ORIGINAL RESEARCH PAPER

General Medicine

A STUDY OF ANTHROPOMETRIC INDICES OF OBESITY IN PATIENTS OF TYPE 2 DIABETES MELLITUS

KEY WORDS: Obesity, Anthropometry, Diabetes Mellitus.

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ABSTRACT

OBJECTIVE: To study various anthropometric indices of obesity in patients of type 2 diabetes mellitus and find out the association of various indices of obesity (BMI, waist circumference, waist hip ratio, waist height ratio and hip circumference) in diabetic males and females.

METHODS: This cross-sectional comparative study was conducted on patients attending or admitted in the department of medicine at Geetanjali Medical College and Hospital, Udaipur, from January 2017 to July 2018. The data were collected and evaluated by reviewing case files and patient interview.

RESULT AND CONCLUSION: Out of 100 diabetic patients, females are found to be more obese/overweight than males. Waist circumference and waist/hip ratio in males and hip circumference in females gave better idea about obesity than BMI. The study highlights the need for early identification of obesity in diabetics for better glycemic control and preventing morbidity and mortality related to obesity.

INTRODUCTION

Diabetes mellitus (DM) is an epidemic of vast proportions around the world that costs the nations billions in medical care, disability and early deaths. The prevalence of type 2 diabetes mellitus (Type 2 DM) is rising much more rapidly because of increasing obesity and reduced activity levels as countries become more industrialized. This is true in most countries, and 6 of the top 10 countries with highest rates are in Asia[1].

Obesity is a nutritional disorder that spans all ages and ethnicities and affects both sexes. It is complex, multifactorial and largely preventable disease which presents a major challenge to chronic disease prevention and health across the life course around the world. While growth trends in overall obesity in most developed countries seem to have levelled off, morbid obesity in many of these countries continues to climb, including among children[2]. Due to obesity many complications arise like Diabetes Mellitus type 2, Hypertension, Stroke, Hyperlipidaemia, Osteoarthritis, Coronary heart disease, Cancer, gall stones and sleep apnea.

Obesity has reached epidemic proportions , In 2016, 39% of adults aged 18 years and over (39% of men and 40% of women) were overweight and about 13% of the world's adult population (11% of men and 15% of women) were obese. This is only the tip of an iceberg and the incidence is growing according to medical experts[3].Being overweight or obese is the main modifiable risk factor for type 2 diabetes. Obese adults are more likely to be diagnosed with diabetes than adults of a healthy weight. Currently 87.5% of adults with type 2 diabetes are overweight or obese. People with severe obesity are at greater risk of type 2 diabetes than obese people with a lower BMI. Hence there is close association of obesity and type 2 diabetes[4].

Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose (fat) tissue. The word "anthropometry" is derived from the Greek word "anthropo" meaning "human" and the Greek word "metron" meaning "measure." The field of anthropometry encompasses a variety of human body measurements. Perhaps the most well-known indicator of body fat is the body mass index or "BMI." For adults, cutoff criteria are fixed: underweight (BMI values < 18.5); normal weight (BMI values 18.5-24.9); overweight (BMI values 25.0-29.9); obese—Class I (BMI values 30.0-34.9); obese—Class II (BMI values 35.0-39.9); and extremely obese—Class III (BMI values > 40.0)[5].

Various studies have shown that anthropometric parameters such as body mass index (BMI), waist circumference (WC), and waist hip ratio (WHR) are useful indicators for predicting incidence of type 2 diabetes in populations.[6]In general, BMI> 25 kg/m2 is a risk factor for diabetes. However, data suggest that the BMI cut point should be lower for the Asian American population> 23 kg/m2 . The anthropometric measures are being used for screening obesity, diabetes, and cardiovascular diseases. BMI is used as an indicator for generalized obesity and WC, WHR are measures of central obesity. Central obesity is considered a better indicator of diabetes, cardiovascular risk and mortality than BMI.[7]

OBJECTIVE

To find out the association of various anthropometric indices of obesity between males and females (BMI, waist circumference, waist hip ratio, waist height ratio and hip circumference) in type 2 diabetes mellitus.

