Research Article

Evaluation of waist-to-hip ratio as a predictor of cardiovascular risk factors

Manjunath Hemberal[1], Veena H Chandregowda[2], Raju H Taklikar[1], Vijayanath Itagi[3]

[1]Department of Physiology, Navodaya Medical College, Raichur, Karnataka, India.
[2]Department of Physiology, Hassan Institute of Medical Sciences, Hassan, Karnataka, India.
[3]Department of Physiology, Koppala Institute of Medical Sciences, Koppala, Karnataka, India.
Correspondence to: Manjunath Hemberal, E-mail: aaryanmunch@gmail.com

Received February 4, 2015. Accepted February 20, 2015

Abstract

Background: Abdominal obesity judged by increased waist-to-hip ratio (WHR) is an important risk factor for atherosclerosis. One of the mechanisms postulated by which truncal obesity increases coronary risk is high blood pressure (BP). It is essential to identify the best anthropometric index in any population to predict cardiovascular risk.

Objective: The objective of this study was to establish the correlations between anthropometric data such as body mass index (BMI) and WHR with BP.

Materials and Methods: A representative clinically healthy sample of 150 individuals (75 men and 75 women) aged between 20 and 80 years was selected and anthropometric indices and BP were measured according to standard protocol. Pearson's correlation coefficient test was applied to evaluate the correlation.

Result: There was a positive correlation between BMI and WHR with BP in both the male and female subjects. The WHR had strongest correlation in men and women with both systolic and diastolic BPs.

Conclusion: It can be concluded that WHR is a better predictor of cardiovascular risk than BMI.

KEY WORDS: Abdominal obesity, waist-to-hip ratio, cardiovascular risk

Introduction

The prevalence of obesity in industrialized and developed countries has increased dramatically to such an extent that the World Health Organization (WHO) reported overweight and obesity to be an escalating epidemic worldwide.[1-4] Obese people are susceptible to other chronic diseases such as diabetes, cardiovascular disease (CVD), and some type of cancers.[4] Body mass index (BMI) has been recommended as an index of obesity by WHO and is related to disease risk.[5,6] But some studies suggest that the pattern of body fat distribution is a more important determinant of disease risk.[7-9] A high proportion of abdominal fat has been indicated as a risk factor for diabetes, hypertension, and CVD.[10-12] Unfortunately, there is no standard measure of abdominal obesity that is widely accepted. Although, the majority of studies recommend waist circumference (WC) as a better indicator of abdominal obesity and a better predictor for cardiovascular risk than either BMI or waist-to-hip ratio (WHR), such findings have not been confirmed in Asians.[13-17] The best index of obesity that is predictive of cardiovascular risk still remains controversial. The present study was designed to evaluate the correlation between anthropometric data such as BMI and WHR with cardiovascular parameters such as systolic blood pressure (SBP) and diastolic blood pressure (DBP).

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2015.04022015197	

Materials and Methods

This was a cross-sectional observational study that included a clinically healthy sample of 150 subjects (75 men

Table 1: Systolic blood pressure, diastolic blood pressure, and anthropometric parameters in male and female subjects

Parameters	Males (Mean ± SD)	Females (Mean ± SD)
BMI (kg/m^2)	23.06 ± 2.40	24.16 ± 3.54
Waist-to-hip ratio	0.92 ± 0.04	0.91 ± 0.06
Systolic blood pressure (mm Hg)	125.0 ± 8.6	122.1 ± 11.6
Diastolic blood pressure (mm Hg)	81.3 ± 7.7	78.2 ± 6.4.

BMI, body mass index

Table 2: Correlation between SBP with BMI and WHR in female subjects

Parameters	*r* Value	*p*-Value
BMI	0.173	>0.05
Waist-to-hip ratio	0.412	<0.05

BMI, body mass index

Table 3: Correlation between DBP with BMI and WHR in female subjects

Parameters	*r*-Value	*p*-Value
BMI (kg/m^2)	0.315	<0.05
Waist-to-hip ratio	0.377	<0.05

BMI, body mass index

Table 4: Correlation between SBP with BMI and WHR in male subjects

Parameters	*r*-Value	*p*-Value
BMI (kg/m^2)	0.174	>0.05
Waist-to-hip ratio	0.385	<0.05

BMI, body mass index

and 75 women) aged between 20 and 80 years. The study protocol was approved by the institute's ethics committee and the subjects signed an informed consent statement before participation. Subjects with any systemic diseases were excluded from the study. Anthropometric indices were measured according to standard protocol. The height was recorded during inspiration using a stadiometer to the nearest 0.1 cm, and weight was measured by a digital standing scale to the nearest 0.1 kg with the subjects wearing light indoor clothes and without shoes. BMI was then calculated using the formula weight (in kg)/height (m)^2. Waist and hip circumferences were measured according to WHO guidelines by using a stretch-resistant tape. Blood pressure (BP) was measured by using a sphygmomanometer in supine position after giving adequate rest to the subject. Pearson's correlation coefficient *r* was used to examine the correlation between BMI and WHR with BP (SBP and DBP). A two tailed *p*-value less than 0.05 was considered significant.

Table 5: Correlation between DBP with BMI and WHR in male subjects

Parameters	*r* Value	*p*-Value
BMI (kg/m^2)	0.308	<0.05
Waist-to-hip ratio	0.353	<0.05

BMI, body mass index

Results

The WHR (mean±SD) in men was 0.92±0.04 and in women 0.91±0.06, and the BMI (kg/m^2) in men was 23.06±2.40 and in women 24.16±3.54. The SBP (mm Hg) in men was 125.0±8.6 and in women 122.1±11.6. The DBP in men was 81.3±7.7 and in women was 78.2±6.4 [Table 1].

