# Study of Anthropometric Measures in Metabolic Disorder Patients

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## ABSTRACT

**Introduction:** Obesity affects all socioeconomic backgrounds and ethnicities and is a pre-requisite for metabolic syndrome.[4] In most people with type 2 diabetes, there is a multiple set of risk factors that commonly appear together, forming Metabolic Syndrome. Hence, the present study was conducted to study basal metabolic index (BMI), waist cirucmference and diabetes in metabolic disorder patients and were compared with age and gender matched controls.

**Material and Methods:** The present study was conducted 50 cases of Metabolic syndrome and 50 controls (age and gender matched) were enrolled into the study. Patients were underwent relevant investigations along with fasting blood sugars. After eight hours of overnight fasting, blood samples for fasting blood glucose were taken. Waist circumference and BMI were measured. Student t test and chi-square test were used for statistical analysis.

**Results:** In the present study significant difference ($p<0.001$) was noted with respect to height, weight, waist circumference and fasting blood sugar among cases and control groups. Majority of subjects in the case group were overweight (56.5% males, 51.9% females) whereas in case of controls, most of the subjects had normal BMI (81.8% males, 96.4% females). 92% cases had Fasting Blood Sugar >100 and mean blood sugar was 166.2mg/dl. 98% controls had Fasting Blood Sugar <100mg/dl with mean blood sugar 85.2mg/dl.

**Conclusion:** Obesity is an established risk factor for type 2 diabetes and a central component of metabolic. Basal metabolic index and waist circumference is an effective method of assessing body weight and should be recommended as routine procedure to prevent obesity related disorders in adults. Hence, it provides an alternative method to predict the risk of metabolic syndrome.


**Keywords:** Basal Metabolic Syndrome, Diabetes, Metabolic Syndrome, Waist Circumference

## INTRODUCTION

Metabolic syndrome (MetS) consists of a cluster of abnormalities with insulin resistance and adiposity as central features. ATPIII had identified five diagnostic criteria and the presence of any three features [dyslipidemia (high triglycerides, low HDL), central obesity, hypertension, and impaired fasting glucose (IFG)] is considered sufficient to diagnose the syndrome.[1] In the United States, 1 in 4 people has metabolic syndrome, and it is allied with an increased tendency for cardiovascular disease and diabetes.[2]

Abdominal obesity is the one of major risk for the development of metabolic syndrome. BMI is simple, and practical method of indexing body weight. It is a statistically calculated value which does not consider physiological differences in the proportions between the muscular, adipose and osseous tissues.[3]

Obesity affects all socioeconomic backgrounds and ethnicities and is a pre-requisite for metabolic syndrome.[4] In most people with type 2 diabetes, there is a multiple set of risk factors that commonly appear together, forming 'Metabolic Syndrome'. Each year, around the world, about 3.2 million people die due to complications associated with diabetes.[5] Hence, the present study was conducted to study basal metabolic index (BMI), waist cirucmference and diabetes in metabolic disorder patients and were compared with age and gender matched controls.

## MATERIAL AND METHODS

The present cross sectional case control study comprised of 100 patients attending Bangalore Medical College And Research Institute (BMCRI) OPD. The study was carried over period of a two years. 50 cases of Metabolic syndrome and 50 controls (age and gender matched) were enrolled into the study. Patients above 18 years of age, fulfilling the criteria of metabolic syndrome IDF [International Diabetes Federation] guidelines were enrolled. Informed consent was taken. The baseline data was collected using a pre-structured proforma. Patients satisfying the inclusion criteria underwent relevant investigations along with fasting blood sugars. After eight hours of overnight fasting, blood samples for fasting blood glucose were taken.

A measurimg tape was placed around abdomen at level of iliac crest in a horizontal plane to measure waist circumference. Measurement was taken at the end of normal expiration.

## STATISTICAL ANALYSIS

Chi-square test and student t test (two tailed, independent) were applied with the help of SPSS version 21 to find the significance of the study parameters.

## RESULTS

Majority of subjects in the case group were overweight (56.5% males, 51.9% females). Whereas most of the subjects in control group had normal BMI (81.8% males, 96.4% females). 6 male and 5 female case subjects belonged to obese class I, 1 each in obese class II, and 1 each in obese class III (table1; figure 1).

