Influence of Sesame Oil on Physiologic and Histopathological Changes in Alloxnized Male Guinea Pigs

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Abstract

The current study was to investigate the effect sesame oil *(Sesamum indicum* L) on glycosylated hemoglobin, blood glucose, Malondialdehyde, semen and hormonal parameters, in addition the histopathological changes on pancreas in diabetic pigs. The physiological indices were examined in control, diabetic and oil treated diabetic pigs. Eighteen male pigs were randomly assigned into three groups, group one as control, group two diabetic as positive control and group three diabetic treatment with sesame oil at dose (1ml/kg) orally, after 30 days whole blood samples were collected to measure the hemoglobin A1c and other samples were separated into serum for blood glucose and MDA and hormonal assays. Epididymal taken for sperm parameters examined, all animals were sacrificed and pancreas was taken for histological study. Outcomes of this study indicate that significantly reduction in serum Malondialdehyde level in associated with lowered levels of blood glucose and hemoglobin A1c, While, significantly elevation in serum testosterone, FSH and LH levels accompanied with the improved spermatogenesis were observed in group treated with the sesame oil. In addition, the a significant islet langer hans restoration was notable. **Conclusion:** The oil has antioxidant and ameliorated effects on pancreatic function and markedly improved sperm profile.

Key words: *Sesame oil, hemoglobin A1c, Malondialdehyde, Hormones, male pigs*

Introduction

Diabetes is a chronic metabolic disease that represents a major public health problem because of the current lifestyle and dietary habits. Type one caused by deficiency in insulin production, type two by ineffectiveness of insulin, clinical and preclinical evidence suggests that diabetes is associated with oxidative stress leading to imbalance of oxidant/ antioxidant [(1)]. The pathophysiology of diabetes involves several interrelated mechanisms, elevated blood glucose induces auto-oxidative glycosylation, formation of glycation product, activates protein kinase-C, increases polyol pathway activity and hexosamine flux, which are the key components of the cascade, these pathways are responsible for the generation of reactive oxygen species which ultimately contribute to oxidative stress [(2)].

Sesame(*Sesamum indicum* Linn.) belongs to the family – Pedaliaceae, Sesame is widely used in food, nutraceutical, pharmaceutical and industry in many countries because of its high oil, protein and antioxidant contents and chemo-preventive agents, some of which have been attributed to a group of compounds called lignans such as sesamin, sesamolin, sesaminol, sesamolinol and tocopherol, which are known to play an important role in the oxidative stability, nutritional antioxidant and medicinal properties. hence, it uses against health problems[(3)]. Sesame seeds are also contain a good type of monounsaturated and polyunsaturated fatty acids highly nutritious, rich in vitamins and a good source

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of minerals[4]. **The work** aimed to evaluate the effects of sesame oil on the Malondialdehyde (MDA), fasting blood glucose and glycosylated hemoglobin(HbA1c), testicular function (epididymal sperm and hormones parameters) and histological changes in pancrease of diabetic male guinea pigs.

Materials and Method

Oil extraction**:** White sesame seeds(*Sesamum indicum* L.). were purchased from a local market in Basra city, and oil extracted from seeds by Soxhlet apparatus as described by[5]

Experimental protocol

Eighteen, healthy adult male guinea pigs weighed between (900-1000) gm, they were managed and housed in suitable cages under optimum conditions 12 hours light/ dark cycle and temperature of 25 ±3°C in the animal house of the College of Veterinary Medicine / University of Basra.

Pigs were randomly distributed into three groups, consisting 6 of pigs per group the treatment continued for 30 days as follows.

Group I : pigs were orally given(1ml/ kg) of normal saline daily serving as (negative control).

Group II: pigs in this group were treated with single dose of alloxan monohydratem according to method [6], diabetic pigs similarly given(1ml/kg) of normal saline daily serving as(positive control).

Group III: the diabetic animals orally received (1ml kg) of sesame oil daily, the dose was chosen as described by [7] .

Pigs in the fasted state and under light ether anesthesia, whole blood samples were collected at thirty days of study through heart puncture technique, blood samples were used for the hemoglobin A1c assayed according to[8] . Other blood samples were separated into serum was used for determination malonaldialdehyde according to[9] blood glucose level was measured by method[10] Testosterone level was determined according to[11], FSH and LH concentrations assayed as described by [12]. Directly after blood collection, testes carefully excised for semen examination, animals were sacrificed, pancreas carefully excised for histological study.

Seminal analysis

Spermatozoa concentration and live spermatozoa percentage were counted according to[13], Percentage motility of sperm was estimated by drop of the sperm suspension that placed on glass slide covered by a coverslip and also degree of individual motility of spermatozoa was recorded.

