
Phytase	2 U
Betaine HCl (betaine hydrochloride)	200mg
Butyric Acid	20mg

Non-medicinal ingredients: Hydroxypropyl Methylcellulose, water

Recommended dose: Adults: 1-2 capsules with each meal, to a maximum of 6 capsules per day.

Duration of use: For prolonged use please consult a health care practitioner.

Indication:
- Digestive enzyme formula.
- This product will aid in the process of digestion, and support intestinal health.

Contraindications: Do not use if pregnant, breast feeding, or after recent surgery. Do not use if you have gastritis, peptic ulcer, duodenal ulcer or bowel obstruction. Do not exceed recommended dose.

Warnings: Keep out of reach of children.

Precautions: None

Adverse Effects: Discontinue use should abdominal pain, nausea, or vomiting occur.

Overdose: For management of suspected product overdose it is recommended to contact your physician.

Symptoms of Overdose: Has not been investigated nor any reports have been filed.

Supporting Research and Traditional Evidence

Protease (*Aspergillus oryzae*) 20, 000 HUT
The function of the gastrointestinal tract is to secrete digestive enzymes to promote the breakdown of food stuffs and facilitate the absorption of nutrients in the upper digestive tract. One type of digestive enzyme, protease, facilitates the breakdown of proteins. There are 6 types of proteases, aspartic, cysteine, glutamic, metallo, serine, and threonine, all which contribute to protein catabolism (Shen and Chou, 2009). Following catabolism, absorption occurs in 3 locations: the intestinal lumen, the brush border and/or the cytoplasm of the mucosa cells. Approximately 50% of digested protein comes from diet (Ganong, 2009). Clinical evidence suggests that a combination enzyme therapy improved digestion and nutrient absorption in patients suffering from chronic pancreatitis. In a parallel-armed, randomized, placebo-controlled study, a supplement containing lipase, protease and amylase was administered with meals for 14 days. Only patients demonstrating pancreatic insufficiency, as determined by a fat excretion amount of less than 10 g/day, were included in the trial. Treatment with the enzyme mixture was associated with increased nutrient absorption when compared with placebo control (O'Keefe *et al.* 2001). Overall, scientific evidence suggests that proteases, as part of a combination enzyme supplement, may enhance digestion and nutrient absorption.

Lipase (*Aspergillus niger*) 900 LU
In the digestive tract, lipase is essential for the breakdown and absorption of fatty acids and triglycerides. *In vivo* studies have been conducted to assess the effects of enzyme supplementation on nutrient absorption rates in broiler chickens. A combination enzyme supplement containing xylanase, amylase and protease was fed to the chickens daily for 3 weeks. Body weights and fecal nutrient levels were recorded weekly. The results indicate that enzymes as a dietary supplement improved nutrient absorption (Cowieson and Ravindran, 2008). Furthermore, clinical evidence suggests that lipase improves the digestive absorption rate in humans. In a double-blind, randomized, crossover, pilot study, healthy participants were given 3 capsules containing pancrelipase, or sucrose as a control, and then fed a fatty meal. The researchers recorded the amount of gastrointestinal discomfort associated with the high fat meal, in the form of abdominal symptom scores and methane production. Treatment with digestive enzymes was associated with a significant reduction of abdominal symptoms which suggests that treatment with enzymes improved digestion and absorption of the fatty acids (Suarez *et al.* 1999). A second single-blind analysis was performed to evaluate the use of lipases to increase digestion and absorption of fatty acids. Patients suffering from pancreatic insufficiency were treated with a supplement of lipase, or placebo, and digestive parameters were assessed for an average of 54 weeks. The results of the study suggest that treatment with digestive enzymes, such as lipase, improves the absorption of fatty acids (Valerio *et al.* 1981). Scientific evidence has suggested lipase is effective in improving fat absorption.

Cellulase (*Trichoderma reesei*) 250 CU
Cellulase is a plant-derived enzyme involved in the catabolism of cellulose. Cellulose is a key component in plant physiology. The fibrous compound gives structural stability to plant cellular walls. Consequently, cellulase is endogenous to plant cells only. Ingestion of cellulose results in increased gastric motility since there is no natural mechanism for the digestion of fibre within the human digestive tract (Campbell, 1996). Supplementation with dietary cellulase would promote the digestion of foods high in cellulose yielding glucose monomers upon complete breakdown of the polymer. Glucose, in its monomeric form, readily undergoes absorption into the gastric mucosal cell. Subsequently, the simple sugar can diffuse through the cytoplasm be transported across the baso-lateral membrane into the blood stream (Ganong, 2009). Therefore, supplementation with a daily supplement of cellulase may help to increase digestion of usually indigestible foods, such as cellulase, and facilitate glucose absorption.

