PROTECTIVE EFFECT OF GHRELIN ON TESTICULAR FUNCTIONS IN ADULT MALE DIABETIC ALBINO RATS

By

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ABSTRACT

Background: Oxidative stress is one of the important causes of type 1 diabetes which can induce changes in male reproductive system. Ghrelin is a peptide hormone that has been shown to have antioxidant properties.

Objective: Evaluation of the ghrelin on testicular dysfunction of rat model of type 1 diabetes mellitus induced by streptozotocin (STZ).

Material and Methods: Forty adult male albino rats were divided into four equal groups: Group 1: served as normal control group received normal saline, group 2: Ghrelin–treated normal group, group 3: STZ-diabetic group, group 4: Ghrelin-treated diabetic group. At the end of experiment, rats were weighed and serum levels of blood glucose, insulin, luteinizing hormone (LH), follicle stimulating hormone (FSH) and testosterone were determined. Also, epididymal sperm count and motility, testicular activity of superoxide dismutase (SOD), catalase (CAT) glutathione peroxidase (GPx), malondialdehyde (MDA), testicular weight and testicular histopathology were determined.

Results: STZ-diabetic rats showed significant decrease in body weight, testicular weight, serum insulin, LH, FSH, testosterone, testicular activity of SOD, CAT, GPx, epididymal sperm count and motility, and significant increase in serum glucose level and testicular MDA level associated with impairment of testicular histology as compared to control group. Ghrelin administration into diabetic rats resulted in significant increase in the body weight, testicular weight, serum insulin, LH, FSH, testosterone, testicular activity of SOD, CAT, GPx, epididymal sperm count and motility, and significant decrease in serum glucose, and testicular MDA levels associated with restoration of testicular histoarchitecture nearly to normal as compared to diabetic group. In the normal group, ghrelin resulted in significant increase in body weight, testicular weight, testicular activities of SOD, CAT, and GPx, sperm motility and significant decrease in testicular MDA, while it produced insignificant changes in the serum levels of glucose, insulin, FSH, LH, testosterone, and sperm count.

Conclusion: Ghrelin has a protective effect against testicular dysfunction in STZ-induced diabetic rats which may be due to its antioxidant properties and improvement of insulin and glucose levels.

Keywords: STZ, Diabetes mellitus, Ghrelin, Oxidative stress, Testicular function.

INTRODUCTION

Diabetes is a common health problem that has been associated with decreased sexual function in both males and females such as penile erection loss, sexual disinclination, adverse effect on pregnancy outcomes, infertility, and decrease of clitoral sensitivity (Kim et al., 2006 and Amaral et al., 2008).

Oxidative stress (OS) increases in DM due to overproduction of reactive oxygen species (ROS) and decrease efficiency of anti-oxidant defenses (Amaral et al., 2008). The generation of ROS is mainly due to glucose autoxidation, increased glycolysis, protein kinase C activation, activation of polyol pathway, and hexosamine pathway (Hakeem et al., 2008).
2008). Increased ROS causes oxidation of proteins, lipids and damage of DNA in reproductive system of diabetic male (Suresh et al., 2013). Stability and capacity of the antioxidant defense against ROS during chronic diabetes plays an important role in the outcome of long term complications caused by ROS (Evans et al., 2002).

Ghrelin is the natural ligand of the growth hormone secretagogue receptor (GHS-R), and was first found to induce GH secretion in various species (Arvat et al., 2001). It also acts on the hypothalamus to increase food intake (Lim et al., 2013). Ghrelin has been primarily detected in the A-cells of stomach (S?nmez and Ozan, 2007). However, ghrelin secreting cells have also been identified in the pancreas (Arnes et al., 2012), hypothalamus (Cowley et al., 2003), pituitary gland (Korbonits et al., 2001), interstitial Leydig cells, and Sertoli cells (Tena-Sempere et al., 2002).

