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A Study on Serum Testosterone Levels in Type 2 Diabetic and Non-Diabetic Males in a Tertiary Care Centre at Ariyur, Puducherry

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ABSTRACT

Introduction:

Diabetes mellitus is on a rise each year that rises the complications caused by the metabolic disorder. The complications include the microvascular and macrovascular ones. It was estimated that in the year 2019, 1.6 million died due to diabetes mellitus and is expected to only increase in the upcoming years. Studies had reported lower levels of testosterone among males suffering from type II diabetes than those who had no diabetes.

Aim and objectives:

The present study was done to compare the testosterone levels between those with type II diabetes mellitus and who were normal. The secondary objective was to correlate serum total cholesterol with the glycaemic status.

Methodology:

This cross sectional study carried out in a tertiary care hospital at Puducherry for a period of one year. Diabetic and non-diabetic males who were above 18 years of age attending to the outpatient department and inpatients were the study participants.

Results and Discussion:

Serum Testosterone was found in lower range among Type 2 Diabetic Males when compared to non-diabetic males which was statistically significant. The serum testosterone levels were also negatively correlated with fasting blood sugar, post prandial blood sugar and HbA1C levels, respectively.

INTRODUCTION

A progressive metabolic disorder leading to serious complications, diabetes is said to be the largest health emergency. A progressive metabolic disorder leading to serious complications, diabetes is said to be the largest health emergency. Among the four types of diabetes mellitus, type II is the predominant and contributes to 85%. The base to all the complications is the imbalance between the free radicals generated and the anti-oxidant enzymes present. The increased reactive oxygen species then leads to mitochondrial dysfunction and endoplasmic reticulum stress.[1]

Out of all these complications, one least dealt and spoken is that involving sexual dysfunction, especially in men, ranging from lack of libido to erectile dysfunction. The root of all these symptoms can be traced to the lower serum testosterone levels in men, more importantly diabetic men. Studies had reported lower levels of testosterone among males suffering from type II diabetes than those who had no diabetes. Even those with impaired glucose tolerance were also found to have lower testosterone levels than their normal counterparts.[2,3,4] Some studies had recommended testosterone therapy in diabetics to attain a better blood sugar control. Some studies have even associated low testosterone among diabetics as risk factor for the development of cardiovascular diseases.[5]

AIM AND OBJECTIVES:

To study the levels of Serum total testosterone levels in Type 2 Diabetic Males in tertiary care center.

OBJECTIVES:

1. To estimate and compare the levels of Serum total testosterone in type 2 Diabetic and Non-diabetic males.
2. To correlate Serum total testosterone with the glycemic status.

MATERIALS AND METHODS:

This is a cross sectional comparative study for a period of 18 months after obtaining approval of IEC (No: 19/SVMCH/IEC-Cert/Oct 22) performed in a tertiary care hospital at Puducherry. Men above 18 years of age with type II diabetes mellitus according to ADA guideline and non-diabetic persons were included in the study.

Exclusion criteria:

- Patients with known history of endocrine disorders like thyroid disorder, hypogonadism
- Consuming drugs affecting serum testosterone eg: Exogenous Steroid intake
- Chronic renal failure
- Trauma to genitals
- Viral infection like mumps

- Head injury

Following clinical history, clinical examination was performed. Under aseptic precautions a 5ml of venous blood was drawn from all the participants using venipuncture technique. Fasting and post prandial samples were taken and sent for biochemical analysis to estimate the fasting blood sugar, post prandial blood sugar, HbA1C levels, blood urea and serum creatinine. The Serum total testosterone levels were estimated using Chemiluminescent Immunoassay (CLIA).

STATISTICAL ANALYSIS

Data were entered into Microsoft Excel 2019 to create a master chart, which was then imported into SPSS version 26 for statistical analysis. Quantitative variables were summarized using mean and standard deviation, while qualitative variables were described using frequencies and percentages. Group comparisons for qualitative variables were done using the Chi-square test, and for quantitative variables using the independent samples t-test. A p-value < 0.05 was considered statistically significant. Pie charts and bar diagrams illustrated categorical data, while Pearson correlation with scatter plots assessed relationships between quantitative variables, with positive or negative *r* values indicating the direction of correlation.

