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Original Research

Association between the abdominal obesity anthropometric indicators and metabolic disorders in a Chinese population

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ABSTRACT

Background: Obesity has become a major health problem in contemporary society and it is closely related to many chronic diseases, so it is an important issue for measuring adiposity accurately and predicting its future. Prevention and treatment of overweight and obesity has become one of the key prevention and treatment of metabolic disorders.

Objective: In this study, we compared the ability of the four anthropometric indicators (body mass index, waist circumstance, waist–height ratio, waist-to-hip ratio) to identify metabolic disorders (hypertension, hyperlipidaemia, hyperglycemia and hyperuricemia) by receiver operating characteristic (ROC) curve analyses and to provide evidence for clinical practice.

Methods: In this large scale cross-sectional study, 13,275 Han adults (including 7595 males and 5680 females) received physical examination between January, 2009 and January, 2010 in Xuanwu Hospital of Capital Medical University were investigated by the means of questionnaire, Meanwhile, the physical examination and serological results were recorded. A package known as Statistical Package for Social Scientist (SPSS) was employed to analyse the responses while t-test, one-way analysis of variance (ANOVA), ROC analysis and chi-square statistical methods were used to test the hypotheses.

Results: WC, WHtR, WHR and BMI were all significantly ($P < 0.001$) correlated with all metabolic risk factors regardless of gender. And the area under the curve (AUC) of WHtR was significantly greater than that of WC, BMI or WHR in the prediction of hypertension, hyperlipidaemia, hyperglycemia and hyperuricemia.

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Conclusion: Our data show that WHtR was the best predictor of various metabolic disorders. The diagnostic value in descending order was WHtR > WHR > WC > BMI. Therefore we recommend WHtR in assessment of obese patients, in order to better assess the risks of their metabolic diseases.

Background

Epidemiological and clinical studies show that obesity has become a major health problem in contemporary society, because it is associated with metabolic risk factors such as high blood pressure, glucose intolerance, blood fat abnormality (including hypercholesterolaemia, hypertriglyceridemia, combined hyperlipidaemia, Low density lipoprotein cholesterol)[1] and high blood uric acid,[2,3] which may influence the morbidity and mortality of cardiovascular diseases.[4,5] Some studies have shown that the prevalence of overweight and obesity is increasing to epidemic proportions at an alarming rate in China over the past 15 years, and the average adult body mass index and overweight rate showed a significant upward trend in China.[6] Overweight and obesity are now major contributors to the global burden of disease[7] and closely related to many chronic diseases (such as cardiovascular disease, diabetes, etc.) and their risk factors.[8–10] So measuring adiposity accurately and predicting its future comorbidities are important issues. Prevention and treatment of overweight and obesity has become one of the key prevention and treatment of chronic diseases. Many surrogate measures of adiposity like body mass index (BMI), waist–height ratio (WHtR), waist circumference (WC), and waist-to-hip ratio (WHR) may be used to predict obesity-related health risks, although they are simple measures, their validity in measuring adiposity has been testified better than some true body fat measures such as dual-energy X-ray absorptiometry (DXA),[11–13] computed tomography (CT)[14] bioelectrical impedance analysis (BIA),[15,16] however uncertainty remains over which of them performs the best. It has been suggested that the indicators of abdominal obesity, namely by waist–height ratio (WHtR), waist-to-hip ratio (WHR) and waist circumference (WC), is associated with different metabolic disorders.[5] Some studies have suggested that WHtR of 0.5 is a good cutoff for male and female across many ethnic groups,[17] however this cutoff has not been used in any clinical guideline in China as the data are inconclusive. Thus, a study was conducted in a large population sample from Han adults in Beijing. In order to verify the diagnostic potential of the WC, WHtR, WHR and body mass index (BMI) for metabolic disorders, and to provide evidence for clinical practice, we explored the association between abdominal obesity anthropometric indicators and various metabolic disorders. Meanwhile accumulating abdominal obesity and metabolic abnormalities related data work can lay a certain foundation for prevention, care and treatment of abdominal obesity.

Methods

Study participants

From January, 2009 to January, 2010, staffs and retirees (18–95 years old) were enrolled during routine health examinations in Xuanwu Hospital of Capital Medical University. Initially, a total of 20,000 records were obtained. Those with hypercortisolism, hypothyroidism, polycystic ovarian syndrome or other diseases known to result in secondary obesity, those with severe liver kidney and heart diseases, those who are taking glucocorticoid and diuretic recently were excluded. In addition subjects who are minority like Hui, man, Meng were also excluded. Those who participate in multiple tests, we take physical examination data results for the last time. After all exclusions, 13,275 subjects were eligible for data analysis. All of the participants signed the informed consent, and this study was approved by the Ethical Committee of Capital Medical University.

Anthropometric measurements

Anthropometric indices were measured with participants dressed in light clothing and barefoot. Height, weight, waist circumference, and hip circumference were measured. Four different measurements of adiposity were conducted: 1) BMI was calculated as the weight (kilograms) divided by the square of the height (metres) (kilograms per square metre); 2) WC (centimetre) was taken at the midway point between the inferior margin of the last rib and the ilium in a horizontal plane; 3) WHtR (Waist-to-height) was calculated as the WC (centimetre) divided by height (metres) (centimetres per metre); 4) WHR (Waist–hip ratio) was calculated as the WC (centimetre) divided by HC (centimetre).

Blood pressure measurement

Blood pressure was measured three times consecutively after five minutes rest with each participant seated and using a standard mercury sphygmomanometer. The average of the second and third measurements was used in the analyses.

Laboratory measurements

Fasting blood samples were collected in the morning after an overnight fast for at least 12 h by venipuncture for laboratory measurements and genotype analysis. Levels of total and high-density lipoprotein (HDL) cholesterol and triglycerides

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