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ORIGINAL ARTICLE

Assessment of serum testosterone levels in type II diabetic males and its relation with lipid profile

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ABSTRACT:

Background: Approximately 90% of cases of diabetes are type-2, a bipolar condition marked by irregular production and reduced insulin action. The present study was conducted to assess serum testosterone levels in type II diabetic males and its relation with lipid profile. **Materials & Methods:**58 diabetic males and 58 healthy control subjects were subjected to assessment of waist-to-hip ratio and body mass index, serum fasting glucose, total cholesterol, triglycerides, HDL, and glycosated haemoglobin were made. Friedwald's algorithm was used to calculate LDL and VLDL levels. The ELISA microplate reader was used to estimate the levels of blood SHBG and serum total testosterone.Using serum total testosterone, SHBG, and albumin based on the Vermeulen's formula, the free testosterone calculator computed serum free testosterone. **Results:** The mean waist circumference (cm) was 84.2 and 76.4, WHR was 0.93 and 0.85, FBG (mg/dL) was 152.4 and 90.6, total cholesterol (mg/dL) was 194.2 and 152.4, HDL- cholesterol (mg/dL) was 39.1 and 41.5, LDL-cholesterol (mg/dL) was 124.2 and 90.4, VLDL- cholesterol (mg/dL) was 28.4 and 22.6, triglyceride (mg/dL) was 146.2 and 112.9, glycated haemoglobin (%) was 8.5 and 5.2, total testosterone (nmol/L) was 10.6 and 18.1, serum SHBG (nmol/L) was 40.3 and 62.4, and free testosterone (nmol/L) was 0.23 and 0.28 in group I and II respectively. The difference was significant ($P< 0.05$).TT≤8nmol/L was seen in 34 diabetic and 6 non- diabetic and FT≤0.225nmol/Ls in 26 diabetics and 8 non- diabetic subjects. The difference was significant ($P< 0.05$). **Conclusion:** Men's blood sugar status and testosterone levels indicated a potential role for testosterone in the development of type 2 diabetes. Men with type 2 diabetes had considerably lower serum testosterone and SHBG levels.

Keywords:diabetes,triglyceride, Testosterone

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INTRODUCTION

Approximately 90% of cases of diabetes are type-2, a bipolar condition marked by irregular production and reduced insulin action.[1] Insulin has a huge function in controlling glucose homeostasis via a well-coordinated series of actions that include stimulating the absorption of glucose in peripheral tissues including muscle and fat, inhibiting the production of glucose in the liver, and controlling the metabolism of lipids.[2] Apart from insulin, other hormones that contribute to glucose homeostasis maintenance include glucagon, growth hormone, cortisol, catecholamines, and insulin like growth factor-1. Recent years have seen a surge in interest in androgen shortage among medical researchers, who have linked testosterone to a number of major systemic disorders, including type 2 diabetes, in addition to men's overall health.[3]

Higher endogenous testosterone concentrations have generally been linked to a more favorable cardiovascular profile, which includes higher HDL cholesterol and lower triglyceride concentrations, blood glucose, blood pressure, and body mass index.[4] However, excessive amounts of exogenous testosterone or other anabolic steroids have been linked to negative health effects, such as liver damage and sudden cardiac death.There have been several discussions on whether low testosterone is a biomarker for diabetes or if it plays a role in the aetiology of the disease.[5] In India, particularly in northeast India, there is a severe lack of study in this area. Thus, the goal of this study is to assess testosterone serum levels in males with type 2 diabetes and identify any meaningful correlations.[6] The present study was conducted to assess serum testosterone levels in type II diabetic males and its relation with lipid profile.

MATERIALS & METHODS

The present study consisted of 58 diabetic males reporting to general medicine department. All gave their written consent to participate in the study.

Data such as name, age, etc. was recorded. They were divided into 2 groups. Group I was diabetics and group II was healthy control group. Anthropometric data, such as waist-to-hip ratio and body mass index, were also collected.Five milliliters of blood were extracted from the median cubital vein while adhering to all aseptic and antiseptic protocols. Within eight hours of sample collection, tests were conducted using separated serum; if not, the samples were stored at -20°C for later use. Using a MERCK microlab 300 serum analyzer, estimates of serum fasting glucose, total cholesterol, triglycerides, HDL, and glycosated haemoglobin were made. Friedwald's algorithm was used to calculate LDL and VLDL levels. The ELISA

microplate reader was used to estimate the levels of blood SHBG and serum total testosterone.
Using serum total testosterone, SHBG, and albumin based on the Vermeulen's formula, the free testosterone calculator computed serum free testosterone. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Comparison of parameters

Parameters	Group I	Group II	P value
Waist circumference (cm)	84.2	76.4	0.04
WHR	0.93	0.85	0.01
FBG (mg/dL)	152.4	90.6	0.01
Total cholesterol (mg/dL)	194.2	152.4	0.03
HDL- cholesterol (mg/dL)	39.1	41.5	0.18
LDL- cholesterol (mg/dL)	124.2	90.4	0.02
VLDL- cholesterol (mg/dL)	28.4	22.6	0.05
Triglyceride (mg/dL)	146.2	112.9	0.01
Glycated haemoglobin (%)	8.5	5.2	0.01
Total testosterone (nmol/L)	10.6	18.1	0.03
Serum SHBG (nmol/L)	40.3	62.4	0.02
Free testosterone (nmol/L)	0.23	0.28	0.04

