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Waist circumference and waist hip ratio as predictor of incident diabetes in young adults: A cross-sectional study

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Abstract

Background: Type 2 diabetes mellitus belongs to a group of diseases labeled as lifestyle diseases‟ and is on the rise in Asians especially Indians. Besides morbidity due to its complications, Type 2 diabetes Mellitus carries a high risk of Myocardial infarction, Stroke and premature death. Thus every effort must be made to prevent or postpone this disease by spreading awareness, risk stratification, early diagnosis, and regular treatment. Waist circumference and waist-hip ratio are markers of Abdominal Obesity. **Aim & Objective:** 1.Waist circumference and waist hip ratio as predictor of incident diabetes in young adults.2.Study the association of waist/hip ratio with incident diabetes **Methods:** A Cross sectional study. Study setting: Department of Physiology Grant Government medical college, Mumbai. Study duration: 1 year (10/01/21 to 9/01/22) **Study population:** The present study was conducted in healthy medical students of first year M.B.B.S. (n = 100) with 50 males and 50 females of 18 to 27 years age groups at Grant Government medical college, Mumbai during study period 10/01/21 to 9/01/22 **Sample size:** 100 **Results:** According to WHR criteria, post prandial blood sugar level was significantly raised in males ‘at risk level’ (WHR $\geq$ 0.90) as compared to males ‘below risk level’ (WHR $\leq$ 0.90) Waist Hip Ratio was positively correlated with fasting blood sugar (r = 0.119) and post-prandial blood sugar level (r = 0.016). None of these correlations were statistically significant (p > 0.05). Conclusion: Majority of our type 2 diabetic patients having waist circumference and waist hip ratio, above cutoff values for Asians. The present study demonstrated strong associations of waist/hip ratio with incident diabetes. But we need to do more studies with higher sample size to corroborate these findings. **Conclusions:** Majority of our type 2 diabetic patients having waist circumference and waist hip ratio, above cut off values for Asians. The present study demonstrated strong associations of waist/hip ratio with incident diabetes.

Keywords: Diabetes, Venous Blood Sample, Waist Circumference, Waist/hip ratio

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Introduction

Type 2 diabetes mellitus belongs to a group of diseases labeled as lifestyle diseases‟ and is on the rise in Asians especially Indians. Besides morbidity due to its complications, Type 2 diabetes Mellitus carries a high risk of Myocardial infarction, Stroke and premature death. Thus every effort must be made to prevent or postpone this disease by spreading awareness,

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risk stratification, early diagnosis, and regular treatment. Waist circumference and waist-hip ratio are markers of Abdominal Obesity.

Obesity has become a major worldwide epidemic affecting more than 300 million people. It is an important risk factor for diabetes mellitus type 2, a chronic disorder of carbohydrate, fat, and protein metabolism. From the clinical perspective, visceral adipose tissue is known to generate diabetogenic substances and, as such, may be more informative than total fat for diagnostic evaluation.[1]

The standard epidemiologic translation of these important clinical facts uses anthropometric measures. Waist circumference and waist/hip ratio have been used as measures of central obesity (where visceral adipose tissue is stored), and body mass index (kg/m2) has been used as a measure of general obesity.[2]

Clinical evidence suggests that the association of diabetes with central obesity is stronger than the association with general fat. Studies using computed tomography and magnetic resonance imaging have provided further evidence to support that central obesity, visceral adipose tissue, and upper-body non visceral fat are the major contributors to the metabolic complications.[2,3]

Central obesity has been associated with decreased glucose tolerance, alterations in glucose insulin homeostasis, reduced metabolic clearance of insulin, and decreased insulin-stimulated glucose disposal.[4,5] Asians with normal BMI may have more than normal abdominal obesity. Thus the choice of waist circumference and waisthip ratio, in present study.

In 2003 WHO laid down guidelines for screening of type 2 diabetes mellitus, risk factors which included Waist-hip ratio and waist circumference, as important risk predictors of type 2 Diabetes Mellitus. Family history of diabetes is given a lot of importance in India, and patients rely on it to predict Diabetes.

Individually it is a risk factor, though not the only one and absence of Family history does not guarantee freedom from developing diabetes.6-8 We aimed to make a comparison between blood sugar level and waist hip ratio in young healthy males and females. We included waist/hip ratio because it was the most common obesity related predictor of diabetes after body mass index.

