

OBSERVATIONS

Optimal Waist Circumference Measurement Site for Assessing the Metabolic Syndrome

In the assessment of diagnostic criteria for the metabolic syndrome, much work, including ours (1), has been done to identify an optimal cutoff value for waist circumference, i.e., one that best predicts the clustering of metabolic risk factors. By contrast, little attention has been paid to the waist circumference site to be measured and its impact on the prevalence of metabolic syndrome, although definitions of waist circumference measurement vary among guidelines for the syndrome. This point should be clarified given the large variations in waist circumference according to the site measured (2).

We measured waist circumference at various sites in 1,140 Japanese subjects (969 men and 171 women), aged 20–70 years, who underwent periodic health examinations at Tsurumi Health Center, Kanagawa, and who agreed to participate in the present study. The waist circumference locations that were measured in this study included the midpoint between the lowest rib and the iliac crest, as defined by the World Health Organization; the umbilical level, as defined by the Japanese metabolic syndrome guidelines; and immediately above the iliac crest, as defined by the National Cholesterol Education Program's Adult Treatment Panel III (NCEP-ATPIII) guidelines.

The mean waist circumference values at the midpoint, umbilical level, and iliac

crest were 85.2, 86.8, and 87.2 cm in men and 73.1, 78.8, and 82.5 cm in women, respectively. The mean difference between the minimum (midpoint) and maximum (iliac crest) measurement was much greater in women (9.4 cm) than in men (2.0 cm). We then drew receiver operating characteristic curves to determine which waist circumference best predicts the presence of two or more components (other than waist circumference) of the metabolic syndrome, as defined by the NCEP-ATPIII. The receiver operating characteristic curves appeared to be very similar; in fact, there was no statistically significant difference in the area under the curve among the three waist circumferences in either men or women. However, the prevalence of metabolic syndrome changed considerably according to the site of waist circumference measurement if the same cutoff value for waist circumference was applied; 11% fewer men and 21% fewer women met the NCEP-ATPIII criteria for the metabolic syndrome with waist circumference measured at the midpoint than at the original site, the iliac crest.

These results raise at least two possibilities. First, the waist circumference measurements assessed at different sites would have a similar ability to screen for clustering of metabolic risk factors. This notion is supported by the conclusion of a review (3) that showed no measurable difference in morbidity or mortality according to the protocol for the waist circumference measurement. Second, the metabolic syndrome prevalence may be either overestimated or underestimated, especially in women, if waist circumference is not measured at the location specified in the corresponding guidelines. This point is critical when comparing the metabolic syndrome prevalence across studies, and close attention should, thus, be paid to whether waist circumference is

measured at the site described in each set of guidelines.

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References

1. Hara K, Matsushita Y, Horikoshi M, Yoshiike N, Yokoyama T, Tanaka H, Kadowaki T. A proposal for the cutoff point of waist circumference for the diagnosis of metabolic syndrome in the Japanese population. *Diabetes Care* 2006;29:1986–1987
2. Wang J, Thornton JC, Bari S, Williamson B, Gallagher D, Heymsfield SB, Horlick M, Kotler D, Laferrère B, Mayer L, Pi-Sunyer FX, Pierson RN Jr. Comparisons of waist circumferences measured at 4 sites. *Am J Clin Nutr* 2003;77:379–384
3. Ross R, Berentzen T, Bradshaw AJ, Jansen I, Kahn HS, Katzmarzyk PT, Kuk JL, Seidell JC, Snijder MB, Sørensen TI, Després JP. Does the relationship between waist circumference, morbidity and mortality depend on measurement protocol for waist circumference? *Obes Rev* 2008; 9:312–325