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Abstract

We re-evaluated the criteria for waist circumference to predict the accumulation of the components of metabolic syndrome. We used data for 3,185 Japanese, aged 20-79 years. Metabolic syndrome has recently been redefined by a new criterion in Japan, in which waist circumference cutoff points, i.e. 85 cm for men and 90 cm for women, are employed. Among the 3,185 Japanese considered in the present study, 335 men (26.8%) and 69 women (3.6%) were diagnosed as having metabolic syndrome. A cutoff point as a predictor for 2 or more components of metabolic syndrome was evaluated by sensitivity/specificity and a receiver operating characteristic (ROC) curve. The optimal point was estimated as being approximately 85 cm of waist circumference in men and 75 cm in women. We therefore recommend a cutoff value, 75 cm of waist circumference, for the criterion of metabolic syndrome in women.

KEYWORDS: metabolic syndrome, waist circumference, sensitivity, specifi city, receiver operating characteristic (ROC) curve

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Short Communication

Re-evaluation of Waist Circumference in Metabolic Syndrome: A Comparison between Japanese Men and Women

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We re-evaluated the criteria for waist circumference to predict the accumulation of the components of metabolic syndrome. We used data for 3,185 Japanese, aged 20–79 years. Metabolic syndrome has recently been redefined by a new criterion in Japan, in which waist circumference cutoff points, *i.e.* 85 cm for men and 90 cm for women, are employed. Among the 3,185 Japanese considered in the present study, 335 men (26.8%) and 69 women (3.6%) were diagnosed as having metabolic syndrome. A cutoff point as a predictor for 2 or more components of metabolic syndrome was evaluated by sensitivity/specificity and a receiver operating characteristic (ROC) curve. The optimal point was estimated as being approximately 85 cm of waist circumference in men and 75 cm in women. We therefore recommend a cutoff value, 75 cm of waist circumference, for the criterion of metabolic syndrome in women.

Key words: metabolic syndrome, waist circumference, sensitivity, specificity, receiver operating characteristic (ROC) curve

Metabolic syndrome is now one of the major targets of the current public health challenge. Since the work of Reaven [1], the syndrome has been well-documented to be associated with an increased risk of cardiovascular disease and is correlated with all-cause mortality [2]. At present, the internationally recognized definitions of metabolic syndrome have been released, namely the criteria of the World health Organization [3], the National Cholesterol Education Program's Third Adult Treatment Panel Report (ATPIII) [4], and the International Diabetes Federation (IDF) [5]. A new criterion for metabolic syndrome has recently been defined in Japan [6], and we have previously reported that 30.7% of men and 3.6% of women can be diagnosed as having metabolic syndrome, with the prevalence being 10-fold higher in men than in women based on use of the new criterion [7]. This difference between men and women was due to the prevalence of women with a waist circumference in excess of 90 cm being significantly lower than that of men with a waist circumference exceeding 85 cm. The cutoff point of waist circumference corresponds to 100 cm^2 of the visceral adipose area measured by computed tomography at the umbilical level. The aim of this study was to re-evaluate the waist circumference for detecting metabolic risk accumulation in Okayama prefecture, Japan.

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Subjects and Methods

We used data for 3,185 Japanese (1,252 men and 1,933 women) aged 20–79 years, who received annual health check-ups at Okayama Southern Institute of Health with informed consent. We measured waist circumference at the umbilical level. Metabolic syndrome was defined among men and women as waist circumferences in excess of 85 cm and 90 cm [6], respectively, in addition to having 2 or more of the following components: 1) Dyslipidemia: triglycerides ≧ 150 mg/dl and/or HDL cholesterol < 40 mg/dl; 2) High blood pressure: blood pressure ≧ 130/85 mmHg; 3) Impaired fasting glucose: fasting plasma glucose ≧ 110 mg/dl [6].

Results

The mean age of the study subjects was 46.7 ± 12.3 years for men and 48.5 ± 12.6 years for women. Among the 3,185 Japanese subjects, 618 men (49.4%) had a waist circumference in excess of 85 cm and 126 women (6.5%) had a waist circumference exceeding 90 cm. In addition, the prevalence of metabolic syndrome was found to gradually increased with age, and 335 men (26.8%) were diagnosed with having metabolic syndrome in men. The prevalence of metabolic syndrome also gradually increased with age in women, especially over the age of 50, though only 69 women (3.6%) were diagnosed with metabolic syndrome.

