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ORIGINAL ARTICLE

Prevalence of Overweight and Obesity and Their Relation to Hypertension in Adult Male University Students in Kerman, Iran

Shahbazpour N.

School of Physical Education and Sport Sciences, Shahid Bahonar University of Kerman, Kerman, I.R. Iran

This study examined cardiovascular risk factors among adult male university students in Kerman, Iran.

Materials and Methods: Study populations of male university students, enrolled for physical education classes during the winter of 2001, at the Shahid Bahonar University of Kerman, were examined and evaluated. Tthe partial correlation coefficient was used to quantify the association between body mass index and waist-to-hip circumference ratio with systolic blood pressure and diastolic blood pressure. Linear regression analysis was used to assess the influence of body mass index and waist-to-hip circumference ratio on the variance of systolic blood pressure and diastolic blood pressure.

Results: The prevalence of overweight and obesity was 13.6% and 2.2%, respectively. 45.5% of the subjects had normal weight and 38.4% were underweight. 11.4% of the participants had waist-to-hip circumference ratio (WHR) ≥ 92. We found a positive correlation between body mass index and waist-to-hip circumference ratio. Stepwise linear regression analysis controlled for age revealed that both body mass index and waist-to-hip circumference ratio were independently correlated with both systolic and diastolic blood pressures.

Conclusion: The present results suggest that of the university students studied, those with either higher body mass index or central adiposity distribution are potential candidates at increased risk of hypertension and cardiovascular disease.

Key Words: Overweight, obesity; body mass index, central adiposity; hypertension

Correspondence: Nosratollah shahbazpour; School of Physical Education and Sport Sciences, Shaheed Bahonar University of Kerman, Kerman, Iran
E-mail: nshahbazpour@yahoo.com

Introduction

Nowadays, most people are aware of the link between obesity and health risks. It is widely believed that cardiovascular disease is a major cause of morbidity and mortality among obese populations.[1,2] It has been shown that overweight and obesity are associated with increased cardiovascular disease risk factors such as, hypertension[3,4] and type 2 diabetes.[5] There also exists evidence suggesting that obesity and high blood pressure are disorders that are closely linked, particularly when obesity is characterized by a central fat distribution.[3,6] The evaluation of central adiposity by way of the waist-to-hip circumference ratio (WHR) has been recognized as a substantial component in the assessment of cardiovascular disease risk factors due to a positive association between high WHR and hypertension.[4] The relationship between overall fat distribution and central adiposity with hypertension, recognized in middle age, has received little attention in young adults. Surprisingly, there

prisingly, there is substantially less published information about the prevalence of overweight, obesity and their associations to hypertension in Iran, particularly among university students. It is therefore, the purpose of this study to report on the prevalence of overweight and obesity and their relationship with high blood pressure for the prediction of cardiovascular disease risk factors in male university students in Kerman, a province in the southeast of Iran.

Materials and Methods

Subjects

Five hundred and thirty seven male university students, aged, 18.3 to 29.7, years who enrolled for general physical education classes during the winter semester of 2001 at Shahid Bahonar University of Kerman in Kerman, Iran, were recruited to participate in the present study. In order to recruit the subjects, students from 30 classes were randomly selected. Written informed consent was obtained from all subjects prior to their participation in the study.

Anthropometrical measurements

Anthropometrical measurements were taken using standard apparatus with the subjects wearing light underwear and without shoes. A trained individual took all measurements. Weight was measured in the upright position with a weighting scale to the nearest 0.01 kilogram (kg). Each day the scale was calibrated with a standard weight. Height was measured to the nearest 0.1 cm. All measurements were taken using a non-stretching tape. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) to estimate overall body fat distribution and was classified into four categories according to Baray.[7] Thus, underweight was defined as BMI < 20.00, normal weight as BMI 20.00 – 24.99, overweight as BMI 25.00 – 29.99 and obesity as BMI ≥ 30.00 Kg/m^2. Waist was measured horizontally at the level just above the uppermost border of the iliac crest. The measurement was made at a normal minimal respiration.[8] Hip was measured as the maximum circumference over the buttocks.[9] Central obesity was also calculated and defined on the basis of WHR. The cut-off value of central obesity was considered ≥ 0.92.[10]

Blood pressure measurement

Blood pressure was measured, using the standard mercury sphygmomanometer, on the right arm with a subject in the upright sitting position, following at least 5 min rest. Hypertension was defined as systolic blood pressure (SBP) > 140 mmHg, and diastolic blood pressure (DBP) >90mmHg.[11]

Statistical analyses

Statistical analysis was carried out using the statistical program available in SPSS version 9.0. Descriptive statistics for anthropometric characteristics and SBP and DBP were calculated. Partial correlation coefficient was used to quantify the association between independent variables (BMI and WHR) and dependent variables (SBP and DBP). Linear regression analysis was used to assess the influence of BMI and WHR on the variance of SBP and DBP. All tests for statistical significance were two tailed and significance was selected at P-value <0.05.

