

## Research Article

# Prevalence of obesity in diabetic and non-diabetic population

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### ABSTRACT

**Background:** In the last two decades there have been marked secular, increases in the prevalence of obesity in the majority of countries worldwide. More than 1.1 billion individuals meet current definitions for overweight or obesity which puts them at increased risk for number of chronic diseases including cardiovascular diseases (CVD) and type-2 diabetes. Its objective is to study anthropometric (measurements) in diabetic and non-diabetic population by taking Indian indicators (Modified ATP III criteria for South Asian population) and WHO criteria for WHR for determining obesity. The study also aimed at finding out whether Waist Circumference (WC) is sufficient enough to measure obesity instead of Body Mass Index (BMI) to detect obesity in Diabetic patients, when we use Modified ATP III criteria South Asians.

**Methods:** Study was undertaken at urban based Medical College and hospital situated at Sola, in Ahmedabad, Gujarat, India. A total of 100 patients attending the medical outdoor patient department were categorized in two sub groups: 1. diabetic, 2. non-diabetic, Obesity was defined by using BMI and waist circumference criteria for South Asian phenotype in modified ATP- III and NCEP criteria and WHO criteria for WHR.

**Results:** Prevalence of obesity using BMI was found to be 71 % (n=71) as most of these patients were obese by the above mentioned criteria. Statistically significant increase in prevalence of obesity in diabetics is noted when Indian indicators were used. This was true for both the indicators WC as well as WHR which noted 83% and 81% more obesity respectively. Further in our study, waist circumference (83%) is found to be marginally better indicator for diagnosis of obesity than BMI (71%).

**Conclusions:** In the present study, obesity was positively related to anthropometric variables such as Body Mass Index (BMI) and WC and WHR. Our study also suggests that only a simple measurement of waist circumference can suffice detection of obesity in diabetics. Our study also highlights the alarming increase in the prevalence of obesity developing countries, such as India due to effect of urbanization and changing lifestyle.

**Keywords:** Diabetes, Obesity, Waist circumference, Body Mass Index (BMI), Waist hip ratio

### INTRODUCTION

People with diabetes in India, Bangladesh and Sri Lanka make up 98.8% of the Region's total diabetes population. The projected increase in regional diabetes prevalence to 10.1% in 2035 is a consequence of ongoing large-scale urbanization and increasing life expectancy (In India, the proportion of the population over 50 years is expected to increase from 27% to 35% between 2013 and 2035).<sup>1</sup>

India is undergoing a rapid epidemiological transition with increased urbanization and socio-economic development which has resulted in a dramatic change in lifestyle, consisting of physical inactivity, diet rich in fat, sugar and salt coupled with a high level of mental stress. This has led to increased incidence of lifestyle diseases like hypertension, type II Diabetes Mellitus dyslipidemia, obesity and ischemic heart diseases. Obesity also contributes to this diseases.<sup>2</sup>

Anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body. Basic anthropometric measurements (weight, height, waist-circumference and hip circumference) and their derived indices (body mass index, waist-hip ratio) are used as indicators for the presence of diseases and their assessment in clinical practice.<sup>3</sup>

The pattern of body fat distribution has been noted to be a determinant of cardiovascular disease risk. Accumulation of fat in the abdominal region is particularly related to an increased risk of cardiovascular disease.<sup>4</sup> Hence, anthropometric indices that measure abdominal fat or central obesity such as WC and WHR are increasingly used in research and clinical settings.<sup>5,6</sup> In terms of body morphology, Asian Indians have lower BMIs, and for any given BMI, Asian Indians have higher central obesity and abdominal fat than do Europeans.<sup>7,8</sup>

Since the excess fat is usually concentrated in the hip in women and the waist in men, the optimum value for the WHR is lower in women (<0.85) than in men (<0.95).<sup>9</sup> Recently waist circumference has been found to be an even better indicator of central obesity than WHR, the recommended waist circumference for Asian Indians is <80 cm in women and <90 cm in men.<sup>10</sup>

## METHODS

This was a cross sectional observational study in a sample of 50 diabetic patients and 50 non diabetic patients (aged > 20 years); The following measurements were taken using standard methodology:

### Anthropometric Measurements:

1. Height: Height in centimeters was measured (to the nearest 0.1centimeter) with a steel, anthropometric rod, with the subject, standing barefooted in erect position.
2. Weight: in kilograms (to the nearest 0.5 kg) was recorded with the subject standing on the weighing scale, barefooted wearing minimum clothes.
3. Circumferences: The waist and hip circumferences in centimeters measured with a non-stretchable measuring tape.
4. Waist circumference (WC) - measured midway between iliac crest and lowermost margin of ribs. According to guidelines, cut-offs for waist circumferences was 90 cm for Indian men (as opposed to 102 cm globally) and 80 cm for Indian women (as opposed to 88 cm at the international level).<sup>3</sup>
5. Hip circumference (HC) - measured at the level of the greater trochanters in centimeters.
6. Body Mass Index (BMI):- BMI calculated as weight in kilograms divided by squared height in meters (weight in kg/height in m<sup>2</sup>).

Normal weight (BMI > 18.5–<23.0 Kg/m<sup>2</sup>) over weight (BMI ≥ 23.0 Kg/m<sup>2</sup>).

7. Waist-Hip Ratio (WHR):- It was calculated using following formula: WHR = WC (cm) /HC (cm).
8. Elevated WHR = 0.95 for males and 0.88 for females.

All patients were then categorized as obese or non-obese using BMI & Waist Circumference (WC) & WHR as diagnostic parameters.

