Effect of Experimentally Induced Diabetes Mellitus on the Pancreas and Myocardium of Adult Male Albino Rat and the Possible Protective Role of Silymarin: Light and Electron Microscopic Study

Submitted for the partial fulfillment of
M.D in anatomy and Embryology

By
Waleed Mahmoud Ragab

Assistant lecturer of Anatomy and Embryology
Faculty of Medicine,FayoumUniversity

Supervisors

Prof. Dr. Ibrahim Labib Abd Allah
Professor of Anatomy and Embryology
Faculty of Medicine,CairoUniversity

Prof. Dr .Medhat Mohamed Morsi
Professor of Anatomy and Embryology
Faculty of Medicine,CairoUniversity

Prof. Dr. Layla Ahmed Rashed
Professor of Biochemistry
Faculty of Medicine,CairoUniversity

Dr.Maha Khaled Abd-El wahed
Assistant professor of Anatomy and Embryology
Faculty of Medicine,Fayoumuniversity

Cairo University
2017

Summary and conclusion

Diabetes mellitus is a metabolic disease characterized by chronic hyperglycemia resulting from defects in insulin metabolism and impaired function of carbohydrate, lipid, and protein metabolism that leads to long-term complications. Silymarin , an antioxidant flavenoid complex derived from the herb milk thistle (Silybummarianum) .

The present study aimed to investigate the effect of experimentally induced diabetes mellitus on the pancreas and myocardium in adult male albino rats and the possible protective effect of silymarin

In this studyfourty adult male albino rats were used.The rats wererandomly divided intofour groups,10 rats each. **Group I** (normal control) was not subjected to any medication,**group II**(Sham control), no difference between the two groups so they considered as control groups.

Group III (diabetic group): the rats received Streptozotocinintraperitoneally once in a dose of 55 mg/kg ,**group IV** (diabetic group treated with silymarin): the rats received streptozotocinintraperitoneally once in a dose of 55mg / kg and siylmarin by gastric tube for four weeks in a dose of 200mg /kg starting 3 days after streptozotocin injection .

After four weeks the rats were sacrificed by cervical decapitation. The pancreas and heart were excised andprocessed for histological (light and ultrastructural studies) and biochemical examination.

Concerning the pancreas ,in comparison with control groupslight microscopic examination of pancreatic sections of diabetic rats stained by haematoxylin &eosin showed focal affection of the pancreas in the form of loss of architecture of pancreatic acini, pyknotic nuclei .widening of spaces between acini,dilated interlobular duct and vacuolation ,other sections revealed extensive haemorrhage, distortion of

shape of islets cells and congestion of blood vessels .Masson's trichrome stain demonstrated excessive collagen fibers deposition around blood vessels and around interlobular ducts .

Electron microscopic examination of ultrathin sections of acinarcells of group III showed rarefaction of cytoplasm, little secretory granules,and dilated rough endoplasmic reticulum. Irregular nuclear membrane and clumbing of chromatin, indentation of nucleus, destructionof mitochondria with loss of cristaeand vacuolation of cytoplasm. Ultrastructural examination of beta cells of islets showed euchromatic nucleus,irregular nuclear membrane and degranulation of secretory granules.

In comparison with diabetic group ,light microscopic examination of pancreatic sections ofgroup IV (diabetic group treated with silymarin) showed normal architecture of some acini, loss of architecture of other acini, but there are wide spaces between themand islet cells appeared to be normal ,minimal collagen fibers deposition around acini , and around blood vessels.

Electron microscopic examination of acinar cells of group IV showed euchromatic nuclei, many secretory granules and apparently normal mitochondria .Some of the rough endoplasmic reticulum were dilated and others were normal. Ultrastructural examination of beta cells of islets showed euchomaticnucleus discontinuity of nuclear membrane and many secretory granules.

Glutathione peroxidase (GPx) and superoxide dismutase (SOD)levels in the pancreatic tissues of diabetic ratswere significantly lower than the other groups. treatment with silymarin for four weeks lead to an increase in GPx and SOD level to normal level in the pancreatic tissues.

Concerning the myocardium,in comparison with control groups,light microscope examination of sections of rat myocardium of group III (diabetic group) stained by haematoxylin & eosin revealed histological changes in the form of loss of normal architecture of myocardium , disarrayed pattern of muscles fibers and nuclei of cardiomyocytes and widening of interstitial spaces .It also showed thickened and vaculated wall of blood vessles which were engorged with blood and extravasation of blood .It also showed vacuolation.Masson's trichrome stain demonstratedexcessive collagen fibers around blood vessels and in-between muscle fibers.

Electron microscopic examination of group III (diabetic group) showedinterruption of muscle fibers, irregular nuclear membrane and indentation of nucleus.It also showed decreased mitochondria, ballooning of mitochondria with disarrayedcristae and loss of normal architecture of mitochondria.It also showed rarefaction of cytoplasm and vacuolation.

In comparison with diabetic group,light microscope examination of sections of rat myocardium of group IV (diabetic group treated with silymarin) revealed normally appeared architecture of myocardium and narrow interstitial spaces with minimal collagen fibers around blood vessels and between muscle fibers.

Electron microscopic examination of ultrathin sections of group IV revealed normally appeared cardiac myofibrils, increasednumber of mitochondria, some mitochondria isenlarged and others are normal.

Glutathione peroxidaseand superoxide dismutase levels in the myocardium tissues of diabetic ratswere significantly lower than the other groups. treatment with silymarin for four weeks lead to an increase in GPx and SOD level to normal level in the myocardium tissues.

In conclusion, the present study demonstrated the pathological effects ofinduced diabetes on the pancreas and myocardium and that the use of silymarincould ameliorate these effects. Therefore, it is recommended to use silymarin to prevent the side effects of diabetes.