

**“COMPARISON OF BODY MASS INDEX, WAIST HIP RATIO AND PERCENTAGE BODY FAT IN TYPE II DIABETES MELLITUS AND IN CONTROL GROUP”****<sup>1</sup>Dr. Anita P. Mandare, <sup>2</sup>Dr. Neelam Deokar, <sup>3</sup>Patil Smita V.\*, <sup>4</sup>Gaikwad Pandurang B.**<sup>1</sup>Assistant Professor, Dept. of Physiology. R.C.S.M. Government Medical College & Hospital Kolhapur (Maharashtra).<sup>2</sup>Professor. Dept. of Physiology. G.M.C. Miraj. (Maharashtra).<sup>3</sup>Assistant Professor, Dept. of Physiology, Bharati Vidyapeeth University Dental College & Hospital, Sangli (Maharashtra).<sup>4</sup>Assistant Professor. Dept. of Physiology, Prakash Institute of Medical Science and Research Islampur. Dist. Sangli (MS).**\*Correspondence for Author: Patil Smita V.**

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**ABSTRACT**

**BACKGROUND:** The prevalence of diabetes is rapidly rising all over the world at an alarming rate. Diabetes is second most after cardio vascular disease (CVD) as a health burden in India. Obesity, especially central obesity, is an important risk factor for the high prevalence of type II diabetes mellitus. **AIM:** The aim of this study is to compare the Body Mass Index, Waist Hip Ratio and Percentage Body Fat in Type II Diabetes Mellitus. **MATERIALS & METHODS:** The study was carried out on 50 type II diabetic selected from the Dr. Patwardhan's Endocrinology and Diabetic Clinic, Miraj between age group of 30-60 yrs. and 50 control subjects taken from Govt. Medical College, Miraj. Body mass index (BMI) was calculated using the formula,  $BMI = Wt \text{ (kilograms)} / Ht^2 \text{ (meters)}$ , Waist to Hip Ratio was calculated using formula = Waist circumference (cm) / Hip circumference (cm), The skin-fold thickness was measured from triceps, biceps, sub scapular and suprailiac skin folds, by using UNA skin fold caliper. Statistical analysis was done using Unpaired t-test. **RESULTS:** In the present study mean value of BMI in normal subjects is  $25.1 \text{ Kg/m}^2$ , and the mean value of BMI in diabetic patients is  $23.6 \text{ Kg/m}^2$ . The mean values of waist hip ratio and percentage body fat in normal subjects were 0.95, 39.8 and mean values in diabetic subjects was 0.81, 28.8. The observed difference in the means of BMI, waist hip ratio and percentage body fat in normal and diabetic was found to be statistically significant ( $P < 0.05$ ). **CONCLUSION:** The BMI, Waist Hip Ratio and percentage body fat is decreased in type II diabetes mellitus as compared to control group. This is because of uncared, poorly controlled diabetic state which may lead to decrease in peripheral subcutaneous fat.

**KEY WORDS:** Body Mass Index (BMI), Waist hip ratio (WHP), % Body Fat (PBF), Skin Fold Thickness (SFT), Type II diabetes, obesity.

**INTRODUCTION**

Obesity has been recognized as a major health problem, in the past two to three decades. Obesity, especially central obesity, is an important risk factor for the high prevalence of type II diabetes mellitus. "Diabetes Mellitus", is a chronic disease which requires long standing medical attention, is a leading cause of death in the developing countries. WHO estimates that by 2010 there will be nearly 221 million diabetics all over the world.<sup>[1]</sup>

Diabetes mellitus is a clinical syndrome characterized by hyperglycemia, caused by a complicated interplay of genes, obesity, environment, increased glucose production in liver, increased fat breakdown, and an absolute or relative deficiency of insulin.

Type II diabetes is the most common type of diabetes, and is usually associated with obesity. It usually develops after the age of 40 and is not associated with total loss of ability to secrete insulin. Type II diabetes was once called adult onset diabetes. Now, because of the 'epidemic' of obesity and inactivity in children, type II diabetes is occurring at younger ages. It is characterized by impaired insulin secretion, with progression towards insulin deficiency and insulin resistance.

Obesity is defined as a state of excessive adipose tissue mass. Obesity is a harbinger to coronary artery disease; stroke and increases risk of type II diabetes. In fact, the syntropy of obesity and type II diabetes is so obvious that a term "Diabesity" has been coined which suggests

interrelationship between the two diseases.<sup>[2]</sup> Diabetes means obesity dependent diabetes mellitus.

