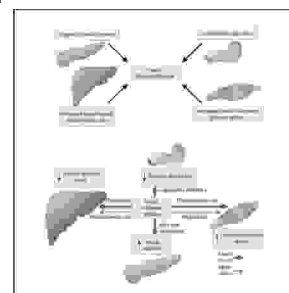


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DIABETES MELLITUS TYPE 2; ASSESSMENT OF BODY MASS INDEX (BMI)

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ABSTRACT... dr_nazir_ahmed_malik@yahoo.com. **Objective:** To assess the body mass index in patients with diabetes mellitus type 2 in a tertiary care hospital. **Study design:** Analytical (cross-sectional) study. **Place and duration of study:** The outpatient clinic at Shahina Jamil Trust Hospital Abbottabad from November 2006 to April 2007. **Patients and methods:** One hundred patients seen in the outpatient clinic were enrolled in the study. All patients were 30 years of age or above, diagnosed as a case of diabetes mellitus were included. Patients with diabetes mellitus type 1 and pregnant diabetic women were excluded. **Results:** Sixty-seven percent were females and thirty three percent were males. Mean age of the patients was 53.4 ± 11.0 years (F: 51.9 ± 12.0 , M: 56.5 ± 7.8) and mean duration of diabetes mellitus type 2 was 7.1 ± 6.5 years (F: 7.1 ± 6.4 , M: 7.9 ± 6.8), mean height of patients with DM type 2 was 1.5 ± 0.09 m (F: 1.5 ± 0.08 , M: 1.6 ± 0.08), mean weight was 71.4 ± 14.3 kg (F: 70.1 ± 15.0 , M: 74.2 ± 12.6), and mean BMI was 28.3 ± 6.4 (F: 28.7 ± 6.9 , M: 27.5 ± 5.2). Among all patients, 34% (F: 23, M: 11) had normal weight, 28% (F: 17, M: 11) were overweight, 32% (F: 23, M: 9) were obese and 6% (F: 4, M: 2) had morbid obesity. **Conclusion:** There was strong association of obesity with type 2 diabetes mellitus with no significant difference of mean BMIs among male and female patients.

Key words: Diabetes mellitus (DM), Body mass index (BMI), Obesity.

INTRODUCTION

Obesity is a chronic disease associated with important additional diseases, such as diabetes mellitus type 2, that both reduce life quality and increase morbidity and mortality from any cause¹. The prevalence of obesity has been increasing dramatically in the last few decades in the whole world, not only in industrialized countries but also in developing areas². Obesity is associated with increased insulin resistance and may be the reason type 2 diabetes is more common in obese individuals. The

precise mechanism by which obesity leads to insulin resistance is not completely described but may be related to several biochemical factors, such as free fatty acids, leptin, tumor necrosis factor, and other substances. In addition, genetic polymorphism may play a part in insulin resistance as well, possibly through post-insulin receptor signal transduction mechanisms³.

It now appears that, in most obese patients, obesity is associated with a low-grade inflammation of white

adipose tissue (WAT) resulting from chronic activation of the innate immune system and which can subsequently lead to insulin resistance, impaired glucose tolerance and even diabetes. WAT is the physiological site of energy storage as lipids^{4,5}. Increasing urbanization, aging populations, increasing obesity, and falling levels of physical activity are all contributing to increasing incidence of diabetes worldwide. It is thought that in the year 2000, the number of people with diabetes worldwide was 171 million. India, China, and the United States have the highest numbers of people with diabetes in the world⁶. It has also been estimated that from 1995 to 2025, the number of people with diabetes in the world will increase by 122%. Furthermore, it is expected that the prevalence of diabetes in developed countries will increase by 27% in adult populations, and the prevalence in underdeveloped countries will increase by 42%. Adjusted for population changes, this would constitute a 170% increase in the number of people with diabetes from 1995 to 2025⁷. It is well established that overweight and obesity are strongly associated with development of type 2 diabetes and may be responsible for the majority of the growing diabetes pandemic⁸.

Body mass index (BMI) is a simple and widely used method for estimating body fat. The current definitions commonly in use establish the following values, agreed in 1997 and published in 2000:

A BMI less than 18.5 is underweight

A BMI of 18.5 - 24.9 is normal weight

A BMI of 25.0 - 29.9 is overweight

A BMI of 30.0 - 39.9 is obese

A BMI of 40.0 or higher is severely (or morbidly) obese

A BMI of 35.0 or higher in the presence of at least one other significant comorbidity is also classified by some bodies as morbid obesity.

This study was conducted to see the prevalence of increased BMI in type 2 diabetic patients and the range of BMIs in male and female type 2 diabetic patients.

PATIENTS AND METHODS

The study was conducted at the outpatients department of Shahina Jamil Trust Hospital Abbottabad from November 2006 to April 2007.

Patients who were more than or equal to 30 years of age, diagnosed as case of diabetes mellitus type 2, were included. Patients with diabetes mellitus type 1 and pregnant women were excluded. Purposive type of sampling was done and consent was taken from the patients to record the data that includes age, sex, residence, duration of diabetes mellitus type 2, height of patients, weight of patients and body mass index. All the data of included patients was recorded on a pre-designed proforma and patients were divided into two groups on the basis of gender. Body mass index was calculated by using the Quetelet formula $\text{weight (kg)/height (m}^2\text{)}$ and patients were ranged into normal weight (BMI = 18.5-24.9), overweight (BMI = 25-29.9), obese (BMI = 30-39.9), morbid obese (BMI \geq 40).

It was an analytical (cross sectional) study. All the data was stored and analyzed using statistical package for social sciences (SPSS) version 14. Independent-sample T-Test was applied to compare the mean of variables between studied groups. Chi square test was applied to test the range of BMIs among male and female diabetic patients. A p-value of <0.05 was considered as statistically significant.

