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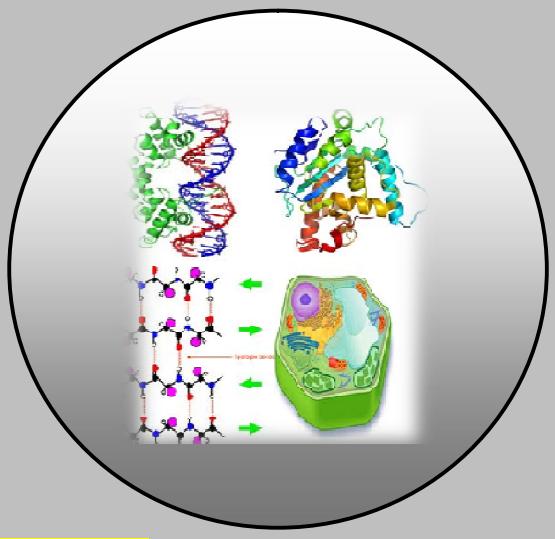

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Vitamin E (A-Tocopherol) Supplementation in Diabetic Rats: Effects on the Pancreaticβ - Cell

Khadija Mehboob, *Khadija Qamar, **Humaira Arshad and ***Zahra Mehboob

Department of Biochemistry, Army Medical College, Rawalpindi, National University of Sciences and Technology, Pakistan
***Department of Anatomy, Army Medical College, Rawalpindi, National University of Sciences and Technology, Pakistan**
****Department of Gynecology and Obstetrics, CMH, Rawalpindi, Pakistan**
*****Department of Gynecology and Obstetrics, Kamra, Pakistan**

ABSTRACT

Evaluationofthe antioxidant role of Alpha tocopherol, in streptozotocin induced diabetic rats.
In experiment Sprague Dawley rats were divided into 3 groups. Group1 served as control rats. Group2 werediabetic rats which were injected with 40mg /kg body weight of streptozotocin to induce diabetes. Group3 rats were treated with alpha tocopherol. Histological sections of the pancreas were examined.
The levels of plasma glucose and lipid profile which were elevated in group2 diabetic rats. The islets were shrunken in group2 diabetic rats in comparison to normal rats. In thealphatocopherol treated diabetic rats there was an expansion of islets.
Alpha tocopherolprotects the pancreatic β -cell against loss and exhibitantidiabetic property.
Keywords: Vitamin E, Pancreatic β - Cell, Diabetic RatsandStreptozotocin.

INTRODUCTION

Diabetes mellitus, a global public health problem, is a non-communicable disease with multiple etiologies which is one of the five leading causes of death and by the year 2025, three quarters of the world's 300 million adults with diabetes will be innon-industrialized countries (Mohan, 2004).

Anti-oxidants act preventively against the formation and action of reactive oxygen and nitrogen radicals, i.e. substances that are formed *in vivo* and cause damage to DNA, lipids, proteins and other molecules. Stress plays a significant role in the etiopathogenesis of diabetes and has key importance in the occurrence and development of diabetic complications. To evaluate the histomorphological changes that occur in rat pancreas after the evolution of streptozotocin induced diabetes and role of alphatocopherol.

MATERIALS AND METHODS

Animals

Sprague dawleystrains of rats were selected from the animal house, NIH, Islamabad.

Chemicals and Reagents

Streptozotocin was purchased from Sigma Chemical Glucose kit. All the reagents were of analytical grade.

Experimental Induction of diabetes

Diabetes was induced in Sprague Dawleyrats by injection of streptozotocin50mg kg^{-} (Opltovaet al, 2000)body weight, dissolved in 0.1M trisodium citrate buffer pH=4. 5 intraperitoneally. Development of diabetes was first determined by the observations of three classical symptoms polyuria, polydypsia and polyphagia and later verified by measuring the plasma glucose levels.

Experimental Design

Group 1: Control rats.

Group2: STZ diabetic rats.

Group 3: STZ diabetic treated with theAlphatocopherol.

The experiment was terminated at the end of 21 days and the animals were fasted overnight.

