# The Effectiveness of Dietary Enzymes in Improving Health

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Dr. Howell did a great deal of research in the 1930s and '40s on digestive enzymes. He worked with many animals, showing that enzyme supplementation decreased the size of the pancreas, and that enzyme concentration in organs and glandular excretions decreased with age and onset of disease. Dr. Howell developed the concept of "adaptive secretion of digestive enzymes." The amount of enzymes needed to be supplied by the pancreas can be diminished by food enzymes in raw foods, or supplemental digestive enzymes. Dr. Howell also proposed the idea of an "enzyme bank." He said that we have a certain, already determined amount of enzymes available in our lifetime and when this bank ran out, we die. This bank could be drawn upon more slowly, and thus life prolonged, by the use of raw food enzymes and supplemental enzymes. This last idea has not been confirmed by scientific evidence.

Well, Dr. Howell did his work over 70 years ago, and the other work he cited is likewise very old. With our modern knowledge of physiology and biochemistry, is there any further evidence that confirms what he said? Is there any evidence that supplementary enzymes are helpful to people?

One study was done by Dr. Rohit Medhekar of National Enzyme Company using a model system of the human gastrointestinal tract located at the Netherlands Organization for Applied Scientific Research TNO in Zeist, Netherlands. The model has chambers for the stomach, small intestines, large intestines, with membranes which mimic nutrient absorption from the chambers. All the appropriate fluids such as saliva, gastric fluid, and pancreatic secretions are pumped into the chambers in the right amounts and times. For the experiment a standard meal was placed into the system and digestion was compared under optimal conditions, under impaired digestion (70% less gastric acid and intestinal secretions) both with and without supplemental digestive enzymes. Even under optimal conditions the digestion was improved by enzyme supplementation, especially for carbohydrates. Under impaired conditions both carbohydrate and protein digestion were substantially improved with the supplemental enzymes.[(1)]

The enzymes used were a mix of plant-produced digestive enzymes produced in fungus. They have a broad pH range and are not easily deactivated in the highly acidic stomach environment. So, the enzymes begin working in the stomach and keep right on working in the small intestine as well. This study highlights the effectiveness of these fungal enzymes in increasing the efficiency of digestion, whether digestion is impaired or not.

A study of nursing home patients who were bedridden and fed using a tube showed that a plant-based enzymes (bromelain and fungal enzymes) improved digestion, noted by a significant improvement in total serum protein and tendencies to improve albumin concentration. When the enzyme supplement was stopped the protein and albumin went back to baseline levels.[(2)]

Plant enzymes produced by fungus are active over a wide range pH range, including the acidic environment of the stomach. Chronic pancreatitis and cystic fibrosis are both conditions which lead to poor digestion of dietary fat due in insufficient enzyme production by the pancreas. The undigested fat ends up in the stool. Pancreatin (often from pigs) is used to provide supplemental enzymes, but very large doses must be used because so much is destroyed by stomach acid. Lipases from fungus

are acid stable, plant-based, and can thus be used in much lower doses to get the same effect. This was shown in a German study where 75,000 units of fungal lipase was equivalent to 360,000 units (4.8 times as much) of conventional pancreatin in treating people with chronic pancreatitis, severe pancreatic insufficiency and steatorrhea.[3] A study in dogs also found that 400 mg of fungal lipase was equivalent to 10,000 mg of conventional pancreatin in overcoming their surgically-created pancreatic enzyme deficiency.[4] The fungal lipase begins to work in the stomach and keeps on working in the small intestine.

Raw foods do contain some enzymes which help them auto-digest. This is part of the reason why raw foods are beneficial to you, because they sometimes require less energy to digest. However, these enzymes are not always that abundant even in raw foods. For example, a study was done comparing the iron absorption from a wheat roll in the presence of raw wheat bran (containing phytase), or in the presence of wheat bran with deactivated phytase, or in the presence of wheat bran with deactivated phytase and a phytase enzyme supplement from *Aspergillus niger*, a fungus. If the phytate is not very well digested it will bind to iron, inhibiting its absorption. Iron absorption in this experiment was the same from the raw wheat bran group and the deactivated-phytase wheat bran group, indicating that the food enzyme phytase was not effective in breaking down the phytate in real life conditions. However, the use of the fungal phytase doubled the absorption of iron, indicating that this phytase did a very good job in digesting the phytate present in that meal. So, supplemental enzymes are beneficial with even our raw foods. The concentration of enzymes is higher and they work in a wider pH range than most raw food enzymes, so they will help all of your food digest better, not just your cooked food.