We investigated the sensitivity and specificity of waist circumference in predicting the association with 2 or more metabolic risk factors, *i.e.* dyslipidemia, high blood pressure, and impaired fasting glucose. In men, the sensitivity and specificity of the waist circumference criterion, *i.e.* 85 cm, were 66.3 % and 62.1%, respectively. However, in women, the sensitivity and specificity of waist circumference criterion, 90 cm, were found to be 16.0% and 96.2%. A cutoff point as a predictor for 2 or more components of metabolic syndrome was evaluated by sensitivity/specificity curves as well as a receiver operating characteristic (ROC) curve. The optimal point yielding the maximal sensitivity plus specificity for predicting 2 or more risk factors was estimated to be

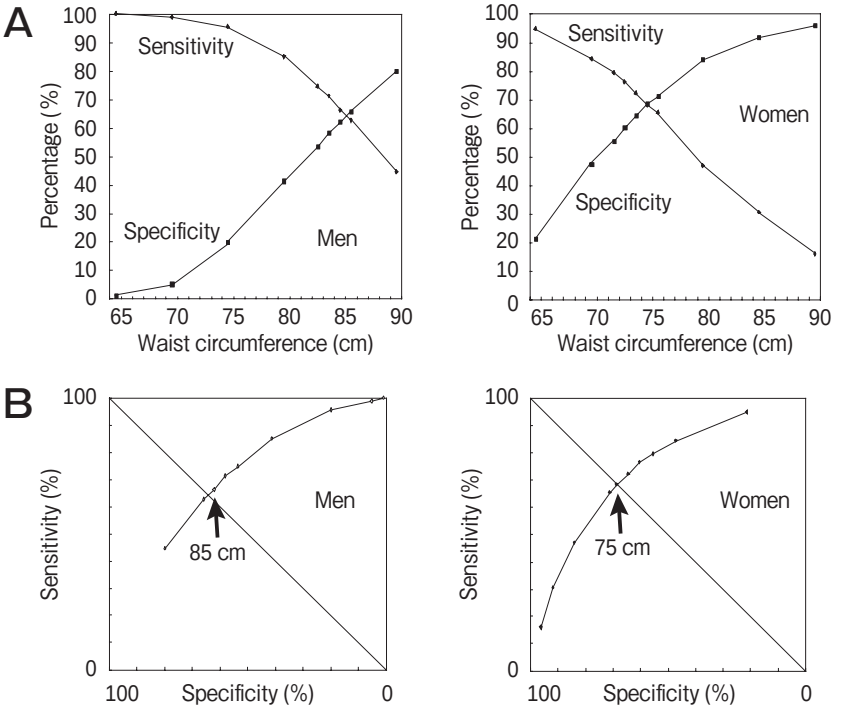

Fig. 1 A, Sensitivity/specificity curve of waist circumference for detecting metabolic risk factor accumulation; B, Receiver operating characteristic (ROC) curve of waist circumference for detecting metabolic risk factor accumulation.

approximately 85 cm (sensitivity: 66.3%, specificity: 62.1%) of waist circumference in men and 75 cm (sensitivity: 68.2%, specificity: 68.7%) in women (Fig. 1). Consequently, 764 women (39.5%) had a waist circumference exceeding 75 cm and 294 women (15.2%) were diagnosed as having metabolic syndrome by using 75 cm as the waist circumference criterion.

Discussion

The primary finding of this study was that a waist circumference of 75 cm in women is appropriate for predicting the clustering of the components of metabolic syndrome. In men, the criterion of waist circumference deduced from our study was exactly matched to that of the new criterion in Japan. In women, however, the cutoff of waist circumference in our study was lower than that of the new criterion in Japan. Hara K and Kadowaki T *et al.* have also reported that waist circumference of 85 cm in men and 78 cm in women are cutoff points yielding the maximal sensitivity plus specificity for predicting the presence of multiple risk factors [8]. Miyazaki T and Nakao K *et al.* have reported that, by using the computed tomography, visceral fat accumulation of 65 cm^2 is optimal for evaluating multiple risk factors, and the corresponding cutoff value for waist circumference is 77 cm in women [9]. Although we did not measure visceral fat accumulation by computed tomography, the prevalence ratio of metabolic syndrome (men/women) based on use of a waist circumference of 75 cm in women was similar to that of cardiovascular diseases in Japan (Ministry of Health, Labor and Welfare, Japan. Available from wwwdbtk.mhlw.go.jp/toukei/kouhyo/data-kou18/data12/junkan-h12-2.pdf accessed Apr 15, 2006, in Japanese).

Potential limitations remain in our study. The cross-sectional study design of our study makes it difficult to infer causality between waist circumference and metabolic risk factors. The enrolled subjects in our study voluntarily received the annual health check-ups; they were therefore more health-conscious than average, which may have caused some bias in the current study. In addition, McNeil AM *et al.* assessed the association between metabolic syndrome using the ATPIII definition and cardiovasucular disease with an 11-year follow-up period, and they reported that waist circumference is not a significant predictor for cardiovascular disease [10]. Therefore, our findings are not fully applicable to clinical and public health practice settings. In conclusion, although follow-up studies are required to prove the feasibility of the definition of metabolic syndrome to predict the development of cardiovascular disease, we would recommend a cutoff value of 75 cm of waist circumference as a criterion for metabolic syndrome in women.

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