The Pancreas-The Whole Story

By Dr. Brian P. Jakes, Jr.

The insidious affects of diabetes can also be seen and best exposed by examining the function of both the endocrine and exocrine sections of the pancreas.

The endocrine section of the pancreas houses primarily four types of cells in what are called islets. There are several other types of cells found only in traces in the endocrine and are not significant to this discussion. In these islets of Langerhan, named after the discoverer, reside the alpha, beta, delta and pancreatic polypeptide cells. They normally work in unison with each other to regulate blood glucose.

Alpha cells occupy about 15% of total endocrine mass. Alpha cells produce glucagon, which is a hormone used to stimulate glycogen release for the purpose of raising blood sugar levels. Beta cells comprise approximately 70% of the pancreatic endocrine. Beta cells synthesize the hormone insulin and release it in response to several different stimuli.

To help better understand the wide range of effects insulin has on the body it is better to view insulin as a hormone that mediates a number of systemic anabolic functions, not just those related to glucose metabolism and regulation.

Insulin activates the systems involved in intracellular transport and utilization of amino acids, fatty acids, proteins, and enzymes. It also stimulates cellular metabolism, gene transcription and DNA synthesis.i[i]

You can see that there is little accomplished in the human body where insulin does not play a vital role and its absence or misutilization will ultimately affect all cell growth and repair.

Delta cells produce the hormone somatostatin, its purpose is to control a number of hormonal releases. These cover the areas of pituitary, digestive and pancreatic, which include insulin and glucagon.ii[ii] They populate only about 5% of the endocrine.

There is an interesting phenomenon that occurs in the islet when beta cells are destroyed. Alpha and delta cell experience hyperplasia, an enlargement of those two cells in the islet. This may result in abnormal functioning for those remaining islets, which may alter threshold for glucagon release. This may be manifested by either allowing elevated levels of glucagon to be released raising blood sugar or by a delayed response to hypoglycemia.iii[iii] iv[iv]

There is one other cell that is found in notable amounts in the endocrine as well as in the exocrine section of the pancreas. It is called PP for pancreatic polypeptide. PP cells take up about 10% of endocrine tissue. The exact function and relation to diabetes of PP cell is not well understood. It may aid in digestive functions, as its release coincides with that event especially with the ingestion of protein and fat.v[v]

The final result is that the diabetic disease process disrupts this fine balance by either autoimmune or environmental factors, which results in an impaired endocrine system that is unable to assist the body in properly utilizing glucose.

The exocrine section of the pancreas has been greatly ignored in the treatment of diabetes even though its impairment is a well documented condition.

It is primarily responsible for the production of enzymes and bicarbonate necessary for normal digestion of food.

The exocrine section occupies almost 98% of the total pancreatic mass, while the endocrine portion resides in only about 2% of total mass. Studies suggest the involvement of the exocrine portion of the pancreas in the diabetic process can be purely the result of the endocrine's dysfunction.vi[vi] vii[vii] viii[viii] The autoimmune attack and destruction of the beta cells, associated with Type I diabetes, may cause atrophy in the surrounding exocrine tissue.ix[ix] x[x]

Beta cell failure as the result of over stimulation, as in Type II diabetes, may effect exocrine function as well.

Also, exocrine dysfunction may result from the long-term consumption of a diet of processed and fat laden foods that lack natural digestive enzymes. This can cause a heighten demand of pancreatic enzyme production to complete digestion, which can possibly lead to failure of that function. It is reasonable to assume that just as the whole body can suffer from the cascade effects of one organ's failing, so can the functioning of a single organ be affected by the failure of its constitutes.

In less than a year from the time of diagnosis both types of diabetics can suffer considerable loss of their pancreatic mass.xi[xi] xii[xii] This is verified by ultrasound imaging.
Beta cells comprise less than 2% of total pancreatic mass. The number of alpha and delta cells in the islets do not appear to be reduced, however their function may be hindered.

With only a nominal loss to total pancreatic mass related to the endocrine section of the pancreas, the resulting difference can be explained by loss from the exocrine portion of the pancreas.

The decreased function of the exocrine section of the pancreas, that appears to significantly affect diabetics, is its hindered ability to produce proteolytic and lipase enzymes and also natural bicarbonate.

Proteolytic enzymes aid in the digesting and converting of proteins to create amino acids. Reduced levels of these enzymes bring about a corresponding reduction of amino acids production. Amino acids are referred to as the building blocks of life and their decrease will adversely affect virtually every function in the human body.

Lipase is an enzyme involved in the metabolism of lipids or fats. The reduction of this enzyme can account for the noted elevation in serum cholesterol and triglyceride levels seen in both types of diabetics.

Bicarbonate produced in the pancreas is used to neutralize the acid the stomach uses for digestion of food. As the food passes through the duodenum into the small intestine the pancreas secretes bicarbonate to raise the pH level in the small intestine. If the acidic pH level is not neutralized to the alkaline pH medium needed in the small intestine, enzymes necessary for the proper absorption of the nutrients in food will be either impaired or destroyed. This can cause systemic deprivation of needed amino acids causing a reduction in enzyme production and create a perpetual chain reaction of events that slowly and indiscreetly take their toll.

It is examples such as this, combined with a number of like scenarios that continue unbeknownst to the diabetic that can allow complications to develop. Once this condition is properly diagnosed it can possibly be remedied by the use of oral digestive enzymes.

It should be noted that this may cause a transient increase in blood sugar due to a more efficient state of digestion, However, this is a necessary step in correcting metabolic abnormalities.

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References are located at http://www.diabetesincontrol.com/features/feature55.shtml