RESULTS:

Comparison of mean age between participants with type II DM and non- diabetic:

The mean age among those with Type II DM was 47.95 ± 5.88 years and that of non-diabetic was 45.80 ± 8.08 years.

Distribution of occupation between type II DM and non-diabetic:

Among the participants with type II DM, 32.5% were farmers followed by 10% who were vendors and retired, respectively. Among those who were non-diabetic, 22.5% were either painters, electrician, tailor or carpenter followed by 12.5% who were driver, daily wager and teacher, respectively. Both the groups were similar with regard to the pattern of occupation with P value of more than 0.05

Distribution of marital status between type II DM and non-diabetic:

Among the participants with type II DM, everyone was married and among those in the non-diabetic group, 97.5% were married both groups were similar with P value of more than 0.05.

Comparison of mean age of marriage, number of children and gap between 1st and 2nd child between participants with type II DM and non-diabetic:

The mean age at marriage among the participants with type II DM and non-diabetic was 25.5 ± 3.21 years and 27.44 ± 2.72 years, respectively significantly earlier in type II DM group. Mean number of children among the participants with type II DM and non- diabetic was 2.33 ± 0.94 and 1.72 ± 0.68, respectively with more number of children in type II DM group than in the non-diabetic group with P value < 0.05.

The mean gap between the 1st and the 2nd child among the participants with type II DM and non-diabetic was 2.53 ± 1.56 years and 2.52 ± 1.03 years, respectively. Both the groups were similar with regard to the gap between 1st and 2nd child with P value of more than 0.05. This was depicted in table 1.

Table 1: Comparison of mean age of marriage, number of children and gap between 1st and 2nd child between participants with type II DM and non-diabetic

Variable	Type II DM (n=40)	Non-diabetic (n=39)*	P value
Age at marriage (in years)	25.5 ± 3.21	27.44 ± 2.72	0.005
Number of children	2.33 ± 0.94	1.72 ± 0.68	0.002
Gap between 1st and 2nd child	2.53±1.56 (n=34)$	2.52±1.03 (n=23)$	0.984

*unmarried -1; $Number with two children.

Distribution according to infertility treatment between type II DM and non-diabetic:

Among the participants with type II DM, 1(2.5%) had infertility treatment and among non-diabetic none had infertility treatment.

Distribution according to hypogonadism symptoms between type II DM and non-diabetic:

As depicted in table 2, among the type II DM group, 17.5% noticed decrease in the enjoyment of life and in the non-diabetic group, 7.5% had noticed decrease in the enjoyment of life. The proportion was similar between type II DM and non-diabetic with a P value > 0.05.

The proportion with difficulty in initiating or maintain erection was 27.5% in the type II DM group and it was 7.5% in the non-diabetic group. The proportion with difficulty in initiating or maintaining erection was more in type II DM group than the non-diabetic group.

In type II DM study participants 40% reported persistent decrease in libido while in the non-diabetic group, it was 7.5%. The proportion was significantly more in the type II DM group than non-diabetic group. Venggadasamy V et al., in their article had stated erectile dysfunction, orgasmic disorders, ejaculatory disorders and reduced libido were more common among males with type II diabetes mellitus.[6]

In the type II DM group, 55% reported lack of energy of muscle mass and in the non-diabetic group, the proportion was 7.5%. The proportion of participants who had history of lack of energy or muscle mass was more in the type II DM group than in the non-diabetic group with P value < 0.05.

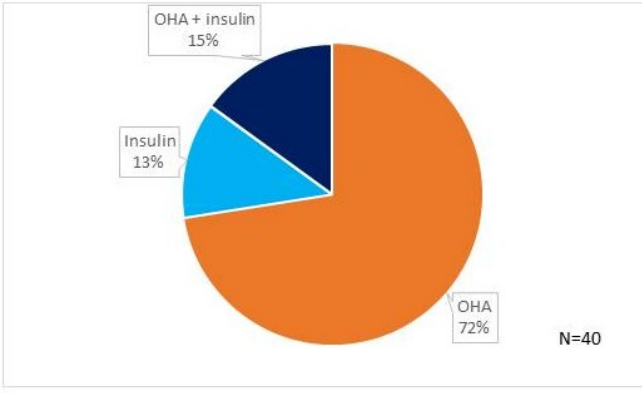
Rezanezhad B et al., (2023) established a causative link between serum testosterone levels and type II diabetes mellitus. The study explored the probability of occurrence of type II diabetes between those who were hypogonadal to those who were eugonadal. The study found hypogonadal men to have higher chance of developing type II diabetes than the eugonadal men.[7]

