

SCIENCE BRIEF: IMPROVED DIGESTION SUPPLEMENTING WITH ORAL DIGESTIVE ENZYMES

Consider the following review of clinical research and observations regarding improved digestion with Transformation's DigestZyme formula

Transformation Enzyme Corporation (TEC) is a nutritional supplement company specializing in the development of quality enzyme-based products for the health care professional. Through clinical and observational research, TEC's efforts focus on teaching the importance of nutrient acquisition as the foundation of wellness and healthy living.

A poor diet and a digestive system that fails to process food for bioavailability and absorption will undermine the body's coping ability and create conditions favorable for disease and metabolic disorders. Based on this fact, TEC strives to educate health care professionals worldwide on the benefits of a balanced diet and proper digestion. The primary benefits are:

1. maintaining a strong digestive system
2. enhancing bioavailability of nutrients to the cells
3. supporting immune health and cellular vitality
4. promoting efficient and timely removal of metabolic byproducts and environmental toxins

The only thing that any biological system ultimately requires is an ensured way of delivering nutrients to the cells.

Historically, supplemental digestive enzymes were obtained from the pancreatic juice of animals, commonly bovine and porcine. However, in the past several decades, enzymes derived from non-animal sources have gained recognition. Plant enzymes such as bromelain and papain are commonly used. More current research suggests mycelial enzymes from *Aspergillus oryzae* and *niger* as well as other microorganisms have been proven safe, effective, and in many cases superior to traditional "animal" and "plant" enzymes for digestion.

Contrary to the long held belief that enzymes do not survive the gastrointestinal environment, several studies have demonstrated that some orally ingested enzymes remain active in the GI tract. Furthermore, some

enzymes are absorbed into the blood stream where they remain active and impart systemic benefit.

TEC's scientific staff with decades of combined experience in biochemistry, nutrition, and cellular and molecular biology has formulated a highly specific digestive enzyme product to facilitate digestion and support the body to maintain health and wellness. This science brief will review the effects of supplemental digestive enzymes on preventive health and wellness as well as their safety and efficacy for human consumption. Additionally, this science brief will highlight the unique features of TEC's DigestZyme formula.

The Importance of Good Nutrition and, More Importantly, Optimal Digestion

The number of reported digestive disorders is on the rise. It is estimated that over 80 million Americans are affected by various forms of digestive diseases. According to the NIH, the related health care cost is estimated at over \$107 billion.

TEC believes this increase can be attributed to poor diet, improper digestion, stressful lifestyles, and the prevalence of toxins in the environment. While genetics may play a part, scientists continue to find more and more evidence that points to the fact that the vast majority of *all* disease can be traced back to poor diet, mal-digestion and the inability of the gut to function properly.

TEC suggests practitioners look at two variables: food choices and digestion. These can be addressed immediately simply by paying attention to what one eats and by supplementing with digestive enzymes. The benefits to overall health are extensive:

- Bioavailability of nutrients to the cell improves cellular vitality and function
 - Proteins supply amino acids, the structural components for every cell, tissue, muscle, and organ
 - Carbohydrates are the body's main energy source
 - Fats supply fatty acids for energy and structural

components of cell walls, cholesterol, and hormones

- Vitamins and minerals are key to all the processes that take place in the body and serve as cofactors for many biochemical reactions
- Efficient, appropriate, and precise immune function
- Reduced digestive distress (inflammatory bowel disorders, GERD, food intolerances, and allergies)
- Improved elimination of waste / decreased toxic load

Reduced oxidative stress and free radical damage
When the body receives good nutrition along with optimal digestion, the opportunity for health and wellness is multiplied.

The Safety of Enzymes Derived from *Aspergillus oryzae* and *Aspergillus niger*

Before a fungal organism is used in fermentation, the specific strain is extensively screened to determine if the organism is capable of producing mycotoxins under the conditions of fermentation. Only those organisms that do not produce any toxins are selected for use in the fermentation process. Even after an organism is determined to be “safe” and is used in fermentation, every second generation is again checked to verify that mutations have not occurred which might enable the organism to produce mycotoxins. Enzymes derived from *Aspergillus* fermentation were first used in food production at the turn of the century. Since their introduction, there has never been a documented case of illness from mycotoxins associated with fermented enzymes, which is testament to the effectiveness of the screening process employed by the enzyme manufacturing industry.

