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Original Research Article

A study to know the serum total testosterone levels in type II diabetes mellitus male patients from North India

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ABSTRACT

Background: Diabetes mellitus is major public health issue facing the world in present century and the prevalence of type 2 diabetes is increasing explosively. There are various diabetes related complications, one of which is low testosterone levels in men. This study was designed to estimate the serum testosterone level in male patients of type 2 diabetes mellitus.
Methods: The patients of type -2 diabetes mellitus were picked up from out-patient and in-patients section of the hospital at random.
Results: Seventy male patients with type 2 diabetes mellitus were enrolled during the study period. The mean age of study population was 56.36±10.26 years (range 36-70), while that of control group patients was found to be 39.80±7.92years. Family history of diabetes was present in 14 (22.2%) patients. The mean HbA1c in study group was 8.83±1.95 %, which was significantly higher as compared to control group with HbA1c 4.82±0.40 %. Among study group, lower serum total testosterone level was observed in 85.7 % cases and normal level in 14.3 % cases. Among control group, lower serum total testosterone level was observed in 6.7 % cases and normal level in 93.3 % cases.
Conclusions: The present study highlighted that significant difference in serum total testosterone level has been observed between cases and control groups (X^2 =55.7, P=0.0001).

Keywords: Diabetes mellitus, Testosterone, Family history

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder of multiple etiologies, and defined by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism. It results from defects in insulin secretion, insulin action (resistance), or both.[1]

The estimated number of diabetic patients worldwide was 171 million in 2000, which is expected to increase to 366 million by 2030 and the percentage of diabetics living in developing countries is projected to increase from 74% in 2000 to 81% in 2030.[2]

In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus followed by China (20.8 million) with the United States (17.7 million) in second and third place respectively.[3] According to Wild et al. ,the prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India.[2]

The aetiology of diabetes in India is multifactorial and includes genetic factors coupled with environmental influences such as obesity associated with rising living standards, steady urban migration, and lifestyle changes.

Diabetes mellitus is strongly associated with microvascular complications such as nephropathy, retinopathy and neuropathy leading to organ and tissue damage and these complications are seen in approximately one-third to one-half of people with the disease.[4] There has been a significant correlation between the microvascular complications and the testosterone level of these patients and this association has been strongest with diabetic neuropathy.[5-7]

Testosterone enhances reproduction and sexual function and also is reported to regulate body composition, enhancement of cognitive function, and cardiovascular health.[8-9] On the other hand, diabetes mellitus may also be considered a risk factor for hypogonadism through visceral obesity, reduced Sex Hormone Binding Globulin (SHBG), inhibition of gonadotrops secretion or production of testosterone by Leydig cells, cytokines mediated inhibition (e.g. TNF α, IL-1β, IL-6) of steroid production and increased aromatase activity resulting in estrogen excess.[10-12]

Numerous studies had concluded that type II diabetes mellitus in men lead to low serum testosterone levels or that low serum testosterone concentrations might even expect the commencement of diabetes mellitus.[13-14] Various other studies have also suggested that men with low testosterone are at a greater risk of developing T2DM and may even predict the onset of diabetes.[15-19]

A systematic review of 43 studies including 6427 men, suggested that higher plasma levels of testosterone were associated with lower risk of T2DM and vice versa.[20] Type 2 diabetes mellitus (DM) associated hypogonadism might exacerbate sexual dysfunction by reducing libido and mood and infertility and further compromising penile vascular reactivity and lipid metabolism.[21]

Hence, this study has been carried out to estimate the serum testoeterone level in male patients of type 2 diabetes mellitus.

METHODS

This study was conducted in Post Graduate Department of Medicine GSVM Medical College Kanpur from 1-7-2016 to 30-12-2018. This cross sectional study was performed in 70 male, type 2 diabetes mellitus patients, either admitted to department or attending medicine OPD, between 30 to 50 years of age. 30 healthy age matched individuals, were selected as controls. Institutional ethical committee clearance was taken. (Exclusion criteria given below)

Exclusion criteria

- Very sick type-2 diabetes mellitus male patients,
- Patients with other co-morbidities not related to type-2 diabetes.