Histological sections of the Pancreas

The animals from each group were anesthetized with ether. The pancreas was dissected out, blotted and all the groups were processed for routine paraffin embedding. Histological examination was done by fixing the pancreas in 10% formalin, processed and embedded in paraffin wax. Tissue blocks were sectioned 5 u thick and stained with Haematoxylin and Eosin. Pancreatic parenchyma was observed for any congestion and degenerative changes. The shapes of the pancreatic acini and islets of langerhanwerenoted.

RESULTS

GROUP A: Hematoxylin and eosin staining showed the presence of several round to elongated, normal islets of Langerhans inthe control groups (Fig.1). Acini were regular with darkly staining cells. The islets were larger in size as compared to the groups B & C. The ducts were regularin shape.

GROUP B: Inthe entirediabetic Groups, Acini showed congestion and degenerative changes were noted. Acnehave not regular arrangements. They showed acidophilic granules in the apical region.

The islet was reduced in number there was decreased cellularity cells appeared to be fusiform. The islet morphology was altered to show shrinkage of the islets of Langerhans anddisplaying and necrotic changes in the cells (Fig.2). Parenchyma was disrupted and the stroma was increased as compared to the groups A & C.

GROUP C: Pancreaticsections, stained with H& E were highly lobulated with delicate septa in between the lobules. The aciniwere closely packed with the pyramidal shaped secretory cells having round basally located nuclei which are characteristic of highly active cells. The severity of degenerative and necrotic changes in the islet cells of Langerhans were less than those in the diabetic group. The islets were more numerous and displayed more compact appearance. The size of the cells was small with poorly stained cytoplasm, reflecting the new population of cells. (Fig.3).