Ghrelin is involved in glucose metabolism, and its effect on the insulin is either inhibitory (Dezaki et al., 2004) or stimulatory (Date et al., 2002 and Granata et al., 2012). It has been reported that ghrelin has antioxidant and anti-inflammatory properties and functions as a free radical scavenger. The antioxidative effects of ghrelin via reduction in lipid peroxidation and increase of antioxidant enzyme activities have been reported in the liver (Alantary et al., 2014), rat ovary (Kheradmand et al., 2010), preadipocyte cell lines (Zwirska-Korczala et al., 2007), gastric injuries (Coskun et al., 2013), in primary cultured cardiomyocytes (Xu et al., 2008), and sensorimotor neuropathy (Tsuchimochi et al., 2013). Also, antioxidant properties of ghrelin in the testis were reported where ghrelin treatment protected testicular germ cells against damage induced by oxidative stress of heat exposure and ischemia reperfusion injury (Kheradmand et al., 2011 and Taati et al., 2012). The present study aimed to investigate the protective effects of ghrelin against testicular dysfunction in rat model of type 1 diabetes mellitus induced by streptozotocin.

**MATERIAL AND METHODS**

**Animals and experimental design:** Forty adult male albino rats of local strain weighing 130-150 g. Animals were kept in cages (20 x 30 x 50 cm–5 rats per cage) at room temperature, maintained on normal light/dark cycle, and fed on commercial rat pellets and water ad libitum. They were left for two weeks for acclimatization before experimental work.

The rats were randomly divided into four equal groups as follows: Group 1 (normal control group) received normal saline once every other day for 30 days by subcutaneous (S.C.) injection, group 2 (Ghrelin -treated normal group) where, each rat received single S.C. injection of ghrelin (Sigma Aldrich Co., USA) dissolved in saline at a dose of 2 nmol / kg / 100 ?l saline every other day for 30 days (Kheradmand et al., 2011), group 3 (STZ-diabetic group), and group 4 (Ghrelin -treated diabetic group) where each rat was given the same dose of STZ, and ghrelin at a dose of 2 nmol / kg/100 ?l saline by S.C. injection every other day for 30 days (Kheradmand et al., 2011).

**Induction of diabetes:** Diabetes was induced by single intraperitoneal injection of freshly prepared STZ (Sigma Aldrich Co.,USA) at a dose of 60 mg/kg after fasting overnight (Shrilatha and Muralidhara, 2007). The STZ was dissolved in 0.1M citrate buffer (pH 4.5) immediately prior to injection. Three days later, a blood sample was collected from the tail vein, and fasting blood glucose was determined using a commercial glucometer (ACCU CHEK, Rhoche
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Diagnostics, Germany). Rats with blood glucose level more than 300 mg/dl were included in this study. Blood glucose level was monitored regularly every week during the experiment.

**Blood and tissue collection:** Twenty four hours after the last dose of ghrelin, rats were weighed, blood was collected from retro-orbital plexus of veins and centrifuged at 3000 rpm for 20 minute to separate serum which was stored at - 20°C. It was used for measurement of the levels of serum glucose (Teitz, 1995), serum insulin (Temple et al., 1992), serum testosterone (Huang et al., 1995), serum FSH (Rebar et al., 1982), and serum LH (Teitz, 1995). Epididymes was used for measuring sperm count and sperm motility (WHO, 1992), while testes were weighed, and the right one was homogenized for measurement of testicular activities of MDA (Ohkawa et al., 1982), SOD (Flohe and Otting, 1984), GPx ((Tappel, 1978), and catalase (Aebi, 1984), and the left one was used for histopathological examination.

**Statistical analysis:** Data were expressed as mean ± standard deviation (SD). Statistical analyses were carried out by using SPSS program (version 18 for windows) (SPSS Inc. Chicago, IL, USA). One-way analysis of variance (ANOVA) was used to test for significance between the groups followed by Tukey’s multiple comparison test. \( P \leq 0.05 \) was considered statistically significant.

**RESULTS**

The results of the present work showed that injection of STZ to rats in group 3 led to significant decrease in the body weight, testicular weight, serum insulin level, serum FSH, serum LH, serum testosterone, sperm count, sperm motility, testicular SOD activity, testicular GPx activity, and testicular CAT activity. Also, there were significant increase in the blood glucose level and testicular MDA activity as compared to control group (Tables 1 and 2).

