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Original Article

Body mass index and Waist circumference in Type 2 Diabetes mellitus patients attending a diabetes clinic

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ABSTRACT

Introduction: Despite the association of obesity with poorer glycemic control and cardiovascular morbidity and mortality less attention has been given to its management relative to the attainment of glycemic targets. The objective of this study was to determine the presence of general and central obesity in patients diagnosed with type 2 diabetes mellitus (DM) for duration of one year or more. Methods: The data of 446 type 2 DM patients attending a diabetes clinic of a university teaching hospital in Southern India was recorded. The demographic and clinical data of all patients were recorded. Extracted data were anonymised before this analysis. BMI ≥ 25 and waist circumference ≥ 90 cm in males and 80 cm in females was taken as an indicator of obesity. Statistical analysis was performed using t-test for continuous variables and chi square test for categorical variables. Significance was defined as $p<0.05$ (two tailed). Results: The percentage of diabetics with general obesity was 48.9% while 68.1% had central obesity.44.4% patients had raised BMI and waist circumference, 26.7% had normal BMI and waist circumference, 24.7% had increased waist circumference only and 4.3% had increased BMI alone. 86.6% of females had a waist circumference above the cut off value as compared to 54.7% males ($p<0.001$).Similarly,59.9% females had raised BMI compared to 40.9% in males ($p<0.001$).Conclusion:The results suggest that a larger percentage of type 2 diabetics have central obesity as compared to general obesity and both types of obesity was higher in females.The high prevalence of obesity in this clinical population of diabetes suggests that structured weight reduction should be an integral part of attainment of glycemic targets.

1. Introduction

Obesity is a major potentially modifiable risk factor for type 2 diabetes [1]. It is associated with poorer control of blood glucose levels, blood pressure and cholesterol, placing persons with diabetes at higher risk for both cardiovascular and microvascular disease. While studies have well established the strong epidemiological association between obesity and development of diabetes [2], little attention has been paid to the significance of obesity in clinical population with diabetes. This is important because of the fact that obesity is an independent risk factor for cardiovascular disease [3], an effect likely to be mediated, at least in part through its known associations with the metabolic syndrome.

Clinical evidence suggests that the association of diabetes with central obesity is stronger than the association with general fat [4]. Waist circumference and waist/hip ratio have been used as measures of central obesity and body mass index has been used as a measure of general obesity. Studies have indicated that central obesity might be more important in the Indian population [5, 6]. Central obesity has been associated with decreased glucose tolerance,

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alterations in glucose insulin homeostasis, reduced metabolic clearance of insulin, and decreased insulin-stimulated glucose disposal [4]. With the rapidly increasing diabetic population in our country it is of paramount importance to determine the prevalence of obesity in these patients and treat it at the earliest by implementing suitable lifestyle measures. The objective of the study was to determine the presence of general and central obesity in patients with type 2 diabetes mellitus (DM) attending a diabetes clinic in Southern India.

2. Methods

The study population comprised of 446 type 2 diabetes patients identified from the hospital diabetes register. This register includes all the adult patients who attended the diabetes clinic of a tertiary care teaching hospital for their clinical review. Ethical approval was obtained from the institutional ethics committee. The demographic and clinical data of all patients were recorded. Extracted data were anonymised before this analysis.

The data collected for each patient were as follows - age, sex, duration of disease, body mass index (BMI), waist circumference, fasting and postprandial blood glucose levels and current antidiabetic medications.BMI $\geq$25, waist circumference $\geq$ 90 cm in males and 80 cm in females were taken as indicators of obesity. Statistical analysis was performed using t-test for continuous variables and chi square test for categorical variables. Significance was defined as $p<0.05$ (two tailed). Results were analyzed using SPSS version 11.5 for Windows.

3. Results

Of the 446 patients, 58.1% were males. The mean age was 54.04±10.55 years in males and 54.64±10.83 in females (p=0.56). The mean duration of the disease was 7.88years±6.77 months.

The percentage of diabetics with general obesity was 48.9% while 68.1% had central obesity. The distribution of BMI has been shown in Table.1. In view of the possible gender difference in the prevalence of obesity the distributions of BMI and waist circumference were determined separately for men and women with type 2 diabetes. The results are shown in Table.2. 59.9% females had raised BMI compared to 40.9% in males ($p<0.001$). Similarly, 86.6% of females had a waist circumference above the cut off value as compared to 54.7% males ($p<0.001$).