The system that ensures and controls health and whose effective performance ultimately guarantees wellness is the digestive system.

Once fermentation by the *Aspergillus* organism is complete, the enzymes are extracted by a complex process that isolates protein compounds from the surrounding material. No living *Aspergillus* cells remain in the isolated enzyme after the extraction process is complete. Mycotoxins are not protein-based substances; therefore, in the extremely unlikely event that mycotoxins were produced during fermentation, they would not be extracted with the enzymes. Instead, any mycotoxins present would remain in the discarded portion of the fermentation. Even so, the final enzyme product is routinely checked for the presence of mycotoxins and aflatoxins.

Enzymes derived from the fermentation of *Aspergillus* are purified compounds which do not contain any living

Aspergillus cells and therefore cannot initiate infection or colonization. *Aspergillus*, like any other fungus, can act as an opportunistic pathogen; however, the relative rarity of *Aspergillus* infections indicates the low degree of innate virulence of these organisms. Infectious diseases associated with *Aspergillus* involve growth of fungal mycelia within body tissue, most commonly within the pulmonary system. In order for mycelial colonization to occur, the *Aspergillus* must be introduced to the body in a living form. It is important to note that no cases of *Aspergillus* infections have ever been documented in association with the consumption of purified fermented fungal enzymes.

Allergic responses to *Aspergillus* organisms and the products of their fermentation rarely occur, and their occurrence is largely isolated to regular air-borne “dust” exposure by workers in the food industry. If an allergic reaction is to occur, it is generally the protein fraction of a substance that will elicit such a reaction. Although enzymes derived from *Aspergillus* fermentation are free of any living *Aspergillus* cells, the fact remains that these enzymes are a purified protein fraction of the *Aspergillus* organism.

DigestZyme – product highlights

Transformation’s oral supplemental digestive enzymes have been carefully researched and selected to provide you with a highly effective, stable and functional digestive enzyme formula. DigestZyme is a comprehensive digestive enzyme formula designed to optimize complete digestion of all foods. DigestZyme contains proteolytic, lipolytic, and polysaccharolytic enzyme blends from microbial fungal sources, making them safe, effective, and GI tract stable and functional. This means the enzyme blends in DigestZyme do not require an enteric coating to survive the harsh environment of the stomach but rather initiate digestion in the stomach and continue the digestive process in the small intestines. This is important when you consider that as much as 80% of the body’s energy is required during the digestive process. DigestZyme will work with the body, making it more efficient in liberating nutrients while lessening the overall burden. In the long term, this can improve health, vitality, and longevity.

Proteases

This formula contains a proprietary blend of proteases that are active throughout the gastrointestinal tract. The proteolytic enzyme blend in DigestZyme includes proteases that maintain activity in a broad pH range of 2.0-8.0. Peak activities are demonstrated at pH of 3.0 and 6-7. This is important because it is consistent with that of the human GI tract. Working with the body’s own digestive enzymes these supplemental enzymes ensure optimal digestion of proteins beginning in the stomach and continuing in the small intestines. The proteases in DigestZyme are standardized using the FCC (Food Chemical Codex).

Clinical Application

Undigested protein can lead to many digestive and systemic disorders ranging from heartburn, acid reflux, gas, and bloating to allergies, inflammation, and auto-immune disorders. Intact protein in the large intestine may be fermented by intestinal flora, resulting in the formation of various metabolites that may be absorbed into the blood circulation. These toxins include ammonia, branch chained fatty acids, phenols, and hydrogen sulfides, all of which under certain conditions can trigger systemic diseases. DigestZyme may also reduce the signs and symptoms associated with autism. Additionally, the trend of high protein diets necessitates a greater need for supplementing with proteolytic enzymes.

