PhytoCeutical Formulations

Formula Rationale

nZymax™

digestive enzyme

full spectrum vegetarian enzyme supplement

Enzymes – A Historical Perspective

While the recognized use of enzymes as dietary supplements and therapeutic agents has only developed within the last century, humans have been benefiting from their presence in food since the dawn of mankind. Consumption of raw foods and traditional food processing practices, including aging of food and fermenting food, take advantage of dietary sources of enzymes. However, many modern food-processing practices actually deplete our food's supply of enzymes. Uniquely modern ailments that have developed since the onset of modern food processing techniques have lead to research into the benefits of dietary enzymes.

All raw food contains the enzymes needed to eventually "digest" itself through decay. The native enzymes found in raw foods actually act synergistically with human endogenous enzymes to help digest our foods, reducing the enzymatic burden of digestion on the body. Early human diets were rich in raw food sources allowing early man to benefit from this synergism. As civilization advanced, cooking and processing of foods became more prevalent. Though humans did not understand the basic mechanisms of enzymatic predigestion in raw foods, they started taking advantage of this fact early on, by allowing foods to age. During the aging process of foods, native enzymes begin the digestive process, making foods more tender, flavorful, and nutritious. A natural adjunct to the aging process was fermentation of foods. The act of fermentation subjects the food to the enzymatic actions of microbes, essentially predigesting the food. For centuries, foods have been fermented with bacteria and fungi to produce nutritious and tasty foods, such as tofu, cheeses, tempe, yogurt, and alcoholic beverages.

In the late Nineteenth Century, large scale canning and heat processing techniques rapidly replaced traditional food preparation/preservation techniques in the Western world. The temperatures used in large scale food processing are specifically designed to destroy enzymatic activity and delay the predigestion (decay) of foods. As a result, processed foods completely lack native enzyme activity, which some feel places the burden of digestion completely on the human body. Some researchers have theorized that the added digestive burden may lead to a variety of diseases and disorders, though this theory has yet to be proven conclusively.

In recent decades, the biological effects of modern food processing have been compounded by a modern lifestyle. Our modern fast paced high stress lifestyles tend to lead to improper digestion. Stress and anxiety trigger hormone releases that interfere with smooth muscle contraction and enzyme secretion, leading to indigestion. This is further compounded by the tendency to eat on the run and to overeat. Because hurried eating results in partially chewed foods being dumped into the digestive tract, the tendency to eat on the run results in food not being properly mixed with salivary enzymes and to be in such large pieces that digestive enzymes can not adequately act on the food. Overeating causes more nutrients to be consumed than what the average human digestive system can handle. These issues can combine to overwhelm the body's ability to completely digest consumed meals, which can lead to digestive discomfort, constipation, and suboptimal nutrient uptake.

Age Related Digestive Insufficiency

A person's ability to properly digest and absorb their food decreases with age. This reduction in digestive capacity is likely related to the fact that pancreatic digestive enzyme production decreases linearly after the second decade of age, at a rate of nearly 10% per decade. As a result, the ability to digest/absorb fats and proteins can become greatly impaired. This impairment can lead to a host of gastrointestinal symptoms and health consequences, including anorexia, abdominal discomfort, flatulence, constipation, reflux disorders, ulcers and diarrhea. Some studies tested the effectiveness of oral enzyme supplementation on the above stated symptoms. In these studies, the gastrointestinal symptoms of study participants improved significantly. While these conditions are in themselves a concern for seniors, malnutrition caused by such enzyme deficiencies can significantly reduce the quality and quantity of life in the aging population. Protein utilization of the elderly is of particular concern, because such deficiency can lead to reductions in immunity and muscle atrophy. Enzyme supplementation significantly improves protein utilization among the elderly.