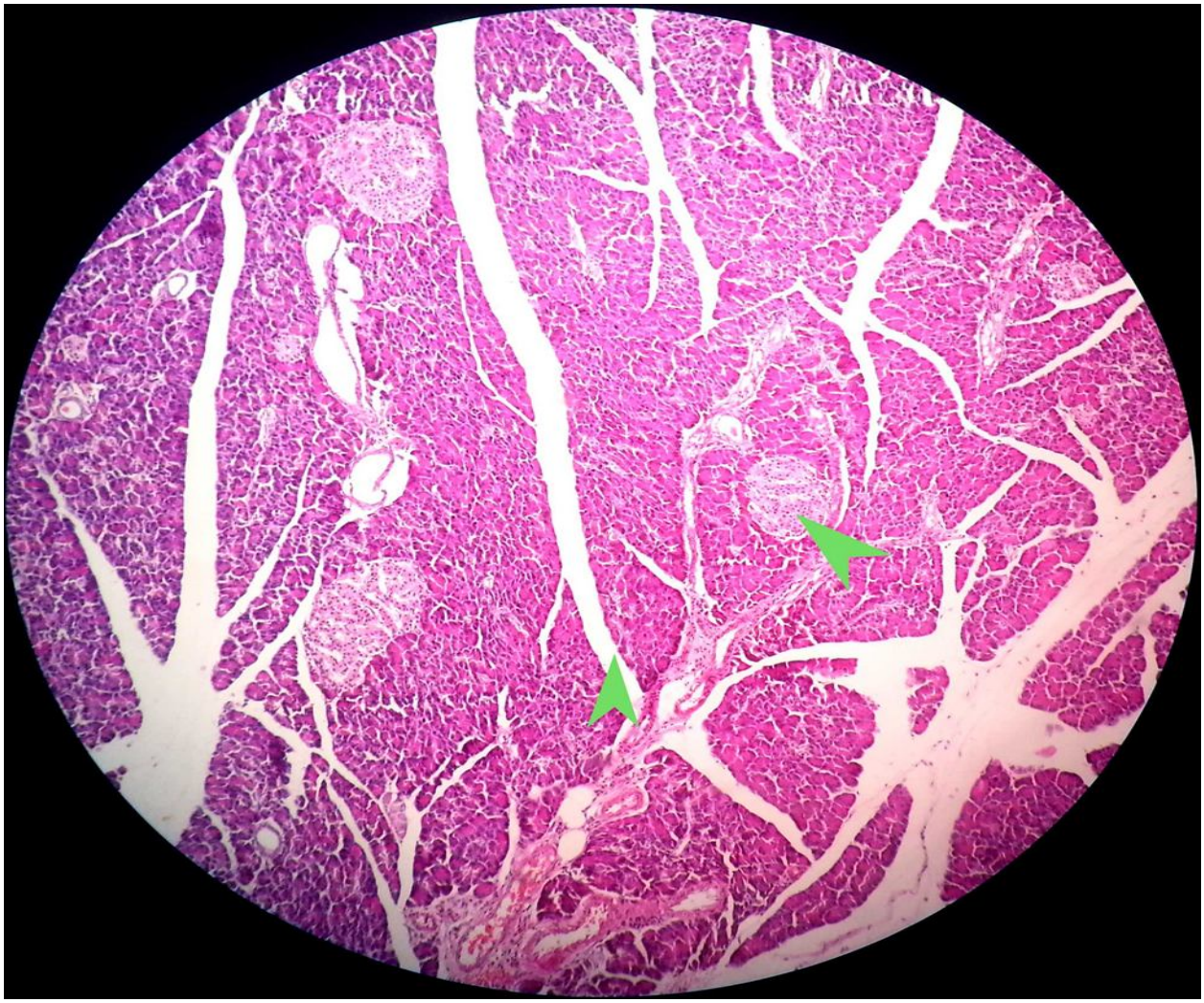

Figure 1. Photomicrograph of a cross section from pancrease of animal of controlgroup showing pancreatic acini and islets of langerhans H&E stain.

