

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Correlation of body mass index and waist- hip ratio in normal and type 2 diabetes mellitus patients with and without hypertension

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### ABSTRACT

In obese patients with type 2 diabetes mellitus, the Waist/Hip ratio and BMI are significantly higher. The present study was undertaken to correlate the W/H ratio and BMI in healthy participants and type 2 diabetes mellitus patients. The study group was divided into control (non diabetic subjects, N= 57), Group 1(diabetic only patients, N=58), Group 2 (diabetic with hypertension patients, N=58). The W/H ratio was taken. In males the W/H ratio > 0.95 and in females W/H ratio > 0.80 is considered as abnormal W/H ratio. BMI is calculated by dividing weight in kilograms by the square of the height in meters (Kg/m<sup>2</sup>). If the BMI is >30 it is considered as obesity. The mean value of W/H ratio in Controls, Group 1 and Group 2 were 0.90 ± 0.00, 0.94 ± 0.00 and 0.95 ± 0.01 respectively. The mean value of BMI in controls, Group 1 and Group 2 were 24.26 ± 0.41, 25.63 ± 0.50 and 26.03 ± 0.71 respectively. When the inter comparison of controls, Group 1 and Group 2 for W/H ratio and BMI shows a significant increase in the two parameters in Group 1 and Group 2. The present data indicate the significant increase in W/H ratio and BMI in diabetes patients.

**Keywords:** W/H ratio, BMI, Obesity, Diabetes with hypertension.

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## INTRODUCTION

Obesity is an abnormal growth of the adipose tissue due to an enlargement of fat cell (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity), or a combination of both. Obesity is a major risk factor for type 2 diabetes mellitus. Obesity is often expressed in terms of body mass index (BMI) [1]. The distribution of adipose tissue in different anatomic depots also has substantial implications for morbidity. Specifically, intra-abdominal and abdominal subcutaneous fat has more significance than subcutaneous fat present in the buttocks and lower extremities. Determining the waist-to-hip ratio (W/H ratio), most easily makes this distinction [2,3].

The distribution of fat induced by the weight gain affects the risk associated with obesity, and the kind of disease that results. It is useful therefore, to be able to distinguish between those at increased risk as a result of “abdominal fat distribution” or “android obesity” from those with the less serious “gynoid” fat distribution, in which fat is more evenly and peripherally distributed around the body [1]. The most important complications of obesity are insulin resistance, diabetes, hypertension, and hyperlipidemia in both men and women, and hyperandrogenism in women, which are linked more strongly to intra-abdominal and/or upper body fat than to overall adiposity [2,4]. In obese patients with type 2 diabetes mellitus, the Waist/Hip ratio and BMI are significantly higher.

In industrialized countries, the increase in body weight has been caused primarily by reduced levels of physical activity, rather than by changes in food intake or by other factors. It has been estimated to affect 20 to 40 percent of the adults and 10 to 20 percent of children and adolescents in developed countries [1].

The present study was undertaken to correlate the W/H ratio and BMI in healthy participants and type 2 diabetes mellitus patients

## MATERIALS AND METHODS

The present work was carried out at KMC hospital, Attavar, Mangalore, after a written consent from all the participants. The study group was divided into control (non diabetic subjects, N= 57), Group 1 (diabetic only patients, N=58), Group 2 (diabetic with hypertension patients, N=58). The waist and the hip circumference was measured and ratio was taken (W/H ratio). In males the W/H ratio  $>0.95$  and in females W/H ratio  $> 0.80$  is considered as abnormal W/H ratio. BMI is calculated by dividing weight in kilograms by the square of the height in meters ( $\text{Kg}/\text{m}^2$ ). If the BMI is  $>30$  it is considered as obesity.

Major selection criteria for diabetes included: a random plasma glucose level of 200mg/dL or greater when the symptoms of diabetes were present and a fasting plasma glucose level of 126 mg/dL or greater.

Major selection criteria for hypertension included: all the untreated hypertensive's with SBP above 140 mmHg and DBP above 90 mmHg or treated hypertensive's on anti hypertensive drug. Type 1 diabetes mellitus patients were excluded.

**STATISTICAL ANALYSIS**

Data are expressed as Mean ± SEM. Statistical analysis was done by using “ANOVA”; students ‘t’ test. Tukey’s test was used in intercomparison of the three groups. P value was taken as significant at 5 percent confidence level (P<0.05).