Histological preparation: The pancreas was removed from all groups, small specimens of pancreas immediately fixed with 10% buffered formalin solution, the fixed tissues prepared according to [14], for histological examination.

Statistical analysis: analysis was done by one way analysis of variance (ANOVA). Data were expressed as means ± standard error (Means±SE). P a Value less than 0.05 ($P<0.05$) were considered to be statistically significant.

Results

Table (1) shows that the MDA level is a good indicator for evaluating oxidative stress in diabetes. The results explain that there is a significant ($P < 0.05$) increased in serum MDA level in associated with the significantly ($P<0.05$) increased in serum glucose concentration and hemoglobinA1c in diabetic pigs compared with control group. While, the significantly ($P < 0.05$) reduction in serum MDA level accompanied by significantly ($P < 0.05$) decreased in levels of glucose and hemoglobinA1c were observed in treated group with sesame oil when compared with diabetic and control groups.

Table(1): Serum malondialdehyed (MDA), blood glucose and hemoglobinA1c(HbA1c) levels from control group, diabetic group and diabetic group treated with sesame oil (*Sesamum indunic L*)

Groups	MDA µ mol/l	Blood glucose Mg/dl	HbA1c %
Negative control	0.45±0.01 c	109.23±1.66 c	4.2±0.02 c
Positive control	2.03±0.05 a	236.20±2.35 a	7.4±0.06 a
Treatment	0.49 ±0.02 b	119.67 ±1.9 b	4.5±0.04 b

The different letter means statistically differences at the ($p < 0.05$) level as compared with control group. Values are expressed as mean ± SE

Table(2)The results indicate that significantly ($P< 0.05$) decreased in sperm concentration sperm, motility and live sperm percentage in diabetic group compared to control group. Whereas, showed significantly($P< 0.05$) elevation of the sperm concentration accompanied by significantly ($P< 0.05$) increase in motility and live sperm percentage for approach the control values in group treated with sesame oil when compared with diabetic group..

Table(2): Concentration of sperm, motility and live percentageof sperm from control group, diabetic group and diabetic group treated with sesame oil (Sesamum indunic L)

Groups	Sperm concentration x106 mm3	Sperm Motility %	Live sperm
Negative control	155.3±3.2 a	88.29±1-80 a	74.14±3.4 a
Positive control	80.32 ±1.47 c	48.44±2.26 c	33.25±1.08 c
Treatment	149.16 ±2.48 b	85.16 ±3.33 b	70.43±1.2 b

The different letter means statistically differences at the ($p < 0.05$) level as compared with control group. Values are expressed as mean ± SE

The data explained that testosterone, FSH and LH levels significantly decrease ($P<0.05$) were also observed in the diabetic group compared to control group. While, the outcomes indicated that significantly (<0,05) increased in serum testosterone, FSH and LH levels in group treated with sesame oil compared with diabetic group in table(3).

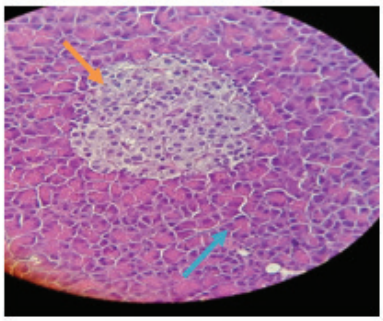
Table(3):Serum testosterone. follicle stimulating hormone and luteinizing hormone from control group, diabetic group and diabetic group treated with sesame oil(*Sesamum indunic L*)

Groups	Testosterone ng/ml	FSH ng/ml	LH ng/ml
Negative control	11.26±0.06 a	22.02±0.21 a	4.12±0.61 a
Positive control	6.99±0.37 c	11.96±0.13 c	1.76±0.2 c
Treatment	9.78±0.42 b	19.88±0.13 b	2.89±0.43 b

The different letter means statistically differences at the ($p < 0.05$) level as compared with control group. Values are expressed as mean ± SE

Histological Findings

The histo-pathological alteration were observed in the pancreas from pig treated with alloxan (150mg/kg B.W) show presence of vacuolation of islet (Fig.2). as compared with negative control. Whereas, showed the restoration in the islet of the pancreas within normal limits in diabetic pigs treated with 1ml /kg of sesame oil (Fig.3). as compared with positive control.



