

**DIGESTIVE ENZYMES**

In the early 1900’s, the importance of vitamins in health and disease was recognized.

This was followed by an emphasis on the roles played by minerals and trace elements. Nutritionists, however, were not entirely satisfied with just vitamins, minerals and trace elements as their only weapons to achieve the optimal health of human beings. They felt that there was a missing link somewhere. Their dream came true about sixty years ago, when Dr. Edward Howell began his study of food enzymes and human health and the missing link was then revealed. His enzyme philosophy, though not universally accepted by all orthodox physicians and other health professionals, is shared by other well-known scientists like Drs. Loeb and Northrop of the Rockefeller Institute of Medicine, Professor R. Pearl of Johns Hopkins University and Drs. MacArthur and Baille of the University of Toronto.

Food enzymes are now considered “the third wave” in nutritional supplementation.

**DEFINITION OF ENZYME**

According to the American Pocket Medical Dictionary, (Nineteenth Edition), “enzyme” is defined as an organic compound, frequently a protein, which is able to accelerate or to produce by catalytic action some change in a substrate for which it is often specific. Medical doctors as well as nutritionists and scientists who are interested in food enzymes accept such a general definition. They agree that humans, animals and plants are composed of cells with different activities, both inside and outside the cell membrane. All these activities need the presence of enzymes in order to function. Without enzymes, there will be no cellular activities. A cell without cellular activities is considered dead. Enzymes, like vitamins and essential minerals, are vital to all living things.

In man, we have different enzymes in different systems. Those that are concerned with digestion are known as digestive enzymes that are secreted by special glands or mucosal cells along the digestive pathway. Their chief function is to metabolize the ingested food so that its components can be absorbed and utilized by our body. This whole process of digestion, absorption and utilization is known as “assimilation”.

Food enzymes are digestive enzymes present in food or food supplements. Their sources can be animal (e.g. uncooked meat) or vegetable in origin. In medical terms, digestive enzymes secreted by our digestive system inside our body are “endogenous”. Those taken as food or food supplements (food enzymes) are “exogenous”. Some common characteristics of these digestive enzymes are:

1. They function best at certain pH and temperature,
2. They are easily destroyed by high temperature, such as cooking and food processing, and
3. Once destroyed, they must be replaced.

**SIMPLE REVIEW OF THE DIGESTIVE ENZYME**

Our food is mainly composed of proteins, carbohydrates, fats, water, vitamins, minerals and trace elements. The exact mechanisms of their assimilation (digestion, absorption and utilization) are very complicated, and digestive enzymes play an essential part in this process. We classify digestive enzymes into four main groups:
1. **Carbohydrase enzymes**: digest carbohydrates that might be simple monosaccharides (glucose, fructose and galactose), disaccharides (sucrose, lactose and maltose) or complex polysaccharides (starch and fibres). The end products are monosaccharides.

2. **Protease enzymes**: digest proteins that are then broken down to proteoses, peptones, polypeptides, dipeptides and finally the end products, amino acids.

3. **Lipase enzymes**: digest fats, that are composed of neutral fat (triglycerides), phospholipids and cholesterols. The main end products of the digestion of fats are fatty acids and glycerides that are not water-soluble. It is only with the aid of the bile acids that the majority of the fat is absorbed through the intestinal epithelial cells into the lymphatic system via the lacteals of the villi. About 10% of the fatty acids are absorbed into the portal blood and carried to the liver for further metabolism. Chylomicrons are small particles of fat formed in the blood during digestion of fat. They are covered with a protein coat that makes them hydrophilic (soluble), allowing a certain degree of suspension stability in the fluid medium (blood).

4. **Cellulase enzymes**: digest cellulose, a complex carbohydrate forming the framework of plant structures (fibres). It plays no significant role in human beings and is not found in the endogenous secretion of the human digestive enzymes. It may be an essential enzyme in herbivorous animals.

5. **Lactase enzymes**: for digesting milk and other dairy products such as cheese, is not included in the 4 main groups, but it can be especially helpful for those with lactose intolerance.

Digestion begins in the oral cavity (mouth) where food is chewed before swallowing. Proper chewing (mastication) is essential because it will allow:

1. The breakage of the indigestible cellulose coat around the nutrient portions of fruits and raw vegetables;
2. Better mixing of the digestive enzymes (ptyalin from the salivary glands and amylase from the small intestine) with the food particles.