**Table (1): Effects of ghrelin on body weight, testicular weight, blood glucose level, insulin level, and serum levels of FSH, LH and testosterone in different studied groups (Mean ± SD).**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>Control (group 1)</th>
<th>Ghrelin normal (group 2)</th>
<th>Diabetic (group 3)</th>
<th>Ghrelin-treated diabetic (group 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (g)</td>
<td></td>
<td>252.8 ± 14.3</td>
<td>285.6 ± 15.15*</td>
<td>157.32 ± 9.54*#</td>
<td>205.13 ± 11.14*#</td>
</tr>
<tr>
<td>Testicular weight (g)</td>
<td></td>
<td>1.75 ± 0.4</td>
<td>2.3 ± 0.48*</td>
<td>1.12 ± 0.12* #</td>
<td>1.56 ± 0.11* #</td>
</tr>
<tr>
<td>Serum glucose (mg/dl)</td>
<td></td>
<td>103.13 ± 15.24</td>
<td>98.2 ± 14.23</td>
<td>389.43 ± 18.21*#</td>
<td>184.21 ± 21.6*#</td>
</tr>
<tr>
<td>Serum Insulin (?IU/mL)</td>
<td></td>
<td>24.7 ± 3.41</td>
<td>26.76 ± 4.15</td>
<td>12.1 ± 2.54*#</td>
<td>19.7 ± 3.01*#</td>
</tr>
<tr>
<td>Serum FSH (ng/mL)</td>
<td></td>
<td>5.7 ± 1.11</td>
<td>5.1 ± 0.96</td>
<td>2.48 ± 0.32*#</td>
<td>4.54 ± 0.54*</td>
</tr>
<tr>
<td>Serum LH (ng/mL)</td>
<td></td>
<td>4.4 ± 0.5</td>
<td>4.15 ± 0.42</td>
<td>1.93 ± 0.23*#</td>
<td>3.64 ± 0.43*#</td>
</tr>
<tr>
<td>Serum testosterone (ng/mL)</td>
<td></td>
<td>4.95 ± 0.50</td>
<td>4.65 ± 0.75</td>
<td>1.52 ± 0.15*#</td>
<td>3.8 ± 0.32*#</td>
</tr>
</tbody>
</table>

Number of rats in each group = 10.
* Significant as compared to control group.
* Significant as compared to diabetic group.
*# Significant as compared to ghrelin normal group.
The administration of ghrelin to diabetic rats led to significant increase in the body weight, testicular weight, serum insulin level, serum FSH, serum LH, sperm count, sperm motility, testicular SOD activity, testicular GPx activity, and testicular CAT activity and significant decrease in the blood glucose level, and testicular MAD activity as compared to diabetic group. Also, administration of ghrelin to normal group resulted in significant increase in body weight, testicular weight, testicular activities of SOD, CAT, and GPx, sperm motility and significant decrease in testicular MDA, while it produced insignificant changes in the serum levels of glucose, insulin, FSH, LH, testosterone and sperm count when compared to the control untreated group. Also, there were significant decrease in body weight, testicular weight, serum levels of insulin, FSH, LH, testosterone, testicular activities of SOD, CAT, and SOD, sperm count, sperm motility and significant increase in blood glucose level and testicular activity of MDA in STZ-diabetic and ghrelin–treated diabetic groups when compared with ghrelin normal group (Tables 1 and 2).