Aim and Objective

1. Waist circumference and waist hip ratio as predictor of incident diabetes in young adults
2. Study the association of waist/hip ratio with incident diabetes

Material And Methods

Study design: A Cross sectional study

Study setting: Department of Physiology Grant Government medical college, Mumbai

Study duration: 1 year (From 10/01/21 to 9/01/22)

Study population: The present study was conducted in healthy medical students of first year M.B.B.S. (n = 100) with 50 males and 50 females of 18 to 27 years age groups at Grant Government medical college, Mumbai during study period from 10/01/21 to 9/01/22

Inclusion criteria: 1. All healthy medical students of first year M.B.B.S.

Exclusion criteria: 1. Not willing to participate

Approval for the study: Written approval from Institutional Ethics committee was obtained beforehand. Written approval of Physiology department was obtained. After obtaining informed verbal consent from all healthy medical students of first year M.B.B.S. Grant Government medical college, Mumbai

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Sample size: 100
Sampling technique: Convenient sampling technique used for data collection.
Methods of Data Collection and Questionnaire
Predesigned and pretested questionnaire was used to record the necessary information. Questionnaires included general information, such as age, sex, religion, residential address, socioeconomic status. Medical history, past history, general examination, systemic examination,BMI, Waist Circumference (WC) and Hip Circumference (HC), Waist - Hip Ratio, fasting and 2 hour post-prandial blood sugar level.

Study procedure
The present study was conducted in healthy medical students of first professional M.B.B.S. (n = 100) with 50 males and 50 females of 18 to 27 years age groups at Grant Government medical college, Mumbai. Waist Circumference (WC) and Hip Circumference (HC) of each subject were recorded and Waist - Hip Ratio (WHR) was calculated. A fasting and 2 hour post-prandial venous blood samples were drawn from each subject for blood sugar assay. The subjects were divided into following groups:
According to WHR
Males with WHR < 0.90: "Below risk level" males
Males with WHR ≥ 0.90: "At risk level" males
Females with WHR < 0.85: "Below risk level" females
Females with WHR ≥ 0.85: "At risk level" females
Blood sugar levels were done by Biochemical Autoanalyser at the pathology lab using Enzymatic –
colorimetric – Trinder – End Point method (Glucose oxidase and glucose peroxidase method). Normal reference value taken as 75 -100 mg/dl (4.2 - 5.6 mmol/L).
Statistical analysis: The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results And Observations
The present study was conducted in healthy medical students of first year M.B.B.S. (n = 100) with 50 males and 50 females of 18 to 27 years age groups at Grant Government medical college, Mumbai during study period from 10/01/21 to 9/01/22.

In males " below risk level" (WHR < 0.9), post prandial blood sugar level ranged from 88 to 119 mg/dl with mean and SD of 101.11±9.14 and in males at risk level (WC ≥ 0.9), post prandial blood sugar ranged from 96 to 184 mg/dl with mean and SD of 114.54±22.47. Post-prandial blood sugar level was increased in males "at risk level" as compared to males "below risk level" and the difference was statistically significant ($p < 0.05$).

Fasting blood sugar level was also increased in males "at risk level" as compared to males "below risk level" but the difference was not statistically significant ($p > 0.05$). In females, the variation in values of fasting and postprandial blood sugar was not statistically significant ($p > 0.05$). Waist Hip Ratio was positively correlated with fasting blood sugar ($r = 0.119$) and post-prandial blood sugar level ($r = 0.016$). None of these correlations were statistically significant ($p > 0.05$).