A detailed history, clinical examination and investigations were done in each patient in order to assess disease severity. They were subjected to CBC, Fasting and Postprandial blood sugar, Blood urea, serum creatinine, HBA1C, lipid profile, urine for albumin creatinine ratio. Diabetes mellitus was defined by ADA guideline 2016.[21-22] Serum testosterone levels (morning sample) were estimated using chemiluminescence immunoassay.[23] Low testosterone was defined as serum total testosterone level <241ng/dl and the prevalence of its deficiency was calculated. Estimation of HbA1c (4.2-6.2%) performed by High Performance Liquid Chromatography (HPLC).

Statistical analysis

Data was compiled using Microsoft Excel and analysed using SPSS Statistics version 20.0. Categorical variables were analysed using percentage and chi-square test. Two tailed 'p' value less than 0.05 was considered significant. Quantitative variables were analysed using mean, standard deviation and student 't' test.

RESULTS

The mean age of study population was 56.36±10.26 years (range 36-70), while that of control group patients was found to be 39.80±7.92years, which was statistically significant (p=0.0001). 63% patients belonged to urban areas and 37% belonged to rural areas. In present study, 65.1% patients were smoker and 34.9 % were non smokers. Of the total, 61.9% patients were alcoholic and 38.1% non alcoholic. Family history of diabetes was present in 14 (22.2%) patients.

BMI of study populations was 25.93±3.36kg/m^2, and among control group it was BMI 25.91±3.25kg/m^2 (p-value=0.89). The mean HbA1c in study group was 8.83±1.95%, which was significantly higher as compared to control group with HbA1c 4.82±0.40 % (p-value = 0.00001).

Table: 1 Demographic parameter of study populations (n=70).

Parameter	Total populations, Mean±SD
Age	56.36±10.26
BMI	25.93±3.36
PY	8.94±15.76
Mean HBA1C	8.83±1.95
Mean total cholesterol	189.04±74.37
Mean HDL	52.40±12.50
Mean LDL	113.27±51.04
Mean serum creatinine	2.3±2.44
Mean Albumin Creatinine Ratio	2084±4692
Mean Serum total testosteron	118.20±88.47

Table 2: Demographic parameters between cases and control groups.

Parameter	Total populations Mean±SD (N=70)	Control Mean±SD (N=30)
Age	56.36±10.26	39.80±7.92
BMI	25.93±3.36	25.91±3.25
HBA1C	8.83±1.95	4.82±0.404
Serum total testosteron	118.20±88.47	400.93±173.54

Among study group, lower serum total testosterone level was observed in 85.7% cases and normal level in 14.3% cases. Among control group, lower serum total testosterone level was observed in 6.7% cases and normal level in 93.3% cases. Serum total testosterone level in study group and control group were 118.2±88.47ng/ml and 400±173.54ng/ml respectively. There is significant difference in serum total testosterone level has been observed between cases and control groups (X^2 =55.7, P=0.0001) (Table 1 and Table 2).

DISCUSSION

Testosteron is the primary male sex hormone and an anabolic steroid and deeply involved in every step of the male sexual response. Testosterone also maintains the bone density and muscle mass.[24] Testosterone synthesis is regulated by the hypothalamus and pituitary gland. Gonadotropin-releasing hormone (GnRH) secreted by the hypothalamus and it stimulates the production of the LH and follicle stimulating hormone (FSH) and both carry stimulatory actions to the testes. FSH triggering spermatogenesis and hormone synthesis, primarily inhibin and LH, stimulating steroidogenesis and testosterone production.[25] A normal male testosterone level peak observed at the age 30 years, and then its level tends to decline with age by approximately 0.5-2% per year which seems to be a normal aging process of men.[26-27]

The prevalence of low serum testosterone among male with type 2 diabetes is high and this has been confirmed by several studies.[8,17,21,28,29]

In present study 85.7% of patients with T2DM had testosterone levels <241ng/dl and 14.3% had testosterone levels >241ng/dl.

