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Original Research Paper

Endocrinology

ASSOCIATION BETWEEN SERUM TESTOSTERONE AND FASTING BLOOD SUGAR IN ADULT MEN IN A TERTIARY CARE CENTRE

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ABSTRACT

Introduction: Type 2 Diabetes mellitus is the major cause of morbidity worldwide..It is also a major component of metabolic syndrome.Testosterone has a key role in insulin sensitivity and metabolism of lipids and cholesterol in adult men. Association between testosterone and all components of metabolic syndrome is not well studied in Indian adult men. Hence we conducted a study to look for the association with FBS. Testosterone replacement along with other mainstay treatment for diabetes might improve the quality of life in those patients and hence decrease the burden of cardiovascular diseases.

Material and Methods: This study was conducted as a cross sectional study, wherein written informed consent was taken prior to the investigation after detailed information given to the participants regarding the study on patients aged more than 40 years admitted in A. J. Hospital and predefined inclusion and exclusion criteria initiated after obtaining clearance from the institutions ethical committee. Testosterone level estimation done by Fluorescence Polarizing Immunoassay. The data was collected in pre-prepared Proforma and then transferred to a master chart for analysis. The collected data was analyzed using student's T test and Chi-Square Test. Statistical Analysis was done using SPSS software version 23.0. A 'p' value less than 0.05($p<0.05$) is considered significant.

Results: In the study conducted on 60 patients aged more than 40, admitted in A. J. Hospital we found that patients with higher FBS had low testosterone levels. After application of statistical analysis using students T test it was found that FBS was inversely related to testosterone level.

Conclusion: In our study we intended to study the association between testosterone and metabolic syndrome, we observed that FBS was inversely correlated with testosterone. We conclude that low testosterone levels in adult men would be an indicator of impending insulin resistance.

KEYWORDS : Serum testosterone, Fasting blood sugar, Cardiovascular diseases Metabolic syndrome.

INTRODUCTION

Type 2 diabetes mellitus is one of the leading cause of cardiovascular diseases and morbidity in the world[1]. It is detected and diagnosed earliest with elevated fasting blood glucose level. Researches are done to look for other earliest indicators or associating factors with diabetes mellitus so that earlier treatment may prevent cardiovascular complications due to the disease[2].

Testosterone has a key role in insulin sensitivity in adult men[3]. Studies have shown deficiency of testosterone as modifiable risk factors for CVDs[4]. Lower total testosterone and SHBG predicts a higher incidence of diabetes mellitus[5,6]. Also, there is evidence that hypo testosteronemia could be an element of metabolic syndrome since low levels of testosterone predict the development of the metabolic syndrome and of diabetes mellitus[7,8].

The association of serum testosterone with fasting blood sugar is not well studied in Indian sub continent.In view of this, this study was done to look for association of testosterone with fasting blood sugar.

AIMS OF THE STUDY

The aim of the study was to study the association between Serum testosterone and fasting blood sugar levels in adult men.

MATERIAL AND METHODS

This study is conducted as a cross sectional study, where a written informed consent was taken prior to the investigation after detailed information given to the participants /patient party regarding the study on minimum of 50 adult men aged more than 40years admitted in A. J. Hospital who fulfilled the predefined inclusion and exclusion criteria. The study was initiated after obtaining clearance from the institutions ethical committee.

The criteria were as follows

Inclusion criteria:

- Adult men> 40 Years

Previously diagnosed Type 2 DM or FBS>100mg/dl or on specific medication.

Exclusion criteria:

1) Patients on hormonal replacements
2) Diagnosed testicular tumors
3) Known liver disease

- **Operational definition.**

Type 2 DM-Patients were classified as having type 2 diabetes mellitus using clinical criteria such as a present/prior history of usage of oral hypoglycemic agents or usage of combination of insulin and the oral hypoglycemic agents.

After selection the following was done

- Detailed history
- Clinical examination
- CBC, ESR,
- FBS,HBA1C
- Urine routine
- SERUM TESTOSTERONE LEVEL
- ECG
- ECHO
- CHEST X RAY PA VIEW
- USG ABDOMEN AND PELVIS

The data was collected in pre-prepared proforma and then transferred to a master chart for analysis.

DATA AND STATISTICAL ANALYSIS

The collected data was analyzed using mean, mode for demographic data and frequency percentage for the analysis of the clinical data.

Statistical Analysis was done using SPSS software version 23.0.
A 'p' value less than 0.05($p<0.05$) is considered significant.

The various measures of central tendencies and graphical representations were used to analyze the data.