The process of digestion is triggered before we even taste our food with our tongue. The sight of seeing a well-prepared meal, the smell of our favourite food or even the thought of tasting a delicious dish, will make our mouth water. The enzymes are all ready for their prey.

Formally, the stomach was considered only as a storehouse where mixing of the ingested food and gastric secretion (hydrochloric acid and digestive enzymes) occurred. The process was known as churning. Physiologists consider the stomach to be functionally divided into two major parts:

1. The upper part (the fundus and body) that is mainly concerned with the storage and mixing, and
2. The lower part (the antrum and the pylorus). The strong peristaltic movements in the antral portion of the stomach coupled with a narrow opening of the pylorus will create a better mixing or churning of the ingested food and gastric secretions. The resulting mixture of the gastric contents is known as “chyme” that has an appearance of a murky or milky semi-fluid substance.

The chyme is gradually emptied into the small intestine for further digestion and absorption. There are two sequences initiated as the stomach empties:

1. The neurological sequence (the distension of the stomach by food will send signals via the nerves to the body’s headquarters, the brain, that will then send orders through the nervous pathway to do the appropriate things) and
2. The hormonal sequence (the presence of food in the stomach also stimulates the release of a hormone known as gastrin from the antral mucosa. The gastrin in turn will control not only the secretion of highly acidic gastric juice by the gastric glands, but also the emptying of the stomach by enhancing the activity of the pyloric pump and simultaneously relaxing the outlet, the pylorus).

Figure 1

We can summarize the functions of the stomach as follows:

1. The upper part acts as a storehouse where partial digestion of food is being initiated.
2. It secretes gastrin, hydrochloric acid and other enzymes that function best in an acidic environment.
3. Churning of food occurs in the lower part of the stomach, the antrum. The chyme so formed is emptied into the small intestine by the “pyloric pump” that is regulated by nervous and hormonal mechanisms.

When the chyme reaches the upper part of small intestine, the whole process of digestion and absorption is much more complicated. In a nutshell, the partially digested food from the stomach will be broken down to end products of carbohydrates, proteins and fats by enzymes secreted from the pancreas and small intestine. Bile is also secreted from the gallbladder for emulsification of the fat particles in our food so that the lipases can perform their job properly. The pancreatic juice is alkaline; the enzymes in the small intestine work best in an alkaline environment (i.e., with high pH). The control of the secretions from the gallbladder, pancreas and small intestine is both hormonal and neurological. The enzymes for each class of food (carbohydrates, proteins and fats) are specific but they make no distinction whether the food comes from animal or vegetable sources. The chief goal of the whole digestive process of food is to break down the three main components of food into their end products of simple sugars, (glucose, fructose and galactose), amino acids, fatty acids and glycerides.
**CONCEPTS OF DIGESTIVE ENZYMES**

The orthodox school believes that our body is able to manufacture sufficient enzymes to metabolize our ingested food. Exogenous food enzymes would be required when there is a deficiency of such enzymes in our body. In cases of malabsorption due to pancreatic insufficiency, physicians prescribe pancreatic digestive enzymes (e.g. pancreatin) as a replacement therapy.

However, over the past 75 years, some well-known scientists, one of who is Dr. Edward Howell, have proposed a new concept of food enzymes. His work is well presented in his two famous books:


Dr. Edward Howell, who is also known as The Father of Food Enzyme Research by nutritionists, has his own concept of food enzymes and their use. For the sake of simplicity, the whole concept can be summed up as follows:

1. Each one of us is given a **limited supply of digestive enzymes** at birth. This supply has to last a lifetime. The faster you use up your enzyme supply, the shorter your life will be.

2. **Raw food** contains enzymes that are easily destroyed by modern cooking. We obtain no exogenous food enzymes from our well-cooked food.

3. **Exogenous enzymes** from raw food are activated when the cell wall of the food is ruptured by chewing, and continue to function not only in the stomach but also in the upper part of the small intestine. Their activities work in a wide range of pH as compared with the endogenous digestive enzymes.