METHODS

This cross-sectional comparative study was conducted on patients attending or admitted in the department of medicine at Geetanjali Medical College and Hospital, Udaipur, from January 2017 to July 2018. To examine the association of various anthropometric parameters of obesity, a total of 100 diabetic patients have been taken in the study.

INCLUSION CRITERIA:

1) All patients with known case or newly diagnosed diabetes mellitus, aged more than 30 years.
2) All diabetics irrespective of glucose control.
3) All diabetics irrespective of treatment (OHA/insulin).

Detailed history including chief complaints and features of diabetes (polyuria, polydipsia, polyphagia, weight gain), age, sex, residence, occupation, family history, past history, general physical examination, vital measurements were done. Peripheral venous samples are obtained for fasting blood sugar levels, glycosylated hemoglobin, postprandial blood sugar levels, to diagnose diabetes.

Anthropometric measurements were measured using standard weighing scale and inch tape. Body Mass Index was calculated by putting values in the formula BMI= weight in kilogram/height in meter square. BMI was classified under WHO criteria normal 18-24.9 kg/m^2, over weight 25-29.9 kg/m^2 , obese > 30 kg/m^2. Waist circumference was measured using standard inch tape at midpoint between costal margin and iliac crest against maximum prominence of abdomen. The cut off value taken in our study is males > 90 cm and females > 80cm. Hip circumference is measured around buttocks at maximum prominence. waist/hip

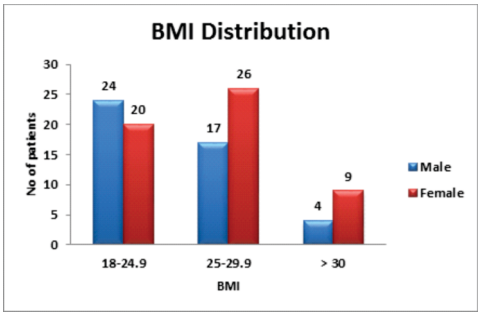
ratio is measured by dividing waist circumference and hip circumference. Waist/height ratio is measured by dividing waist circumference and height.

RESULTS

Table 1: Bmi Wise Distribution

BMI (kg/m2)	Male	Female	No of Patients
18-24.9	24 (53.3%)	20 (36.3%)	44 (44%)
25-29.9	17 (37.7%)	26 (47.2%)	43 (43%)
> 30	4 (8.8%)	9 (16.3%)	11 (11%)
Total	**45 (45%)**	**55 (55%)**	**100 (100%)**
Mean BMI	**24.87 ± 4.13**	**26.36 ± 3.25**	
P value	**0.0462**		

FIGURE-1



In the present study, according to BMI distribution it was found that diabetic females were obese/ overweight predominantly (63.5%) than diabetic males (46.6%). Moreover, The mean BMI between the males and females was 24.87 ± 4.13 kg/m2 and 26.36±3.25 kg/m2 respectively which was statistically significant **(p=0.0462)**.

Table 2: Anthropometric Parameters

Anthropometric Parameters	Male mean	Female mean	P value
Waist Circumference	88.37 ± 9.6	84.65 ± 8.58	**0.0437**
Hip Circumference	83.31 ± 10.59	86.52 ± 13.07	0.1837
Waist/Hip ratio	1.06 ± 0.07	0.97 ± 0.10	**0.0001**
Waist/Height ratio	0.53 ± 0.05	0.54 ± 0.06	0.3742
Total	**45 (45%)**	**55 (55%)**	**100 (100%)**

In the current study, the Anthropometric parameters such as Waist Circumference and Waist/Hip ratio are found high in diabetic males than diabetic females which was statistically significant (88.37 ± 9.6 vs 84.65 ± 8.58; p=**0.0437** and 1.06 ± 0.07 vs 0.97 ± 0.10; **p<0.0001**). Whereas, Hip Circumference was high in diabetic females with more fat distribution of 86.52 ± 13.07cm than males with 83.31 ± 10.59 cm similarly Waist/Height ratio is 0.54 ± 0.06 and 0.53 ± 0.05 in females and males respectively (p>0.05).

