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Abstract- Introduction: There is a high prevalence of low serum testosterone in type 2 diabetes mellitus patients. In this study, we tried to determine the level of serum testosterone in type 2 diabetes mellitus patients.

Methods: A total of 241 patients were taken in the study. Out of this, 121 patients had type 2 diabetes mellitus and 120 were normal. For diagnosis of diabetes HbA1c level of ≥ 6.5 was taken. Serum testosterone levels were measured in all the participants.

Results: The mean age of the participants was 46.95 ± 6.89 in diabetic patients and 45.86 ± 5.45 in the controls. The mean serum testosterone levels in the diabetes population was 312 ± 14.6 ng/dl and in the control population was 678 ± 17.5 ng/dl. On applying chi square test, the p value was calculated to be 0.02. This shows the difference is statistically significant.

Conclusion: Type 2 diabetes mellitus is associated with low levels of serum testosterone levels.

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Serum Testosterone Levels in Type 2 Diabetes Mellitus Patients

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I. INTRODUCTION

It is estimated that 285 million people worldwide are affected by diabetes mellitus. By 2030, around 438 million people will be affected by diabetes mellitus. About 66% of this population is in low to middle income countries (1). As compared to western population, Asian population has a much higher tendency to develop diabetes. This occurs at a younger age, at lower degrees of obesity and a much higher rate given for the same amount of weight compared to Western population(2).

Many studies have reported that there is a high prevalence of low serum testosterone in men with type 2 diabetes mellitus (3, 4, and 5). Some studies have also showed a co-relation between reduced total testosterone and insulin resistance and then subsequent development of diabetes mellitus (6,7). The symptoms of low serum testosterone are loss of libido, erectile dysfunction, reduced muscle mass, low energy, increased adiposity (8, 9).

Total testosterone is largely determined by circulating sex hormone binding globulin. In normal

men, 54% testosterone is bound to albumin and other proteins, 44% is bound to sex hormone binding globulin and 2% is in unbound state. Some studies believe that low levels of serum testosterone are associated with changes in the levels of FSH and LH. There is an ongoing controversy about whether the low serum levels of serum testosterone are associated with hypogonadotropic hypogonadism or not. The study by Ali et al showed that in patients with diabetic neuropathy, low serum testosterone levels were associated with low FSH and low LH. In this study, we tried to find a co-relation between levels of serum testosterone and type 2 diabetes mellitus.

II. MATERIALS AND METHODS

A total of 121 patients were taken in the study who consistently attended the diabetes clinic from May 2017 to May 2018 were taken in the study. 120. For diagnosis of diabetes HbA1c level of ≥ 6.5 was taken. Serum testosterone levels were measured in all the participants. All calculations were done statistically. P value of <0.05 was considered to be statistically significant.

III. RESULTS

Table 1: Baseline Characteristics of the Population

	Diabetic Patients	Normal Population
Age (yrs)	42 ± 5.7	40 ± 6.7
Height (cm)	168 ± 5.3	170 ± 4.2
Weight (kg)	73 ± 6.5	69 ± 7.4
Smoking : Never	66	72
Smoking : Former	12	10
Smoking: Current	43	38
Hypertension: Yes	39	2
Hypertension: No	118	92
Dyslipidaemia : Yes	17	14
Dyslipidaemia: No	104	106
Duration of Diabetes	5.6 ± 1.67	
Mean HbA1c	7.8 ± 0.8	4.7 ± 0.3

As shown in the table above, the baseline characteristics of all the participants are showed in the table. The average age of the diabetic patients was 42 ± 5.7 . The average age in the normal population was

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40 ± 6.7. Average height was 168 ± 5.3cm in the diabetic patients and 170 ± 4.2cm in the normal population. Average weight was 73 ± 6.5kgs in the diabetic patients and 69 ± 7.4 in the normal population. 66 patients with diabetes never smoked while 72 participants in the normal population were non-smokers. The number of former smokers in the diabetic patients and normal population was 12 and 10 respectively. Current smokers are 43/121 in the diabetic patients and 38/120 in the normal population. 39 patients in the diabetic population were hypertensives and 118 were normotensives. 2 patients were hypertensive in the normal population and 92 were normotensive. 17 patients had dyslipidaemia and 104 did not have dyslipidaemia in the diabetic population. 14 participants had dyslipidaemia and 106 participants did not have dyslipidaemia in the normal population. Mean duration of diabetes was 5.6 ± 1.67. Mean HbA1c was 7.8 ± 0.8 in the diabetic population and 4.7 ± 0.3 in the normal population.

Table 2: Serum Testosterone Levels in Patients and Controls

	Type 2 Diabetes	Control	P Value
Serum Testosterone Levels (Ng/Dl)	312±14.6	678±17.5	0.02

Serum testosterone level in the diabetic population was 312±14.6 ng/dl. In the normal population, it was 678±17.5ng/dl. After applying student t test, the p value was calculated to be 0.02. This is less than 0.05 which shows that the difference in the two group is significant and not due to chance.

IV. DISCUSSION

Many studies have shown that about 25% of patients with type 2 diabetes mellitus have low serum testosterone levels. About 4% have subnormal testosterone concentrations with high FSH and H (10). Some studies have also shown that low serum testosterone is associated with diabetes related sexual dysfunction.

A study from Australia showed that 43% of type 2 diabetes patients have total testosterone levels less than 10 (11). A study from United Kingdom showed that 355 men with type 2 diabetes mellitus have total testosterone levels of less than 8 and 25% had symptoms of hypogonadism associated with 8-12 total testosterone (12). 33.2% type 2 diabetes patients had hypogonadism in a study in Egypt (13). A study from Brazil also showed that free testosterone and total testosterone levels were low in type 2 diabetes patients (14). The Endocrine society also recommends measuring the levels of testosterone of patients with type 2 diabetes on a regular basis (15,16). Many cross-

sectional and longitudinal studies have showed that with the increase in age the level of total testosterone reduces in men (17, 18, 19).

Many studies have also showed a co-relation between BMI and low serum testosterone levels in type 2 diabetes mellitus. However, these studies are controversial. Some studies have showed that the association between BMI and serum testosterone is significant (20,21). On the contrary, there is also a study that has showed no co-relation between BMI and low testosterone (22).

There are many limitations of this study. It is a cross-sectional study and so we could not find the trend of the serum testosterone levels in the participants. From our study and conclusion, we can strongly say that an early universal screening program can help in diagnosis of low serum testosterone levels and testosterone supplementation can be started accordingly. We recommend that all patients of type 2 diabetes mellitus undergo screening for serum testosterone. A hormonal baseline can also be established for comparison in future follow-ups.

V. CONCLUSION

Type 2 diabetes mellitus is associated with low levels of serum testosterone levels in our study population with a p value significance of 0.02.

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