In addition to these studies with people some enzyme studies have been done with livestock as well. Nutrition science is intensely applied with livestock, because enzymes can help animals utilize cheaper feeds and still grow and produce as well as when they are fed the more bioavailable feed stock. Also, by reducing nutrient waste from the animals it cuts down on environmental pollution. It is true that livestock are more scientifically fed than people.

For example, α-amylase is an enzyme which digests starch. When beef cattle were fed chopped whole corn plants with 0.05% α-amylase added to it, the animals gained weight faster and digested their food better, evidenced by a better weight gain per unit of dry feed consumed.[6] Steers fed cottonseed hulls supplemented with α-amylase also had higher feed intake and better weight gain compared to a control group.[7] Seven-day old chicks which were fed a diet supplemented with α-amylase had daily weight gain that was 9% better than control and 4% better feed conversion compared to the control chicks.[8] The pancreases of these chicks fed α-amylase also were significantly smaller, just a Dr. Howell had seen many years ago in animals.

Combinations of enzymes have been often used as well. Often enzymes which help break down plant cell walls are used with animal feeds. Grains can become very viscous due to soluble non-starch polysaccharides, forming a gel in the intestinal tract. This gel binds up nutrients and makes it difficult to fully utilize all of the nutrients from the food. Enzymes which help digest this polysaccharide gel are beneficial in this case. Cellulase, hemicellulase, xylanase, α-amylase, glucanase, invertase, galactanase, mannanase, and pectinase are all enzymes which assist in this process.

Dairy cows that were fed silage treated with an enzyme mixture to break down the plant cell walls had an increase in feed intake and an increase in milk production.[9] Dairy cows that were fed forage

sprayed with an enzyme solution containing cellulases and xylanases also increased the feed intake and improved their milk production.[10, 11]

Various enzymes tests have been done with young chickens. Young chicks fed a 60% rye diet supplemented with cellulase enzymes had a 71% increase in feed consumption and a 193% increase in weight gain (43% increase in feed to gain ratio) compared to the control group.[12] When lupins were added to chicks diet their growth performance decreased, but the addition of a crude enzyme preparation restored growth to a high-quality control diet. The pancreas was reduced by 5% and the crop by 22% in the chicks given the enzymes in this experiment,.[13] again confirming what Dr. Howell had reported. Garcia and coworkers similarly found that an enzyme mix improved retention of nutrients while reducing the weight of the pancreas and small intestine, but increasing the villus height and surface area in the small intestine, thus increasing the surface area for nutrient absorption.[14] Foods that are difficult to digest stress the digestive tract, but enzyme supplementation can relieve that stress and reduce the body's work load. Energy can go to other activities besides digesting food.

Multiple enzymes in combination have often yielded the best results. Each enzyme works on a particular substrate molecule. However, several different types of enzymes are actually required to break down carbohydrates, and several more for proteins, and another set of enzymes for fats. Getting the right combination of enzymes is key to successfully improving digestion. These animal studies, and others not cited, demonstrate that enzymes indeed are helpful in improving livestock performance. Several companies have done extensive work in perfecting enzyme blends just for this purpose.

So, how does this information apply to people? First, Dr. Howell was right in saying that enzyme nutrition is important. Foods that help digest themselves (raw foods, soaked grains, or lactobaccili-fermented foods) will be more easily assimilated and ease the amount of work the body has to do to extract the nutrients from them. Second, fungal enzymes used as dietary supplements for people have a wide pH range and are beneficial in improving digestion. These enzymes begin working in the acidic environment of the stomach without being deactivated, and continue on working even in the small intestine. Third, supplemental enzyme formulas can be tailored for different needs. For people eating a plant-based diet, having a formula that improves the digesting of plant cell wall material helps them get as much out of their food as possible. Some formulas do not have the cellulase enzymes in them, but the formula used by Hallelujah Acres does have them because we want to break down some of the fiber and get nutrition from the plants we eat. (The reason cellulase is removed is that it would digest the very small amount of dietary fiber that most Americans eat, leaving them with no bulk to move the digested food through the intestinal tract.) So, even people eating a mostly raw plant food diet can benefit from some enzymes as they assist digesting raw food, too. There is indeed evidence showing that digestive enzymes are beneficial and make a difference.

Now, protease enzymes can be used between meals to allow systemic absorption of a small amount of these enzymes. This can result in anti-inflammatory activity, scar tissue removal, improved rates of healing of acute injuries, digestion of blood clots, and other functions as welll. But that is a topic for another time.

## *References*


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