Table (2): Effects of ghrelin on testicular SOD, CAT, GPx and MDA activity, epididymal sperm count and motility in different studied groups (Mean ± SD).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>Control (group 1)</th>
<th>Ghrelin normal (group 2)</th>
<th>Diabetic (group 3)</th>
<th>Ghrelin-treated diabetic (group 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testicular SOD activity (U/mg protein)</td>
<td>125.9±13.8</td>
<td>158.34 ± 11.65*</td>
<td>52.4± 6.8* #</td>
<td>110.5± 10.6* * #</td>
<td></td>
</tr>
<tr>
<td>Testicular CAT activity (U/mg protein)</td>
<td>19.32 ± 2.13</td>
<td>27.26 ± 2.59*</td>
<td>10.46±1.89*#</td>
<td>17.87± 2.43*#</td>
<td></td>
</tr>
<tr>
<td>Testicular GPx activity (U/mg protein)</td>
<td>38.14 ± 3.11</td>
<td>49.21 ± 5.57*</td>
<td>17.51 ± 1.94*#</td>
<td>35.3 ± 2.69 * * #</td>
<td></td>
</tr>
<tr>
<td>Testicular MDA level (nmol/gm tissue)</td>
<td>118.21 ± 8.47</td>
<td>76.91 ± 9.12*</td>
<td>209.43 ± 16.32*#</td>
<td>140.12± 12.87**#</td>
<td></td>
</tr>
<tr>
<td>Epididymal sperm count (million/ mL)</td>
<td>49.95 ± 5.78</td>
<td>48.67 ± 4.12</td>
<td>22.54 ± 3.01*#</td>
<td>40.45 ± 2.98* * #</td>
<td></td>
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<tr>
<td>Sperm motility (%)</td>
<td>62.21 ± 6.43</td>
<td>68.45 ± 6.11*</td>
<td>25.11 ± 4.32*#</td>
<td>51.87 ± 6.71** #</td>
<td></td>
</tr>
</tbody>
</table>

Number of rats in each group = 10
* Significant as compared to control group.
# Significant as compared to ghrelin normal group.
+ Significant as compared to diabetic group.
DISCUSSION

Diabetes is a chronic metabolic disease leading to severe complications such as retinopathy, nephropathy, atherosclerosis and reproductive dysfunction (Ricci et al., 2009). DM interferes with male fertility on many levels. Endocrine control of spermatogenesis, penile erection, ejaculation distortion, sperm count and motility all are affected by diabetes (Rato et al., 2013). Various studies showed that experimentally induced diabetes with STZ had a destructive effect on testis tissue structure (Khaki et al., 2010). Previous
studies showed that testicular weight, sperm count, sperm motility and testosterone level are significantly reduced in diabetic subjects associated with vacuolization in spermatogonia and spermatocytes (Kanter et al., 2012).

Growing evidence indicates that oxidative stress increases in diabetes and plays a role in the development of its complications (Amaral et al., 2008). Excess amounts of ROS and free radicals have adverse effects on sperm motility and fertility due to damage to lipids and DNA of spermatozoa (Naziroglu, 2003). Ghrelin is a peptide hormone predominantly produced by the stomach, and it is the endogenous ligand for growth hormone secretagogue receptor. It was found that ghrelin has antioxidant properties (Kheradmand et al., 2009-a).

In the present study, body weights of diabetic rats significantly decreased when compared to control group, and ghrelin administration led to significant increase in the body weight in diabetic group and normal group. Reduction in body weight observed in diabetic rats might be the result of protein breakdown and wasting due to the unavailability of carbohydrate for utilization as an energy source (Andulla and Varadacharyulu, 2003). Antonyselvi et al. (2012) reported that body weight improved by the administration of ghrelin by stimulating food intake at central neuroendocrine level. It was reported that ghrelin induces this effect by acting on arcuate nucleus of the hypothalamus where it stimulates neurons containing the orexigenic factors neuropeptide Y and agouti related peptide, and inhibits neurons producing the anorexigenic peptides pro-opiomelanocortin, cocaine and amphetamine related transcript through binding to GHSR-1a (Chen et al., 2004).

