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Larger hip circumference independently contributed to reduced metabolic risks in Tehranian adult women

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Abstract

Background: It has been suggested that health professionals may discard measurement of hip circumference from public health screening efforts. Before discarding the hip circumference in epidemiological surveys, it is important to consider whether any important information is likely to be lost.
Objective: To evaluate the relationship between hip circumference and metabolic risk factors in an urban adult population of Tehranian women.
Design: In this population-based cross-sectional study, a representative sample of 5720 women aged 18–74 years, were included. Demographic data was collected; anthropometric indices and blood pressure were measured according to standard protocol. Hypertension was defined based on Joint National Committee VI (JNC VI). Biochemical analysis was conducted on fasting blood samples. Diabetes was defined as fasting plasma glucose (FPG) $\geq$126 mg/dl or 2-h plasma glucose (2hPG) $\geq$200 mg/dl. Lipid disorders and components of metabolic syndrome were considered based on Adult Treatment Panel III (ATP III).
Results: Mean age of women was 39.9±14.6 years. Mean body mass index, waist-to-hip ratio, waist and hip circumferences for subjects were 27.1±5.1 kg/m^2, 0.83±0.08, 86.5±13.1 cm and 103.5±9.8 cm, respectively. Higher hip circumference was associated with lower levels of serum total- and LDL-cholesterol, serum triglyceride, fasting plasma glucose, 2-h plasma glucose, systolic and diastolic blood pressure. Subjects in the top quintile of hip circumference had higher values of serum HDL-cholesterol concentration compared to those in the lower category. After adjustment for potential confounding variables and anthropometric measures associated with higher hip circumference, a significant decreasing trend was observed for odds of having high LDL-cholesterol (odds ratios among quintiles: 1.00, 0.98, 0.97, 0.95, 0.84, respectively, *P* for trend=0.04), diabetes (1.00, 0.68, 0.58, 0.45, 0.42, *P* for trend=0.01), hypertension (1.00, 0.96, 0.82, 0.78, 0.70, *P* for trend 0.02), low serum HDL-cholesterol (1.00, 1.03, 0.86, 0.82, 0.56, *P* for trend=0.04), elevated blood pressure (1.00, 0.99, 0.82, 0.70, 0.61, *P* for trend=0.01) and abnormal glucose homeostasis (1.00, 0.69, 0.66, 0.54, 0.48, *P* for trend=0.01) among hip circumference quintile categories. Individuals in the upper category of hip circumference had lower odds of having hypercholestrolemia (0.86 vs. 1.00) and high serum triglyceride levels (0.74 vs. 1.00) compared to those in the lowest category.
Conclusion: Hip circumference is independently and inversely associated with metabolic risk factors. This study underscores the importance of continuing to measure hip circumference in epidemiologic surveys in Tehranian adult women.

Keywords: Anthropometry; Hip circumference; Metabolic risk factors; Women

1. Introduction

Obesity is one of the most common health problems, such that World Health Organization (WHO) reported overweight and obesity to be an "escalating epidemic" worldwide [1]. Obesity is associated with risk of diabetes, cardiovascular disease and some cancers [2,3]. Previous studies in Iran showed an increasingly high prevalence of obesity [4,5] and cardiovascular disease [4,6].

The obesity epidemic has raised the need for simple indicators of health risk due to obesity [7]. Anthropometric

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measurements like weight, height, waist and hip circumferences are considered simple obesity indicators [8]. Although, body mass index (BMI) as an obesity measure is related to disease risk [9], some studies suggest that the pattern of body fat distribution is a more important determinant of disease risk than body mass index [10–12] and individuals with a high proportion of abdominal fat run a higher risk for developing diabetes [13], hypertension [14] and cardiovascular disease [15].