Lipases

DigestZyme includes lipase to support digestion of dietary fats and reduce digestive stress. It is an acid-resistant lipase for the hydrolysis of tryglycerides, yielding mono- and diglycerides, glycerol, and free fatty acids. These enzymes are an effective digestive aid because of their broad substrate specificity on fats and oils from vegetable and animal origin. Additionally, they demonstrate an effective 3.0-8.0 pH range, making them highly stable and functional in the gastrointestinal tract. The lipase in DigestZyme is measured in FCC (Food Chemical Codex).

*DigestZyme is Transformation's
"original" digestive formula:
gentle and soothing to the
gastrointestinal tract*

Supplement Facts

Serving Size 2 Capsules

Servings Per Container 60/120/180

Amount Per Serving	% Daily Value
Enzyme Proprietary Blend	300 mg
Protease	66,500 HUT †
Amylase	12,200 DU †
Lactase	800 ALU †
Cellulase	1320 CU †
Diastase	500 DP° †
Lipase	1000 FIP †
Invertase	200 SU †
Lactobacillus acidophilus (200,000,000 cfu)	1 mg †
Bifidobacterium longum (60,000,000 cfu)	0.6 mg †

† Daily Value not established

Other Ingredients: Vegetable Capsule (Hypromellose, Water), Rice Bran Extract

Did you know?

- Digestive diseases are the third largest category of illness in the US with as many as 70 million reported cases, making it second only to the common cold as the most frequent reason to seek medical advice.
- The digestive system has more nerve endings than the spine and manufactures more neurotransmitters than the brain. 90% of all serotonin is made in the gut and a full 70% of the immune system is located in or around the digestive system.
- DigestZyme is used by surgeons, medical doctors, naturopaths, chiropractors, acupuncturists, psychologists, colon hydrotherapists, massage therapists, dieticians, nutritional counselors, and more!

Clinical Application

Over-consumption of fat and difficulty digesting fat can lead to gall bladder stress, gallstones, diabetes, obesity, high cholesterol, and other cardiovascular diseases. Given the fact that diabetes (type II), obesity, and cardiovascular disease are among the Top 10 most prevalent health challenges facing Americans today, a closer look at prevention deserves attention. DigestZyme addresses prevention by promoting absorption of essential fatty acids, which are known to help reduce the risk of cardiovascular disease.

Carbohydrases

DigestZyme contains a blend of carbohydrases for maximum digestion of starches and sugars. This proprietary carbohydrase blend is acid stable and works in a wide pH range, therefore functioning throughout the gastrointestinal tract. DigestZyme contains amylase and malt diastase for assistance in breaking down starchy foods. Invertase and lactase are for optimal digestion of sugars. Additionally, this blend contains cellulase to help with the breakdown of fiber, promoting the release of vital nutrients often "locked" within these chemical structures. This does not, however, negatively impact or diminish the presence of fiber necessary for proper elimination of wastes. The carbohydrases in DigestZyme are standardized using the appropriate FCC units of activity.

Clinical Application

Assisting with the proper digestion of various carbohydrates can alleviate and control many digestive disorders. DigestZyme can reduce the discomfort associated with gas, bloating, cramping, diarrhea, and constipation. DigestZyme may also reduce the signs and symptoms associated with Crohn's disease, Celiac disease, milk intolerance, and many other food intolerances or allergies.

Probiotics

In addition to the presence of highly effective enzymes, DigestZyme contains *L. acidophilus* (DDS-1) and *B. Longum*, probiotics unique to this formula that enhance its effectiveness. The well known benefits of probiotics include assisting with pH balance in the GI tract, production of digestive enzymes, vitamins and minerals, and immune support.

Clinical Application

As a comprehensive enzyme blend with probiotics, DigestZyme is an excellent choice for everyone! It is also ideal for individuals with a weak constitution or a sensitive GI tract such as those with IBS, frequent nausea, and/or intolerance to other supplements. This formula may also be used for gall bladder stress, nausea, vomiting, indigestion, chemical or environmental sensitivities, and colic. Digestzyme is suitable for pregnant and lactating mothers and is ideal for children.

