Optimal definitions for abdominal obesity and the metabolic syndrome in Andean Hispanics: The PREVENCION Study

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Additional information for this article can be found in an online appendix at http://care.diabetesjournals.org

Submitted 23 December 2009 and accepted 19 February 2010.

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Objectives: We aimed to establish optimal definitions for abdominal obesity and metabolic syndrome (MetS) among Andean adults.

Research Design and Methods: Among 1448 Andean adults, we assessed the relationship between waist circumference (WC) and: (1) Subclinical vascular disease assessed by carotid intima-media thickness (cIMT); (2) Manifest cardiovascular disease (M-CVD).

Results: Optimal WC cutoffs to classify individuals with abnormal cIMT or M-CVD were >97 and >87 cm in men and women, respectively. With these cutoffs, there was substantial disagreement between the original American Heart Association/National Heart, Lung and Blood Institute (AHA/NHLBI) and the recently updated MetS definition, particularly among men (kappa=0.85). Subjects with MetS identified by the updated definition but not meeting original AHA/NHLBI MetS-criteria demonstrated significantly increased cIMT ($p<0.001$) compared to subjects who did not meet MetS-criteria by either definition.

Conclusions: Our findings support the use of ethnic-specific WC cutoffs and the updated MetS-definition in Andean adults.
In contrast to the Third Report of the High Blood Cholesterol Adult Treatment Panel and the original American Heart Association/National Heart, Lung and Blood Institute (AHA/NHLBI) criteria for the diagnosis of metabolic syndrome (MetS) (1), the International Diabetes Federation (IDF) established abdominal obesity as a prerequisite for the diagnosis of MetS (2) and suggested ethnic-specific waist circumference (WC) cut-points. A recent statement by IDF/NHLBI/AHA, World Heart Federation, International Atherosclerosis Society and International Association for the Study of Obesity, established an updated MetS-definition (hereby referred to as “updated definition”) based on ethnic-specific WC-cut-points but not requiring the presence of abdominal obesity, as long as at least 3 remainder components are present. In the absence of data from South-Americans, WC-cut-points derived from South-Asians were recommended (3), but it is unclear whether these are truly appropriate (4; 5; 3; 6).

We aimed to determine:
(1) Appropriate WC-cut-points for defining abdominal obesity in Andean-Hispanics;
(2) The agreement between the presence of MetS diagnosed by original AHA/NHLBI versus updated criteria and resulting differences in MetS prevalence estimates;
(3) The relationship between both criteria and the presence of subclinical and manifest vascular disease.

RESEARCH DESIGN AND METHODS
The design and methods of the PREVENCION study have been previously published (7). The study included a large probabilistic sample of Andean-Mestizos aged 20-80 years from Arequipa, Peru. The study was approved by the Santa Maria Catholic University Human Research Committee. Participants gave informed consent. Details regarding original AHA/NHLBI and updated MetS-definitions are available elsewhere (8; 3). In the updated MetS-definition, abdominal obesity was defined using ethnic-specific WC-cut-points derived from initial analyses in our study. cIMT was measured with high-resolution carotid-ultrasonography in the 1-cm proximal to the carotid bulb. (9)

To define cut-points for abnormal-cIMT, we selected a reference sample (n=472; 45.3% men) using the following exclusion-criteria: (1) Coronary heart disease, heart failure, stroke, peripheral vascular disease, or previous myocardial infarction; (2) Systolic blood pressure ≥140mmHg, diastolic blood pressure ≥90mmHg, antihypertensive drug treatment; (3) Diabetes mellitus (fasting blood glucose ≥126mg/dL or pharmacologic treatment for diabetes); (4) LDL-cholesterol >130mg/dL; (5) Lipid-lowering-therapy; (6) Current smoking; (7) Body mass index ≥30 kg/m².

Age-independent, gender-specific cIMT-cut-points were defined from 95th-percentiles from all men and women in the reference sample. Gender/age-specific cIMT-cut-points for high-cIMT were defined using curve-estimation procedures (R²>0.95) in reference participants based on 95th-percentiles within each decade of life. (10) Manifest-CVD was defined as coronary heart disease, heart failure, stroke, peripheral vascular disease, previous myocardial infarction or diabetes mellitus (considered a vascular-disease risk-equivalent) (1).

We constructed receiver-operator-characteristic (ROC)-curves to identify optimal WC-cut-points as values resulting in the largest sum of sensitivity and specificity for the presence of abnormal-cIMT or manifest-CVD. A final WC-cut-point value was defined for each gender as the average value weighted for the area under the ROC-curve for each endpoint.
Once optimal WC-cut-points were defined, we assessed statistical agreement between original AHA/NHLBI and updated MetS definitions using the kappa-statistic. We compared cIMT between agreement categories using analysis of covariance, adjusting for gender. Analyses are age-standardized to the World Health Organization standard world population (11).