Among the male subjects in cases, 43.48% had WC in the range of 90-99 cms, 47.83% had WC between 100-109 cms. 86.37% subjects in control group had WC in the normal range (70-89 cms) (table 2).

Among the females, majority of cases had WC in the range of 90-99 cms (29.63%), followed by 25.92% in the range 100-109 cms. 85.71% of females in control group had WC in the normal range (70-79 cms) (table 3).

In the patients with metabolic syndrome 88% were diabetics,

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| BMI (kg/m²) | Cases | | | | Controls | | | |
|---|---|---|---|---|---|---|---|---|
| | Male (n=23) | | Female (n=27) | | Male (n=22) | | Female (n=28) | |
| | No. | % | No. | % | No. | % | No. | % |
| 18-22.9 (normal) | 1 | 4.3 | 0 | 0 | 18 | 81.8 | 27 | 96.4 |
| 23-24.9 (normal) | 2 | 8.7 | 1 | 3.7 | 3 | 13.6 | 1 | 3.6 |
| 25-29.9 (over weight) | 13 | 56.5 | 14 | 51.9 | 1 | 4.5 | 0 | 0 |
| 30-34.9 (obese class 1) | 6 | 26.1 | 6 | 22.2 | 0 | 0 | 0 | 0 |
| 35-39.9 (obese class 2) | 1 | 0 | 5 | 18.5 | 0 | 0 | 0 | 0 |
| >40 (obese class 3) | 1 | 4.3 | 1 | 3.7 | 0 | 0 | 0 | 0 |

**Table-1:** Shows BMI distribution among cases and controls

| Waist Ciruemference in centimetres | Cases (n=23) | | Controls (n=22) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| 70-80 | 0 | 0 | 6 | 27.27 |
| 81-90 | 0 | 0 | 14 | 63.64 |
| 91-100 | 12 | 52.17 | 2 | 9.1 |
| 101-110 | 9 | 39.13 | 0 | 0 |
| 111-120 | 2 | 8.7 | 0 | 0 |

**Table-2:** Showing waist cirucmference in males

| Waist Ciruemference (in centimetres) | Cases (n=27) | | Controls (n=28) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| 70-80 | 0 | 0 | 26 | 92.86 |
| 81-90 | 5 | 18.52 | 2 | 7.14 |
| 91-100 | 9 | 33.33 | 0 | 0 |
| 101-110 | 6 | 22.22 | 0 | 0 |
| 111-120 | 6 | 22.22 | 0 | 0 |
| >120 | 1 | 3.7 | 0 | 0 |

**Table-3:** Shows waist cirucmference in females

| Diabetes | Cases (n=50) | | Controls (n=50) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| **Yes** | 44 | 88.0 | 0 | 0.0 |
| <1 year | 11 | 25.0 | - | - |
| 1 to 5 years | 22 | 50.0 | - | - |
| 5 to 10 years | 5 | 11.0 | - | - |
| >10 years | 6 | 14.0 | - | - |
| No | 6 | 12.0 | 50 | 100.0 |

**Table-4:** Shows prevalence of diabetes is cases and controls with duration

whereas there were no diabetics in the control group. Majority of cases (50%) had diabetes of duration between 1to 5 years (figure 2).

In present study Fasting Blood Sugar was >100 in 92% cases and mean blood sugar was 166.2 mg/dl. In control group, 98% had Fasting Blood Sugar <100 mg/dl with mean blood sugar 85.2 mg/dl.

## DISCUSSION

BMI (body mass index) is defined as body weight (in kilograms) divided by the square of body height (in metres). The index divides patients into appropriate categories: normal weight, overweight, obese and underweight. BMI is a commonly used index for monitoring the occurrence of obesity in the population, it has numerous limitations. It does not provide any information on the distribution of the adipose tissue in the organism.[3]