Results

Anthropometric and blood pressure characteristics of the subjects are shown in Table 1. Based on BMI according to definition used, descriptive analysis revealed that 38.4% of the study population was classified as underweight, 45.8% as normal weight, 13.6% as overweight, and 2.2% as obese (Fig. 1). The BMI cut-off points for overweight and obesity were ≥ 84th and ≥ 97th, respectively. The results revealed that at the WHR cut-off point recommended for central obesity in men (WHR ≥ 0.92 cm), abdominal adiposity was present in 11.4% of the subjects. Partial correlation controlled for age revealed strong

Table 1. Descriptive analysis for anthropometrics and blood pressure characteristics

Variables	*Median*	*Mean*	*S.D.*	*Range*
Age (y)	21.3	21.7	2.4	18.3 – 29.7
Height (cm)	175.0	174.6	6.1	157.0 – 193.0
Weight (kg)	64.0	65.7	11.1	42.3 – 109.5
Waist (cm)	77.0	78.7	9.2	60.0 – 114.0
Hip (cm)	91.0	92.0	6.7	58.0 – 117.0
WHR	0.85	0.85	5.3	0.74 – 1.09
BMI (kg/m^2)	21.1	21.6	3.4	14.5 – 34.2
SBP (mmHg)	120.0	120.8	13.4	90.0 – 160.0
DBP (mmHg)	75.0	73.6	9.35	45.0 – 100.0

WHR = Waist-to-hip ratio; BMI = Body mass index; SBP = Systolic blood pressure; DBP = Diastolic blood pressure

positive correlation between BMI and WHR (r = 0.680, P < 0.0001) (Fig. 2).Inspection of the data obtained for the hypertension, indicated that 33 subjects of the study population (4.8%) had systolic high blood pressure, and 21 (4%) had diastolic high blood pressure. Results of the partial correlation coefficient controlled for age, indicated a significant positive correlation between SBP and DBP (r= 0.617, P<0.0001). Likewise, partial correlation revealed that, there were significant correlation between the independent and dependent variables. BMI was positively correlated with SBP (r = 0.410, P<0.0001) and DBP (r = 0.210, P<0.0001), respectively. Similarly, positive correlation was found between WHR and SBP (r = 0.356, P < 0.0001) and between WHR and DBP (r = 0.213, P < 0.0001).

Stepwise linear regression models were fitted for each SBP and DBP as the dependent variable and BMI and WHR as the independent variables controlled for age to determine the influence of BMI and WHR on the variance of SBP and DBP. In this study BMI was generally correlated with SBP more strongly (beta 0.30, SE 0.21, P< 0001) than DBP (beta 0.13, SE 0.16, P<0.027). Significant results also were found for WHR as an independent positive correlate to SBP (beta 0.15, SE 13.50, P< 0.04) and DBP (beta 0.12, SE 10.16, P< 0.034).

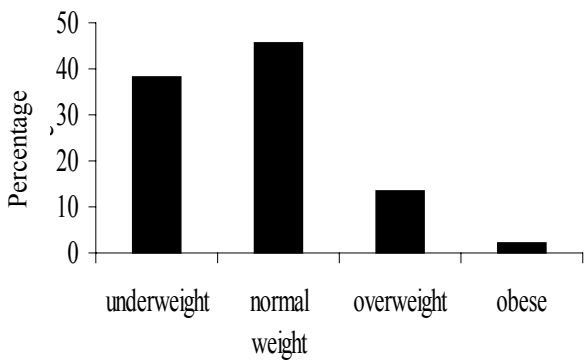

Fig. 1. Prevalence of overall body fat distribution by four categories of body mass index, for male Kermanian university students (n = 537)

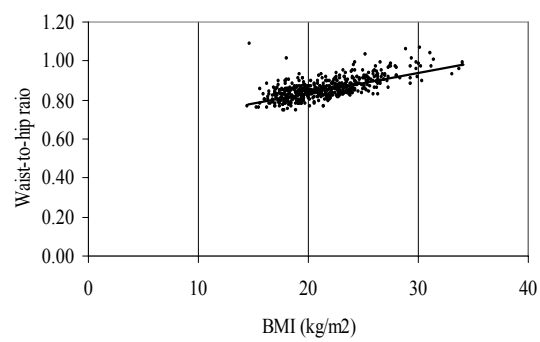

Fig. 2. Relationship between BMI and WHR in 537 Kermanian university, r= 0.680, p<0.0001

