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Original Research

Assessment of obesity indices for prediction of hyperglycemia

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ABSTRACT:

Background: Diabetes mellitus (DM) is a known obesity related non-communicable disease. Both obesity and DM cases are currently on rise, especially in India. The present study was conducted to assess obesity indices for prediction of hyperglycemia. **Materials & Methods:** 120 healthy subjects of both genders were subjected to BMI, WC, WHtR, and Random Capillary Blood Glucose (RCBG) levels were measured. **Results:** The mean random capillary blood glucose was 114.6 mg/dl in males and 110.3 mg/dl in females, weight was 65.4 Kgs in males and 58.6 Kgs in females, height was 163.6 cm in males and 152.6 cm in females, body mass index was 24.2 Kg/m2 in males and 24.0 Kg/m2 in females, waist Circumference was 91.4 cm in males and 90.2 cm in females. Waist-height ratio was 0.51 in males and 0.56 in females. The correlation analysis showed that age of subjects in males and WC in females was positively correlated with RCBG levels. WHtR showed positive correlation with RCBG. **Conclusion:** WHtR was the best obesity index to predict hyperglycemia.

Key words: Capillary blood glucose, Hyperglycemia, Obesity

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INTRODUCTION

Diabetes mellitus (DM) is a known obesity related non-communicable disease. Both obesity and DM cases are currently on rise, especially in India.[1] The prevalence of prediabetes and diabetes is on rise globally as well as in India, even in young population, imparting adverse effects on health and economy. A large number of prediabetic and diabetic cases remain undiagnosed in India, warranting requirement of suitable screening method for early identification of these cases.[2]

Present studies showed that the pattern of body fat distribution has a major role in DM development and considerable increasing body of evidence support the role of visceral adiposity tissue in insulin resistance risk and hyperglycemia formation. Respecting DM is not a completely curable disease and has a heavy burden, preventing and prediction of this disease became more necessary.[3]

Multiple methods and criteria to assess obesity are available, such as BMI, WC, WHR and Waist-Height Ratio (WHtR), which are now internationally recognized and accepted. BMI is used as criteria for recognition and classification of generalized obesity, while WC, WHR and WHtR are simpler methods of assessing fat distribution and central obesity. It has been suggested that measure of central or abdominal obesity is better overall obesity related disease risk predictor.[4] Of the methods used to measure body fat and its distributions, anthropometric measurements play an important role in clinical practice. Body mass index (BMI) is most widely used to measure total adiposity, while waist-to-height ratio (WHtR), waist to-hip ratio (WHR) or waist circumference (WC) is a surrogate marker for abdominal adiposity.[5] The present study was conducted to assess obesity indices for prediction of hyperglycemia.

MATERIALS & METHODS

The present study comprised of 120 healthy subjects of both genders. Enrolment of subjects in the study was done after their written consent.

Data such as name, age, gender etc. was recorded. All were subjected to BMI, WC, WHtR, and Random

Capillary Blood Glucose (RCBG) levels were measured. RCBG < 140 mg/ dl was considered as normal and ≥140 mg/dl was taken as hyperglycemia to classify subjects. WC was measured at the level between lower border of costal margin and iliac crest. BMI (Kg/m2) was calculated from Wt and Ht data and following criteria were applied – <18.5 – Underweight; 18.5–22.9 – Normal; 23–24.9 – Overweight and ≥25 - obese. WHtR cut off was taken as ≥0.5 for all subjects. WC cutoff was taken as ≥90 cm for male and ≥80 cm for female subjects. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Assessment of parameters

Parameters	Male	Female	P value
Random capillary blood glucose (mg/dl)	114.6	110.3	0.02
Weight (Kgs)	65.4	58.6	0.01
Height (cm)	163.6	152.6	0.03
Body mass index (Kg/m2)	24.2	24.0	0.91
Waist Circumference (cm)	91.4	90.2	0.86
Waist-height ratio	0.51	0.56	0.05

Table I graph I shows that mean random capillary blood glucose was 114.6 mg/dl in males and 110.3 mg/dl in females, weight was 65.4 Kgs in males and 58.6 Kgs in females, height was 163.6 cm in males and 152.6 cm in females, body mass index was 24.2 Kg/m2 in males and 24.0 Kg/m2 in females, waist Circumference was 91.4 cm in males and 90.2 cm in females. Waist-height ratio was 0.51 in males and 0.56 in females. The difference was significant (P< 0.05).