### Inclusion criteria:

The study included patients attending the medicine outdoor patient department having diabetes and non-diabetic between the age group of 20-70 years.

### Exclusion criteria:

1. Age > 70 years.
2. Age < 20 years.
3. Patients on medications like steroid treatment for any cause, decongestants, appetite suppressants, cyclosporine, tricyclic antidepressants, mono Amin oxidase inhibitors, erythropoietin, nonsteroidal anti-inflammatory agents, cocaine.
4. Renal failure.
5. Obstructive sleep apnea.
6. Hypothyroidism, hyperthyroidism, hypercalcemia, acromegaly.
7. Preeclampsia/ eclampsia.

Obesity in these patients was defined by the International Diabetes Federation (IDF) criteria as the presence of any one or more of the following parameters.

International Diabetes Federation (IDF) - Modified ATP III criteria
BMI : >23
WC : >90cm (Male)
WC : > 80cm (Female)

Recommended WHO criteria for WHR in women (<0.85) and in men (<0.95).

### Analysis:

Descriptive statistics, chi-squared test was used to examine the data. All continuous variables were reported as mean, standard deviation (SD) and range throughout the study. Differences were considered significant at P ≤ 0.05.

## RESULTS

Clinical and anthropometric characteristics of the study group were shown on the Table 1. In comparison with non-diabetic subjects, the diabetic subjects were older (P < 0.001) and had higher Body Mass Index (BMI (P <

001). Diabetic patients also had higher waist circumference, hip circumference and waist hip ratio.

**Table 1: Clinical and anthropometric characteristics of study subjects.**

Parameters	Healthy normal subjects (n=50)	Type 2 diabetic subjects (n=50)	P value	Significance
Body mass Index (kgs/m <sup>2</sup> )	24.56±5.57	26.33±4.74	-1.71	Insignificant
Waist circumference (cm)	89.48±11.80	96.08±11.09	-2.88	Significant
Hip circumference (cm)	100.91±12.11	102.76±10.94	-0.79	Insignificant
Waist hip ratio	0.9±0.077	0.94±0.08	-2.53	Significant

**Table 2: Frequency of parameters of obesity according to International Diabetes Federation (IDF) - Modified ATP III criteria and WHO guideline for WHR in patients with and without diabetes.**

Modified ATP III	Diabetic Patients (n=50)		Non Diabetic patients (n=50)		Total (n=100)	Chi test	Significance	
	No.	%	No.	%				
BMI	41	82	30	60	71	71	0.015	Significant
Waist Circumference	47	94	36	72	83	83	0.003	Significant
WHR	42	56	39	36	81	81	0.44	Insignificant

**DISCUSSION**

Diabetic subjects were older with mean age of 59.64 years than the normal subjects. Diabetic subjects have higher Body Mass Index (BMI) 26.33kgs/m<sup>2</sup>. This was further confirmed by the study done Daousi C et al.<sup>11</sup> where they had 86% of diabetics obese. 84% diabetic patients were obese in Mayur Patel et al.<sup>12</sup> Eric and John<sup>13</sup> and NHANES<sup>14</sup> report indicates that most adults with diagnosed diabetes were overweight or obese.

**Table 3: Comparison of diabetic patients in study by Archana et al.<sup>15</sup> and in our study.**

Parameters	Archana Dambhal (n=30)	Our study (n=50)
Height	158.20±9.37	157.5±8.56
Weight	71.2±12.7	65.3±12.84
BMI	28.83±5.87	26.33± 4.74
Waist circumference	92.46±10.23	96.08±11.09
Hip circumference	105.58±6.09	102.76±10.94
WHR	0.91±0.11	0.94±0.08

Most importantly BMI, in Patel et al.<sup>15</sup> was 27.07, in Sharma et al.<sup>16</sup> 26.67, in Balkees<sup>17</sup> 29.3 and in Pandya et al.<sup>18</sup> it was 26.6. Virtually in all studies, diabetics are found to be obese. Waist circumference was again on higher side in Patel et al.<sup>15</sup> it was 93.12, in Pandya et al.<sup>18</sup> 95.7 and in ours 96.08.

Hip circumference again marker for general obesity was 98.46±8.83 in Patel et al.<sup>15</sup> and 102.76±10.94 in our study.

Waist hip ratio in Sharma et al.<sup>16</sup> was 1.0 ±0.01 and in ours 0.94±0.08.

**Table 4: Comparison of non-diabetic patients in study by Archana et al.<sup>15</sup> and in our study.**

Parameters	Archana Dambhal (n=30)	Our study (n=50)
Height	154.63±8.05	159.64±9.20
Weight	65.84±13.06	62.48±14.63
BMI	24.42±5.51	24.56±5.57
Waist Circumference	88.3±4.10	89.48 ±11.80
Hip Circumference	98.63±9.87	100.91±12.11
WHR	0.61±0.64	0.9±0.07

Most surprisingly, even in comparative studies of non-diabetic patients mean BMI were on higher side, so was waist circumference, hip circumference and WHR. These data strongly suggest that incidence of obesity is on rise and it is independent of diabetic status. Although data do suggest propensity of diabetics towards obesity. Small set of population in our study was major drawback. Further studies for prevalence of obesity in population are advisable.

**CONCLUSION**

In the present study, obesity was positively related to anthropometric variables such as Body Mass Index (BMI) and WC and WHR. Our study also suggests that only a simple measurement of waist circumference can suffice detection of obesity in diabetics. Our study also highlights the alarming increase in the prevalence of obesity developing countries, such as India due to effect of urbanization and changing lifestyle.

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