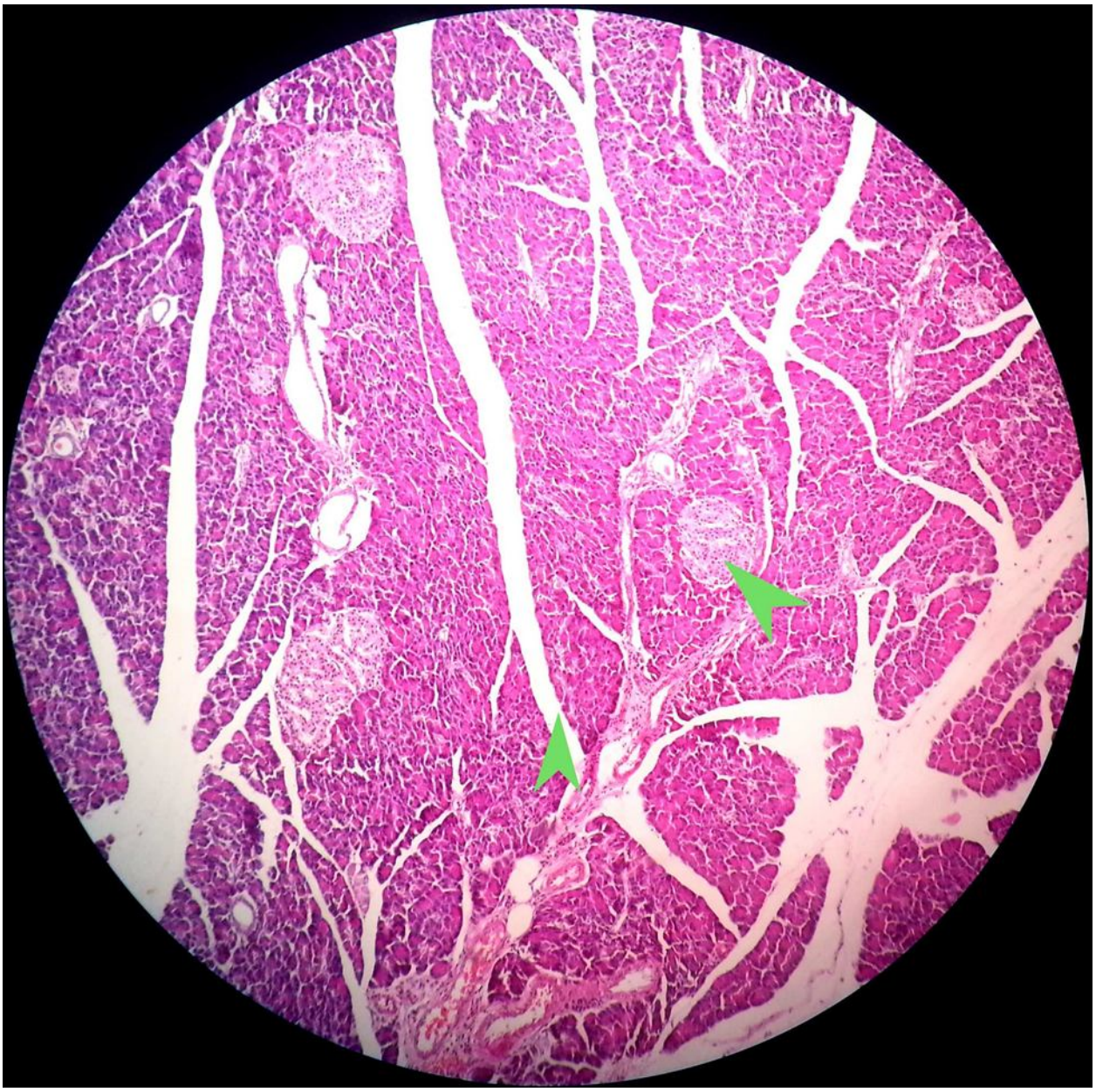

Figure 2. Photomicrograph of a cross section from pancreas of animal of the diabetic group showing pancreatic acini and islets of LangerhansH&E stain.