Graph I Assessment of parameters

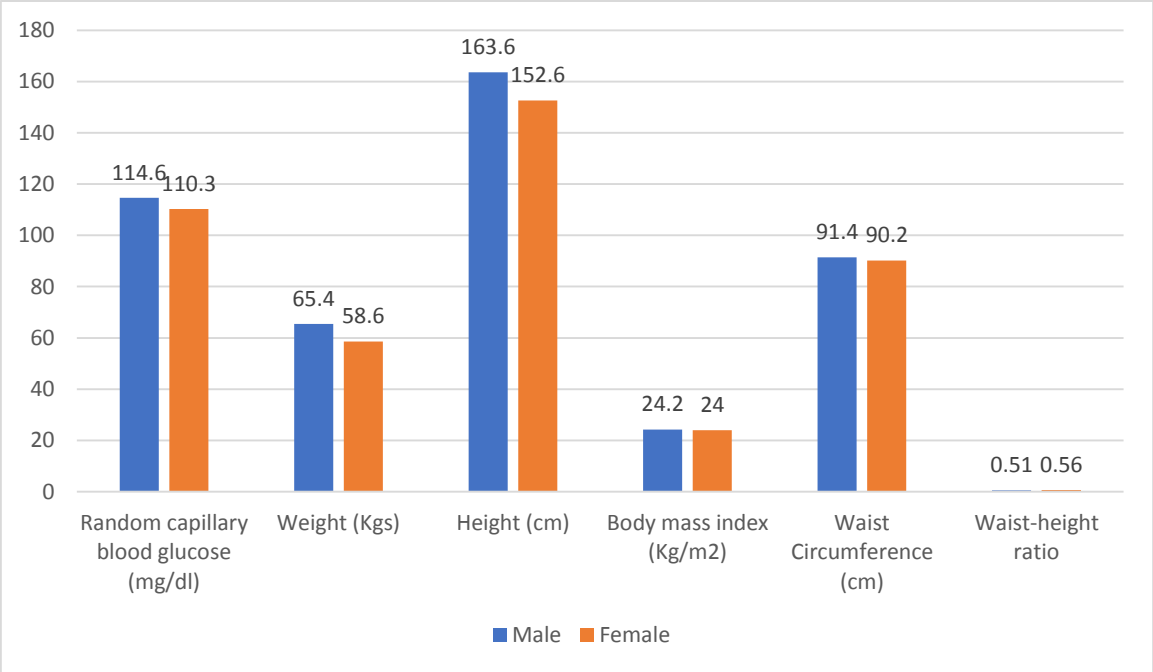

Table II Pearson correlation with RCBG levels

Parameters	Male		Female	
	r	P	r	P
Age (Years)	0.31	0.01	0.24	0.02
Weight	-0.03	0.61	0.14	0.32
Height	-0.12	1.41	0.092	0.15
Body mass index (Kg/m2)	0.017	0.82	0.067	0.92
Waist Circumference (cm)	0.018	0.37	0.31	0.02
Waist-height ratio	0.15	0.07	0.25	0.062

Table II shows that correlation analysis showed that age of subjects in males and WC in females was positively correlated with RCBG levels. WHtR showed positive correlation with RCBG.

