Original Article

Association of Wrist Circumference with Cardio Metabolic Risk Factors

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Abstract

Objective: The current study aimed to investigate the association of wrist circumference with major cardio metabolic risk factors.

Methods: This study was conducted in 2005-2007 among 3000 first-degree relatives of diabetic patients in Isfahan, Iran.

Results: Overall, 1709 (386 males and 1323 females) participants were enrolled in this study. The association of wrist circumference with cardio- metabolic risk factors was significantly positive with waist circumference (p=0.001), BMI (p=0.001), and LDL-C (p=0.01), but significantly inverse with HDL-C (p=0.001). The corresponding figure was not significant for triglycerides (p=0.13), total cholesterol (p=0.13), systolic BP (p=0.15), diastolic BP (p=0.6), and HbA1c (p=0.4).

Conclusion: Measurement of wrist circumference can serve as an easy-to-detect clinical marker to identify individuals at risk of cardio metabolic disorders, and can be used in large epidemiological studies.

Keywords: Anthropometric, Type 2 diabetes, Oral glucose tolerance test, First degree relatives, Obesity (JPMA 62: S-34; 2012).

Introduction

Non-communicable diseases, notably diabetes and cardiovascular diseases have become a global medical and public health threat. Systematic review of data from 370 country-years and 2·7 million participants revealed that glycaemia and diabetes are rising globally.[1] Of special concern in this regard is the situation of Middle Eastern countries, which is expected to have the world's highest increases in the absolute burden of diabetes in the next two decades.[2]

Epidemiological studies have suggested that genetic factors and obesity are major risk factors for the development of diabetes.[3-5]

The association of obesity and diabetes is well documented.[6,7] However, the dispute about the most valid

anthropometric index related to diabetes and cardio-metabolic risk factors remains to be resolved. For early screening, various anthropometric measurements are proposed to identify individuals at risk. Body mass index (BMI) is perhaps the commonest index used. Nonetheless, as this index cannot distinguish fat from muscle mass and cannot represent the body fat distribution, the appropriateness of this overall obesity index in predicting cardio-metabolic risk factors is questionable. Various other anthropometric indexes as waist circumference, waist-to- hip ratio and waist-to-stature ratio have been used to determine the index more closely related to cardio metabolic risk factors.[8,9] As measurement of these indexes is not easy in large population-based studies, other indexes as wrist circumference are proposed.[10] Limited experience exists in this regard.

Relatives of diabetic patients are at increased risk for developing diabetes and related cardio metabolic risk factors.[11-13] A study, entitled the Isfahan Diabetes Prevention Study was conducted in this regard among the first-degree relatives of diabetic patients in Isfahan, Iran.[14]

The current research was conducted among the participants of this study, and aimed to investigate the association of wrist circumference with major cardio metabolic risk factors in the first degree relatives of type 2 diabetes (T2DM) patients.

Methods

This study was conducted by Isfahan Endocrine and Metabolism Research Center (IEMRC) affiliated to Isfahan University of Medical Sciences, Isfahan, Iran. Participants were selected by consecutive convenient sampling from among 3000 participants aged 35-60 years who were the first degree relatives of T2DM patients, and were enrolled from 2005 to 2007 in a cohort study entitled Isfahan Diabetes Prevention Program study.

The IEMRC Medical Ethics committee approved the study and all participants gave written informed consent.

This study recruited those individuals who were the first-degree relatives of patients with T2DM, and had normal glucose tolerance test. Participants with bilateral wrist deformity as well as pregnant women were not recruited. All participants underwent an oral glucose tolerance test after 10-12 hours overnight fasting. Normal results were considered according to the 2003 American Diabetes Association (ADA) criteria.[15]

Then, persons with diabetes or pre-diabetes were excluded from the study. Plasma glucose and HbA1c were measured by GOD- PAP and ion-exchange chromatography.