RESULTS

There were 100 patients in total and divided into male and female groups (F: 67, M: 33). For the means of baseline characteristics of all the patients refer to table I.

Variable	Valid N	Mean	Std. Deviation
Age	100	53.4	11.0
Duration	100	7.1	6.5
Height	100	1.5	0.09
Weight	100	71.4	14.3
BMI	199	28.3	6.4

Mean age was 53.4 ± 11.0 years, mean duration of diabetes mellitus type 2 was 7.1 ± 6.5 years, mean height of patients with DM type 2 was 1.5 ± 0.09 m, mean weight was 71.4 ± 14.3 kg, and mean BMI was 28.3 ± 6.4 .

Table-II. comparison of means of different variables among female and male type 2 diabetic patients.

	Sex	N	Mean	Std. Deviation	P value
Age	Female	67	51.9	12.0	0.04
	Male	33	56.5	7.8	0.02
Duration	Female	67	7.1	6.4	0.91
	Male	33	7.0	6.8	0.91
Height	Female	67	1.5	0.08	0
	Male	33	1.6	0.08	0
Weight	Female	67	70.1	15.0	0.17
	Male	33	74.2	12.6	0.15
BMI	Female	67	28.7	6.9	0.37
	Male	33	27.5	5.2	0.32

Table-III. Comparison of range of BMIs in female and male patients

Sex	Normal weight	Over weight	Obese	Morbid obese	Total
Female	23(34.3%)	17(25.3%)	23(34.3%)	4(5.9%)	67
Male	11(33.3%)	11(33.3%)	9(27.3%)	2(6%)	33
Total	34	28	32	6	100

There were 33 males with mean age of 56.5 ± 7.8 years, mean duration of DM type 2 was 7.0 ± 6.8 years, mean height was $1.6 \pm .08$ m, mean weight was 74.2 ± 12.6 kg, mean BMI was 27.5 ± 5.2 . Regarding the range of BMIs of all the patients, 33.3% (11 out of 33) were normal weight, 33.3% (11 out of 33) were overweight, 27.3% (9 out of 33) were obese and 6% (2 out of 33) were morbid obese.

There were 67 females with median age 51.9 ± 12.0 years, mean duration of DM type 2 was 7.1 ± 6.4 years, mean height was $1.5 \pm .08$ m, mean weight was 70.1 ± 15.0 kg and mean BMI was 28.7 ± 6.9 . 34.3% (23 out of 67) were normal weight, 25.3% (17 out of 67) were overweight, 34.3% (23 out of 67) were obese and 5.9% (4 out of 67) were morbid obese.

The difference between the ages of both sexes was statistically significant ($p=0.04$). The difference between

the heights was also statistically significant ($p=0.00$) but the difference between the weights and BMI was not significant ($p=0.17$, and 0.37 respectively).

DISCUSSION

Obesity is associated with higher rate of diabetes mellitus type 2. This study showed that 67% of the patients with diabetes mellitus had BMI ≥ 25 . Shera et al. showed in their study that 61% of the diabetics had BMI ≥ 25 ⁹. Eberhart et al showed in their study that about 55% of type 2 diabetics were obese¹⁰.

The mean age of both male and female patients was 56.5 ± 7.8 and 51.9 ± 12.0 respectively, which differ significantly between the both sex ($p < 0.05$). Khalilur-Rehman et al. reported mean age of 56.4 ± 9.9 years¹¹ and study done by Shera et al. showed mean age of 55.2 ± 10.6 years. Mean duration of diabetes mellitus type 2 was 7.0 ± 6.8 years and 7.1 ± 6.4 years in male and

female patients while Khalilur-Rehman et al. found mean duration of 6.4 ± 6.9 years in their patients. Mean BMI of all the included patients was 28.3. Mansoor et al. conducted a study on the prevalence of comorbid depression among adults with diabetes mellitus in southern Iraq in 2007 and found mean BMI of 27.1 ± 5.2 in the type 2 diabetic patients¹².

This study showed that there was statistically significant difference between the heights of male and female diabetic patients (1.6 ± 0.08 m and 1.5 ± 0.08 m respectively) as the p value is <0.05 . There was no statistically significant difference ($p>0.05$) regarding the mean weight of male and female patients (74.2 ± 12.6 kg and 70.1 ± 15.0 kg respectively) similarly there was no statistically significant difference ($p>0.05$) regarding the mean BMIs of patients (Males: 27.5 ± 5.2 and Females: 28.7 ± 6.9). Mumtaz et al. documented mean BMI of 26.9 ± 5.2 in females¹³.

In our study the range of BMIs in both sex was as under: normal weight female were 23 out of 67 (34.3%), normal weight male were 11 out of 33 (33.3%), overweight female were 17 out of 67 (25.3%), overweight male were 11 out of 33 (33.3%), obese female 23 out of 67 (34.3%) obese male were 9 out of 33 (27.3%), morbid obese female were 4 out of 67 (5.9%) and morbid obese male were 2 out of 33 (6%). Although there is a difference in the percentages of different ranges of BMI among male and female patients, but it did not differ statistically among the sex as the p value is >0.05 . According to study done by Warsy et al. prevalence of obesity was 13.05% and 20.26% and of overweight was 27.23% and 25.20% in male and female respectively¹⁴. Szurkowska et al. conducted a study that showed a mean BMI equal to 31.7 ± 4.6 kg/m² with no significant difference among both sex¹⁵.

CONCLUSION

Our study demonstrates a significant association of obesity in diabetes mellitus type 2. However, there was no significant difference of mean BMI among males and females type 2 diabetic patients. It is mandatory to check the BMI of each diabetic patient at their visit to physician and patients should be encouraged to reduce the weight.

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