Food Intolerance

Not all enzyme deficiencies are caused by disease or aging. Some enzyme deficiencies are the result of normal genetic variation. This normal genetic variation in the production of digestive enzymes can result in food intolerances. While most food intolerance is a mere nuisance, food intolerances have been implicated in numerous digestive disorders, including Irritable Bowel Syndrome and Celiac Disease. In recent years, lactose intolerance has been a buzzword for many people. Lactose intolerance refers to a broad class of symptoms that result from the ingestion of lactose containing foods by people who fail to produce adequate amounts of the enzyme lactase. The undigested lactose can be fermented by gut flora producing belching, cramping, diarrhea and flatulence. Studies show that supplementation of *Aspergillus* lactase can significantly reduce symptoms of lactase deficiency. However, not all people who believe they are lactose intolerant respond to this therapy. This is because these people may actually be suffering from milk hypersensitivity, likely triggered by milk proteins. These milk proteins are addressed by the proteolytic enzymes found in this formula.

This formulation was designed specifically to support digestion in people who eat the typical modern diet, which is high in protein, fat, and carbohydrates. It contains a proprietary blend of proteolytic, lipolytic, and carbohydrolytic enzymes specifically designed to aid the digestion of these nutrient dense meals. Supplementation with these enzymes is critical in order to handle the increased digestive demands placed on the body when eating a diet that is high in fat, protein, and carbohydrate. Supplemental enzymes also help assure that the maximum amount of available nutrition is obtained from the food eaten. In addition, fructooligosaccharides have been added to support the body's beneficial endogenous microflora. Ginger has been added as well, due to its soothing effect on the gastrointestinal tract.

These ingredients and their specific functions are outlined below.

Proteolytic Enzymes

Protease 3.0 is characterized by its ability to hydrolyze proteins under acid conditions. The broad specificity of acid-stable protease enables the enzyme to, easily and efficiently, hydrolyze most soluble proteins. Because protease 3.0 has an effective pH range of 2.75 to 4.7, it is uniquely suited to work synergistically with endogenous pepsin to provide protein digestion in the stomach.

Protease 4.5 is a mixture of acid, neutral and alkaline proteases that demonstrate both exo-peptidase and endo-peptidase activity with high substrate specificity. Protease 4.5 has an effective pH range of 2.75 to 6.25. For this reason, protease 4.5 works synergistically with endogenous enzymes to provide protein digestion in the stomach and pyloric regions of the small intestine.

Protease 6.0 is a mixture of acid, neutral and alkaline proteases that demonstrates both exo-peptidase and endo-peptidase activity with high substrate specificity. Protease 6.0 has an effective pH range from 2.75 to 7.0. For this reason, protease 6.0 works synergistically with endogenous enzymes to provide protein digestion through all portions of the digestive tract. Protease 6.0 is unique in its high substrate specificity, demonstrating reduced occurrence of carbohydrase side activity.

Bromelain contains several proteolytic enzymes, which differ in their specificity and optimum environments. Bromelain has an effective pH range of 4.0 to 9.0 and works synergistically with endogenous enzymes to provide protein digestion throughout the entire digestive tract.

Papain contains a wide array of proteolytic enzymes, incorporating a broad range of substrate specificity and optimum environments. Because of this attribute, papain easily and efficiently hydrolyzes most soluble protein, yielding peptides and amino acids. Papain has an effective pH range of 3.0 to 10.5 and works synergistically with endogenous trypsin and chymotrypsin to provide protein digestion throughout the small intestine.

The proteolytic enzymes in this formula are used to help digest protein to produce amino acids, which are important building blocks in the human body. The amino acids are used to build muscles, metabolic enzymes, neurotransmitters, and many other essential biochemicals. Proteolytic enzyme supplementation can be essential to maintaining lean muscle tissue while on any type of diet, and allows you to get the maximum nutrition from the protein consumed in a typical diet.

Lipolytic Enzymes

Lipase AN catalyzes the hydrolysis of triglycerides of simple fatty acid esters, yielding mono- and diglycerides, glycerol and free fatty acids. It has broad substrate specificity on the fats and oils of vegetable and animal origins. Lipase AN works synergistically with endogenous enzymes to help digest fatty foods.