Our study showed that administration of STZ to rats caused significant increase in the serum blood glucose and significant decrease in the serum insulin level as compared to the control group. STZ causes diabetes by rapid depletion of the beta cells mass probably through generation of ROS which leads to a reduction in insulin release and hyperglycemia (Gupta et al., 2004). Administration of ghrelin to STZ diabetic rats caused significant lower levels of the blood glucose and significant higher levels of the serum insulin, while its administration into normal rats produced insignificant changes in these parameters. These findings were in agreement with those observed by Irako et al. (2006) who stated that administration of ghrelin to STZ-treated newborn rats resulted in significant increases of insulin secretion and significant decrease of blood glucose level, and prevent development of diabetes at adult age by increasing pancreatic expression of insulin and Pdx1 mRNA together with increased replication of pancreatic beta cells. Increased insulin secretion by ghrelin may be partly attributed to increased Ca\(^{2+}\) level in beta cells via activation of phospholipase C (Date et al., 2002). Also, these results were in accordance with the results observed by Granata et al. (2010) who reported that treatment with either acylated ghrelin, unacylated ghrelin, or obestatin reduce blood glucose level, enhance insulin level and increase pancreatic islet area and number in STZ diabetic rats through upregulation of antiapoptotic protein BCL2, and insulin &
Pdx1 mRNA expression which are the main regulators of β-cell function and survival suggesting that these peptides may either prevent β-cell death or stimulate β-cell regeneration.

The results of this study showed significant decrease in the serum levels of testosterone, FSH and LH in STZ diabetic group as compared to control group. These findings were parallel to that of the previous investigations (Baccetti et al., 2002, Olivares et al., 2009 and Khaki et al., 2014) which showed that these changes are due to dysfunction of hypothalamo-pituitary-testicular axis by direct effect of insulin deficiency associated with marked reduction of activities of Leydig cellular enzymes. Insulin plays a physiological role in the secretory activity of pituitary gland, and is needed for normal LH release and Leydig cell function (Perez-Diaz et al., 1982). Moreover, insulin receptors are expressed in the hypothalamic neurons expressing gonadotropin releasing hormone (GnRH), and insulin induces expression of GnRH suggesting that GnRH neurons are directly sensitive to insulin (Salvi et al., 2006). Thus, insulin deficiency in STZ-induced diabetes causes decrease in the pituitary gonadotropins secretion associated with decreased testicular steroidogenesis either due to decreased GnRH release or reduced responsiveness of pituitary to GnRH (Baccitti et al., 2002).

The present study showed that exogenous administration of ghrelin to STZ-induced diabetic group lead to significant increase in the plasma levels of FSH, LH and testosterone, while administration of ghrelin to normal group resulted in insignificant changes in the levels of these hormones as compared to control group. These results were in accordance with that reported by Maher et al. (2013) who stated that these effects of ghrelin in diabetic rats may be due to enhanced secretion of insulin and antioxidant effects of the ghrelin.

The results of the current study revealed significant decrease in the epididymal sperm motility and sperm count in STZ-diabetic rats as compared to control group. These results were in agreement with previous studies (Khaki et al., 2010, Akondi et al., 2011, Khaki et al., 2014 and Ghanbari et al., 2015) which showed that sperm count and sperm motility significantly decreased in rats treated with STZ. Spermatozoa are very susceptible to oxidative stress because its polyunsaturated fatty acids in plasma membrane, nuclear and mitochondrial DNA are susceptible to oxidation (Aitken and Koppers, 2011). Moreover, sperms are very poor in free radical scavengers (Bal et al., 2011). Amaral et al. (2006) reported that the cause of these changes is due to oxidative stress produced by hyperglycemia that causes changes in the sperm membrane specially lipid peroxidation, DNA damage in the sperm nucleus and errors in spermiogenesis affecting fertilizing potential. Also, damage to testicular mitochondria by oxidative stress decreases energy available for the sperms resulting in these changes (Palmeria et al., 2001).

Administration of exogenous ghrelin to diabetic rats resulted in significant increase in epididymal sperm count and sperm motility. These findings were supported by Kheradmand et al. (2009-b), Taati et al. (2012) and Maher et al. (2013)
who attributed these findings to the antioxidative effects of ghrelin on the plasma membrane of the sperms which protects it against oxidative damage. Administration of ghrelin to normal group resulted in insignificant changes in the sperm motility and significant increase in the sperm motility.

