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A Comparison of Waist to Stature Ratio in Type 2 Diabetes Individuals and Non-Diabetic Individuals

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Abstract **Original Research Article**

Diabetes is a global problem, particularly type 2, majorly due to sedentary lifestyle and changing food habits. Abdominal obesity increases the resistance to insulin, which increases due to above mentioned modifications of lifestyle. Anthropometric measurements to evaluate central obesity can be of both prognostic and diagnostic help in evaluating patients with diabetes and also individuals with history of type 2 diabetes. The present study is to evaluate the differences in waist to stature ratios of 50 diabetics and 50 non-diabetics individuals, within the age group of 20-60 years. Waist circumference and height are measured for all the individuals. Waist to stature ratio were calculated and unpaired t test and odds ratio were calculated for the values. The mean value of WSR has increased in diabetic group both in males and females. Mean WSR in males diabetics 0.59 and males in non-diabetic group had a mean WSR of 0.51. And mean WSR in females 0.62 and females in non-diabetic group had a mean WSR of 0.47. Females with diabetes group had more individuals in obese category compared to females in non-diabetes group, where most of the females are in healthy category. Odds ratio was significantly high for both males and females. It was extremely high for females (114.89) compared to males, where it was only (6.61). Overall odds ratio was 20.444. The values show that individuals with diabetes have more central obesity. This study concludes that diabetics have higher WSR compared to individuals with no diabetes. WSR is potential indicator for diagnosing individuals with diabetes and also to prognostically evaluate the diabetic individuals during the course of their treatment.

Keywords: Diabetes mellitus Type 2, Waist to stature ratio, Waist to height ratio, abdominal obesity, central obesity.

INTRODUCTION

Diabetes mellitus is a pandemic in the world. The prevalence has increased over the last decade due to changes in lifestyles. In WHO report, country profiles for India regarding diabetes made in 2016, with an estimated population of 1311000000, the prevalence of diabetes was 7.8% (males were 7.9%, and females were 7.5%) [1]. People with diabetes are at increased risk of developing coronary diseases, kidney diabetic nephropathy diabetic neuropathy and diabetic neuropathy [2]. One of the significant hazard factors for T2DM is heftiness. Clinical proof shows a more grounded relationship of Diabetes with central obesity than general obesity [3]. There are 380 million individuals on the planet expected to have Diabetes by 2025. Regardless of moderately lower levels of obesity as identified by Body Mass Index (BMI) cutoff values, South Asians will, in general, have higher waist circumferences and waist-to-hip proportions (WHR), demonstrating a more prominent level of central obesity [5]. Association with a characteristic metabolic profile of higher insulin levels, a greater degree of insulin resistance, and a higher prevalence of Diabetes are also seen in these individuals [4].

It was predicted in 2005 in India that, chronic illnesses causing deaths will increase by 18% - especially, deaths from Diabetes will increase by 35%, in 2016 they have reached 1.6 million deaths directly due to diabetes [5]. Basic anthropometric estimations have been utilised as surrogate estimations of obesity and have more incentive in both clinical practices and for large scale epidemiological studies [6]. BMI is a straightforward technique which is utilised to compute the predominance of overweight and obesity in the populace. Waist circumference (WC) is the best proportion of both intra-abdominal fat mass and total fat. Nevertheless, BMI can be deluding, for example, in people with a great extent of lean muscle mass. WC, a more appropriate measurement of body fat distribution, has been demonstrated to be all the more unequivocally

connected with morbidity and mortality [7]. More of late, the waist to-stature proportion (WSR) has been proposed as a superior screening apparatus than WC and BMI for grown-up metabolic hazard factors [8].

Since anthropometric parameters are easy to evaluate, the present study is done in patients attending Endocrinology Outpatient department and healthy individuals from a nearby locality, to observe the relevance of Waist to stature ratio in individuals with type 2 diabetes mellitus and non-diabetics.