Table 2: Distribution according to hypogonadism symptoms between type II DM and non-diabetic

Variables	Type II DM (n=40)		Normal (n=40)		P value
	N	%	N	%	

Noticed decrease in the enjoyment of life	7	17.5	3	7.5	0.176
Difficulty in initiating or maintaining erection	11	27.5	3	7.5	0.019
History of persistent decrease in libido	16	40	3	7.5	0.001
History of lack of energy or muscle mass	22	55	3	7.5	0.001

Distribution of participants with Type II DM according to duration of diabetes:
30% participants were suffering from diabetes for the past 3 years followed by 20% for the past 5 years. 10% were suffering from it for 4 and 6 years.
Pie chart 1 shows distribution according to medication



Distribution according to the pattern of hypoglycaemic agents prescribed:
80% of the participants with diabetes were treated with metformin and 27.5% with injection mixtard. 30% were treated with glimepiride.
Distribution according to usage of chronic drugs:
1(2.5%) was on chronic medication and the person was treated with both T. Aspirin and T. Atorvastatin.
Comparison of mean height, weight and BMI between participants with type II DM and non-diabetic:
Table 3: Comparison of mean height, weight and BMI between participants with type II DM and non-diabetic.

Variable	Type II DM (n=40)	Non-diabetic (n=40)	P value
Height (in cms)	168.35 ± 4.11	168.30 ± 5.47	0.963
Weight (in Kgs)	72.10 ± 5.81	67.30 ± 6.97	0.001
BMI (in Kg/m^2)	25.46±2.15	23.74 ± 2.03	0.001

Table 3 demonstrates the mean height in the type II DM and non-diabetic group was 168.35 ± 4.11 cms and 168.30 ± 5.47 cms respectively. Both groups were similar in the height of the individuals with P value > 0.05.
The mean weight in the type II DM and non-diabetic group was 72.10±5.81 kgs and 67.30±6.97 kgs, respectively. The mean weight among participants in the diabetic group was significantly more with P value < 0.05.
The mean BMI among the participants in the type II DM and non-diabetic group was 25.46 ± 2.15 kg/m^2 and 23.74 ± 2.03 kg/m^2. The mean BMI among participants in the diabetic group was significantly greater. Bluher and Stumvoll reported a common genetic risk background for both type II diabetes and obesity. In an obese individual, abdominal fat distribution, dysfunction of the adipose tissue and inflammation along with secretion of diabetogenic adipokine make them more prone to type II diabetes mellitus.[8]
Comparison of mean waist circumference and waist hip ratio between participants with type II DM and non-diabetic:
The mean Waist circumference in the type II DM and non-diabetic group was 99 ± 3.75 cms and 95.4 ± 4.06 cms. The mean waist circumference in the diabetic group was significantly greater than the non-diabetic group. The mean Waist hip ratio in type II DM and non-diabetic group was 1.01 ± 0.17 cms and 0.91 ± 0.06 cms. The mean waist hip ratio among participants in the diabetic group was significantly more than those in the non-diabetic group with P value of less than 0.05.
Distribution according to build between type II DM and non-diabetic:
Among the participants in the type II DM group, 67.5% were moderate built and 27.5% were well built. In the non-diabetic group, 70% were moderate built and 27.5% were well built. The pattern of built was similar between the groups with P value of >0.05.
Distribution according to facial hair, male pattern baldness, pubic hair and gynaecomastia between type II DM and non-diabetic:
As depicted in table 4, in the type II DM group, 7.5% had decreased facial hair and who were non-diabetic none of them reported facial hair loss.
70% had male pattern baldness in the type II DM group while in the non-diabetic group, the proportion was 20%. The proportion was significantly more in the type II DM group than non-diabetic.
Among the participants in the type II DM group, 2.5% reported decreased pubic hair and 2.5% reported absence of pubic hair. In the non-diabetic, none reported absence or decrease in pubic hair. The participants in the type II DM group 7.5% had gynaecomastia and in the non-diabetic group the proportion was 5%.