Similar are the findings of Yeap et al, in which they have shown that diabetic men were found to have around two time's lower testosterone levels as compared to men without diabetes mellitus.[30] Ding et al, conducted a meta-analysis which included 3825 men and confirmed that there Washigher prevalence of lower level of serum testosterone in type 2 Diabetic men.[20] Oh et al, also showed a reciprocal relationship between serum total testosterone and type 2 diabetes mellitus.[16] Corona et al, conducted more recent meta-analysis including 1822 diabetic men and 10009 non diabetic controls and have found that serum total testosterone level was lower in men with diabetes mellitus than non-diabetic controls (mean difference, -2.99nmol/liter).[31]

Hayek et al, found that 36.5% of patients with T2DM had testosterone levels <300ng/dl and 29% had symptoms of androgen deficiency.[8] Kapoor et al showed that 20% of men with diabetes have testosterone levels <230ng/dl and 31% have levels between 230-346ng/dl.[32] Grossman et al have shown similar results where 43% of men with T2DM had low testosterone levels (<288ng/dl), which increased up to 61% in men who were 80 years or older.[6]

Bajaj S et al, done a study to evaluate the levels of serum testosterone in 83 male patients with T2DM and to correlate serum testosterone levels with microvascular complications. They further concluded that out of the 83 patients of T2DM, low serum testosterone was found in 37(44.58%) while it was present in only 10(11.8%) of 85 controls, which was statistically significant (χ^2 = 20.84, df =1, p<0.0001). Microvascular complications were seen in 25(67.56%) patients with low testosterone while only 4(8.7%) patients had microvascular complications with normal testosterone level which was statistically significant (p<0.0001).[33] In present study, only 6.7% control had low testosterone level.

Chaudhary S et al, done a study among 193 male patients with T2DM to know the total testosterone levels and free testosterone levels in men with type 2 diabetes mellitus in age group of 30-50 years. They further observed that 34.7% have low total testosterone levels, 29.53% have low free testosterone levels and 23.3% have both low and free testosterone levels.[34]

Trivedi J et al, had done a study to estimate the serum total testosterone levels in 30 type 2 diabetes mellitus male patients and 30 healthy age matched as controls. They further observed that the serum total testosterone level of diabetic group was significantly lower than that non diabetic control group (p-value = 0.000). The mean of serum total testosterone of diabetic group was found 3.53±1.38ng/ml and serum total testosterone of non-diabetic control group was 5.81±2.42ng/ml.[35]

Agbecha A, had carried out a case control study to determine the impact of type 2 diabetes mellitus (T2DM) on serum testosterone, (63 cases and 60 controls). They highlighted that there was a significantly lowered testosterone (P = 1 × 10-13) in the diabetics compared to the matched controls. A significantly elevated (P<0.0005) fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), and (P =0.015) homeostatic model assessment of insulin resistance (HOMA IR) was observed in the diabetics compared with the matched controls.[36]

Khosa Z et al, carried out a study to assess total testosterone concentration in 200 male patients with type

2 diabetes mellitus and 50 aged and BMI matched control. They highlighted that 69% diabetic cases had low testosterone level, while 31% cases had normal level of testosterone and testosterone levels among diabetic cases was 2.47ng/dl which was much lower than the testosterone level seen in control mean 6.23ng/dl done in age and BMI groups.[37] In present study group serum total testosterone level was found to be significantly lower than control group with serum total testosterone, (p-value =0.0001.

CONCLUSION

The present study had shown that lower serum total testosterone level was observed in 85.7 % cases in type II diabetes mellitus and normal level in 14.3% cases. Further studies are required to establish the benefit of testosterone replacement therapy on the quality of life in men with type 2 diabetes mellitus.

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