Malt Diastase (*Hordeum vulgare*- grain) 125 DP
Complex carbohydrates, such as starches are not readily absorbed in their parent structure. They require digestive enzymes to provide nutritional value following ingestion. Physiologically, diastase is important for digestion of starches in the upper intestinal lumen (Ganong, 2009). Currently, the term diastase means an enzyme mixture consisting of α-amylase, β-amylase and/or γ-amylase which function as hydrolases to mediate the breakdown of starches (Gibbons, 1979). Classically, diastase was isolated from barley and considered to be one of the first discovered enzymes, and a first step towards the development of modern enzyme kinetics (Schultz, 1994). The breakdown of starch yields disaccharides or trisaccharides which may be transported into the intestinal mucosa cells and across the baso-lateral membrane to be absorbed into the bloodstream. In the human digestive tract, there are various enzymes which work in harmony to catabolise macromolecules and facilitate the absorption of nutrients (Ganong, 2009). Diastase one of these enzyme which when taken as a daily supplement may aid digestion to enhance nutrient absorption.

Amylase (*Aspergillus oryzae*) 9,000 DU
Amylase is an enzyme which facilitates the breakdown of complex carbohydrates into maltose and maltriose (Whitcomb and Lowe, 2007; Ganong, 2009). There are various forms of amylase, including α-amylase, β-amylase and γ-amylase. α-amylase is present in the saliva as the first mechanism of carbohydrate catabolism. α-amylase can also be secreted by other organs, such as the pancreas (Whitcomb and Lowe, 2007). A small-scale study by Layer *et al.* (1986) used an amylase inhibitor to assess the effects of digestive enzyme inhibition on gastric motility. Fasting participants were given 50 g of rice starch with either an α-amylase inhibitor or placebo. The results suggest that amylase inhibition reduced starch digestion and consequently nutrient absorption in the small intestine. Furthermore, in a randomized, placebo-controlled study, a supplement containing lipase, protease and amylase was administered with meals for 14 days. Only patients demonstrating pancreatic insufficiency, as determined by a fat excretion amount of less than 10 g/day, were included in the trial. The results of the study suggest that treatment with the enzyme mixture was associated with increased nutrient absorption when compared with placebo control (O'Keefe *et al.* 2001). Clinical evidence suggests that amylase aids digestion by degrading starch which may potentially facilitate nutrient absorption within the intestine.

Lactase (*Aspergillus oryzae*) 250 LacU
Lactase, a β-galactosidase, is responsible for the hydrolysis of lactose into its monomers, galactose and glucose (Ganong, 2009). Lactase is present in the brush border of the upper intestine and indirectly plays a role in the absorption of simple sugars. Inactivity of the enzyme is common in society and the condition is generally known as lactose intolerance (as reviewed by Lomer *et al.* 2007). Associated with lactose intolerance is gastrointestinal discomfort which occurs when lactose is not degraded in the intestine. Typical side effects include abdominal pain, bloating, flatus, diarrhea, nausea and vomiting (Lomer *et al.* 2007). Since lactase is an enzyme involved in the digestion of milk sugar supplementation with the enzyme may increase the digestion of lactose which could potentially increase nutrient absorption in the intestine.

Invertase (Sucrase) (*Saccharomyces cerevisiae*) 50 SU
Physiologically, invertase (also known as sucrase) is found in the brush border of the small intestine and facilitates the breakdown of sucrose into glucose and fructose (Ganong, 2009). Sucrose is commonly known as table sugar and is ingested in our daily diets in desserts and sweets. In the intestinal lumen, both glucose and fructose can be transported across the apical cell membrane. Fructose readily passes across the cellular plasma membrane, whereas glucose typically undergoes active diffusion to be absorbed (Gray, 1971). Increased digestion of the sugar would result in increased nutrient absorption within the small intestine. In a double-blind placebo-

controlled clinical trial, a yeast-derived sucrase enzyme was administrated to patients suffering from sucrase-isomaltase deficiency and the prevalence of digestive disturbances was evaluated. Patients received enzyme replacement therapy at various doses in addition to ingesting sucrose in their daily diets. The findings of the study suggest that supplementation with yeast-derived sucrase replacement therapy improved sucrose digestion as indicated by the reduction of gastrointestinal disturbances (Treem *et al.* 1993). Clinical evidence suggests that daily supplementation with sucrase may help digestion and potentially contribute to the increased absorption of glucose and fructose within the intestine.

Pectinase (*Aspergillus niger*) 150 ADJU

In plant physiology, pectinase is important since it facilitates the extension of plant cell walls and the softening of plant tissues for storage and fruit ripining. Pectinases catalyze the breakdown of various pectic substances, such as pectin, pectinic acids, pectic acids and protopectin (as reviewed by Jayani *et al.* 2005). Pectin itself is soluble, but is not readily absorbed from the intestinal lumen. If unabsorbed, pectin passes into the colon where it is undergoes bacterial fermentation. A small-scale clinical trial was conducted to assess the digestion of pectin healthy subjects. Twenty-two participants were fed a meal containing 5 g of pectin and their fecal matter was collected following pectin administration. The study suggested that approximately 90% of the pectin was not degraded and that only a small amount was fermented. This study suggests that pectin is not naturally cleaved and/or absorbed in the human gastrointestinal tract (Chinda *et al.* 2003), such that supplementation with an enzyme such as pectinase may improve the degradation of pectin and facilitate the absorption of nutrients in the human digestive tract.