Figure(1):Pancreas section explains islet of langer hans ( ) and exocrine( ) in normal pigs **H&E X400**

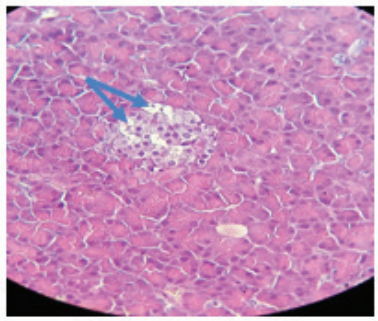
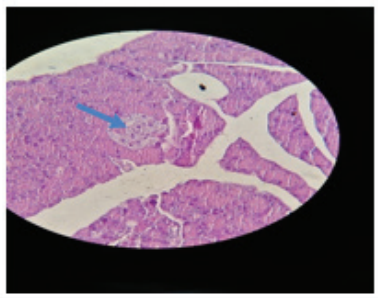


Figure (2):Pancreas section explains vacuolation in islet of langer hans ( ) in diabetic pigs **H&E X400**



Figure(3): Pancreas section explains islet of langer hans within normal limils ( ) In diabetic pigs given sesame oil 1 ml/kg B.W **H&E X400**

Discussion

Our current study demonstrated that sesame oil administration affecting on the oxidative stress this may be due to the prevention of the entering of glucose into the polyol pathway leading to an increased NADPH/ NADP ratio and prevent glycation end products[15]. On the other hand, administration of sesame cause a significant reduction in malondialdehyde (MDA) content due to the sesame oil has the most powerful antioxidant properties on free radicals[16]. our results agreement with [17] stated that the sesame oil can inhibited lipid peroxidation, significantly improved activity of the antioxidant enzymes and reduced glutathione (GSH) content may be attributable to presence of the natural antioxidant and gammatocopherol lignin fraction in sesame oil which are play an important role in its oxidative stability and antioxidant activity**.** The results indicate that sesame oil *(Sesamum indicum*)has hypoglycemic effect of diabetic animal this may be attributed to sesame oil induce hypoglycaemia by increasing the glycogen deposition in the liver and by increasing the secretion of insulin from pancreas, [18].The results are similar with findings obtained by[19] showed that bioactive molecules present in *Sesamum indicum* extract may probably possess insulin- like effect or stimulate the β cells of the pancreas to produce insulin which in turn lowers the blood glucose level.

The HbAIC level significantly increased in diabetic group suggesting glycosylation of Hb in the presence of hyperglycaemia, glycosylated Hb shows reduced affinity to oxygen a process that aid free radical release [20]. Our current findings, prominent decrease in HbAIc concentration was observed in treated group with sesame oil indicating decrease in blood glucose level and recovery to Hb. Results agreement with the [21] demonstrated that sesame administration cause to significantly decreased in the glycosylated hemoglobin level which could be due to an improvement in insulin secretion from the remnant pancreatic beta cells in diabetic rats. From our experiment showed decreased in sperm concentration, sperm motility, live sperm in diabetic pigs. The results in agree with[22] stated that hyperglycemia is usually accompanied by extensive disturbances in the metabolism of glucose and fatty acids, the lipid peroxidation in the testis and epididymal that lead to the impacts of sperm concentration, sperm motility, viability and abnormalities. In the present study showed that the sesame oil treatment could be improved sperm concentration and sperm motility this effect of sesame oil may be due to its potent antioxidant properties.[23]. The results agree with previous studies have indicated that treatment with antioxidants decrease the radical oxygen and improve the testicular dysfunction and subsequently ameliorate fertility in diabetic patients [24]. From our study show significantly decrease in testosterone, FSH and LH levels of diabetic group. testosterone production and leydig cells function are diminished in insulin-dependent diabetes due to the absence of is possible to affect the stimulatory effect of insulin on leydig cells and to an insulin –dependent decrease in FSH, which in turn decreases LH levels [25]. These findings agree with reported by[26] who found reduced in serum FSH,LH and testosterone levels suggesting leydig and sertoli cells which decrease with insulin deficiency and defects in insulin secretion may change testicular and accessory sexual glands function. The treatment with sesame oil that cause to increase levels of testosterone, FSH and LH hormones, this alteration in levels of hormones is attributed to the antioxidant nature of sesame oil that is possible to affect the biosynthesis of hormones balance [27].These results agree with reported by[28] who found that the sesame oil contains effective compound which cause to higher protein receptors or lignans also this lead to elevated in the FSH level, this effect is possible to return to the direct effect on the brain through the pituitary- hypothalamus axis in stimulating the secretion of hormones librated gonadotropin releasing hormones(GnRH).

Conclusion

Sesame oil has antioxidant and ameliorated effects on pancreatic function and markedly improved sperm profile.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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