Table 1. Distribution of body mass index in type 2 diabetes mellitus patients

Body mass index category (Kg/m^2)	Percentage of patients (n=446) (%)
<18.51	2.7
8.5-22.9	23.3
23-24.9	25.6
25-29.9	38.3
>30	10.1

Table 2. Body mass index and waist circumference according to gender

BMI category (Kg/m2)	Males (%) N=259	Females (%) N=187	p value
< 18.5	9 (3.5)	3 (1.6)	0.37
18.5 – 22.9	66 (25.5)	38 (20.3)	0.25
23 – 24.9	78 (30.1)	36 (19.3)	0.01
25 – 29.9	92 (35.5)	79 (42.2)	0.18
> 30	14 (5.4)	31 (16.6)	< 0.001
Waist circumference			
≥90 cm in males, ≥80 cm in females	141 (54.7)	162 (86.6)	< 0.001cm in females

The mean fasting blood glucose was 162.54±58.84 mg/dl and postprandial blood glucose 233±82.4 mg/dl. The fasting and postprandial blood sugar levels in relation to BMI and waist circumference is shown in Table.3.

Table 3. Fasting and postprandial blood sugar levels in relation to BMI and waist circumference

	Normal BMI	Elevated BMI
FBS (mg/dl)	163.25±55.94	161.79±61.87
PPBS (mg/dl)	239.71±84.73	225.76±79.43
	Normal waist circumference	**Elevated waist circumference**
FBS (mg/dl)	169.92±59.24	159.23±58.45 (p=0.04)
PPBS (mg/dl)	254.31±86.58	243.33±78.73 (p=0.001)

Values expressed as mean±Standard deviation, BMI=Body mass index, FBS=Fasting Blood sugar, PPBS=Postprandial blood sugar, waist circumference ≥90 cm in males and 80 cm in females

The percentage use of various antidiabetic drugs is shown in Table 4. Sulfonylureas were utilized more in non-obese diabetics (p=0.044) while there was no statistically significant difference in the use of metformin (55.5% versus 48.7%, p=0.156). Of the 44.5% obese patients not on metformin 45.4% were not on any antidiabetics.

Table 4. Percentage use of antidiabetic drugs in the study sample

Antidiabetic drug	Percentage utilization (N=446)
Insulin	14.8%
Sulfonylureas	59.4%
Metformin	52%
Thiazolidenidiones	10.8%
Alpha glucosidase inhibitors	0.7%

4. Discussion

The data shows that obesity is common in the representative sample of type 2 diabetes patients attending a diabetes clinic. This is similar to the association between obesity and diabetes shown in other studies [5, 6]. The percentage of patients with central obesity was higher than those with general obesity indicating that early detection and control of central obesity might be more important in Asian population.

Although there are no conclusive studies to demonstrate the superiority of BMI or waist circumference as an indicator of diabetes, atleast there is an indication of waist circumference being an important indicator of progression to diabetes [7]. Individuals with impaired fasting glucose and prone to develop overt diabetes tend to gain visceral fat more selectively than subcutaneous fat, compared with those who remained nondiabetic. This could be sustained by defects in adipogenesis or specificities in adipose tissue morphology, independently of body fat level [8]. Those presenting with new type 2 diabetes are more overweight than non-diabetic subjects [9], and obesity plays a causal part in the pathogenesis of type 2 diabetes. In contrast, obesity does not predispose to type 1 diabetes, and patients with type 1 diabetes, although younger, are less obese [6]. Although this may reflect a continuation of the original predisposing factors that caused weight gain and diabetes in the first place, in conjunction with the ageing process and gradual decline in physical activity, current weight is also influenced by modifiable factors such as poor diet, and to some extent use of some drugs, such as sulphonylureas, insulin, and thiazolidinediones.

About 25% of the patients in our sample are overweight as per the revised guidelines for measurement of obesity for Asian population [10]. This group forms an important target for primary prevention which would otherwise have been missed if the western guidelines were to be followed. Males predominated in the overweight category while BMI>30 was significantly more common in females. Also, increased waist circumference was more common in females. However, the blood glucose levels did not differ significantly between the obese and nonobese individuals. To the contrary, blood glucose levels were found to be lesser in those with increased waist circumference. The difference might be due to a skewed distribution, since the number of patients with normal waist circumference was less, had longer duration of disease and might have been treated less aggressively

To conclude, our study showed that obesity is common in type 2 diabetics. Central obesity is significantly more common in our population. Both general and central obesity is more common in females. Although our study did not reveal any derangement of blood sugar values as compared to non obese diabetics, impaired control of blood glucose and lipid levels has been shown in other studies. The main reason could have been the smaller sample size of nonobese diabetics and proper treatment of both group of diabetics. It is important to consider whether the treatment of obesity, comparatively late in the natural history of cardiovascular disease, would be likely to make any impact. In favour of this proposition, it is known that weight loss in overweight patients with type 2 diabetes rapidly reverses the state of insulin resistance and can restore normal blood glucose concentrations [11]. A variety of intervention studies show that patients with type 2 diabetes who succeed in losing weight often enjoy modest improvements in glycaemic control and cardiovascular risk profiles, as long as the weight loss is maintained [12].

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