DISCUSSION

There were 55 females and 45 males with diabetes in ratio of 1.2:1 in our study which was similar to the study of MK. Reid et al[8] where female:male ratio is 1.5:1. In general, in our hospital there were more females than males who presented in the study during the study period.

The mean BMI in 100 type 2 diabetic patient studied was 25.6 which is slightly on higher level. The mean BMI of patients in the study conducted by A Kumar et al[9] on Indian population also showed a similarly high value(27.29 ± 3.6). Moreover, in our study the mean BMI of diabetic males and females were 24.87 ± 4.13 kg/m2 and 26.36 ± 3.25 kg/m2 respectively which difference is statistically significant (p=0.0462) which showed that females presented in our study were more obese/overweight than males. Similar to study done by SMS Islam et al[10] (25.7 ± 4.2 kg/m2 in males and 27.2 ± 4.0 kg/m2 in females with p<0.0001) which also showed statistically significant difference of BMI in males and females and is equivalent to our study.

In our study waist circumference in diabetic males is (88.37 ± 9.6cms) and in females is (84.65 ± 8.58cm) which difference is statistically significant (p=0.0437). SMS Islam et al[10] also found waist circumference in (males 92.0 ± 8.2 vs females 89.9 ± 8.9) to be statistically significant (P values 0.006) which was comparable to our study. Bhowmik B et al[11] also found that men (81.7cm) had significantly greater mean for waist circumference than women (79.7cm) which also correlate with our study. Lotfi MH et al[12] demonstrated waist circumference in males (97.58 + 8.64cm) more than females (95.05 + 11.46cm) associated with diabetes which is also consistent with our study findings.

In our study the association between Waist/Height ratio between male and female is (0.53 ± 0.05) and (0.54 ± 0.06) respectively. AK Maria et al[13] also showed waist/height ratio in male (0.58 ± 0.12) and female (0.6 ± 0.10) regarding it to be a better predictor of diabetes mellitus which is comparable to our study findings. The cut off for Waist/Height ratio used in the study was > 0.5 which was also the same cut off used in our study. It means that if waist circumference is more than half of the vertical height, the individual is at risk of cardiovascular disease and diabetes. Nager SR et al.[14] also showed existence of strong association of waist/height ratio above 0.5 with type 2 diabetes which is also seen in our study. Hadaegh F et al.[15] stated that waist/height (0.57 ± 0.05) ratio in individuals were significantly associated with type 2 diabetes which is comparable to our study.

In our study hip circumference was found high in females (86.52 ± 13.07cm) than males (83.31 ± 10.59cm) but difference is not statistically significant (p=0.1837). Abdoljalal Marjani[16] in his study also showed high hip circumference in females (107.33 ± 9.45) than males (104.83 ± 12.14) which is also similarly seen in our study.

Waist/hip ratio is derived by dividing waist and hip circumferences. In our study it was found high in males (1.06 ± 0.07) than females (0.97 ± 0.10) which difference is statistically significant (p=0.0001). Similarly bhowmik B et al[11] who also found waist/hip ratio in males (0.9) higher than females (0.86) and was sensitive index for predicting obesity in diabetic males which is comparable to our study. Shilpi sharma and shashi jain[17] studied total of 60 type 2 diabetic subjects and found mean waist hip ratio of male and female patients was 1.0±0.01 and 0.96±0.07 respectively, which indicate that female subjects had more fat around buttocks , equivalent to what is seen in our study.

CONCLUSION

In our study conducted among 100 type 2 diabetes patients to see which anthropometric parameter of obesity is more closely related to diabetes in males and females, in diabetic males it is found that waist circumference and waist/hip ratio were more deranged, hence it is better predicting parameter of obesity in them.

Similarly in diabetic females hip circumference was more deranged, thus it is a better predicting parameter of obesity in them. As compared to BMI (measure of general obesity), central measures of obesity (waist circumference, hip circumference, waist/hip ratio, waist/height ratio) were more altered in diabetes patients and thus gave better idea of obesity in diabetes.

