

The Basics of Digestive Enzymes as Dietary Supplements

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What are enzymes?

Enzymes are specialized proteins that *accelerate* chemical reactions that otherwise would not occur under conditions to sustain life. The enzyme itself does not change during the reaction, but changes one compound (known as the “substrate”) into another (known as the “product”).

Enzymes are involved in almost every metabolic function in any living organism. There are over 10,000 separate and distinct enzymes that have been characterized.

Each enzyme usually has only one function, or works on one substrate to produce one product; therefore, enzymes demonstrate specificity in their function.

Not all enzymes are useful when taken orally. Metabolic enzymes are types of enzymes that work inside of specific cells and taken orally cannot be directed to enter the correct cell from the digestive tract. **Digestive enzymes, however, are active orally as they do not need to enter a specific cell to perform their function.**

How do digestive enzymes work?

Digestive enzymes include proteases/peptidases (break down proteins/peptides), carbohydrases (break down carbohydrates), and lipases (break down triglyceride fats). Proteins are degraded to peptides and amino acids, carbohydrates to sugars, and triglycerides to fatty acids by breaking specific chemical bonds within the compound.

Are enzymes safe?

Yes. Studies have determined that the great majority of orally available enzymes produce no toxicity or adverse side effects, even when taken in extremely large doses¹⁻¹⁰.

Which enzymes are in dietary supplements?

Most dietary enzyme supplements are derived from plants such as papaya, pineapple, and *Aspergillus* fungi. The fungal derived enzymes constitute the majority of enzymes in dietary supplements, and are **highly purified** from the fungal organism. **These fungi are not the same as yeast (*Candida albicans*), and cannot promote or cause any kind of fungal infection.** Many people who are sensitive to molds can take the enzymes with no problems. Often, fungal enzymes are better tolerated than enzymes from plant latex sources, such as papaya and pineapple. The enzymes available include different proteases, carbohydrases and lipases.

Proteases	Carbohydrases	Lipases
Peptidases (DPP IV, PEPs, etc.)	Amylase	Lipase (various)
Protease 6.0	Glucoamylase	
Protease 4.5	Lactase	
Many Others	Cellulase	
Trypsin	Maltase	
Chymotrypsin	Galactosidase	
Elastase	Glucanase	
Papain	Xylanase	
Bromelain		
Ficin		

Pancreatic enzymes derived from cattle and pork are also available, usually by medical prescription only. They consist of protease, amylase (breakdown starch), and lipase.

What is the difference between plant enzymes and pancreatic enzymes?

Pancreatic enzymes are found in the small intestine, where they are released by the pancreas. They only work in a narrow pH range, and do not survive the acid environment of the stomach. Therefore, oral pancreatic enzymes must be enteric-coated to protect the enzyme from stomach acid. Once in the neutral pH of the small intestine, the enzymes are activated. Pancreatic enzymes are usually available only by prescription.

Plant enzymes are acid-stable, and so start to work in the stomach. Some plant enzymes work best at the low pH found in stomach. Plant enzymes are regulated as a food by the FDA, so are available without prescription.

What happens if I take an enzyme supplement and don't eat?

Nothing. An enzyme is specific for one substance, if that substance is not present, the enzyme does nothing. For example, if one is lactose intolerant and takes the enzyme lactase, but then consumes no dairy or lactose-containing food, then the lactase enzyme simply continues along the digestive tract, eventually being degraded by enzymes in the GI tract.

Will oral enzymes affect my pancreatic enzymes?

Not usually. Most studies show **no** effect on pancreatic enzyme production or release when volunteers take oral enzyme supplements. One recent study, however, showed a slight decrease in certain pancreatic enzymes when an oral pancreatic enzyme supplement was given, but the effect was only seen when taking large doses of pancreatic enzymes and was temporary. Normal pancreatic enzyme release returned within 3 days. This study did not use plant-based enzyme supplements, so it may well be that the observed decrease occurs only with pancreatic enzyme supplements, not plant-derived enzymes.

Who should take enzyme supplements?

The best answer is: Anyone who eats food! Seriously, though, anyone can benefit from a good enzyme product. Because of the amounts and diversity of the foods we consume, and our hectic lifestyle, digestion can be less than optimal. Maldigestion can produce severe bloating and gas, cramping, diarrhea or constipation, and food intolerances. Incomplete digestion of food proteins may be linked to food allergies.

Taking plant enzymes with meals allows digestion to start in the stomach, and helps the pancreatic enzymes do the “finishing” work. More thorough digestion of foodstuffs prevents foods from being fermented in the gut. Food fermentation can cause “bad” bacteria and yeast to proliferate at the expense of “good” intestinal bacteria. More complete digestion of carbohydrates removes a potential food source for bad bacteria.

Another benefit of enzymes is that more nutrition can be derived from the food we eat, and less waste is generated. Regular bowel movements are also a byproduct of better digestion.

What about children?

Enzymes are fine for children and even infants. Adjust the enzyme dosage based on meal size, not age or body weight, since enzymes are not absorbed from the gut in appreciable amounts. The enzymes can be added to foods or drinks and even baby formula, and will help breakdown the proteins, complex carbohydrates, and fats in food for easier assimilation by the GI tract.

Children with food intolerances often have special dietary needs. Many have intolerances to proteins such as gluten (in wheat) and casein (in dairy). Dietary enzymes can help break down these proteins such that the incomplete peptides, which often are the source of the intolerances, are either not produced or are broken down into inactive compounds. A by-product of better protein digestion is often noted as better mood and disposition in these children. However, it should be noted that enzymes are not a cure or treatment for any medical condition. Enzymes simply support good digestive function, which can help anyone's mood and disposition!

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