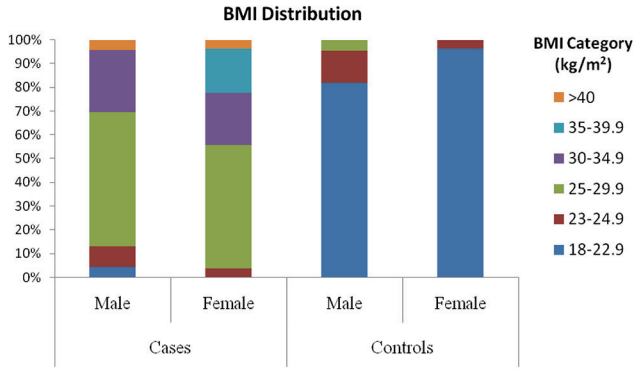


**Figure-1:** Distribution of BMI among cases and controls

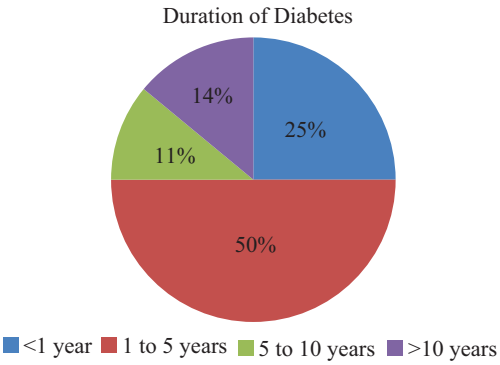


**Figure-2:** Pie chart showing prevalence of diabetes is cases and controls with duration.

In the present study significant difference ($p<0.001$) was noted with respect to waist circumference, weight, height and fasting blood sugar among cases and control groups. 92% cases had Fasting Blood Sugar >100 and mean blood sugar was 166.2mg/dl. 98% controls had Fasting Blood Sugar <100mg/dl with mean blood sugar 85.2mg/dl. Most of the subjects in control group had normal BMI (81.8% males, 96.4% females) whereas majority of subjects in the case group were overweight (56.5% males, 51.9% females). Gierach M et al[3] commenced a study to find out a correlation between waist circumference (WC) and body mass index (BMI) in patients with metabolic syndrome and WC was found to be significantly correlated with BMI ($R = 0.78$, $P < 0.01$). The presence of overweight in men (BMI 25, 84 kg/m²) and in women even normal body weight (BMI 21,62 kg/m²) corresponds to an increased volume of visceral tissue in the abdomen and the study revealed that introduction of primary prophylaxis in those people to limit the development of diabetes mellitus type 2 and cardiovascular diseases should be considered.

Janghorbani M et al[6] estimated the prevalence and risk factors of metabolic syndrome in people with type 2 diabetes mellitus

and reported that metabolic syndrome was associated with duration of diabetes, fasting blood glucose, blood pressure, body mass index (BMI), smoking, proteinuria, insulin-treatment, triglyceride, cholesterol, HDL cholesterol, hypertension, and dyslipidemia**.** WHO has recognized that waist circumference is the easiest and most efficient anthropometric index for fatness and fat location.[7] Bouguerra et al[8] conducted a study and concluded that waist circumference is an easy method to assess abdominal adipose tissue, which is a diabetes risk factor. Sinha R et al,[9] Seppala-Lindroos A et al,[10] Bjorntorp P[11] reported that the elevated waist circumference is a well-accepted cause of insulin resistance, resulting in diabetes mellitus, impaired fasting glucose, hypertension and dyslipidaemia.

Li Y[12] reported that both BMI and waist circumference are effective in predicting the development of type 2 DM and other metabolic disturbances. Aye M et al[13] reported that waist circumference is a better predictor of metabolic risk factors for metabolic syndrome development as compared to body mass index and thus suggested that if waist circumference ≥ 80 cm is found in both genders regardless of BMI, the metabolic risk factors should be screened.

Chinedu SN et al[14] evaluated the correlation between body mass index (BMI) and waist circumference and examined their significance as indicators of health status in adults and reported that the waist circumference of overweight and obese categories were significantly higher than the normal weight category. The study indicated that waist circumference can serve as a positive indicator of overweight and obesity in the selected communities; however, it may not be used to determine underweight in adults. Overweight is allied with psychological trauma, physical discomfort and renders a person to metabolic syndrome characterized by diabetes, sleep apnea, lipid disorders, osteoarthritis and cardiovascular diseases.[15-17]

## CONCLUSION

Obesity is an established risk factor for type 2 diabetes and a central component of metabolic syndrome[18] and is a socioeconomic burden on the society. Basal metabolic index and waist circumference is an effective and easy method of assessing body weight and should be recommended as routine procedure to prevent obesity related disorders in adults. Hence, it provides an alternative method to predict the risk of metabolic syndrome.

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