**RESULTS**

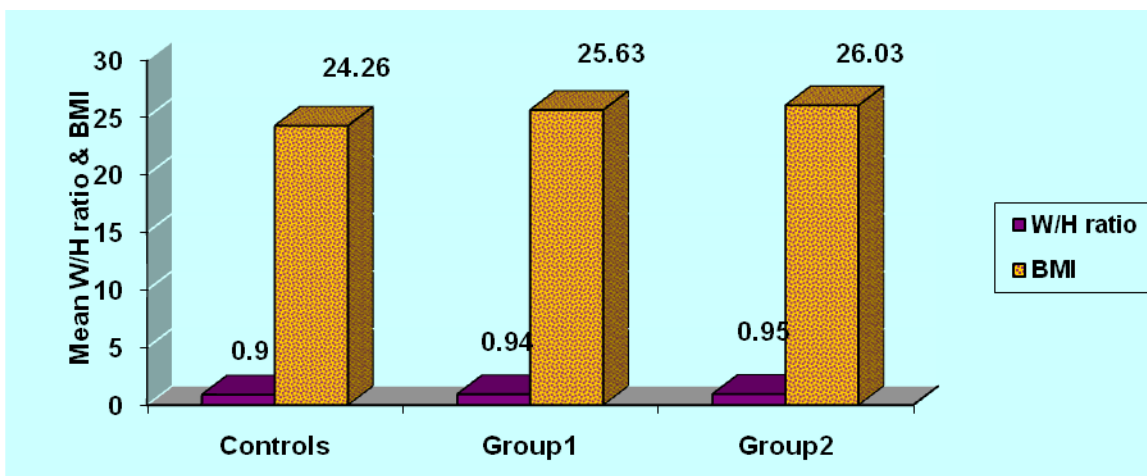
The mean value of W/H ratio in Controls, Group 1 and Group 2 were 0.90 ± 0.00, 0.94 ± 0.00 and 0.95 ± 0.01 respectively. The mean value of BMI in controls, Group 1 and Group 2 were 24.26 ± 0.41, 25.63 ± 0.50 and 26.03 ± 0.71 respectively.

When the inter comparison of controls, Group 1 and Group 2 for W/H ratio and BMI shows a significant increase in these two parameters in Group 1 and Group 2 (Table-1, Fig-1).

**TABLE -1. Waist-Hip Ratio (W/H Ratio) and Body Mass Index (BMI) in control and study groups. Data were expressed as Mean ± SEM.**

Parameters	Controls (N=57)	Group 1 (N=58)	Group 2 (N=58)	P value
W/H Ratio	0.90 ± 0.00	0.94 ± 0.00	0.95 ± 0.01	0.005
BMI	24.26 ± 0.41	25.63 ± 0.50	26.03 ± 0.71	0.05

**Note:** Controls- Non-diabetic subjects, Group 1- Diabetic only patients, Group 2- Diabetic with hypertension patients. P<0.05 was considered as the level of significance.



**FIG 1: Mean Waist-Hip Ratio (W/H Ratio) and Body Mass Index (BMI) in non-diabetic subjects, diabetic only patients and diabetic with hypertension patients.**



## DISCUSSION

Obesity is an important and well-established risk factor for type 2 diabetes mellitus. Anthropometric measures of general and central obesity as predictors of type 2 diabetes mellitus risks have been well-studied. The risk of diabetes increases progressively with increasing body mass index and waist-hip ratio. Weight gain is associated with an increase in insulin resistance and deterioration in glucose tolerance. Mainly the centrally located adipocytes have specific metabolic roles in the pathogenesis of insulin resistance and type 2 diabetes mellitus [5]. Our study has revealed that compared with non-diabetic group, diabetic group showed increased body mass index (BMI). Chan J M [6] et al., found a strong positive association between overall obesity as measured by BMI and risk of diabetes. Our findings can be correlated very well with this study. Body mass index is an indicator of generalized obesity, whereas waist-hip ratio (W/H ratio) indicates central obesity. W/H ratio is also used as an indicator for assessing the risk of development of type 2 diabetes mellitus. Our study showed a significantly higher W/H ratio in diabetic group compared to non-diabetic group. Similar observations have been made by Dalton M [7] et al. They found that W/H ratio had the strongest relationship with type 2 diabetes mellitus and hypertension. Since, most of the type 2 diabetes mellitus patients are obese, weight loss and exercise of moderate degree, are associated with insulin sensitivity, and often improve glucose control in diabetics [2].

## CONCLUSION

The present data indicate the significant increase in W/H ratio and BMI in diabetics and diabetes with hypertension patients. Obesity is a major risk factor for type 2 diabetes mellitus, and most of the patients with type 2 diabetes mellitus are obese.

## REFERENCES

- [1] Park K. Obesity. In: Park's textbook of Preventive and Social Medicine. 18<sup>th</sup> ed. M/S Banarsidas Bhanot: Jabalpur (India): 2005; 316-319.
- [2] Flier JS, Flier EM. Obesity. In: Kasper DL (ed). Harrison's Principles of Internal medicine. 16<sup>th</sup> ed. Mc Graw-Hill Companies, INC. 2005; II: 422-429.
- [3] Powers AC. Diabetes Mellitus. In: Kasper DL (ed). Harrison's Principles of Internal medicine. 16<sup>th</sup> ed. Mc Graw-Hill companies. Inc.2005; II: 2152-2180.
- [4] Masharani U. Diabetes Mellitus and Hypoglycemia. In: Tierney LM, McPhee SJ, Papadakis MA (ed). Current Medical Diagnosis and Treatment. 44<sup>th</sup> ed. Mc Graw-Hill Companies, Inc. 2005; 1157-1190.
- [5] Carey VJ, Walters EE, Colditz GA et al. Am J Epidemiol. 1997; 145: 614-19.
- [6] Chan JM, Rimm EB, Colditz GA, Stampfer MJ, Willett WC. Diabetes Care. 1994; 17(9): 961-9.
- [7] Dalton M, Cameron AJ, Zimmet PZ et al. J Intern Med. 2003; 254(6): 555-63.