Total fasting cholesterol and HDL-cholesterol (HDL-C) were measured by CHOD-PAP and triglyceride (TG) was measured by GPO-PAP method. LDL-Cholesterol (LDL-C) was calculated using the Friedewald formula, when total TG was less than 400 mg/dl.[16]

Anthropometric parameters were measured under standard protocol and by using calibrated instruments. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Blood pressure (BP) was measured twice in a seating position after 5 minute resting. Waist circumference was measured by standard method at top of iliac crest in mid axillary line. Wrist circumference was measured on the right arm at the wrist crease distal to the styloid processes (minimum circumference in this region) without the tape is too tight or too loose and with lying flat on the skin. In the case of any deformity, we measured left wrist in examination.

Statistical Analysis:

Statistical analysis was performed by SPSS software version 16.0 for windows (SPSS Inc., Chicago, Illinois, USA). Data are expressed as mean and standard deviation (SD) if distribution was normal, otherwise median is reported.

The Student t-test was used for comparison of quantitative variables, and Chi square test for comparison of categorical parameters.

Regression models determined the association of wrist circumference with other variables. P value of less than 0.05 was considered as statistically significant.

Results

Overall, 1709 (386 males and 1323 females) participants were enrolled in this study. Table presents mean and standard deviation (SD) of anthropometric, clinical and laboratory characteristics of the first-degree relatives at T2DM patient with normal glucose tolerance test.

The association of wrist circumference with cardio-metabolic risk factors revealed that this association was significantly positive with waist circumference (p=0.001), BMI (p=0.001), and LDL-C (p=0.01), and inverse with HDL-C (p=0.001).

Table: Characteristics of the study population.

	Mean (SD)
Age (years)	42.3 (6.5)
Body mass index(kg/m2)	28.4 (4.2)
Waist circumference (cm)	87.7 (9.8)
Wrist circumference (cm)	16 (1.2)
Systolic blood pressure (mmHg)	11.3 (1.6)
Diastolic blood pressure (mmHg)	7.4 (1.2)
Triglycerides (mg/dl)	155 (93.1)
Total cholesterol(mg/dl)	193 (38.3)
LDL- cholesterol(mg/dl)	117 (33.7)
HDL- cholesterol(mg/dl)	45 (11.7)
HbA1c (%)	4.9 (0.7)

The corresponding figure was not significant for triglycerides (p=0.13), total cholesterol (p=0.13), systolic BP (p=0.15), diastolic BP (p=0.6), and HbA1c (p=0.4).

Discussion

In this study, wrist circumference was significantly

correlated with indexes of generalized and abdominal obesity, i.e. BMI and waist circumference, respectively. This finding proposes that in large population-based studies, measuring wrist size as can be useful as an easy-to-detect clinical marker to identify individuals at risk of cardio metabolic disorders. Our study provides complementary evidence on recent findings on the appropriateness of measuring wrist circumference in relation to cardio metabolic risk factors. In a study among obese children and adolescents in Italy, a statistically significant association was documented between wrist circumference and insulin levels or homeostasis model assessment of insulin resistance. These associations were stronger than those between body mass index and insulin levels or homeostasis model assessment of insulin resistance. In this study, nuclear magnetic resonance imaging revealed that the relationship between wrist circumference and insulin levels or homeostasis model assessment of insulin resistance reflected the correlation with bone tissue-related areas but not with the adipose tissue ones.[17]

Several studies have determined the correlation of different anthropometric indexes with cardio metabolic risk factors. Some studies conducted in South Asian adult population found that waist-to-stature ratio is the best anthropometric parameter. For instance, a study among Singaporean women,[18] and Hong Kong Chinese[19] found that waist-to-stature ratio might be the best anthropometric index in relation to cardio metabolic risk factors. A study in Japan showed that waist-to-stature ratio is more sensitive than BMI or waist circumference to evaluate clustering of risk factors among non-obese individuals.[20] However, some studies in Western countries did not confirm this finding. A study among Canadians suggested that waist circumference and BMI correlated most closely with blood pressure and plasma lipids.[21] In a study among Americans of three race-ethnicity groups, waist circumference was more sensitive than BMI in predicting CVD risk.[22]

Measurement of wrist circumference can serve as an easy-to-detect clinical marker to identify individuals at risk of cardio metabolic disorders, and can be used in large epidemiological studies. Because of ethnic differences influencing anthropometric measures, more studies should be conducted to determine the cut points for wrist circumference.

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