Glycemic control (FBS, PPBS, HbA_{1c}) is determined by multiple factors. Anthropometric indices of obesity (BMI, waist circumference, hip circumference, waist/hip ratio, waist/height ratio) alone were not consistently shown to influence glycemic status in diabetic patients in short span, however reducing weight helps in controlling FBS, PPBS, HbA_{1c} in the long run. Anthropometric parameters are cheap and easy to use clinically in diabetic patients to assess obesity, these parameters should be monitored periodically to look out for improvement or worsening of obesity which will help manage blood sugar levels effectively, with proper diet and exercise these parameters can be kept within normal limits and prevent future risk of cardiovascular diseases.

REFERENCES

1. Asmita PB, Jayashree GV (2014). Glycosylated hemoglobin and fasting blood glucose levels in type 2 diabetes mellitus. Indian J Basic Appl Med Res; 3(2):555-559.

2. Hruby, A., & Hu, F. B. (2015). The epidemiology of obesity: a big picture. Pharmacoeconomics, 33(7), 673-689.
3. World Health Organization. (2016). World Health Organization obesity and overweight fact sheet.
4. Centers for Disease Control and Prevention. (2017). National diabetes statistics report, 2017. Atlanta, GA: Centers for Disease Control and Prevention.
5. Centres for Disease Control and Prevention: National Health and Nutrition Examination Survey-anthropometry procedures manual: January 2017.
6. Marjani, A. (2011). Waist circumference, body mass index, hip circumference and waist-to-hip ratio in type 2 diabetes patients in Gorgan, Iran. Journal of Clinical and Diagnostic Research, 5(2), 201-206.
7. Hsu, W. C., Araneta, M. R. G., Kanaya, A. M., Chiang, J. L., & Fujimoto, W. (2015). BMI cut points to identify at-risk Asian Americans for type 2 diabetes screening. Diabetes care, 38(1), 150-158.
8. Tulloch-Reid, M. K., Williams, D. E., Looker, H. C., Hanson, R. L., & Knowler, W. C. (2003). Do measures of body fat distribution provide information on the risk of type 2 diabetes in addition to measures of general obesity?: comparison of anthropometric predictors of Type 2 diabetes in Pima Indians. Diabetes care, 26(9), 2556-2561.
9. Kumar, A. (2013). Prevalence of glycemic status, obesity and waist circumference in Punjabi type 2 diabetics. Journal of Exercise Science and Physiotherapy, 9(1), 1.
10. Islam, S. M. S., Alam, D. S., Wahiduzzaman, M., Niessen, L. W., Froeschl, G., Ferrari U., Lechner, A. (2015). Clinical characteristics and complications of patients with type 2 diabetes attending an urban hospital in Bangladesh. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 9(1), 7-13.
11. Bhowmik, B., Munir, S. B., Ahmed, K. R., Siddiquee, T., Diep, L. M., Wright E., Hussain, A. (2014). Anthropometric indices of obesity and type 2 diabetes in Bangladeshi population: Chandra Rural Diabetes Study (CRDS). Obesity research & clinical practice, 8(3), e220-e229.
12. Lotfi, M. H., Saadati, H., & Afzali, M. (2014). Association between anthropometric parameters (WC, BMI, WHR) and Type 2 diabetes in the adult Yazd population. Iran. J Diabetes Metab, 5(444), 2.
13. Maria KA, Verma K, Kumar S, et al (2015). Comparative analysis of anthropometric parameters and lipid profile of type 2 diabetic patients in south west Punjab;3(5):489-96.
14. Nagar, S. R., & Jain, M. (2017). Study to assess predictive value of waist to height ratio and body mass index as a risk factor of hypertension and type 2 diabetes mellitus. International Journal Of Community Medicine And Public Health, 4(4), 1099-1103.
15. Hadaegh F, Zabetian A, Harati H, Azizi F (2006). Waist/height ratio as a better predictor of type 2 diabetes compared to BMI in Tehranian adult men. Experimental and clinical endocrinology and diabetes.;114(6):310-5.
16. Marjani, A. (2011). Waist circumference, body mass index, hip circumference and waist-to-hip ratio in type 2 diabetes patients in Gorgan, Iran. Journal of Clinical and Diagnostic Research, 5(2), 201-206.
17. Sharma S, Jain S (2009). Prevalence of Obesity among Type-2 Diabetics. Journal of Human Ecology; 25(1): 31-35.