DISCUSSION

Obesity is a substantial risk factor for type 2 diabetes and its complications, including hyperinsulinemia, insulin resistance, dyslipidemia, and cardiovascular diseases, and that different body fat patterning, for example, abdominal adiposity or overall obesity, may have different impacts on the risk of type 2 diabetes.[6] Most of the previous studies managed to demonstrate a close association between diabetes and body mass index (BMI) and waist circumference (WC), which are commonly considered as the valid measures of obesity.[7] Nevertheless, considering the inability of BMI in differentiating adipose tissue from lean body mass, its reliability as an indicator of obesity has recently been questioned. BMI together with some other obesity parameters such as body adiposity index and waist-to-height ratio has shown to present poor prognosis of fat mass among young healthy adults since it reflects skeletal muscle mass.[8] WC can also predict the status of abdominal adipose tissue. However, whether the range of WC associates to body size remains obscure. Therefore, it is suggested that other appropriate parameters are applied to present improved indices of obesity. It seems that a combination of traditional anthropometric indices like height, weight, BMI, or WC together with novel parameters would be helpful for us to achieve our goal.[9] The present study was conducted to assess obesity indices for prediction of hyperglycemia.

In present study, mean random capillary blood glucose was 114.6 mg/dl in males and 110.3 mg/dl in females, weight was 65.4 Kgs in males and 58.6 Kgs in females, height was 163.6 cm in males and 152.6 cm in females, body mass index was 24.2 Kg/m2 in males and 24.0 Kg/m2 in females, waist Circumference was 91.4 cm in males and 90.2 cm in females. Waist-height ratio was 0.51 in males and 0.56 in females. Rai et al[10] assessed and classified obesity status, including Body Mass Index (BMI), Waist Circumference (WC), and Waist-Height Ratio (WHtR) for their usefulness in predicting hyperglycemia. BMI, WC, WHtR, and Random Capillary Blood Glucose (RCBG) levels were measured in total 188 adult volunteers. Receiver operating curve analysis was performed to find best obesity indices to predict hyperglycemia (RCBG ≥140 mg/dl) and to find optimal cut off values for prediction. Age of subjects, WC and WHtR (but not BMI) were found significantly correlated with RCBG levels. WHtR classified highest number of subjects as obese, compared to BMI and WC. WHtR was also found to be the best obesity index to predict hyperglycemia in both male and female subjects.

We found that correlation analysis showed that age of subjects in males and WC in females was positively correlated with RCBG levels. WHtR showed positive correlation with RCBG. Xu et al[11] found that the overall cumulative incidence of hyperglycemia was 8.6% (8.0% in men, 9.0% in women). Relative risks across quartiles of WHtR, WHR, WC and BMI were 1.00, 1.33, 1.67, 3.40; 1.00, 2.38, 2.53, 3.87; 1.00, 1.29, 1.75, 2.90; and 1.00, 1.45, 1.49, 2.41 in men, and 1.00, 1.24, 1.99, 2.87; 1.00, 1.14, 2.28, 2.66; 1.00, 1.32, 1.80, 3.14; and 1.00, 1.39, 1.50, 2.08 in women, respectively. p for trend was <0.01 for each marker and gender. Adjustment for potential confounders did not change such dose-response relationships materially. ROC analysis indicated that WHtR had the best sum of sensitivity and specificity compared to the other measures. Optimal cut-offs for WHtR, WHR, WC and BMI were 0.51, 0.92, 85 and 24 for men, while 0.55, 0.86, 82 and 25 for women, respectively.

Abolhasani et al[12] assessed the accuracy of several obesity indices to predict hyperglycemia in overweight and obese Iranian populations and determining the value of such indices in comparison to the conventional parameters. Combined latent scores and WHtR (waist-to-height ratio) gave us a higher area under the curve in predicting hyperglycemia associated with WC (waist circumference) in women, whereas FFMI (fat-free mass index) gave low values. Additionally, BRI (body roundness index) and latent scores had slightly higher AUC values in predicting hyperglycemia in men. According to the age-adjusted odds ratio (OR) in the presence of hyperglycemia, OR was the highest for WHR (waist to hip ratio) in women. The association of WHR and hyperglycemia remained significant by adjusting for BMI (body mass index), WC and menopausal status.

CONCLUSION

Authors found that WHtR was the best obecity index to predict hyperglycemia.

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