There was a positive correlation between BMI and WHR with BP in both men and women. The WHR had strongest correlation in men and women with both SBP and DBP [Tables 2–5].

Discussion

From this study, it is clear that though BMI and WHR are positively correlated with both SBP and DBP, the strongest correlation is with WHR. In line with our findings, some other investigators have also reported WHR to be a better predictor of cardiovascular risk factors than WC and BMI.[18] Another study carried out on Canadian adult men and women showed that WHR can predict CVD risk factors more accurately than BMI and is as capable as WC in identifying subjects at risk for CVD[15]. This is based largely on the rationale that increased visceral adipose tissue is associated with a range of metabolic abnormalities, including decreased glucose tolerance, reduced insulin sensitivity, and adverse lipid profiles, which are risk factors for type 2 diabetes and CVD. The principal limitation of this study was the use of cross-sectional data to compare the ability of anthropometric indices to predict CVD risk factors. Future studies using longitudinal data and including other cardiovascular parameters such as lipid profile will provide stronger evidence on this evaluation.

Conclusion

It can be concluded that WHR is a better predictor of cardiovascular risk than BMI alone.

References

1. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The continuing epidemic of obesity in the United States. JAMA 2000;284:1650–1.
2. Kuczmarski RJ, Flegal KM, Campbell SM, Johnson CL. Increasing prevalence of overweight among U.S. adults. JAMA 1994;272:205–11.

3. de Onis M, Blossner M. Prevalence and trends of overweight among preschool children in developing countries. Am J Clin Nutr 2000;72:1032–9.
4. World Health Organization. *Obesity Epidemic Puts Millions at Risk from Related Diseases*. Press Release WHO/46(online), June 12, 1997; Available at: www.who.int/inf-prp 1997/en/pr97-46.html (last accessed on April 16, 2013).
5. World Health Organization. *Obesity: Preventing and Managing the Global Epidemic, Report of a WHO Consultation on Obesity*, June 3–5, 1997, WHO/NUT/NCD/98.1. Geneva: WHO.
6. Stevens J, Cai J, Pamuk ER, Williamson DF, Thun MJ, Wood JL. The effect of age on the association between body mass index and mortality. N Engl J Med 1998;338:1–7.
7. Wei M, Gaskill SP, Haffner SM, Stern MP. Waist circumference as the best predictor of non-insulin dependent diabetes mellitus compared to BMI, WHR over other anthropometric measurements in Mexican Americans: a 7-year prospective study. Obes Res 1997;5:16–23.
8. Folsom AR, Kaye SA, Sellers TA, Hong CP, Cerhan JR, Potter JD, et al. Body fat distribution and 5-year risk of death in older women. JAMA 1993;269:483–7.
9. Pi-Sunyer FX. Obesity: criteria and classification. Proc Nutr Soc 2000;59:505–9.
10. Seidell JC, Han TS, Feskens EJ, Lean ME. Narrow hips and broad waist circumference independently contribute to increased risk of non-insulin dependent diabetes mellitus. J Intern Med 1997;242:401–6.
11. Beegom R, Beegom R, Niaz MA, Singh RB. Diet, central obesity and prevalence of hypertension in urban population of south India. Int J Cardiol 1995;51:183–91.
12. DiPietro L, Katz LD, Nadel ER. Excess abdominal adiposity remains correlated with altered lipid concentrations in healthy older women. Int J Obes Relat Metab Disord 1999;23:432–6.
13. Pouliot MC, Despres JP, Lemieux S, Moorjani S, Bouchard C, Tremblay A,et al. Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. Am J Cardiol 1994;73:460–8.
14. Ledoux M, Lambert J, Reeder BA, Despres JP. A comparative analysis of weight to height and waist to hip circumference indices as indicators of the presence of cardiovascular disease risk factors. Canadian Heart Health Surveys Research Group. Can Med Assoc J 1997;157(Suppl 1):S32–S38.
15. Dobbelsteyn CJ, Joffres MR, MacLean DR, Flowerdew G. The Canadian Heart Surveys Research Group. A comparative evaluation of waist circumference, waist-to-hip ratio and body mass index as indicators of cardiovascular risk factors: the Canadian Heart Health Surveys. Int J Obes Relat Metab Disord 2001;25:652–61.
16. Seidell JC, Cigolini M, Charzewska J, Ellsingen BM, di Biase G. Fat distribution in European women: a comparison of anthropometric measurements in relation to cardiovascular risk factors. Int J Epidemiol 1990;19:303–8.
17. Lin WY, Lee LT, Chen CY, Lo H, Hsia HH, Liu IL, et al. Optimal cut-off values for obesity: using simple anthropometric indices to predict cardiovascular risk factors in Taiwan. Int J Obes Relat Metab Disord 2002;26:1232–8.
18. Lakka HM, Lakka TA, Tuomilehto J, Salonen JT. Abdominal obesity is associated with increased risk of acute coronary events in men. Eur Heart J 2002;23:706–13.

How to cite this article: Hemberal M, Chandregowda VH, Taklikar RH, Itagi V. Evaluation of waist-to-hip ratio as a predictor of cardiovascular risk factors. Int J Med Sci Public Health 2015;4:961-963

Source of Support: Nil, **Conflict of Interest:** None declared.