Table 4: Distribution according to facial hair, male pattern baldness, pubic hair and gynaecomastia between type II DM and non-diabetic

Variables	Type II DM (n=40)	Non-diabetic (n=40)	P value

Distribution according to Type II DM management:
72.5% of those with type II diabetes were treated with OHAs alone and 12.5% with insulin alone. 15% were treated with both OHAs and insulin shown in Pie Chart 1.

		N	%	N	%	
Facial hair	Decreased	3	7.5	0	0	0.077
	Normal	37	92.5	40	100	
Male pattern baldness	Present	28	70	8	20	0.001
	Absent	12	30	32	80	
Pubic hair	Present	38	95	40	100	0.359
	Decreased	1	2.5	0	0	
	Absent	1	2.5	0	0	
Gynaecomastia	Present	3	7.5	2	5	0.644
	Absent	37	92.5	38	95	

Comparison of RBS, FBS and PPBS between participants with type II DM and non-diabetic:

The mean RBS among the participants in the type II DM and non-diabetic group was 251.45 ± 89.48 mg/dl and 139.32 ± 22.54 mg/dl, respectively. The mean RBS among participants in the diabetic group was significantly higher than those in the non-diabetic group with P value of less than 0.05.

The mean FBS among the participants in the type II DM and non-diabetic group was 174.85±37.72 mg/dl and 104.78±8.07 mg/dl, respectively. The mean FBS among participants in the diabetic group was significantly higher than those in the non-diabetic group with P value of less than 0.05.

The mean PPBS among the participants in the type II DM and non-diabetic group was 284.77 ± 53.34 mg/dl and 133.23±5.67 mg/dl, respectively. The mean PPBS among participants in the diabetic group was significantly higher than those in the non-diabetic group with P value of less than 0.05

Comparison of mean HbA1C between participants with type II DM and non-diabetic:

The mean HbA1C among the participants in the type II DM and non-diabetic group was 8.42 ± 2.24 % and 5.54 ± 0.61 %, respectively. The mean HbA1C levels among participants in the diabetic group was significantly higher than those in the non-diabetic group with P value of less than 0.05.

Distribution according to urine sugar between type II DM and non- diabetic:

Among the participants in the type II DM group, 40% had nil urine sugar followed by 32.5% with 1+ and 17.5% with 2+ values. Among those who were non-diabetic, all had nil urine sugar. The pattern of urine sugar was significantly different between the type II DM group and non-diabetic with P value of less than 0.05.

Comparison of blood urea and serum creatinine between participants with type II DM and non-diabetic:

The mean blood urea among the participants in the type II DM and non-diabetic group was 26.59 ± 5.51 mg/dl and 28.78 ± 8.81 mg/dl, respectively. The mean blood urea among participants was similar between the groups with P value of more than 0.05.

The mean serum creatinine among the participants in the type II DM and non-diabetic group was 0.98 ± 0.16 mg/dl and 0.91 ± 0.13 mg/dl, respectively. The mean serum creatinine among participants in the diabetic group was significantly higher than those in the non-diabetic group with P value of less than 0.05.

Comparison of mean serum testosterone between participants with type II DM and non-diabetic:

The mean serum testosterone level among the participants in the type II DM and non-diabetic group was 350.94 ± 141.96 ng/dl and 461.67 ± 171.24 ng/dl, respectively. The mean serum testosterone level among participants in the diabetic group was significantly lower than those in the non-diabetic group with P value of less than 0.05. Singh AK et al reported one third among the type II diabetics to have lower testosterone levels.[9] Jiang C et al (2023) reported an inverse relationship between type II diabetes and serum testosterone values. The above relationship as reported by Jiang C et al was consistent with that of the present study.[2] Corona G et al., (2022) reported not only those with type II diabetes but also those with impaired blood glucose levels itself were having lower testosterone levels.[3] Similar pattern of low testosterone levels among those with type II DM than normal was also reported by Sheikh-Ahmad M et al.[10]

Comparison of proportion of low testosterone levels between type II DM and normal:

Among the participants with type II DM, 42.5% had low testosterone levels and among those non diabetic, the proportion was 20%. The difference was statistically significant with P value of less than 0.05.