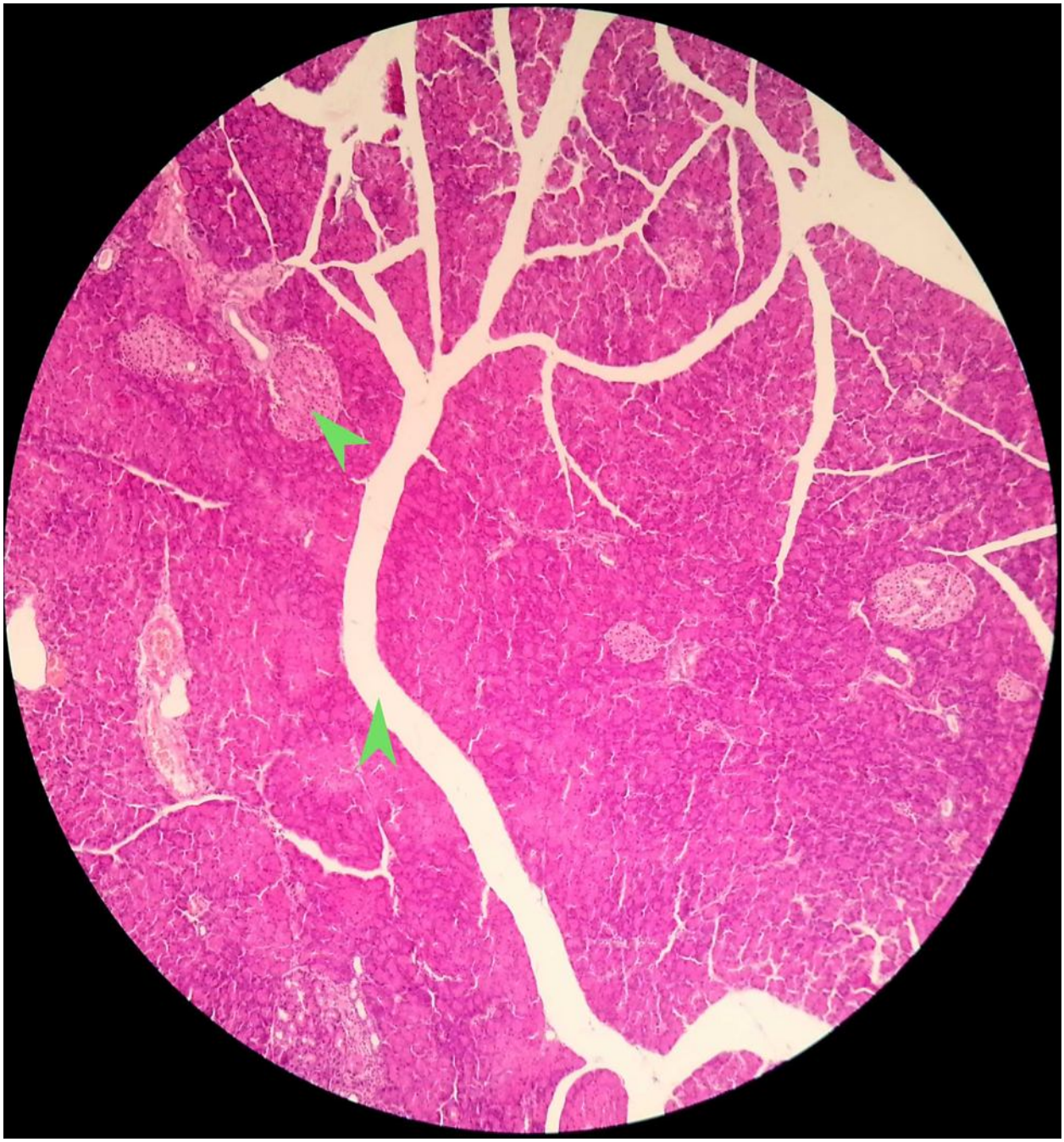

Figure 3. Photomicrograph of a cross section from pancreas of animal of the diabetic group treated with the Alpha tocopherol showing pancreatic acini and islets of Langerhans H&E stain.

DISCUSSION

The islet cells are susceptible to damage caused by oxygen free radicals from the antioxidant defense system is weak under diabetic condition. The levels of antioxidant defense system are altered in STZ induced diabetic rats but treatment of diabetic rats with the Alpha tocopherol for 21 days prevents its destruction (Yajnik, 2001).Streptozotocin (Streptozocin, STZ,) is a chemical that is particularly toxic to the insulin-producing beta cells of the pancreas in mammals (Kubinova, 1999 and Neaas, et al 1997). Streptozotocin is well known for its selective pancreatic islet beta-cell cytoxicity and has been extensively used to induce diabetes mellitus in animals. It interferes with cellular metabolic oxidative mechanisms.

Pancreatic sections stained with Haematoxylin and Eosin showed slight congestion and mild degenerative changes in the acini. The acinar epithelium was swollen. The islets were shrunken in group B diabetic rats in comparison to Control rats. In the alpha tocopherol treated diabetic rats there was an expansion of islets.

The islets of Langerhan's revealed decreased cellularity and in some islets the cells appeared to be fusiform (Fig. 1). The decrease in cellularity within islets langerhan's and cell swelling observed in the present study reflects the cytotoxicity of streptozotocin. Steptozotocin destroys beta cells selectively and a single adequate dose produces lasting hyperglycemia and insulin deficiency.

The decrease in cellularity within the islets of Langerhan's observed in the present study reflects the cytotoxity of streptozotocin. (Bartoikova.1998). The reduction in the number of beta cells was also confirmed in rabbits using special stains. Streptozotocin destroys beta cells selectively and a single adequate dose produces lasting hyperglycemia and insulin deficiency (Guo C et al.2004). In the present study beta cells in some islets was found to be fusiform. The change in the shape of cells can be attributed to the partial damage of streptozotocin to some beta cells. Lower dose of streptozotocin produced an incomplete destruction of pancreatic beta cells even though rats became permanently diabetic (Rahimi et al, 2005). The histologic changes observed in this study correspond to the ultrastructural changes observed in the islets of Langerhans of mice in response to STZ (Sena, et al 2008) .Electron microscopic observation revealed early chromatin aggregation and cytoplasmic vesiculation in the central beta cells during the first 2 hrs of STZ treatment and other cell types of the islets of Langerhans did not show any ultrastructural alteration. (Luciana et al, 2009).

CONCLUSION

We conclude that the drug Alpha-tocopherol used in the present study offers protection of beta cells against hyperglycemia in chemically induced diabetes.Antidiabetic effect of *alphatocopherol*may be due to increased release of insulin from the existing *β*-cells of pancreas.

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Corresponding author: Dr. Khadija Qamar, Department of Anatomy, Army Medical College, Rawalpindi, National University of Sciences and Technology, Pakistan
Email: colkhadijaqamar@gmail.com