Increased oxidative stress is a commonly accepted contributor in the development and progression of DM and its complications (Ceriello, 2000). It was found that DM is accompanied by increased production of free radicals and impaired antioxidant defenses (Baynes and Thorpe, 1999). The findings of the present study proved that testicular activity of MDA significantly elevated and testicular activity of SOD, CAT, and GPx significantly decreased in the STZ-induced diabetic group as compared to control group. Increased oxidative stress causes damage of DNA in all tissues including retina, kidneys, myocardium, brain and testis (Amaral et al., 2006). Moreover, excess lipid peroxidation and reduced antioxidant enzymes concentration impair male fertility in type 1 DM (Aybek et al., 2008). The results of our study were consistent with other studies (Shrilatha & Muralidhara, 2007 and Khaki et al., 2014) which revealed that treatment of rats with STZ significantly increased testicular MDA and decreased testicular antioxidant enzymes. Administration of ghrelin into diabetic rats resulted in significant reduction in the activity of testicular MDA and significant increase in the activity of SOD, CAT and GPx as compared to normal control group. Kheradmand et al. (2015) reported that ghrelin enhances testicular antioxidant enzymes activities and reduces lipid peroxidation and consequently attenuates testicular injury in diabetic rats. Also, rat testicular damage following experimentally induced cryptorchidism and testicular ischemia/reperfusion was attenuated by ghrelin through its antioxidant effects (Kheradmand et al., 2014 and Taati et al., 2012). Also, it has been shown that ghrelin increases antioxidant defense system and reduces lipid peroxidation in different organs including ovary (Kheradmand et al., 2010), adipocyte tissue (Zwirksa-Korczala et al., 2007), brain (Obay et al., 2008), stomach (Iseri et al., 2005), hypertensive rats (Kawczynska Drozdz et al., 2006), and liver (Alantary et al., 2014).

In this study, the histopathological sections showed abnormal structure of seminiferous tubules with necrotic shredded cells, decrease of spermatogonia and extensive edema in the interstitial tissue in STZ–diabetic group as compared to control group. These findings were in agreement with Shrilatha and Muralidhara (2007), and Khaki et al. (2010) who observed atrophy of seminiferous tubules with necrosis of spermatogenic cells and interstitial cells. These changes induced by diabetes are partially attributed to testicular oxidative stress, decreased testosterone level which is essential for growth of reproductive organs, and also decreased FSH level which is needed by Sertoli cells to secrete androgen binding protein which binds testosterone needed for differentiation of spermatids into mature sperms (Holdcraft and Braun, 2004). Administration of ghrelin into
diabetic rats resulted in marked recovery of testicular histoarchitecture of diabetic rats. These results were consistent with Kheradmand et al. (2014) who reported that ghrelin led to recovery of testicular histoarchitecture following experimentally-induced cryptorchidism. The enhancement of testicular histopathology may be due to restoration of the levels of FSH, testosterone, LH, insulin and glucose nearly to the normal values and antioxidant effect of ghrelin.

It has been shown that hyperglycemia, in addition to generation of ROS, causes overexpression of proinflammatory cytokines such as interleukin-1β, interleukin-6, and tumor necrosis factor α (TNFα) in rat testis that cause germ cell apoptosis and decrease of testosterone secretion from Leydig cells (Lysiak, 2004). Also, ghrelin receptors are expressed in lymphocytes, monocytes and macrophages (Dixit and Taub, 2005), and its binding to these receptors inhibits the production of TNFα, IL1β and IL6 in testicular tissue (Taati et al., 2015). Therefore, the inhibitory effect of ghrelin on proinflammatory cytokines, besides its antioxidant properties, is another way to suppress the apoptosis of testicular cells.

**In conclusion:** Ghrelin exerted a potent protective effect against testicular dysfunction in STZ-induced diabetic rats by increasing levels of FSH, LH and testosterone, decreasing lipid peroxidation, increasing antioxidant enzymes SOD, GPx, CAT, enhancing carbohydrate metabolism as proved by significant increase in serum insulin level, and significant decrease of serum glucose level. The protective effect of ghrelin against pituitary-testicular dysfunction should be further investigated to assess its ability as new drugs in clinical medicine.