Waist-to-hip ratio (WHR) is a measure of fat distribution and waist circumference as indicator of fat located in the abdomen. There are a number of problems inherent in the use of a ratio indicator such as WHR, including biological interpretation [16], since obese and lean individuals can have equal values of WHR. From a statistical viewpoint, ratio indices have limitations, which has been emphasized by other investigators [17]. On the other hand, recent studies suggest waist circumference (WC) as a better index for assessing body fat distribution [18,19] and prefer it to WHR because of simplicity of measurement, the ease of interpretation [20] and the stronger relation with disease risk [20,21]. Based on this association, it may possible that health professionals discard measurement of hip circumference from public health screening efforts. Before discarding the hip circumference in epidemiological surveys, it is important to consider whether any important information is likely to be lost by doing so. Limited studies published on this issue have demonstrated an apparent protective effect of a large hip circumference against the risk of developing diabetes [22], cardiovascular disease [23] and hypertension [24]. On the other hand, most studies examined such an association have been based on data from Europe or the United States and no information are available from the Asia-Pacific region, particularly from the Middle-East countries. As the predictive power of anthropometric measures for chronic disease risk is population-dependent [16] and varies from race to race [25,26], it is interesting to know that whether these associations could be extrapolated to the other populations, especially to those living in Middle-East countries. We showed in our previous investigation that WHR is a better screening measure for cardiovascular risk factors in Iranian and Middle-Eastern adult men compared to other anthropometric indicators [12]. Therefore hip circumference is of higher importance in Iran and Middle East countries compared to that in Europe or USA. This study was conducted to evaluate the association of hip circumference with metabolic risk factors in an urban adult population of Tehranian women.

2. Subjects and methods

2.1. Subjects

This study was conducted within the framework of the Tehran Lipid and Glucose Study (TLGS), a prospective study performed on residents of district-13 of Tehran with the aim of determining the prevalence of non-communicable disease risk factors and developing a healthy lifestyle to improve these risk factors [27]. In the TLGS, the samples were selected by using multistage cluster random sampling method. First, three health centers were randomly chosen from among the health centers in the area. List of all households under coverage by these health centers in this area was prepared. Households were specified according to each health center. Then, approximately 7150 households were randomly selected for participation in the TLGS. Totally, 15 005 people aged 3 years and over who are under coverage by health centers were participated in TLGS. There were 10 837 people (4543 males and 6294 females) aged 18–74 years. After excluding subjects with known coronary artery disease, diabetes and stroke and those who taking medications that would affect serum lipoprotein, blood pressure and carbohydrate metabolism, 5720 women aged 18–74 years with full relevant data were included in this study. This study was approved by the research council of Endocrine Research Center of Shaheed Beheshti University of Medical Sciences and informed written consent was obtained from each subject.

2.2. Methods

Weight was measured, while the subjects were minimally clothed without shoes using digital scales and recorded to the nearest 100 g. Height was measured in a standing position, without shoes, using tape meter while the shoulders were in a normal state [28] and body mass index (BMI) was calculated. Waist circumference was measured at the narrowest level and that of the hip at the maximum level over light clothing, using an unstretched tape meter, without any pressure to body surface and measurements were recorded to the nearest 0.1 cm, as reported previously [29]. Waist-to-hip ratio was calculated as WC divided by hip circumference. To reduce subjective error all measurements were taken by the same person.

To measure blood pressure, participants were initially made to rest for 15 min. Then a qualified physician measured blood pressure two times in a seated position using a standard mercury sphygmomanometer and thereafter the mean of two measurements was considered as the participant's blood pressure. The systolic blood pressure was defined as the appearance of the first sound (Korotkoff phase 1) and diastolic blood pressure was defined as the disappearance of the sound (Korotkoff phase 5) during deflation of the cuff at a 2–3 mm/s decrement rate of the mercury column [30].

Fasting blood samples for the measurement of glucose and lipid concentrations were drawn after the subjects had fasted overnight [31]. A 75-g oral-glucose-tolerance test was administered and 2-h postchallenge glucose concentration was measured. Fasting plasma glucose (FPG) was measured on the day of blood collection by