MATERIALS AND METHODS

The present study was a hospital-based cross-sectional study, between September 2018 to August 2019, which includes 50 cases of known diagnosed patients of type 2 diabetes mellitus who attended the out-patient department of Endocrinology, King George Hospital, Visakhapatnam, which is a tertiary care referral hospital, and the control group includes 50 nondiabetics from nearby locality. The study population includes the people between 20 to 60 years of age of both genders.

Exclusion criteria were typing 2 DM patients with significant complications like CHF, Renal failure and liver failure. Patients with untreated hypothyroidism, Cushing's syndrome and depression are excluded as the above diseases can cause increased subcutaneous fat deposition. Patients whose age is below 20 years of age and patients more than 60 years of age.

The sample size was 50 diabetics with type 2 DM and 50 individuals with No diabetes evidenced through history taking and random blood sugar estimation.

Waist circumference is calculated using non-stretchable tape at the midpoint between the lower costal margin and the iliac crest in centimetres and rounded off to nearest millimetre.

Height is calculated using wall mounted height measuring scale, and values are taken in meters and rounded off to nearest cm value.

Statistical Analysis

Data were analysed to obtain means and standard deviations. To observe the relationship between the averages, the Chi-square test was used. The data were tabulated and analysed in the program SPSS (Statistical Package for the Social Sciences -SPSS version 20.0).

RESULTS

The study results include 50 subjects of diabetics between the age group of 20 to 60 years, whose mean age was 50.6 years and in the control group of 50 people who were non-diabetics, the mean age was 48.7 years. In the study population of diabetics, 21 (42%) were males and 29 (58%) were females, in the control group 23 (46%) were males and 27 (54%) were females. Demographic details of the study are placed in Table-1.

Table-1: Showing the distribution of males and females in test and control groups

	Diabetics (50)	**Non diabetics (50)**
Males Females	21 (42%) 29 (58%)	23 (46%) 27 (54%)
Mean Age (years)	50.6	48.7

Waist to stature ratio was calculated by dividing waist circumference by height. ≤ 0.52 was considered normal and healthy, 0.53 to 0.57 is considered as overweight, 0.58 to o.62 is considered as very overweight and ≥ 0.63 is considered as obese for males and ≤ 0.48 was considered normal and healthy, 0.49 to 0.53 is considered as overweight, 0.54 to 0.57 is considered as very overweight and ≥ 0.58 is considered as obese for females [8].

Table-2: Showing the distribution of Waist to stature ratios (WSR) in males

	Diabetics	**Mean**	**SD**	**Non-Diabetics**	**Mean**	**SD**	**Chi Square test T value**	**P value**
Healthy (≤ 0.52)	4(19%)	0.48	0.039	14(60%)	0.47	0.032	3.96231	<0.000282
Overweight (0.53-0.57)	5(23.5%)	0.55	0.015	5(22%)	0.54	0.013		
Very overweight (0.58-0.62)	5(23.5%)	0.61	0.015	4(18%)	0.6	0.001		
Obese (≥ 0.63)	7(34%)	0.66	0.029	0(0%)	0	0		

The waist to stature ratio values when subjected to unpaired t test, had a Chi-square value of 3.96231 and had a p value of <0.000282 and was statistically significant. More no of males (7) in diabetics group are obese compared to males in non-diabetic group (14) who are mostly healthy. Males in diabetic group have a total mean WSR of 0.59 and males in non-diabetic group had a mean WSR of 0.51.

Table-3: Showing the distribution of Waist to stature ratios (WSR) in females

	Diabetics	Mean	SD	Non-Diabetics	Mean	SD	Chi Square test T value	P value
Healthy (≤ 0.48)	0(0%)	0	0	18(67%)	0.44	0.027		
Overweight (0.49-0.53)	0(0%)	0	0	5(18%)	0.51	0.018		
Very overweight (0.54-0.57)	5(17%)	0.56	0.007	2(7.5%)	0.55	0.015	9.58854	<0.00001
Obese (≥ 0.58)	24(83%)	0.64	0.046	2(7.5%)	0.64	0.059		

The waist to stature ratio values when subjected to unpaired t test, had a Chi-square value of 9.68854 and had a p value of <0.00001 and was statistically significant. More no of females (24) in diabetics group are obese compared to females in non-diabetic group (18) who are mostly healthy. Females in diabetic group have a total mean WSR of 0.62 and females in non-diabetic group had a mean WSR of 0.47.