BMI is a good indicator of obesity. According to WHO, a BMI value of 25-29.9 is considered to be overweight. But BMI does not give an idea about the type of obesity, whether Android or Gynoid. So estimation of waist hip ratio is done which gives a better viewpoint about the type of obesity. Taking into account we planned to assess the anthropometric parameters like Body Mass Index, Waist Hip Ratio and Percentage Body Fat in Type II Diabetes Mellitus.

## MATERIAL AND METHODS

After the approval by institutional ethical committee, a case control study was carried out on 50 diabetic patients taken from Dr. Patwardhan's Endocrinology and Diabetic Clinic, Miraj and 50 normal individuals were taken from Govt. Medical College, Miraj. The diabetic patients taken were undiagnosed cases and were only diagnosed when fasting blood sugar levels (FBSL) were taken.

**Anthropometric measurements:** Height (in meters) - using a stadiometer, weight (in kilograms) - using a digital weighing scale (precision of 100 grams), were measured. Body mass index (BMI) was calculated using the formula,  $BMI = Wt (kilograms) / Ht^2 (meters)$

### Waist to Hip Ratio

Waist circumference was measured in centimeters, midway between the uppermost point on the iliac crest and the lowermost margin of the ribs with the measuring tape parallel to the ground and the subject in inspiration.<sup>[2]</sup> Hip Circumference was measured in centimeters, at the maximum circumference of the buttocks at the level of the greater trochanter.<sup>[2]</sup>

Waist hip ratio was calculated as,

**Waist to Hip Ratio** = Waist circumference (cm) / Hip circumference (cm)

### Skin-fold thickness

The skin-fold thickness was measured from triceps, biceps, sub scapular and suprailiac skin folds, by using UNA skin fold caliper.

### Calculation of percent body fat

Percent body fat is calculated as,

Then using Durnin and Womersley equation, percent body fat was calculated<sup>[45]</sup>

$$\text{Percentage body fat} = \frac{495}{\text{Body Density}} - 450$$

Body density equation determined by Jackson & Pollock,  
1) Equation for males:  $\Sigma 4SKF$  equals sum of biceps, triceps, sub scapular and suprailiac skin fold thickness.

$$\text{Body density} = 1.10938 - (0.0008267 \times \Sigma 4SKF) + ([0.0000016 \times \Sigma 4SKF]^2) - (0.0002574 \times \text{AGE})$$

## Statistical Analysis

Results were presented as Mean  $\pm$  SD. Unpaired t-test and ANOVA test was used to find the significance of study parameters by using SPSS 16.0 version.  $P < 0.001$  was considered as statistically significant.

## OBSERVATIONS AND RESULTS

**TABLE NO.—1 Distribution of of Body Mass Index (BMI) between Normal and Diabetic subject**

BMI(kg/m <sup>2</sup> )	Normal Subject (n=50)	Diabetic Subject (n=50)
10-15	0	2
15-20	11	9
20-25	22	31
25-30	10	6
30-35	4	2
35-40	3	0

**Table No .2 Distribution of Waist Hip Ratio between Normal and Diabetic subject.**

Waist Hip Ratio(Cm)	Normal Subject (n=50)	Diabetic Subject (n=50)
0.7 - 0.75	5	1
0.76 - 0.8	7	10
0.81 - 0.85	11	7
0.86 - 0.9	12	7
0.91 - 0.95	10	10
0.96 - 1	5	12
1.01 - 1.05	0	2
1.06 - 1.10	0	1

**TABLE NO.3 Distribution of Subject according to Percentage Body Fat between Normal and Diabetic subject.**

PBF %	Normal Subject (n=50)	Diabetic Subject (n=50)
1 to 25%	20	27
25 to 50%	17	16
50 to 75%	9	6
75 to 100	2	1
100 to 125	1	0
125 to 150	1	0

**Table No.4 - Comparison of BMI, Waist Hip Ratio and % body Fat between Control and Type II diabetic Group.**

Parameters	Mean $\pm$ S.D of Control (n=50)	Mean $\pm$ S.D of Type II Diabetic (n=50)	SE	Z Value	p- Value
BMI (Kg/m <sup>2</sup> )	25.1 $\pm$ 5.65	23.6 $\pm$ 3.6	0.93	2.258	< 0.05
Waist Hip Ratio(cm)	0.95 $\pm$ 0.08	0.81 $\pm$ 0.08	0.016	2.5	< 0.05
Percentage Body Fat (%)	39.8 $\pm$ 26.44	28.8 $\pm$ 16.88	4.59	2.17	< 0.05

## DISCUSSION

In our study, markers of obesity that is body mass index (BMI), waist hip ratio and percentage body fat are significantly decreased in Type II diabetic patient as compared to control.