Pearson correlation test to show the relationship between blood sugar levels and serum testosterone:

When the random blood sugar level increased by 1 unit the serum testosterone level decreased by 0.14 units. But the correlation was not significant.

When the Fasting blood sugar levels increased by 1 unit, the serum testosterone level decreased by 0.22 units. There was a significant negative correlation between FBS and serum testosterone levels. Trivedi J et al (2019) also reported a negative correlation between fasting blood sugar values and serum testosterone values.[11]

When the Post Prandial blood sugar levels increased by 1 unit, the serum testosterone level decreased by 0.32 units. There was a significant negative correlation between PPBS and serum testosterone levels.

When the HbA1C levels increased by 1 unit, the serum testosterone level decreased by 0.23 units. There was a significant negative correlation between HbA1C and serum testosterone levels.

Correlation of Height, weight and BMI with serum testosterone levels among those with type 2 diabetes and normal, respectively.

No correlation was found between height, weight and BMI with that of serum testosterone values among type II DM and normal, respectively with P value of more than 0.05.

Comparison of mean testosterone values with regard to symptoms among those with type 2 diabetes and normal, respectively.

The mean testosterone values were lower among those with symptoms than those without symptoms among those with type II DM and normal, respectively with P value of less than 0.05.

REFERENCES

- Huang R, Chen J, Guo B, Jiang C, Sun W. Diabetes-induced male infertility: potential mechanisms and treatment options. Mol Med [Internet]. 2024;30(1). Available from: https://doi.org/10.1186/s10020-023-00771-x
- Jiang C, Wang Y, Yang W, Yang X. New evidence for the effect of type 2 diabetes and glycemic traits on testosterone levels: a two-sample Mendelian randomization study. Front Endocrinol (Lausanne). 2023;14(October):1–9.
- Corona G, Vena W, Pizzocaro A, Vignozzi L, Sforza A, Maggi M. Testosterone therapy in diabetes and pre-diabetes. Andrology. 2023;11:204–14.
- Zhong O, Ji L, Wang J, Lei X, Huang H. Association of diabetes and obesity with sperm parameters and testosterone levels: a meta-analysis. Diabetol Metab Syndr [Internet]. 2021;13(1):1–12. Available from: https://doi.org/10.1186/s13098-021- 00728-2

- Mei Y, Lyu Y, Zhao Z, Li Y. Circulating Fibroblast Growth Factor 21 and Total Testosterone in Type 2 Diabetes Mellitus Men with Coronary Heart Disease. Front Endocrinol (Lausanne). 2022;13(July):1–7.
- Venggadasamy V, Ho LS, Ahmad B, Kadir KA. Sexual Dysfunction in Asian Males with Type 2 Diabetes Mellitus. Prog Microbes Mol Biol [Internet]. 2021 Dec 31 [cited 2024 Mar 26];4(1). https://hhpublisher.com/ojs321/index.php/pmmb/article/view/519
- Rezanezhad B, Borgquist R, Elzanaty S. Testosterone Level and Risk of Diabetes: Follow-Up Study. Med Res Arch [Internet]. 2023 Sep 28 [cited 2024 Mar 24];11(9). Available from: https://esmed.org/MRA/mra/article/view/4473
- Blüher M, Stumvoll M. Diabetes and obesity. Endocrinol [Internet]. 2020 [cited 2024 Mar26];1–49. https://link.springer.com/referenceworkentry/10.1007/978-3-030-36694-0_1
- Singh A, Kumar P, Tyagi V, Reddy H, Ahmad S. TESTOSTERONE LEVELS AMONG CASES OF diabetes mellitus and risk of metabolic Syndrome Among Men with hypogonadism: A Cross. J. Cardiovasc Dis Res. 2024;15(1):1173–82.
- Sheikh-Ahmad M, Nakhleh A, Riskin A, Yovanovich E, Chen-Konak L, Reut M, et al. The correlation between testosterone, inflammation and cytokine status in type-2 diabetes men. Andrologia [Internet]. 2022 Nov 1 [cited 2024 Mar 24];54(10). Available from: https://pubmed.ncbi.nlm.nih.gov/35796052/
- Trivedi J, Kapoor S, Arora R. Variation in Serum Total Testosterone Levels in Men with Type 2 Diabetes Mellitus. J Clin Diagnostic Res. 2019;9–11.