Vegetarian Formula

DigestZyme is a vegetarian product that contains absolutely no fillers or binders. It is dairy free and gluten free. As with the majority of Transformation's products, this product is presented in a capsule made of cellulose and water. DigestZyme includes no fillers and is non-allergenic.

Recommended Usage

The ultimate goal of digestion is getting nutrients to the cells. Nutrients not only feed the cell, they protect it from free radical damage. Healthy cells lead to optimal metabolism, energy, and immunity. Supplementing with digestive enzymes is a vital part of this nutrient acquisition process. This unique formula is the perfect introduction to digestive enzymes, supporting immune system health by encouraging more complete digestion of proteins, carbohydrates, and fats for increased absorption and availability of nutrients.

This gentle formula of GI stable and functional digestive enzymes is designed to safely and effectively encourage more complete digestion. The probiotics *L. Acidophilus* and *B. Longum* are included in this formula for enhanced tolerance and digestive comfort. This product is ideal for food intolerances, nutritional support during pregnancy and lactation, and children's occasional digestive issues. The smaller capsule size is well tolerated for children as well as adults.

To assist the body in maximum digestion of nutrients, production of energy, and immune system support, take two (2) capsules with every meal or as directed by a health care practitioner. Take with adequate liquid. The vegetarian two-piece capsules can be pulled apart and the contents may be taken by spoon immediately after mixing with a small amount of tepid water.

Questions? 1-800-777-1474
email moreinfo@tecenzymes.com
www.transformationenzymes.com



*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

Appendix - The Efficacy of GI Stable and Functional Enzymes

Enzymes, as proteins, are normally susceptible to pH change as well as hydrolysis and denaturation by various factors. A common argument against the oral administration of supplemental digestive enzymes has been their susceptibility to denaturation and hydrolysis by the gastric secretions. Thus, there has been a need to determine the efficacy as well as the stability of some of these supplemental enzymes in the gastric environment. Several enzymes are on the market, yet few of these products have been shown to sustain the harsh gastric environment.

Therefore, TEC participated in a study to determine the level of stability of specific supplemental enzymes and their effectiveness in hydrolyzing food macromolecules. The specific enzymes that were tested include fungal protease 4.5 (*A. oryzae*), fungal acid stable protease (*A. niger*), bromelain and papain, amylase (*A. oryzae*), lactase (*A. oryzae*), glucoamylase (*A. niger*), lipase (*A. niger* and *Rhizopeus oryzae*), and cellulase (*Trichoderma longibrachiatum*).