RESULTS
Characteristics of the study population are shown in online-appendix Table-A1 which is available at http://care.diabetesjournals.org. Areas under the ROC-curves for WC as a predictor of abnormal-cIMT (online-appendix Table-A2) ranged between 0.58-0.70. In women, optimal WC-cut-points to detect an abnormal-cIMT based on age-specific cutoffs, abnormal-cIMT based an age-independent cutoff and manifest-CVD were 86, 86 and 89 cm, respectively. In men, corresponding optimal WC-cut-points were 96, 99 and 96 cm. Optimal weighted-average WC-cut-points for were 97 cm for men and 87 cm for women. These cut-points correspond to waist-to-height ratios of 0.577 and 0.560 in men and women, respectively.

Using these cutoffs, the updated MetS-definition generated greater prevalence estimates than the original AHA/NHLBI definition (online-appendix Table-A3). The original AHA/NHLBI and updated definitions differed in classifying 4.4% of men (κ=0.85) and 1.3% of women (κ=0.99; Figure-1A). Between-gender differences in the prevalence of MetS were less pronounced with the updated definition than the original AHA/NHLBI definition.

Figure-1B shows gender-adjusted mean-cIMT among subjects with and without MetS according to the original AHA/NHLBI definition (left-panel) and subjects with and without MetS according to the updated definition (center-panel). The right-panel compares cIMT among subjects meeting updated but not original AHA/NHLBI criteria (middle-bar) versus those who do not meet criteria by any definition (left-bar) and those who meet criteria by both definitions (right-bar). Either definition identified subjects with increased cIMT. However, compared to those who did not meet criteria by either definition, cIMT was significantly higher among subjects who met updated but not original AHA/NHLBI MetS-criteria, but was highest in subjects who met criteria by both definitions (P<0.001).

CONCLUSIONS
In Andean-Hispanic adults, WC-cut-points of >97 cm in men and >87 cm in women provide optimal discrimination for cardiovascular risk assessment as judged by the presence of manifest-CVD or increased cIMT. Using these cut-points in the context of the updated MetS-definition, we found considerable disagreement between the updated and original AHA/NHLBI definitions among men. The updated criteria identified a larger proportion of subjects. Individuals who met only updated MetS-criteria (and not original AHA/NHLBI-criteria) demonstrated higher cIMT compared to subjects who did not have MetS by either criteria, indicating that the more sensitive updated classification is not spurious but rather predictive of early vascular disease. These findings are important because they provide preliminary definitions of abdominal obesity for the purpose of atherosclerotic risk assessment and because they identify a useful operative MetS-definition in Andean-adults, until more definitive, prospective data become available.

The lower WC-cut-points identified among Andean men may result from a lower body height (resulting in lower WC for any given fat distribution and waist-to-height ratio), from ethnic-related differences in body fat accumulation or from competing risk factors (unrelated to abdominal obesity) for the development of CVD in this population.
Our study is limited by its cross sectional nature and because it may not representative of all mixed-Andean populations.

In conclusion, our findings support the use of ethnic-specific cutoff points for abdominal obesity (>97 cm in men and >87 cm in women) and the use of the updated definition for the diagnosis of MetS in Andean Hispanic adults.

ACKNOWLEDGMENTS

Sources of funding: The PREVENCION study was supported by the Santa Maria Research Institute, AQP, Peru. JAC is supported by National Institutes of Health grant RO1-HL080076 and American Heart Association National Research Award #0885031N. CAP is supported by the National Institutes of Health Office of the Director, Fogarty International Center, Office of AIDS Research, National Cancer Center, National Eye Institute, National Heart, Blood, and Lung Institute, National Institute of Dental & Craniofacial Research, National Institute On Drug Abuse, National Institute of Mental Health, National Institute of Allergy and Infectious Diseases Health, and NIH Office of Women’s Health and Research through the International Clinical Research Fellows Program at Vanderbilt University (R24 TW007988).

Conflict of interest/disclosures: We declare that we have no conflicts of interest.

Figure 1.
Prevalence of different categories of agreement between updated and AHA/NHLBI MetS definitions in men (n=723) and women (n=662) (A) and mean cIMT in subjects with and without MetS according to the original AHA/NHLBI definition and the updated definition (B).

In figure 1B, the left panel shows mean cIMT among subjects with (n=401) and without (n=984) MetS according to original AHA/NHLBI definition. The middle panel shows the mean cIMT among subjects with (n=444) and without (n=941) MetS according to updated MetS definition. The right panel shows mean cIMT among subjects who do not meet MetS criteria by any definition ("No MetS", left bar; n=941), those who meet updated criteria but not original AHA/NHLBI criteria ("Updated criteria only", middle-bar; n=43) and those who meet MetS criteria by both definitions ("Both", right bar; n=401). Point estimates and 95% confidence intervals (bars) are shown. All comparisons are adjusted for gender.
REFERENCES


 Definitions for MetS in Andean Hispanics

Figure 1a

![Bar chart showing proportion of No MetS, MetS by AHA/NHLBI, and MetS by updated criteria only for men and women. K values are 0.85 for men and 0.99 for women.]

Figure 1b

![Graph showing carotid IMT (mm) for different categories of MetS using AHA/NHLBI and updated definitions, with p-values indicated.]