

## *Module 4, Lesson 1 Handout:*

# Digestive Enzymes 101

To understand the gut, you must understand digestive enzymes. Digestive enzymes may not be a topic you think about as often as, say protein, but we need them for digestion and proper digestion is key for gut health and overall health. If we don't digest our food properly we won't have the proper nutrition for our body to do anything it needs to do. Gut health is a pretty good indicator of our health as a whole and enzymes play a key role.

### What are Digestive Enzymes?

Digestive enzymes are substances in your body that help break down food into nutrients that can be absorbed, moved into the bloodstream and be utilized by the body. Different enzymes work on different nutrients. Here is quick overview of the enzymes needed for each macronutrient:

**Carbohydrates.** There are several different enzymes that digest carbohydrates, including:

- Salivary amylase, which begins breaking down starches in the mouth
- Amylase made by the pancreas, which continues carbohydrate digestion in the duodenum of the small intestine
- Maltase, which breaks down maltose into glucose in the small intestine
- Sucrase, which breaks down sucrose into glucose and fructose in the small intestine
- Lactase, which breaks down lactose into glucose and galactose in the small intestine

**Fat.** The digestive enzymes that break down fats are in the lipase family and most of them are lower down in the digestive tract. Lipase enzymes break down triglycerides into free fatty acids and glycerol. A few examples include:

- Hepatic lipases in the liver
- Hormone-sensitive lipases in fat cells
- Lipoprotein lipases on the surface of blood vessels
- Pancreatic lipases in the small intestine

**Protein.** Proteases (also referred to as peptidases or sometimes called proteinases) begin breaking down protein in the stomach. Enzymes here work by splitting off and breaking down proteins by cutting long sequences of amino acids into smaller fragments through hydrolysis. Once they reach the small intestine they are broken down by specific proteases such as trypsin and chymotrypsin.

## **Digestive Enzyme Imbalances**

You can have an imbalance of digestive enzymes or not produce enough. This will cause digestion to slow down or be incomplete which can lead to all kinds of discomfort including gas, bloating and gas.

Lacking the enzyme lactase is fairly common, but otherwise, it isn't too common to see digestive enzyme disorders, which typically occur in people with pancreatic illnesses, such as pancreatitis or pancreatic cancer and people with cystic fibrosis.

With age, the amount of enzymes we produce may decline, but the amount of food we require declines as well. If a client complains of discomfort and it sounds like it may be an issue with digestive enzymes, you can start with an elimination diet, which is outlined in another handout.

Besides Beano and Lactaid, two over the counter enzyme products, there aren't many well known digestive enzymes that work. If a client really wants to give them a go, make sure they look for the USP seal on a standardized, large company supplement brand. This may be an area where you'll need to work together with a GI doctor if the issue is not so clear cut. Some foods, particularly fruits and fermented foods, can also be a natural source of enzymes. For example, bananas naturally contain amylase, pineapple contains bromelain, papaya contains papain and fermented foods will contain a variety of enzymes. Though the research isn't overwhelming that these natural enzymes will actually contribute to better digestion, they're pretty much all found in the foods we're already recommending anyway, so they certainly won't hurt.