4. **The Law of Adaptive Secretion of Digestive Enzymes.** In 1904, Professor B.P. Babkin in Russia published *The Theory of the Parallel Secretion of Enzymes*. It stated that the three main digestive enzymes (amylase, protease and lipase) were secreted at the same strength, regardless of whether the food eaten was carbohydrate, protein or fat. Many scientists, but not all accepted this theory. Another theory was proposed as early as 1907 and stressed again in 1930. It held that only the corresponding enzymes of that particular food would be adequately secreted in the digestive system. Thus, one would expect that a baked potato would stimulate only the secretion of amylase (a carbohydrate digestive enzyme). Similarly, a piece of lean meat, containing mainly protein substance with little fat and carbohydrate, would cause the secretion of protease enzymes with token amounts of lipase and amylase. This selective secretion of digestive enzymes was said to be present in man as well as in animals. 1,2 Dr. E. Howell called this “**The Law of Adaptive Secretion of Digestive Enzymes**”.

5. **The Enzyme Bank Account.** According to Dr. Howell, we are born with a limited supply of enzymes at birth. Dr. Howell stated clearly in his book, *Food Enzymes for Health and Longevity*, “When we eat cooked, enzyme-free food, the body is forced to produce enzymes needed for digestion. This “stealing” of enzymes from other parts of the body sets up a competition for enzymes among the various organ systems and tissues of the human body. The resulting metabolic dislocations may be the direct cause of ... many chronic incurable diseases.”

6. **The vital force.** Dr. Howell and other scientists challenged the idea that enzymes are only lifeless catalysts with certain chemical structures and reactions. They consider enzymes to possess a vital force or “biotic energy”. In this publication, “The Status of Food Enzymes in Digestive and
Metabolism”, Dr. Howell wrote: “It is no longer warranted to consider vitality and life energy as intangible forces. The available evidence does not justify a placid continuance of nihilistic attitude toward the vital forces operating in the living organism. Enzymes emerge as the true yardstick of vitality. Enzymes offer an important means of calculating the vital energy of an organism. That which has been referred to as vitality, vital force ... probably is synonymous with that which has been known as enzyme activity...” Dr. Howell was not alone in holding this concept which is equally shared by prominent scholars like Professor Moore of the University of Oxford in England, professor Willstatter of Munich in Germany and Northrop of the Rockefelllar Institute for Medical Research.

**USE OF DIGESTIVE ENZYMES**

Digestive enzymes are widely used by practicing orthodox physicians as well as by nutritionists who are students of Dr. Howell’s school of food enzymes. Physicians prescribe digestive enzymes and bile preparations to correct deficiency states in their patients. This is a form of replacement therapy. Nutritionists advocate the liberal use of food enzymes in normal persons to achieve optimal health and longevity. With the introduction of a number of food enzymes, they hope to enhance digestion. However, Dr. Howell strongly advises lay people who would like to try food enzyme therapy, to seek advice from a qualified health professional. Ordinary digestive enzymes sold over the counter (OTC) are prepared from either animal or vegetable sources. For example, Pancreatic B.P. comes from the animal source and will not be accepted by vegetarians. Unripe papaya and pineapple will yield digestive enzymes for proteins only.

Vegetarians should not be disappointed because scientists have found a good source of digestive enzymes in the aspergillum plants. These enzymes work on the full range of fats, proteins, carbohydrates and cellulose.

Digestive enzymes are significant because digestion of food is impossible without them.

In a young and healthy person, there may be an adequate supply of digestive enzymes to handle the whole process of digestion. Conventional wisdom uses digestive enzymes as a replacement supplement. It also advocates the ingestion of raw fruits and vegetables that have a high content of vitamins and food enzymes. Dr. Howell’s use of food enzymes suggests that the supply of human enzymes is limited at birth. The faster we consume our enzymes, the shorter will be our life span. Raw food is a good source of food enzymes. Ingestion of raw food or enzyme supplements will lessen the work of our digestive system so that more energy is reserved for other metabolic activities. This new concept in the use of food enzymes has already created a third wave in the nutritional supplement industry following in the footsteps of vitamins and minerals.

Food enzymes are necessary in order to break down large food components into smaller ones that the body can absorb. Each enzyme has a specific job and can only break down certain components. The heat of cooking and food processing can destroy the enzymes found naturally in food. Further, aging and some illnesses such as diabetes and pancreatic problems can decrease internal enzyme production. Since supplemental enzymes have been shown to work synergistically with internal enzymes to enhance digestion3, it is prudent to supplement each meal with the four food enzymes.

The advanced nutritional supplement, the **source**, includes all the food enzymes for improved digestion.