RESULTS AND OBSERVATIONS

In the study titled ***STUDY OF ASSOCIATION BETWEEN FASTING BLOOD SUGAR AND SERUM TESTOSTERONE IN ADULT MEN*** conducted on 60 patients of age more than 40 year admitted in A. J. Hospital these were our observations

AGE

TABLE 1

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	60	41	69	54.55	7.823

The mean age of the study participants is 54.5 years with the standard deviation of 7.8 years.

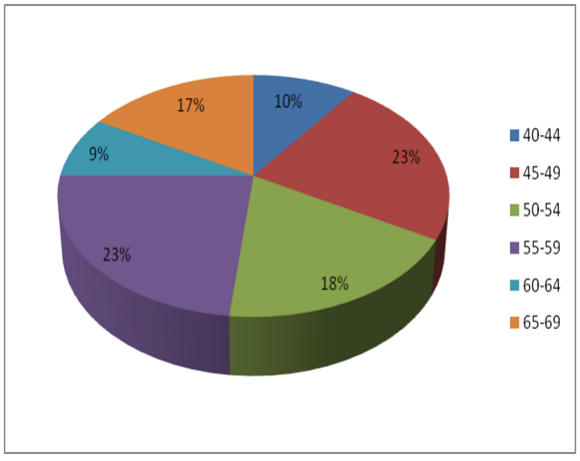
Table representing the age wise distribution of study participants

TABLE 2

Age (in years)	Frequency	Percent
40-44	6	10.0
45-49	14	23.3
50-54	11	18.3
55-59	14	23.3
60-64	5	8.3
65-69	10	16.7
Total	60	100.0

39(64.9%) of the study participants were found between 45-59 years.

Pie Chart Representing The Distribution Of Study Participants On The Basis Of Age FIGURE 1



Correlation Table Between Serum Testosterone And Fasting Blood Sugar TABLE 3

		FBS
SERUM TESTOSTERONE	Pearson Correlation	-.422
	Sig.(2-tailed)	.001
	N	60

In this table, FBS and testosterone was negatively correlated and the association was highly significant (p<0.01).

Table 4 Systoilic Blood pressure

			Testosterone		Total
			Low	Normal	
SBP	High	Count	18	34	52
		% within SBP	34.6%	65.4%	100.0%
	Normal	Count	4	4	8
		% within SBP	50.0%	50.0%	100.0%
Total		Count	22	38	60
		% within SBP	36.7%	63.3%	100.0%

In this table,34.6% of patients with high SBP had low testosterone in comparison with 50.0% of patients who had normal SBP which was non significant.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.707	1	.401	
N of Valid Cases	60			

Statistically the difference was non significant (p>0.05)

DIASTOLIC BLOOD PRESSURE

TABLE 5

			Testosterone		Total
			Low	Normal	
DBP	High	Count	16	29	45
		% within DBP	35.6%	64.4%	100.0%
	Normal	Count	6	9	15
		% within DBP	40.0%	60.0%	100.0%
Total	Count		22	38	60
	% within DBP		36.7%	63.3%	100.0%

In this table,35.6% patients with high DBP had low testosterone in comparison with 40.0% patients who had normal DBP which was non significant.

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.096	1	.757
N of Valid Cases	60		

Statistically the difference was non significant (p>0.05)

Table 6 Descriptive Statistic

	N	Minimum	Maximum	Mean	Std. Deviation
FBS	60	79	420	207.03	87.030
SERUM TESTOSTERONE	60	10	104	31.22	23.653
Systolic BP	60	110	190	144.67	16.309
Diastolic BP	60	70	100	88.90	9.605

INTERPRETATION

- On comparison with FBS and serum testosterone, it was observed that, FBS and Serum testosterone negatively correlated which was statistically significant with p value<0.05.
- On FBS levels, minimum was 79mg/dl and maximum 420mg/dl with standard deviation of 87.1.
- On comparison with Systolic blood pressure and Serum testosterone, SBP was high in 34.6% of individuals who had low testosterone levels which was clinically and statistically not significant with p>0.05.
- On Systolic blood pressure levels, minimum was 110mmHg and maximum was 190mmHg with S.D 16.3.
- On comparison with Diastolic blood pressure and serum testosterone, DBP was high in 35.6% of individuals who had low testosterone levels which was clinically and statistically not significant with p>0.05.
- •On diastolic blood pressure levels, minimum was 70mmHg and maximum 100mmHg with S.D 9.605.
- The mean age of the study participants was 54.5 years with standard deviation of 7.5 years.
- On age wise distribution ,23% belonged to the age group of 40-49 years and another 23% of the age group 55-59 years.