Table II, graph I shows that mean waist circumference (cm) was 84.2 and 76.4, WHR was 0.93 and 0.85, FBG (mg/dL) was 152.4 and 90.6, total cholesterol (mg/dL) was 194.2 and 152.4, HDL- cholesterol (mg/dL) was 39.1 and 41.5, LDL- cholesterol (mg/dL) was 124.2 and 90.4, VLDL- cholesterol (mg/dL) was 28.4 and 22.6, triglyceride (mg/dL) was 146.2 and 112.9, glycated haemoglobin (%) was 8.5 and 5.2, total testosterone (nmol/L) was 10.6 and 18.1, serum SHBG (nmol/L) was 40.3 and 62.4, and free testosterone (nmol/L) was 0.23 and 0.28 in group I and II respectively. The difference was significant (P< 0.05).

Table II Prevalence of low testosterone levels in type II diabetic patients

Testosterone levels	Total	DM present	DM absent	P value
TT≤8nmol/L	40	32	6	0.01
FT≤0.225nmol/Ls	34	26	8	0.03

Table II, graph I shows that TT≤8nmol/L was seen in 34 diabetic and 6 non- diabetic and FT≤0.225nmol/Ls in 26 diabetics and 8 non- diabetic subjects. The difference was significant (P< 0.05).

DISCUSSION

Sex hormone-binding globulin (SHBG) and total and free testosterone levels are low in men who are obese, have the metabolic syndrome, and have type 2 diabetes.[7] On the other hand, low testosterone and/or SHBG levels indicate a higher risk of type 2 diabetes and metabolic syndrome.[8,9] Proinflammatory variables play a role in visceral obesity, which is prevalent in males with low testosterone, the metabolic syndrome, and/or type 2 diabetes.[10,11] These inflammatory indicators raise the risk of cardiovascular disease (CVD) and erectile dysfunction by impairing vascular endothelial function.[12,13]The present study was conducted to assess serum testosterone levels in type II diabetic males and its relation with lipid profile.
We found that mean waist circumference (cm) was 84.2 and 76.4, WHR was 0.93 and 0.85, FBG (mg/dL) was 152.4 and 90.6, total cholesterol (mg/dL) was 194.2 and 152.4, HDL- cholesterol (mg/dL) was 39.1 and 41.5, LDL- cholesterol (mg/dL) was 124.2 and 90.4, VLDL- cholesterol (mg/dL) was 28.4 and 22.6, triglyceride (mg/dL) was 146.2 and 112.9, glycated haemoglobin (%) was 8.5 and 5.2, total testosterone (nmol/L) was 10.6 and 18.1, serum SHBG (nmol/L) was 40.3 and 62.4, and free testosterone (nmol/L) was 0.23 and 0.28 in group I and II respectively. Goto et al[14]conducted a case-control study that included 300 diabetes cases (215 men and 85 women) and 300 matched controls. Diabetes was defined by either fasting plasma glucose levels ≥126 mg/dL, 2-h post-load glucose levels ≥200 mg/dL after a 75 g oral glucose tolerance test, or diabetes diagnosed by physicians. After adjusting for age, family history of diabetes, smoking, physical activity, BMI, and FLI, SHBG levels were inversely associated with diabetes among women (odds ratio [OR] comparing the highest with the lowest quartiles, 0.13 [95% confidence interval {CI}, 0.02-0.96]), but not among men. Similar patterns were observed in a subgroup analysis restricted to postmenopausal women"(OR, 0.12 [95% CI, 0.01-1.17]). In contrast, testosterone levels were inversely associated with diabetes among men (OR, 0.45 [95% CI, 0.23-0.89]), but not among women.
We found that TT≤8nmol/L was seen in 34 diabetic and 6 non- diabetic and FT≤0.225nmol/Ls in 26 diabetics and 8 non- diabetic subjects. Mattack et al[15]assessed the relation of testosterone levels with

type 2 diabetes mellitus and lipid profile. The case control study comprised of 40 type 2 diabetic men and 40 age matched non diabetic healthy men. Testosterone, SHBG levels and lipid profile were evaluated in both the groups. Serum total and free testosterone and Sex Hormone Binding Globulin were significantly lower in the test group than in the control group. Prevalence of type 2diabetes was five times higher in men having a total testosterone less than 8nmol/L and 5.57 times higher in those having a free testosterone of less than 0.225nmol/L. Fasting blood glucose showed a strong negative correlation with total and free testosterone. Glycated haemoglobin correlated negatively with SHBG but no such correlation was seen with total or free testosterone. Serum total and LDL cholesterol showed significant negative correlation with total testosterone and SHBG but no significant correlation was found with free testosterone. Serum VLDL, HDL and triglycerides did not show any significant correlation with total or free testosterone and SHBG levels.

The limitation of the study is the small sample size.

CONCLUSION

Authors found that men's blood sugar status and testosterone levels indicated a potential role for testosterone in the development of type 2 diabetes. Men with type 2 diabetes had considerably lower serum testosterone and SHBG levels.

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