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The Protective Effect of Green Tea and Garlic on the Pancreas of Albino Rat in Cases of Induced Diabetes Mellitus

Thesis submitted for partial fulfillment of
M.D degree of anatomy

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Contents

Introduction and Aim of the Work

Diabetes mellitus is a common metabolic disorder associated with degenerative changes in the pancreas ***(Crawford and Cortan, 1994).*** Moreover, Diabetes mellitus is a group of diseases characterized by high blood glucose levels resulting from defects in insulin secretion, insulin action or both ***(Granner et al., 2000)***. Abnormalities in the metabolism of carbohydrate, protein and fat are also present. Due to its high prevalence and marked effects on a patient physical and psychological state, diabetes mellitus, which can result in a morbid condition, is a major medical concern ***(Halpern et al., 2000*** and ***Macedo et al., 2002).***

Many alternative medicines were studied to be used in the treatment of diabetes mellitus, beside or instead of the traditional treatment of diabetes with oral hypoglycemic drugs and insulin injections. Garlic ***(Ryan et al., 2001)*** and green tea ***(Swen et al., 2006)*** were used nowadays as anti-diabetic agents depending on their powerful hypoglycemic action. The anti-diabetic effect of garlic extract (Allium Sativum) induced a significant decrease in blood glucose level and improved diabetic changes occurring in pancreatic tissue ***(Jelodar et al., 2005)***.

Concurrent histological studies of the pancreas of diabetic rats showed regeneration of beta cells after administration of green tea ***(*Chakravarthy *et al., 1982).*** On the other hand, the antidiabetic properties of green tea polyphenol (Epigallocatechin -3- gallate) were studied by ***Tsuneki et al., 2004)*** who proved that, green tea lowered blood glucose level in diabetic mice.

Up to our knowledge, few studies were made to investigate the effects of alternative treatments of diabetes using green tea and garlic. Yet, reviewing the literature, the detailed electron microscopic studies of such effects were lacking. Hence, the aim of the present work is to study the histological, ultra structural and biochemical effect of green tea and garlic on the pancreatic tissue to asses their use in the treatment of diabetes mellitus.

I - Normal structure and function of the pancreas :

Pancreas was discovered by Herophilus (335- 280 B.C.E.) a greek anatomist and surgeon. A few hundred years later, Ruphos, another greek anatomist, gave the pancreas its name. The term (Pan) from the greek means (all) and (kreas) means (flesh) (Harper , 2007) .

A - Anatomy of the pancreas

Stefan et al., (1987) clarified that, the pancreas of the adult rat consisted of a body and two lobes. The body was found along the cranial part of the duodenum, the right lobe extended along the duodenal margin, while the left lobe extended towards the spleen. The two lobes met forming one duct, which entered the duodenum beside or with the bile duct.

Lawrence and Amadeo (1996) added that the human pancreas is a soft, easily traumatized gland that lies behind the peritoneum lining the abdominal walls. ***Schwartz et al., (1994)*** stated that the pancreas received an ample blood supply from both superior pancreatico duodenal artery, that

arise from gastroduodenal artery and inferior pancreatico duodenal artery, that arise from superior mesenteric artery. Moreover, the splenic artery gives multiple pancreatic branches, which supply the neck, body and tail of the pancreas. Blood from the pancreas drains into the superior mesenteric and splenic veins. Both are joined together to form the portal vein. On the other hand ***Berne and Levy (1996)*** stated that the pancreas receives innervation from the vagus (cranial X). This parasympathetic supply of the pancreas stimulates the secretion of digestive juices. While the sympathetic supply of the pancreas is received from celiac plexus, superior mesenteric plexus and hepatic plexus. These plexuses lie outside the pancreas and send postganglionic fibers to the pancreatic cells. These sympathetic nerves inhibit the production of digestive enzymes.

Moreover, ***Susan et al., (2005)*** described the human pancreas as a retroperitoneal organ (except a small part of its tail) that lies mostly posterior to the stomach. It extends across the posterior abdominal wall from the duodenum on the right, to the spleen on the left. It consists of; head, uncinate process, neck, body and tail. The pancreatic duct begins in the tail of the pancreas, passes to the right through

the body of the pancreas and after the head of the pancreas , turns inferiorly . In the lower part of the head, the pancreatic duct joins the bile duct. The joining of these two ducts forms the hepatopancreatic ampulla (ampulla of vater) which open in the duodenum at the major duodenal papilla . The accessory pancreatic duct empties into the duodenum at the minor duodenal papilla. The main and accessory pancreatic ducts usually communicate with each other.

B - Histology of the pancreas

The pancreas of the rat is defined as a mixed gland having endocrine part (islets of Langerhans) and exocrine part (secretory acini) ***(Williams and Goldfine, 1985)***

Traditional histological descriptions of the pancreas in human divide the exocrine and the endocrine pancreas into two separate entities. However, scientists, in fact have revealed several relationships occurring between islet and acinar tissues that, on the whole, are referred as the islet-acinar axis ***(Williams and Goldfine, 1993)***.

1 - The pancreatic acini : (Exocrine part)

In the rat pancreas, it was noticed the existence of periinsular halos consisting of acinar cells, surrounding the islets. These peri-insular acini were twice as large as those of the tele-insular region, located far from the islets. Moreover, the organelles of the peri-insular acinar cells were larger and their zymogen granules were more numerous causing a halo around the faint stained islets. This was attributed to the high concentration of insulin in the vessels passing through the peri- insular cells