Table-4: Showing Odds ratios for Waist to stature ratios (WSR) in diabetics and non-diabetics

	Cases (Diabetics)	Controls (Non-Diabetics	Total
Abnormal	46 (a)	18 (b)	56 (a+b)
Normal	4 (c)	32 (d)	44 (c+d)
Total	50 (a+c)	50 (b+d)	100 (a+b+c+d)

The odds ratio for waist to stature ratio in diabetics and non-diabetics is 20.44444 and has a significant p value <0.0001. Odds ratio for males was 6.61 with p value of <0.0071 and for females was 114.89 with a p value of <0.0014.

DISCUSSION

Central obesity or abdominal obesity is considered the main reason for insulin resistance in type 2 diabetes mellitus.

Many anthropometric measure have been studied in detail, BMI and WHR were considered as good measurements for prognostic follow-up of diabetic patients in the past. Recently WSR is considered as a better measurement as BMI doesn't take into consideration, the amount of the lean body mass [8].

In the present study diabetic group had more people in obese category as compared to individuals in non-diabetic group, where mostly individuals are in healthy group. Males had a mean WSR of 0.59 in diabetics and 0.51 in non-diabetics (Table-2). Maximum difference in WSR was observed in females where the mean WSR was 0.62 in diabetics and 0.47 in non-diabetics (Table-3). The odds ratio was significant for females with a value of 114.89. Odds ratio for males was 6.61. Overall odds ratio irrespective of gender was 20.444 (Table-4).

Possible explanations for the association between increased waist to stature that is central obesity to insulin resistance and development of type 2 DM can be summarized as following. Abdominal obesity is more related to diabetes type 2 than overall Obesity [9] [10]. Kahn SE et al in his study listed various mechanisms linking obesity to insulin resistance [11]. Continuous insulin resistance causes beta cells exhaustion in pancreas which further causes decreased insulin secretion [12]. It has also been noted that visceral adiposity is an independent risk factor [13].

Similar results were reported by Hou X *et al*., where Waist circumferences (WC) and WSR were compared between Normal glucose regulation groups and newly diagnosed diabetes groups. WSR and WC had high positive correlation compared to BMI [14].

Yang Hui *et al*., in a cross-sectional study of 8084 individuals found out that WSR was more powerful in predicting metabolic syndrome when compared to WC and BMI. They took optimal cutoff as 0.51 for both genders, instead of 0.52 and 0.48 for males and females [15].

Giobana Jamar et al in their study evaluated the WSR to predict insulin resistance in non-diabetic obese individuals. Insulin resistance was assessed indirectly using the homeostatic model assessment (HOMA)-IR and HOMA-β indexes. WSR had highest predictor value for insulin resistance followed by WC and BMI [16].

Christian Obirikorang *et al.*, in their study of 384 diabetic individuals, evaluated the association of wrist circumference and WSR with cardiometabolic risk factors. Optimal cutoffs for WSR for males was taken as 0.52 to 0.61 and for females 0.53 to 0.59. WSR was significant positive predictor for triglycerides in females (p<0.001) [17].

The results of the study suggest that abdominal obesity is high in diabetics compared to Non-diabetics and WSR can be used as a tool for evaluating Diabetes mellitus Type 2 and also individuals with history of Type 2 DM.

CONCLUSION

This study concludes that Diabetics have a higher chance of having increased waist to stature ratio and WSR can be used as tool for screening individuals with history of diabetes mellitus type 2 and also for evaluating individuals with Type 2 DM.

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