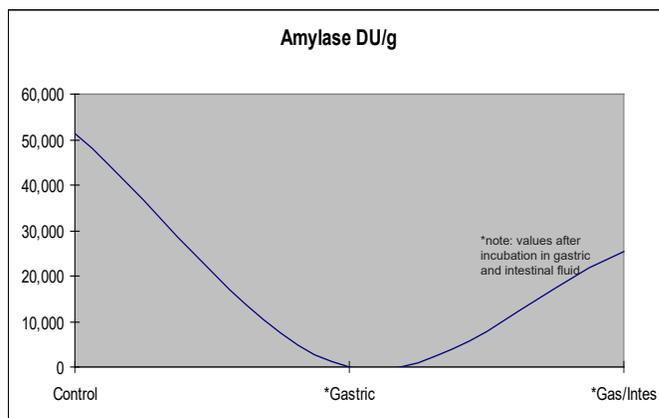
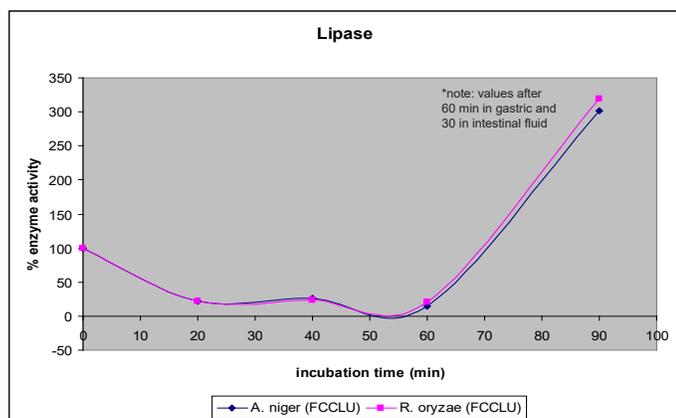
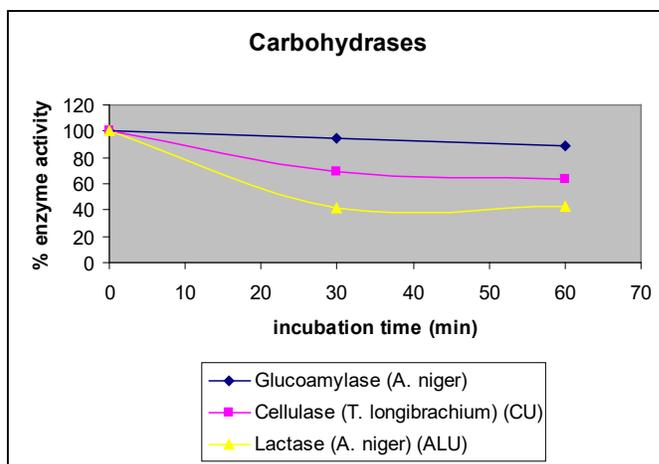
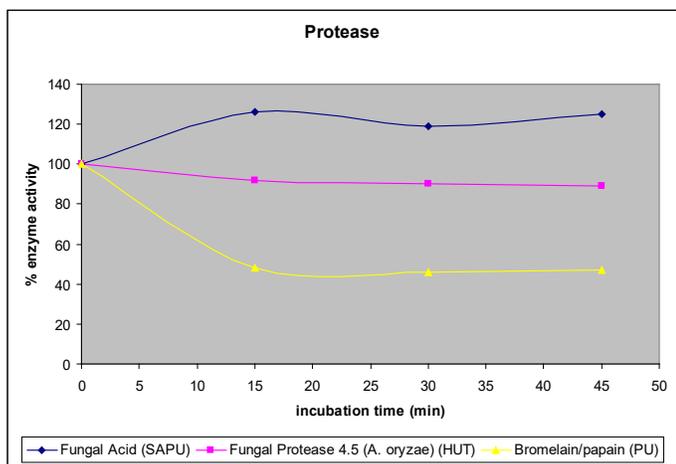
In all cases, the enzymes assayed proved to sustain the simulated gastric fluid, albeit with varying degrees of stability. Some enzymes appeared to have considerably lower activity, so a sample was further incubated in a simulated intestinal fluid that was void of any pancreatic enzymes. Upon assay, the sample incubated in gastric fluid and then in intestinal fluid recovered its activity and moreover had a higher enzyme activity than even the control that was not subjected to any gastric fluid treatment. This indicated that the gastric fluid did

not irreversibly denature that enzyme and, interestingly, there appeared to be some activity enhancement resulting from the treatment(s) as seen in the following graphs.

Furthermore, the conditions of these experiments (i.e., direct contact of the enzymes with the harsh simulated gastric fluid) do not occur under normal conditions. Upon taking supplemental digestive enzymes with meals, various macromolecules act as a "protective shield" protecting the direct exposure of the enzymes to the low pH. Some foods actually contribute some buffering of the gastric content during the initial phases of eating. During that initial time, supplemental enzymes within the food bolus are able to continue their hydrolytic action.

The data here indicates that even without the benefits therein mentioned of the ingested foods, the supplemental enzymes used in this study could sustain the stomach environment, as can be deduced from the simulated gastric fluid exposure, and help in enhancing the digestion of the food macromolecules. Additionally, under some conditions, the enzymes appeared to temporarily lose their activity until they reached a more favorable environment in the small intestine.

This study indicates that the enzymes in TEC's formula maintained enzyme activity after exposure to simulated gastric fluid as used in pharmaceutical studies. This proves our digestive enzymes are stable to low pH conditions thereby enhancing the digestive process and promoting health.



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