DISCUSSION

Diabetes mellitus is a metabolic disorder which leads to various metabolic and cardiovascular complications in body and it is considered as the health crisis of the 21st century[8].

Many Cross sectional epidemiological studies have reported a direct correlation between serum testosterone and insulin sensitivity and also found that low testosterone levels are associated with an increased risk of type 2 diabetes mellitus[9].

Lower serum testosterone levels and sex hormone binding globulin (SHBG) levels were found to predict a higher incidence of diabetes mellitus and subsequent metabolic syndrome[10]. There is a

discussion if hypo-testosteronemia should be added as an element in the definition of the metabolic Syndrome. Also there is a debate if administration of testosterone to hypogonadal adult men reverses part of the unfavorable risk profile for the development of metabolic syndrome or its individual components and its complications[11-14].

So far, studies done on the effects of normalization of testosterone in hypogonadal men on glucose homeostasis are limited and there is still a confusion if Testosterone supplements are truly indicated to prevent the risk of developing insulin resistance. Hence we decided to do a study on **"ASSOCIATION BETWEEN SERUM TESTOSTERONE AND FASTING BLOOD SUGAR IN ADULT MEN"** in our set up and to look if testosterone levels are true markers of impaired blood glucose levels.

Age distribution in the study

In our study, the mean age of the study participants is 54.5 years. And, 64.9% of the study participants were found between the age of 45-59 years.

FBS AND SERUM TESTOSTERONE

The mechanisms of association of testosterone with insulin resistance and type 2 diabetes are still not fully understood15. Its proposed that testosterone deficiency leads to an increased fat deposition and this would result in increasing insulin resistance.

- In our study, FBS and testosterone negatively correlated where testosterone levels were low in men with high FBS.
- Another study by Dhindsa et al.[16] investigated the prevalence of hypogonadism in type 2 diabetes by measuring free testosterone in a cohort of 103 type 2 diabetes patients and they found that 33% of these men had free testosterone below the normal range which was consistent with biochemical hypogonadism.
- In three other studies, the Tsai EC et al[17], the Tint AN et al.[18] showed an inverse correlation between baseline testosterone and a cross-sectional study by Atlantis et al[19] on 355 men with type 2 diabetes, demonstrated overt hypogonadism which was diagnosed with low testosterone levels.
- In a study by Simon et al[20] on 1292 healthy non diabetic men, there was an inverse correlation between total testosterone and insulin levels independent of age.
- A Finnish study done by Laaksonen et al[21]. showed that low baseline levels of testosterone and SHBG predicted metabolic syndrome and diabetes after a 11-year follow up.

Testosterone and hypertension

- In our study we found that there was no significant association with increase in systolic or diastolic blood pressure.
- This was against the study done by Khaw K.T [22]et al. which showed low testosterone levels in men 48% of men with hypertension.
- Study by Kamide.K et al[22] showed that Lower levels of testosterone in men are associated with higher blood pressure, left ventricular mass, and left ventricular hypertrophy.
- Empen.K et al[23] showed 54% of men with hypertension had low testosterone levels which was statistically significant.
- Svartberg et al study favoured our study where there was no significant association between serum testosterone and hypertension

SUMMARY

In view of the increasing incidence of Diabetes mellitus and the risk of cardiovascular morbidity and mortality globally, we conducted a study titled ""**ASSOCIATION BETWEEN SERUM TESTOSTERONE AND FASTING BLOOD SUGAR IN ADULT MEN"** which was conducted on 60 patients of age more than 40 years admitted in A. J. Hospital and we found that

- FBS and Testosterone had negative correlation.
- Systolic and Diastolic blood pressures did not show any clinical association.

CONCLUSIONS

In our study, we wanted to look if there is an association between serum testosterone level and fasting blood sugars and we concluded

- We conclude that low serum testosterone levels has high association in men with type 2 diabetes mellitus and it can be used as a reliable indicator in person with risk of diabetes.
- Higher the fasting blood sugar , lower the serum testosterone levels were.
- Systolic and diastolic blood pressures did not have any correlation with testosterone levels and cannot be used as an indicator in hypertensive individuals.

LIMITATIONS AND RECOMMENDATIONS

The limitations of the study were

- Study group was small. More number of subjects would give a better outcome.
- Short duration of study.
- Study was done in one tertiary care center and hence would not represent entire general population.
- Insulin resistance was not quantified and was relied only on fasting blood sugar levels.
- We recommend that
- A larger study subject group would validate the study
- To quantify insulin resistance by HOMA-IR method for better reliability
- It is important to identify earlier markers of diabetes mellitus like low testosterone levels and to replace them to prevent further complications due to the disease.

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