



## Study of Morphometrical Changes in the Testis of Diabetic Rats

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### ABSTRACT

*Diabetes mellitus causes biochemical abnormalities affecting different system. It is found that diabetes mellitus also affects male reproductive system causing infertility in men. The morphological study of the testis in diabetic condition was done as it represents the primary organ of male reproductive system. A total of twelve adult male Wistar rats were used in this study. The rats were divided into two groups, control and diabetic group. One group of rats was made diabetes by intraperitoneal injection of streptozotocin (STZ) whereas the other group remains as control. After six months, the testis was removed from the scrotum of both the groups, to study the morphological changes in the testis. It was found that hyperglycemia significantly alters the morphology of the testis of diabetic rats.*

**KEYWORDS : Diabetes mellitus, Testis, Morphology**

### Introduction

Diabetes mellitus is an endocrine as well as metabolic disorder characterized with hyperglycemia and malfunction in insulin secretion or insulin action. Diabetes mellitus represents a major concern of the global health due to its serious complications. Moreover, the increase incidence of diabetes mellitus has been associated with falling birth rates and fertility.<sup>1,2</sup> Sexual dysfunction is a well recognized consequence of diabetes mellitus.<sup>3,4</sup> Erectile dysfunction and retrograde ejaculation is frequently seen in type 1 diabetes mellitus.<sup>5-7</sup> Although, the exact mechanism by which diabetes mellitus affects male reproductive health is unknown, this pathology has a significant impact on male reproductive function at multiple levels.

Study of the male reproductive dysfunction in diabetes mellitus in animal models and humans have been reported.<sup>3,8</sup> Hyperglycemia resulted in atrophy of sex organs<sup>9</sup>, decrease in sperm count<sup>10</sup>, along with decrease in gonadotropins and testosterone hormone.<sup>10,11</sup> Decrease in copulatory behavior has been reported in streptozotocin-induced diabetic rats.<sup>10</sup> Similarly, in diabetic men testicular atrophy and hypogonadism have been reported.<sup>12,13</sup> Disruption in germinal epithelium of seminiferous tubules<sup>14</sup> and changes in the interstitial space was observed in diabetic men.<sup>15</sup>

The studies done in the diabetic kidney, liver, retina, heart and nervous tissue are many and varied but the study done on the testis is less. As a metabolic disorder, diabetes mellitus induces structural and functional alterations in cells, tissues and organs and testis is no exception. The studies done on the testis of diabetic state are focused on microscopic structural and functional changes. The detail study of the morphological changes in the testis in diabetic condition is lacking behind. Thus, this study was design to examine the gross structural changes in the testis of diabetic rats.

### Materials and methods

Twelve adult male Wistar rats weighing 200-250 gm were used in this study. They were maintained in captivity in cages under natural light condition. They were housed in standard cages and had free access to water and food. The rats were divided into two groups, each containing six rats. One group of rats was injected with streptozotocin intraperitoneally at a dose of 50 mg/kg dissolved in freshly prepared citrate buffer (pH 4.5). The control group was given the same volume

of citrate buffer. After 72 hrs of STZ injection, the blood sample of STZ group rats were taken from the tail vein to measure the fasting blood glucose level by automated glucose analyzer. The fasting blood glucose level above 200 mg/dl was considered as a diabetic rat. The fasting glucose level of control group was also measured to confirm the non diabetes. The fasting glucose level was monitored periodically to confirm the diabetic and non diabetic rats. Both groups of rats were sacrificed after six months. The testes were taken out from the scrotal sac and submitted for morphological study. The different diameters of the testis of control and diabetic groups were taken by the digital Vernier caliper. The weight of the testis in grams was measured by digital weighing machine. All the data were collected, calculated and tabulated.

### Result

The serum fasting glucose level were significantly decreased ( $p < 0.05$ ) in diabetic group when compared to control group ( $305.6 \pm 7.3$  vs  $93.8 \pm 5.4$  mg/dl). Similarly, decrease in body weight gain ( $126.3 \pm 2.6$ ) was seen in diabetic group than the control group ( $340.2 \pm 6.4$ ). The result of the various morphological studies was given in the table.

**Table 1: Measurement of various diameters of testis in diabetic and non diabetic rats:**

S.N	Groups	Vertical Diameter	Transverse Diameter	Anteroposterior Diameter
1.	Control	$21.22 \pm 0.24$	$21.22 \pm 0.24$	$11.94 \pm 0.07$
2.	Diabetic	$20.03 \pm 0.11^*$	$20.03 \pm 0.11^*$	$10.24 \pm 0.25^*$

All the diameters were measured in millimeters. Results are given as mean  $\pm$  SEM.

\* Subscript denotes significant difference between diabetic and non diabetic rats  $p < 0.05$ .

**Table 2: Measurement of weight and volume of testis in diabetic and non diabetic rats:**

S.N.	Groups	Weight in gram	Volume in ml
1.	Control	$1.72 \pm 0.03$	$1.68 \pm 0.06$
2.	Diabetic	$1.43 \pm 0.05^*$	$1.3 \pm 0.05^*$

Results are given as mean  $\pm$  SEM., \* subscript denotes significant difference between diabetic and non diabetic rats  $p < 0.05$ .

## Discussion

Hyperglycemia leads to structural and functional changes in different organ of diabetic patient.<sup>16</sup> Streptozotocin induced diabetes in rats is a standard model for studying and evaluating the effects of diabetes on various organs.<sup>17,18</sup> The STZ lysis the beta cells of pancreas which leads to deficiency of insulin and leads to diabetes mellitus. Thus, the morphological changes that occurred in the testis of STZ- induced diabetic rats are not the direct effect of the drug, but rather by diabetes.

The change in the reproductive system due to hyperglycemia has been reported<sup>16,19,20</sup> but there is very limited data about the alterations of the detail morphological changes of the testis in diabetic condition. Testis represents the central organ of the male reproductive system. Its morphological study is equally important as functional study. In our study, STZ-induced diabetes was associated with decreased body weight gain as well as decreased testicular weight. We concurred in this matter with Jackson and Hutson (1984),<sup>21</sup> and Ford and Hamilton (1984).<sup>22</sup> Another study by Hutson et al.<sup>23</sup> have reported that these changes were mimicked in the adult male Wistar rat by semi-starvation. Oksanen (1975),<sup>24</sup> found the decreased testicular weight over time. Other authors found an increase in testicular weight at short term (one month after onset of diabetes) or a decrease in testicular weight at long term (six months after onset of diabetes) (Anderson and Thliveris, 1987).<sup>25</sup> Atrophy of testes in diabetic rats was reported by Schoellar.<sup>26</sup>

In our study, the vertical diameter (length) is significantly decreased in diabetic group than the control group. Similarly, other diameters i.e. antero posterior diameter and transverse diameter were also decreased ( $p < 0.05$ ) in diabetic group when compared to non diabetic group. We did not find more data on diameters and volume of diabetic testis to compare our results. Our findings on dimensions of testis do not match with the results of Kianifard et al.,<sup>27</sup> who reported that there was no significant difference in length and diameter of the testis between diabetic and non diabetic rats. However, the duration of diabetic conditions in rats was less (70 days) than our groups (six months). In our study, the volume of the testis of diabetic rats was decreased significantly than the control group. The study done by Khaneshi et al.,<sup>28</sup> also reported significant decrease in the volume of testis of diabetic rats.

## Conclusion

From this study it is concluded that the high blood glucose level in diabetes mellitus doesn't only decrease the weight of the body but also decreases the weight of the gonads. Further, the hyperglycemia alters the morphological changes in the testis including the volume.

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