Association of waist and hip circumference and waist hip ratio with percentage body fat among young females of Kanpur India: A correlational study

Dr Digvijay Sharma, *Assistant professor, UIHS, CSJM University, Kanpur*
Chandra Shekhar Kumar, *Assistant professor, UIHS, CSJM University, Kanpur*

ABSTRACT

Background: Presently, overweight and obesity is a problem for both developed as well as developing countries. Obesity nutritional status is associated with body fat levels.

Objectives: The study aimed to assess the association between waist circumference, hip circumference and the waist hip ration with body fat percentage among young females of Kanpur, India.

Method: After initial assessment, weight, height, waist circumference, hip circumference, and triceps girth was documented in 40 female participants aged 18-25 years for this correlational study by purposive sampling method. Body mass index and waist to hip ratio was calculated. Data on the percentage of body fat was obtained using the equation %Body Fat = 42.42 + 0.003 × age (years) + 7.04 × gender (M=1, F = 2) + 0.42 × triceps skinfold (mm) + 0.29 × waist circumference (cm) + 0.22 × weight (kg) −0.42 × height (cm).[14]

The descriptive data was presented as mean $\pm$ SD. Pearson correlation was used to assess the correlations. A p value less than 0.05 was considered statistically significant.

Results: There was a significant positive correlation between waist circumference and hip circumference with the percentage of body fat (p =0.0001).

Conclusions: Waist and hip circumference has positive correlation with percentage body fat among females. It is important to screen females with increased waist and hip circumference in routine settings as a preventive strategy

Keywords: Body weight, body mass index, percentage body fat, obesity.

Introduction

Overweight and obesity are among the leading risk for global deaths. The growing number of overweight and obese individuals has been described as epidemic and even pandemic. Overweight and obesity which is also a risk factor for various non communicable diseases.[1] In 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million were obese, 39% of adults aged 18 years and were overweight and 13% were obese.[2] AS per a recent report, more than 50% of the 693 million obese individuals in the world live in just 10 countries (listed in order of number of obese individuals): USA, China, India, Russia, Brazil, Mexico, Egypt, Pakistan, Indonesia, and Germany).[3]

Health survey in England 2010-12 reported that men were more overweight and women were more obese.[4] Females with creased weight and fat are more likely to have menstrual disturbances, face more complications during pregnancy, have higher maternal and perinatal complications and mortality, difficultly to conceive along with other complications.[5,6] An increase in abdominal obesity and waist size by 88 cm increases the risk of increase in type 2 Diabetes Mellitus.[5,6]

Obesity is measured by various methods including body mass index (BMI), waist circumference (WC), waist hip ratio (WHR), body fat (BF) distribution and abdominal fat mass, each having its own merits and limitations. A considerable disadvantage of BMI is its inability to distinguish increased body fat content from augmented lean body mass, which may be a reason of misclassification of some individuals with an excess of adipose tissue as being nonobese.[7]

The WHO recommends the use of measurement of waist circumference and calculation of waist-to-hip ratio in association with BMI; a WC of 102 cm or more in men, or 88 cm or more in women, is associated with health problems and a waist hip ratio of greater than 0.90 in men and greater than 0.85 in women, is associated with health problems.[8] Also. there are reports that for Asian population, WC > 90cm for men and WC > 80cm for women is indicator for greater risk.[9]

There is a general tendency of considering individuals with greater body weight or BMI as at risk. A considerable disadvantage of BMI is its incapability to differentiate augmented body fat content from increased lean body mass, which may be a reason of misclassification of some individuals with an excess of adipose tissue as being non obese.[10] Individuals with normal body weight by body mass index (BMI) may have high body fat percentage.[11]

Thus, the present study aimed to assess the association between waist circumference, hip circumference and the waist hip ratio with body fat percentage among young females of Kanpur, India.

Methodology

A total of 40 female participants aged 18-25 years with body mass index between 18.5 to 29.9 Kg /m^2 were included for this correlational study by purposive sampling method. Participants were included if they were asymptomatic with stable vital signs, life time nonsmoker, absence of any acute disease in the four weeks preceding the study. Criteria for exclusion from the study included resting heart rate (HR) $\geqslant$100 bpm, systolic blood pressure >139 mmHg and diastolic blood pressure > 89 mmHg, any health problem or use of medication, having history of tobacco use or present use of tobacco in any form, past or present consumption of alcohol in any form and pregnant females.

After initial screening and assessment body weight (in kg) was measured with a beam balance scale. Body height (in cm) was measured using a height scale and Body Mass Index (BMI = Weight/Height^2 kg/m^2) was calculated.

Waist and hip circumferences were measured using a non-stretch tape with minimal clothing, standing straight.[12] Waist circumference is measured halfway between the lower ribs and the iliac crest, and hip circumference is measured at the largest circumference around the buttocks.[12] Then waist hip ratio was calculated. Triceps skinfold measurements were obtained using standardized methods.[13]

Percentage body fat was calculated using the equation %Body Fat = 42.42 + 0.003 × age (years) + 7.04 × gender (M=1, F = 2) + 0.42 × triceps skinfold (mm) + 0.29 × waist circumference (cm) + 0.22 × weight (kg) −0.42 × height (cm).[14]

Statistical analyses

Mean and standard deviation (SD) for all continuous variables were calculated. Correlations were estimated using Pearson's coefficient of correlation (r). A p value < 0.05 was considered as statistically significant. All the analysis was done using the software SPSS 20 (SPSS, Inc., Chicago, Illinois).

Results

A total of 40 females were included. The characteristics of the participants are summarized in the table 1. 32.5 % of the participants (n=13) had waist circumference greater than 80cm.