Discussion

The purpose of this study was to provide data on the prevalence of overweight and obesity and their associations with hypertension among male Kermanian university students. BMI and WHR were used in the present study for two reasons. First, due to simplicity and reproducibility of height, weight, hip and waist circumferences measurements and second, because both have been recognized as important indicators for estimating cardiovascular disease risk factors, in particular their positive association with hypertension.[12,4]

The results of the present study demonstrated that the overall prevalence of overweight and obesity were 13.6% and 2.2%, respectively. In addition, according to the present results, 11.4% of the participants had waist-to-hip circumference ratio $\geq$ 0.92.[11] The principal finding in this study was that, the prevalence of obesity among the young adult population (18.3 – 29.7 y) was lower than those reported in literature. Ajlouni et al,[13] reported that the prevalence of obesity (BMI $\geq$ 30 kg/m^2) among Jordanian adult men (25 – 29 y) was 17.8%. In the study conducted by Bonora et al,[14] to examine cardiovascular risk profile in 18 and 38 year old men, the prevalence of obesity (BMI $\geq$ 30 kg/m^2) in both groups was 8.5%. In addition, comparison between the mean BMI in the present study with those in the above-mentioned studies is also notable. Using the same definition for obesity as the present study (BMI $\geq$ 30 kg/m^2), in both the Ajlouni[13] and Bonora et al,[14] investigations, the mean BMIs were 24.9 kg/m^2 and 25.6 kg/m^2, respectively, which are much higher than 21.6 kg/m^2 , that of the present study. However, although comparison with some university students in European countries may not be entirely justified, because their data were collected as answers provided to questionnaires,[15] the mean BMI in the present study is similar to those reported for England and France (21.8 kg/m^2 and 21.6 kg/m^2, respectively), but is less than those in Greece, Iceland and Spain (Table 2).

The results of the present study showed that the prevalence of hypertension seem low. These are compared with 20.5% of overall hypertension with cut-off points of 140 or 90 mmHg or greater in young subjects aged 15-24 y.[15]

Significant positive association between either BMI or WHR and SBP and DBP was found in the present study. The independent association between BMI and either SBP or DBP is in line with previous findings.[18,19] Similarly, the results of this study that described the independent relationship between WHR and either SBP or DBP are consistent with previous reports.[19-21]

Surprisingly, however, contrasting results have been found in a number of studies.[14,22] Borona et al,[14] reported that BMI was an independent predictor for diastolic blood pres sure and not for systolic blood pressure. However, they reported that WHR was not an independent predictor for either systolic or diastolic blood pressures. They argued that

Table 2. Comparison of anthropometric characteristics (mean and standard deviation) of university students reported in different countries[15]

Country	*N*	*Age (y)*	*Weight (kg)*	*Height (cm)*	*BMI (kg/m^2)*
England	303	20.0±2.0	69.0±10.4	178.0±6.7	21.8±2.6
France	289	21.1±2.3	68.0±9.3	178.0±7.2	21.6±2.2
Greece	310	20.9±1.9	75.0±9.5	179.0±5.9	23.5±2.4
Iceland	393	21.2±2.9	76.0±10.0	182.0±5.9	23.0±2.7
Spain	369	21.2±2.6	72.0±10.0	176.0±6.6	23.1±2.7
Current study	537	21.7±2.4*	65.7±11.1	176.4±6.1	21.6±3.4

* Numbers represent Mean ± SD

failure to find an independent association between WHR and blood pressure might have been due to the fact that most of the study populations were nonobese. This argument is based on the evidence that showed regional fat distribution has an impairment effect on metabolic and haemodynamic measures only when the overall body fat is larger than a certain quantity.[23,24]

An important result of the present study is a considerably high prevalence of underweight (38.4%) among young male university students. This has been observed to be more common among girls.[15,16] Janghorbani and Parvin[16] reported that the prevalence of underweight among high school girls aged 14-21 years in Kerman, Iran was 54.6%. The authors suggested that "under-nutrition" which has been referred to as an outcome of recent post war socio-economic changes might be one of the causes, although not entirely, this may be true for Kermanian young men as well. Another possible explanation for the tendency toward being underweight among male university students may be that, since majority of the students that enrolled in Kerman University came from other provinces and lived far from their family, they may be mal- or undernourished. In order to indicate whether the BMIs of those in the sample living at home and those living far from their family are different, independent samples T-test was calculated. The results revealed a highly statistically significant (P<001) difference between the two groups. Further research in this area is needed to demonstrate these effects on the university students in Kerman, Iran.

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