Some Aspects of Nicotine Induced Toxicity in Experimentally Diabetic Albino Rats

BY

Heba Ahmed Abd El-Hamed Hassan El-Dash

B.Sc. 2004 (Zoology & Chemistry), Faculty of Science at

Fayoum, Cairo University

A Thesis

Submitted for the Fulfillment of M.Sc. Degree

In

Zoological Physiology

Department of Zoology

Faculty of Science

Fayoum University

2011

APPROVAL SHEET

Some Aspects of Nicotine Induced Toxicity in Experimentally Diabetic Albino Rats

BY

Heba Ahmed Abd El-Hamed Hassan El-Dash

B.Sc. 2004 (Zoology & Chemistry), Faculty of Science at

Fayoum, Cairo University

Submitted to

The Faculty of Science, Fayoum University

For the Fulfillment of M.Sc. Degree in Zoological Physiology

Supervission Committee:

1 – Dr. Sayed Fouad Abdel-Aziz
   Full time prof.: Zoological Physiology
   Zoology Department, Faculty of Science, Fayoum
   University

2 – Dr. Suzan Fahmy El-Sisy
   Ass. Prof.: Zoological Physiology
   Branch of zoology, National Organization of drugs
   control and Reaserch, Cairo.

2011

SUMMARY

Diabetes mellitus is a syndrome with disordered metabolism and inappropriate hyperglycemia due to either a deficiency of insulin secretion or to a combination of insulin resistance and inadequate insulin secretion to compansate.

In humans, insulin deficiency is a common and serious pathologic condition. In animals, it can be produced by pancreatectomy, by administration of alloxan, streptozotocin, or other toxins that in appropriate doses cause selective destruction of the β-cells of the pancreatic islets, by administration of drugs that inhibit insulin secretion, and by administration of anti-insulin antibodies.

Diabetes is characterized by polyuria, polydepsia, weight loss in spite of increased appetite, hyperglycemia, glycosuria, ketosis, acidosis, and coma. There are widespread biochemical abnormalities, but the fundamental defects to which most of abnormalities can be traced are (1) Reduced entry of glucose into various peripheral tissues and (2) Increased liberation of glucose into the circulation from the liver due to excess secretion of glucagon.

There is therefore an extracellular glucose excess and, in many cells, an intracellular glucose deficiency, a situation that has been called "starvation in the midst of plenty". There is also a decrease in the entry of amino acidis into muscles and an increase in lipolysis.

The induction of diabetes to male albino rats in the present work has been obtained by the use of streptozotocin.

In addition to STZ-diabetes induced to animals, nicotine has been also sub-cutaneously injected in a dose equivalent to the nicotine present

in 40 cigarettes/day in order to model diabetic, nicotinized animals to diabetic, moderate smokers.

Some of dietary supplements, such as vitamin E, garlic and essential phospholipids have been therapeutically used to correct abnormalities obtained as a complication of combined effects of both diabetes and smoking.

The net results have been obtained from 80 adults male albino rats, which were classified into (3) major categories, each sub-divided into groups of (8) rats.

The 1st category (Control groups) was sub-divdided into (4) control groups, follows:

1) Normal Blank Control (C)
2) Diabetic Control (STZ)
3) Nicotinized Control (Nic.)
4) Diabetic, nicotinized Control (STZ+Nic.)

The 2nd category (Three diabetic treated groups) were arranged and treated as:

5) Treatment with vitamin E (STZ+VE)
6) Treatment with garlic (STZ+G)
7) Treatment with essential phospholipids (STZ+ESS.)

The 3rd category (Three diabetic, nicotinized treated groups) were arranged as:

8) Treatment with vitamin E (STZ+Nic.+VE)
9) Treatment with garlic (STZ+Nic.+G)
10) Treatment with essential phospholipids (STZ+Nic.+ESS.)

The determined parameters:

1) Blood glycosylated hemoglobin (HbA$_1$c)
2) Serum glucose.

3) Serum total cholesterol (T-Ch).

4) Serum triglycerides (TG).

5) Serum HDL-Cholesterol (HDL-C).

6) Serum LDL- Cholesterol (LDL-C)

7) Serum malondialdehyde (MDA).

8) Serum reduced glutathione (GSH).

The numbers 1, 7 and 8 of abnormalities determined by using HPLC method, while the others were determined by using the chemical kits.

The results were statistically analysed by (ANOVA) with the determination of least significant difference test (LSD) at conventional probability levels ($P < 0.05$).

The final results can be summarized as follows:

Treatment with dietary supplements (vitamin E, garlic and essential phospholipids) leads to lower the levels of serum glucose, T-Ch, TG, LDL-C, MDA and blood glycosylated hemoglobin (HbA_1c). It also leads to elevated levels of serum HDL-C and GSH in treatment groups, but vitamin E showed a potent effect in improving the oxidative stress. Garlic treatment showed the best effect in improving hypoglycemia and the potent effect of essential phospholipids was through improving hyperlipidemia.