Anthropometry is a common field method, used to measure obesity.<sup>[3]</sup> in the present study measures the following anthropometric parameters namely BMI, Waist hip ratio and percentage body fat, which seem to be strongly associated with the early onset of type II diabetes mellitus.

Distribution of Subject according to BMI, Waist hip Ratio & Percentage Body Fat between Normal and Diabetic subject are given in Table No.I, II, III.

### Body mass Index

BMI is a good predictor of diabetes. In the present study mean value of BMI in normal subjects is 25.1 Kg/m<sup>2</sup>, and the mean value of BMI in diabetic patients is 23.6 Kg/m<sup>2</sup>. [Table No.4] The observed difference in the means of normal and diabetic is statistically significant (P<0.05).

In the present study the BMI in diabetic patients, is low as compared to the BMI in normal individuals, which is exactly a reverse picture, seen in diabetes.

Our study coincides with studies of other authors, Wei M, et al.<sup>[4]</sup>, Toufiq Rashid et al he stated that diabetes in India is related more to body fat than body mass index. Indians are likely to get the disease when they are thinner, compared to people in the West.<sup>[5]</sup> This low BMI in diabetes patients than the control group may be due to, Genetic predisposition may be the cause in Indians, who are likely to suffer from diabetes even when they are thinner.<sup>[6]</sup> It is postulated that, uncared, poorly controlled diabetic state may lead to decrease in peripheral subcutaneous fat, because of which their BMI levels are low.<sup>[7]</sup>

### Waist Hip Ratio & Percentage Body Fat

In the present study the percentage body fat in diabetic patients, is low as compared to the normal individuals but waist hip ratio is increased in type II diabetic patients as compared to control. In present study mean values of waist hip ratio and percentage body fat in normal subjects were 0.95  $\pm$  0.08, 39.8 $\pm$ 26.44 and mean values in diabetic subjects was 0.81  $\pm$  0.08, 28.8  $\pm$  16.88. The

observed difference in the means of waist hip ratio and percentage body fat was found to be statistically significant with P<0.05.

Our study coincide with studies done by Marjaana Lahti-Koski et al, in Finland<sup>[8]</sup> Patil S.V. et al.<sup>[9]</sup> also similar studies done in non-obese, South Indian population, showed android pattern of body fat, typified by more upper body adiposity (measured as waist hip ratio), was a greater risk factor for type II diabetes mellitus than general obesity.<sup>[10]</sup>

This may be due to, the central obesity was found to be a greater risk factor for type II diabetes mellitus than general obesity. Adipose tissue is metabolically relevant site of insulin action. Regulation of lipolysis with subsequent release of glycerol and free fatty acids in to the circulation, by insulin, has major implications for glucose homeostasis. It is said that increased availability and utilization of free fatty acids contribute to the development of skeletal muscle insulin resistance.<sup>[11, 12, 13]</sup>

Free fatty acids also increase endogenous glucose production by stimulating the key enzymes and by providing energy for gluconeogenesis.<sup>[14]</sup> Thus, resistance to the antilipolytic action of insulin in the adipose tissue, results in excessive release of free fatty acids and glycerol, having deleterious effects on glucose homeostasis. Since failure to turn off lipolysis directly affects liver and muscle metabolism, it is speculated that adipose tissue, might even be the primary site for defect, leading to insulin resistance and ultimately, to type II diabetes mellitus.

At cellular level, insulin signaling is mediated by binding of insulin to specific receptor. Insulin binding to the receptor stimulates autophosphorylation of the intra cellular region of the receptor beta subunit.<sup>[11]</sup> Obesity is said to be a major contributory factor for the development of a reduced insulin receptor activity. This may suggest that, the defective insulin receptor kinase activity is secondarily acquired due to obesity and metabolic changes like hyperinsulinemia and hyperglycemia. Another probable cause may be, saturation of subcutaneous fat depot, which is the primary event in pathophysiology of insulin resistance.

## CONCLUSION

From study it is conclude that, BMI Waist Hip Ratio and percentage body fat is reduced in type II diabetic patients as compared to control. This is because of uncared, poorly controlled diabetic state which may lead to decrease in peripheral subcutaneous fat. The typical picture of central obesity seen as increased waist to hip ratio is seen in diabetic patients this is because Omental and mesenteric adipose tissue (visceral adiposity is associated with insulin resistance which results in development of type II diabetes mellitus.

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