**ACKNOWLEDGMENT**

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**REFERENCES**


خلفية البحث: يعتبر الإجهاد الناتج عن الأكسدة في مرض السكري من النوع الأول واحدًا من أهم الأسباب التي تحدث تغييرات في الجهاز التناسلي الذكري. والجريلين هرمون يبتعد ثبت له خواص مضادة للأكسدة.

الهدف من البحث: تقييم تأثير الجريلين على إضطرابات وظائف الخصية في النوع الأول من مرض السكري المستحدث بواسطة سترتيزوتوسين في ذكور الجرذان البيضاء.

مواد وطريقة البحث: تم إجراء الدراسة على أربعين من ذكور الجرذان البيضاء البالغة، قسمت إلى أربع مجموعات متشابهة: المجموعة الأولى: مجموعة ضابطة أعطيت محلول ملحيا، المجموعة الثانية: مجموعة طبيعية عولجت بالجريلين، المجموعة الثالثة: مجموعة مصابة بالسكر، المجموعة الرابعة: مجموعة مصابة بداء السكري وعولجت بالجريلين. وبعد إتهام التجربة تم قياس وزن الجسم، والسكري، والجريلين، والابطائيات، والسكري ونوع الحيوانات المنوية وعددها ونشاط إنزيمات كتالاز، سوبرأكسيد ديميسوتاز، وجريلينو بروكسيداز، ونشاط مالون داي آداهي في الخصي، ووزن الخصية، وكذلك فحص مجهري للخصي.

النتائج: أظهرت الجرذان المصابة بداء السكري المستحدث سترتيزوتوسين نقصا في وزن الجسم ووزن الخصي ومستوى الإنسولين. وعند إثاث وإنشت والنسرين في الدم، وكذلك نشاط كتالاز، سوبرأكسيد ديميسوتاز والجريلينو بروكسيداز في الخصي وكذلك عدد وحركة الحيوانات المنوية. كما أظهرت زيادة في مستوى جلوكوز الدم ومستوى مالون داي آداهي في الخصي بينjal مثالية متغيرة يتدور في التركيب الهرموني للخصى بالمقارنة مع المجموعة الضابطة. عندما تم حفظ الجرذان المصابة بداء السكري بالجريلين لدى ذلك زيادة وزن الجسم وخصى الجرذان، ومستوى الإنسولين، وهرمونات التستروئدن وإنشت والنسرين في الدم وكذلك الإنزيمات المعنية في الخصي، وعدد وحركة الحيوانات المنوية. كما أدأ إلى نقص مستوى الجلوكوز في الدم ومستوى مالون داي آداهي في الخصي بسبب دالة إخصائيا، كما كان هناك استنام في التركيب الخلوي للخصي تجريبيًا إلى الحد الطبيعي بالمقارنة بالمجموعة المصابة بداء السكري ولم تتجاوز الجريلين. وقد أدأ حق الجريلين في الجرذان الطبيعي إلى زيادة وزن الجسم وخصى الجرذان، ومستوى الإنسولين، ومستوى الجلوكوز، ومستوى الجلوكوز. وعدد وحركة الحيوانات المنوية، وكذلك نقص مالون داي آداهي بسبب دالة إخصائيا، بينما أحدث تغييرات في مستوى جلوكوز الدم والإنسبولين، وإنشت والنسرين، وعدد الحيوانات المنوية بسبب غير دالة إخصائيا.

الاستنتاج: الجريلين له تأثير وقائي على إضطرابات وظائف الخصية في الجرذان المصابة بداء السكري المستحدث وذلك ربما يكون بسبب تأثيره المضاد للأكسدة وتحسين مستوى الإنسولين والجلوكوز في الدم.

مجرى يوسف السعيد - محمد جابر - إبراهيم محمد شتلة - رضا محمد عبد ربه

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