Supplementing with Lipase AN can help the body to properly digest the excessive fat being eaten in today's typical high fat, high carbohydrate diet. Considerable digestive distress and even malabsorption of nutrients such as vitamins A and E can result from improper fat digestion.

Carbohyrdolytic Enzymes

Amylase will randomly hydrolyze the interior alpha-1,4-glucosidic bonds of starch to release simple sugars for digestion. This enzyme works synergistically with endogenous human amylase to digest starchy foods.

Glucoamylase will hydrolyze terminal 1,4-linked alpha-D-glucose residues successively from non-reducing ends of amylose chains to release free glucose. This enzyme also possesses the ability to hydrolyze alpha-1,6-glucosidic linkages in isomaltose and dextrins. This enzyme works synergistically with endogenous human amylase and supplemental amylase to potentiate the complete digestion of carbohydrate rich foods.

Malt Diastase is characterized by its ability to hydrolyze amylose and other polysaccharides to remove successive maltose units (glucose-glucose dimers) from the non-reducing end. This enzyme works synergistically with amylase and glucoamylase to digest carbohydrate rich foods, particularly those produced from grains.

α-galactosidase is characterized by its ability to hydrolyze the alpha-1-6 linkages in melibiose, raffinose, and stachyose. These are indigestible sugars containing alpha-galactosyl groups, and commonly occur in vegetables, especially in members of the legume and cruciferous families.

Lactase is characterized by its ability to hydrolyze lactose over a wide range of temperatures and pH. NEC's lactase catalyzes the hydrolysis of the lactose beta-D-galactoside linkage liberating one mole of D-glucose and one mole of D-galactose. This enzyme works synergistically with endogenous human lactase to digest the sugars found in milk and dairy products.

Cellulase hydrolyzes the beta-D-1,4-glucosidic bonds of cellulose (an indigestible structural carbohydrate of plant cell walls), its oligomers and derivatives. This enzyme is a complex composed of three distinct enzymes to convert cellulose to glucose. Since humans lack the endogenous enzymes required to digest cellulose, the supplementation of cellulase provides humans with an additional source of nutrition and reduces the bulking effect of fibrous foods.

Pectinase is a mixture of pectin methylesterase, which demethylates pectin (an indigestible structural carbohydrate of plant cell walls), and polygalacturonase which hydrolyzes β-D-1, 4-galacturonide. Since humans lack endogenous pectinase, the supplementation of pectinase provides humans with an additional source of nutrition and reduces the bulking effect of fibrous foods.

This combination of carbohydrases is designed as a comprehensive approach to carbohydrate digestion, which allows for a more complete digestion of the carbohydrates consumed. This enables a person to properly digest and receive the maximum amount of nutrients available from their carbohydrate intake.

Other Enzymes

Phytase catalyzes the hydrolysis of phytic acid into its component parts, releasing inositol and ortho-phosphate. Phytic acid is known as an antinutrient because it tends to bind important minerals. Since humans lack endogenous phytase, the supplementation of phytase releases important mineral nutrients that would otherwise be lost.

Prebiotic Ingredient

Fructooligosaccharides (FOS) are special fibrous carbohydrates that are not metabolized by the human body, but instead provide nutritive support to the natural flora of the intestines. FOS has been included to help support the growth of beneficial microorganisms. By providing a nutritional source for endogenous microflora, it enables them to better thrive in the intestine. Having a healthy intestinal flora can lead to the improved breakdown of nutrients in the intestine, thus leading to improved digestive efficiency and nutrient availability.

Herbal Ingredient

Ginger is a perennial herb that is native to parts of China and India. It is now cultivated in tropical locales, worldwide. Ginger has been commonly used by traditional herbalists to treat gastrointestinal upset and nausea. In addition to its gastrointestinal soothing properties, ginger was added to this formula to promote digestion by increasing the flow of saliva, gastric juices, and bile. These properties enable ginger to work synergistically with the digestive enzymes to promote proper digestion and reduced gastrointestinal upset.

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