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Table No. 1: Blood sugar level (mg/dl) according to waist hip ratio (N=100)

	Male		**Female**	
	Below risk level n=14	**At risk level n=16**	**Below risk level n=14**	**At risk level n=16**
Fasting Sugar	88.60±6.90	92.95±6.28	89.05±5.20	88.01±3.65
PP Sugar	101.11±9.14	114.54±22.47	106.97±10.13	106.06±9.35

Table 2: Correlation coefficients analysis

Variable	**WHR**
Fasting Sugar	0.119
PP Sugar	0.016

Discussion

In present study of type 2 diabetes patients, waist circumference, and waist-hip ratio was above cut off in majority, both males and females, thus emerging as an important marker. This parameter of abdominal obesity has been widely studied all over the world. In the USA, as

early as 1992 and 1997 studies established a link between waist circumference and type 2 diabetes.[1,2]

In the Carribean Islands, people of African origin, like Nigerians, Jamaicans and African-Americans were studied, by Okosun IS, et al. and were found to have a high risk of hypertension and high fasting blood sugar. Mexican population was studied by Berber A, et al. reporting a high cut off of BMI of 25.2 to26.6, and 90cms and 85 cms as cut off waist circumference for prediction of type 2 diabetes mellitus [8].

In 2003 WHO laid down guidelines for screening for diabetes mellitus in which most important measurements were Waist circumference and Waist hip ratio, and the correct method of measurement Snehalata C, et al. in a study from India defined waist and hip circumference cutoff values for Asian Indian Adults and also the correct way to measure the same [9,10]. Another

Indian study by Misra A, et al. not only gave cut offs but also action levels : action level 1 for Asian Indians : WC >78cms for men and >72cms for women should be advised to avoid weight gain and maintain increased physical activity [11].

Post-prandial blood sugar level was increased in males “at risk level” according to waist hip ratio (WHR $\geq$ 0.9), as compared to males “below risk level” (WHR < 0.9), and the difference found was statistically significant ($p < 0.05$). McKeigue et al.[12] (1991) and Mohan et al.[13] (2003) similarly found increase in glucose intolerance with increase in WHR. Gharakhanlou et al.[14] (2012) found that in men, WHR was a significant predictor for glucose.

Though, Ghosh et al. (2004)[15] reported that centrally obese subjects had a significantly higher FPG ($P<0.001$) compared with centrally non-obese subjects. Ko et al [16] (1999) concluded that higher levels of WHR is associated with risk of diabetes. Palacios et al.[17] (2011) found that WHR had the highest prevalence odds ratio for overall cardio metabolic risk and glycosylated hemoglobin.

In study by Joshi et al.[18] (2019), the range of WHR in both male and female diabetic participants (100) was higher than non-diabetic participants (100) and the result was

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statistically significant in both the cases. Kharal et al.[19] (2013) stated that mean waist hip ratio was 0.87 and increase in Waist hip ratio correlated significantly with increase in random blood sugar level both in males (p=0.008) and females (p=0.007).

Gu et al.[20] (2011) stated the associations of anthropometries with each metabolic factor(in metabolic syndrome) to be significant and equal for BMI, WC, WHR and WHtR. Vazquez et al. (2007) concluded waist/hip ratio was the most common obesity related predictor of diabetes. Shah A et al.[21] (2009) showed that in female, age (82.9%) is the strongest predictor followed by WHR (78.1%), WC (70.2%) and least for BMI (55.0%) whereas for male WC (87.0%) is the strongest followed by WHR (81.6%), BMI (68.5%) and least: for age (6.4.6%) using Receiver Operating Characteristic (ROC) curves.

Perez-pavida et al.[22] (2019) opined that one in four subjects had post-prandial hyperglycaemia despite normal fasting glycaemia. Similar to our result, they found that anthropometric indices of central fat distribution were strongly and independently associated with an increased risk of post-prandial hyperglycaemia.

Misra et al. also reported that post-prandial blood sugar level was raised in subjects with high WHR. But contrary to this, Hardiman et al. observed that there was no association between blood glucose level and WHR and Ghosh et al.[15](2004) found WHR to be associated with fasting plasma glucose level which was again different from our result. The difference in the results may be due to their larger and wide spectrum groups of all ages.

Abdul Ghani MS et al. (2009)23 proved that measurement of the post load plasma glucose concentration has additive value to models based only on fasting measurements in predicting the future risk for type 2 diabetes. Jiang J et al.[24] opined that post prandial blood sugar is more informative for screening of coronary heart disease and in our study also, we are finding post prandial hyperglycemia to be more significant.

Conclusion

Present study did show, majority of our type 2 diabetic patients having waist circumference and waist hip ratio, above cut off values for Asians. The present study demonstrated strong associations of waist/hip ratio with incident diabetes.

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