Phytase (*Aspergillus niger*) 2 U

Phytate is a compound present in plant materials such as grains and oil seeds. The enzyme is responsible for the digestion of phytate, but unfortunately is not present in the human digestive system. The breakdown of phytate yields carbohydrate moieties and phosphorus (Schlemmer *et al.* 2009). The effects of dietary phytase on the breakdown of phytate in the human small intestine were assessed in a small scale-clinical study. Nine patients who had previously undergone proctocolectomy for ulcerative colitis were given a low-fibre diet for a week and then supplemented with 16 g of phytase-deactivated grain products, grain products containing active phytase or a low fibre diet the following week. The phytase-active grains and low-fibre diet treatment groups demonstrated increased phytate degradation when compared to the phytase-deactivated treatment groups (Sandberg and Andersson, 1988). Since phytase is not present endogenously in the human gastrointestinal tract, daily supplementation with the enzyme may enhance the natural digestion processes and indirectly increase nutrient absorption.

Betaine HCl (betaine hydrochloride)

Betaine hydrochloride has been implicated in promoting gastrointestinal health through its delivery of hydrochloric acid into the digestive tract (Alternate Medicine Review, 2003). Betaine HCL works in accordance with proteases, enzymes also present in this formulation of DigestMAX HCL, to increase the hydrolysis of polypeptides and increase the potential for the absorption of protein moieties. The combination has also been implicated in the treatment of the symptoms associated with dyspepsia and other gastrointestinal disorders (Sweetman, 2007). A clinical trial by Pereira (2006) evaluated the effects of betaine as part of a combination therapy on the suppression of symptoms associated with gastroesophageal reflux disease. In a 40 day randomized, single-blind study, a dietary supplement containing melatonin (6 mg), tryptophan (200 mg), vitamin B12 (50 µg), methionine (100 mg), vitamin B6 (25 mg), betaine (100 mg) and folic acid (10 mg) was administered to 176 patients suffering from moderate to very-severe heartburn. Omeprazole (20 mg) was administered to an additional 175 patients suffering from severe heartburn as a positive control for heart burn relief. Upon comparison, the results suggested that betaine was as effective as omeprazole in reducing the symptoms associated with gastroesophageal reflux disease. Scientific evidence suggests that a daily supplement containing betaine HCL may enhance digestion and potentially stimulate nutrient absorption in the intestine.

Butyric Acid (calcium/magnesium butyrate)

Butyrate, acetate and proprionate are short chain fatty acids which play a role in maintaining gastrointestinal health (Topping and Clifton, 2001). In the lower bowel, butyric acid is produced via fermentation by enteric bacteria. These short chain fatty acids function to modulate of colonic muscular activity, enhance blood flow to the tissue and stimulate electrolyte and fluid uptake (Oz and Ebersole, 2008). In vitro studies have suggested that butyric acids contributes to gastrointestinal health by repairing DNA damage in colonocyes (reviewed by Oz and Ebersole, 2008; Topping and Clifton, 2001). Clinical trials have been conducted to assess the correlation between gastrointestinal health and butyrate levels in the human colon over a 9 day span. Gastric motility was controlled using raw wheat bran plus senna tablets and loperamide to increase and decrease motility, respectively. Following dosing with the described supplements, levels of short chain fatty acids, rate of stool output and whole gut transit time were measured. The results of the study suggest that butyric acid levels increased following treatment with senna and decreased following treatment with loperamide suggesting that butyric acid levels positively correlate with rate of gastric motility (Lewis and Heaton, 1997). Overall, scientific evidence suggests that supplementation with butyric acids may increase gastric motility and promote gastrointestinal health.

Ingredient Summary:

Digestive enzyme blend consisting of:
Protease (*Aspergillus oryzae*) 20, 000 HUT
- Helps with the digestion of proteins

Lipase (*Aspergillus niger*) 900 LU
- Helps with the digestion of fats

Cellulase (*Trichoderma reesei*) 250 CU
- Helps with the digestion of fibre

Malt Diastase (*Hordeum vulgare*- grain) 125 DP
- Helps with the digestion of starch

Amylase (*Aspergillus oryzae*) 9,000 DU
- Helps with the digestion of starch

Lactase (*Aspergillus oryzae*) 250 LacU
- Helps with the digestion of lactose

Invertase (sucrase) (*Saccharomyces cerevisiae*) 50 SU
- Helps with the digestion of table sugar

Pectinase (*Aspergillus niger*) 150 ADJU
- Helps with the digestion of pectin

Phytase (*Aspergillus niger*) 2 U
- Helps with the digestion of phytate

Betaine HCl (betaine hydrochloride)
- Contributes hydrochloric acid to aid digestion

Butyric Acid (calcium/magnesium butyrate)
- Contributes to gastrointestinal health

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