Table1: Characteristics of the participants.

Characteristic	Mean	Standard Deviation
Age	19.4	1.56
Height	1.57	0.047
Weight	54.055	8.605632
Body Mass Index	21.8695	3.081838
Waist Circumference	0.8375	0.059989
Hip Circumference	86.2425	15.53073
Waist Hip ratio	72.4225	13.53312
Triceps skinfold measurement	24.825	8.191263
Percentage body fat	127.7883	37.76296

There was a significant positive correlation between waist circumference and hip circumference with the percentage body fat (p =0.0001). Correlations are shown in table 2.

		Percentage body fat
Hip circumference	Pearson Correlation	0.552[**]
	Sig. (2-tailed)	.0001
	N	40
Waist circumference	Pearson Correlation	0.598[**]
	Sig. (2-tailed)	.0001
	N	40
Waist Hip Ratio	Pearson Correlation	.269
	Sig. (2-tailed)	.093
	N	40

Table 2: Correlation of hip and waist circumference and WHR with percentage body fat

P< 0.05 is considered significant.

Discussion

To the best of our knowledge this is the first study to assess the association between waist circumference, hip circumference and the waist hip ration with body fat percentage among young females of Kanpur India. As far as possible, we controlled the procedural factors that affect with respect of contraindications, and choice of supervisor and standardized guidelines.[8,12,13]

32.5% of the participants in the present study had waist circumference greater than 80 cm which is indicated as a risk for health conditions for Asian adults.[9] 17.5% participants were overweight as per WHO guidelines and obese as per recommendations for Asian adults.[8] There was positive correlation of hip circumference and waist circumference with percentage body fat indicating that participants with a higher percentage body fat had higher fat distribution over the abdominal region. The diagnostic criteria for abdominal obesity is 85 cm or more for women, and they are also at high risk for metabolic syndrome.[15]

WHR has been widely used as a person's health indicator and associated with the risk of developing serious health disorders. 42.5% had waist hip ration greater than 0.85 indicating greater risk.[8] However, there was no association between waist hip ratio and body fat percentage. The probable reason could be the small sample size of the study.

The study had few limitations. The sampling was non probability sampling though we had a strict inclusion and exclusion criteria. The body fat was calculated using a published equation precisely for Asian Indian adults but future multicentre studies should be conducted using gold standard assessment of body fat.

Conclusion

Waist and hip circumference has positive correlation with percentage body fat among young females. It is important to screen females with increased waist and hip circumference in routine settings as a preventive strategy.

References

1. Sowers JR. Obesity as a cardiovascular risk factor. Am J Med. 2003;115(Suppl 8A):37S–41.
2. World Health Organization (WHO. Obesity and Overweight factsheet from the WHO. Health. 2017 Oct 24.
3. Marie Ng, Tom Fleming, Margaret Robinson et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis . Lancet 2014; 384(9945):766-781

4. Berrington de Gonzalez A, Hartge P, Cerhan JR, et al. "Body-mass index and mortality among 1.46 million white adults". N. Engl. J. Med. 2010 363 (23): 2211–9.

5. Susan Y. Chu, William M. Callaghan, Shin Y. Kim, Christopher H. Schmid,Joseph Lau et.al. Maternal Obesity and Risk of Gestational Diabetes Mellitus . Diabetes Care 2007 Aug; 30(8): 2070-2076

6. Pasquali R., Patton L., Gamineri A. Obesity and infertility . Curr Opin Endcrinol Diabetes Obes 2007 Dec; 14(6) 482-7

7. Romero-Corral A, Somers VK, Sierra-Johnson J, et al. Accuracy of body mass index in diagnosing obesity in the adult general population. Int J Obes (Lond). 2008;32:959 –966.

8. World Health Organization. Obesity: preventing and managing the global epidemic. Geneva (Switzerland):World Health Organization;2008

9. Misra A , Chowbey P, Makkar B. Consensus statement for diagnosis of obesity, abdominal obesity, and metabolic syndrome, for Asian Indians and recommendations for physical activity, medical and surgical management. JAPI. 2009;57:163-170.

10. Consultation WHOE: Appropriate body-mass index for Asian populations and its implications for policy

and intervention strategies. Lancet 2004, 363(9403):157–163.

11. Estefania O, Virend K S, Ondrej S. The Concept of Normal Weight Obesity. Progress in Cardiovascular

Diseases 2014;56 (4):426-433

12. J. Eaton–Evans, in Encyclopedia of Human Nutrition (Second Edition), 2005

13. Ramírez-Vélez, R., López-Cifuentes, M. F., Correa-Bautista, J. E., González-Ruíz, K., González-Jiménez, E., Córdoba-Rodríguez, D. P., Vivas, A., Triana-Reina, H. R., & Schmidt-RioValle, J. (2016). Triceps and Subscapular Skinfold Thickness Percentiles and Cut-Offs for Overweight and Obesity in a Population-Based Sample of Schoolchildren and Adolescents in Bogota, Colombia. *Nutrients*, *8*(10), 595. https://doi.org/10.3390/nu8100595.

14. Goel, K., Gupta, N., Misra, A., Poddar, P., Pandey, R. M., Vikram, N. K., & Wasir, J. S. (2008). Predictive equations for body fat and abdominal fat with DXA and MRI as reference in Asian Indians. *Obesity (Silver Spring, Md.)*, *16*(2), 451–456. https://doi.org/10.1038/oby.2007.55

15. Yoon YS, Oh SW. Optimal waist circumference cutoff values for the diagnosis of abdominal obesity in Korean adults. Endocrinol Metab. 2014;29(4):418–26.