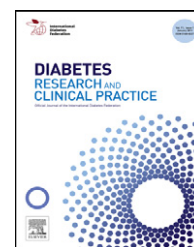




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Determination of the cutoff point for waist circumference that establishes the presence of abdominal obesity in Latin American men and women

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ABSTRACT

Aims: The recent definitions of the metabolic syndrome (MS) recognize the need for ethnic and region-specific waist circumference (WC) cut-offs that identify people with abdominal obesity. We tested WC as a diagnostic tool to identify people with visceral adiposity in Hispanics from the Latin America region.

Methods: We used the area of visceral adipose tissue (VAT) ≥ 100 cm² at the level between the 4th and 5th lumbar vertebrae in abdominal CT scans as a marker of visceral adiposity and established the optimal WC threshold for men and women by means of receiver operating characteristic (ROC) curves.

Results: 179 men and 278 women from Mexico, El Salvador, Venezuela, Colombia and Paraguay were included. The ROC curves were highly discriminative of excess VAT for men and women (area under the curve 0.9 and 0.8 respectively) and the WC threshold was identified at 94 cm for men and between 90 and 92 cm for women.

Conclusion: In men the WC cutoff was equal to that proposed for Europeans and suggested for US adults who may have strong genetic contribution to insulin resistance such as Hispanics. In women the threshold was significantly higher than previously proposed for South and Central Americans.

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1. Introduction

There have been recent developments in the concept of the Metabolic Syndrome (MS) and its diagnostic implications. Since its original description as an insulin resistance syn-

drome [1], the emphasis has been shifting towards visceral adiposity as one of the main determinants of insulin resistance and the other abnormalities found in the MS. This led to the most recent harmonized definition of the MS proposed as a joint interim statement of the International Diabetes Federation (IDF), the National Heart, Lung, and Blood

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Institute (NHLB), the American Heart Association (AHA), the World Heart Federation (WHF), the International Atherosclerosis Society (IAS) and the International Association for the Study of Obesity (IASO), where abdominal obesity (AO) is considered one of the essential components and the waist circumference (WC) is recommended as the best way to assess it [2]. The document recognizes the need for ethnic-specific WC cut-offs and incorporates regional values based on available data linking WC to other components of the MS in different populations. For ethnic South and Central Americans they followed the previous recommendation made by the IDF to use the Asian cut-offs (WC ≥ 90 cm for men and ≥ 80 cm for women) until more specific data is available [3]. In the International Day for Evaluation of Abdominal adiposity (IDEA), a large international, cross-sectional study evaluating WC measured by a standardized protocol in 168,000 primary care patients on two pre-specified half-days in 63 countries, the mean WC found in Latin American men and women was higher than that found in Asians and more similar to that found in Eastern Europe [4]. In fact, AO was grossly overestimated in women compared with men within the normal BMI range when the 80 cm and 90 cm cut-offs were used respectively [5], suggesting the need to reconsider these values particularly in Latin American women and to establish more adequate WC cut-offs for our region. The purpose of the present study is to evaluate the optimal WC cutoffs for South and Central men and women by relating them with the amount of visceral adipose tissue.

2. Materials and methods

This was a multicenter study for the evaluation of a diagnostic test and cut-off point determination involving five Latin American countries: Mexico, El Salvador, Venezuela, Colombia and Paraguay.

Study population: men and women aged more than 18 years who had to undergo an abdominal CT scan ordered by their physician were selected consecutively in each of the participant centers. They were asked to allow the analysis of the area of visceral adipose tissue (AVAT) in their scan and measure their weight, height and WC on site by signing an informed consent.

Subjects were excluded if they had any health condition or procedure that may alter the distribution of body fat compartments or the anatomy of the abdominal cavity such as pregnancy, recent laparotomy (≤ 8 days), invasive procedures in the abdomen (catheters, etc.), ascitis, congestive heart failure (III–IV NYHA), intra-abdominal masses, metastatic cancer in the abdominal cavity, peritonitis, peritoneal abscess, visceral enlargement, neumoperitoneum, intestinal obstruction, toxic megacolon and other causes of bowel distension, abdominal radiotherapy, liposuction, VIH positive with retroviral treatment and glucocorticoid treatment (except inhaled or topical).

Body composition measurements: WC was measured by a trained health professional at the midpoint between the lower rib and the iliac crest using a tape which surrounded the bare skin of the abdomen parallel to the floor at the end of normal expiration. Participants were asked to stand with their weight

equally distributed on both feet, and arms at their sides. Measurements were made twice and the average was used as the recorded value to the nearest 0.1 cm. Height was measured to the nearest 1 cm and weight to the nearest 0.1 kg.

Area of visceral adipose tissue (AVAT) measurement: The CT scans were obtained from different equipments but using a standard procedure capable of taking 1 cm slices during suspended respiration. Images were recorded in the DICOM format and read centrally at the San Ignacio University Hospital using the validated biomedical image analysis software slice-O-matic (Tomovision, Montreal, Canada) [6]. The readings were done by a single trained radiologist who was blinded to the body composition measurements. The AVAT was measured in cm^2 in a single slice at the level between the 4th and 5th lumbar vertebrae. The radiologist also screened for signs revealing any exclusion criteria identifiable in the CT scan which invalidated the reading, such as invasive procedures in the abdomen (catheters, etc.), ascitis, intra-abdominal masses, metastatic cancer in the abdominal cavity, peritonitis, peritoneal abscess, visceral enlargement, neumoperitoneum, intestinal obstruction, toxic megacolon and other causes of bowel distension.

2.1. Statistical analysis

The sensitivity and specificity of the different cutoff points for WC were calculated using an AVAT $\geq 100 \text{ cm}^2$ measured in the CT scan as the reference test for the diagnosis of AO. The receiver operating characteristic (ROC) curves were constructed using the established cut-off point for the reference test (AVAT $\geq 100 \text{ cm}^2$) and the performance of WC was evaluated as the anthropometric predictor. The sensitivity and specificity were calculated for every 1 cm of WC, and the point with the highest value for both (the least distance from upper-left corner to ROC curve) was selected as the optimal threshold.

Pearson's correlation coefficient (r) was also calculated for the relationship between waist or VAT and weight, height, BMI or age.

3. Results

179 men and 278 women were included in the analysis. Their general characteristics are shown in Table 1. 72% of the men

Table 1 – General characteristics of the people included in the study expressed as mean $\pm$ standard deviation or percentage.

Characteristic	Men	Women
n	179	278
Age (yrs)	44.8 $\pm$ 15	45.9 $\pm$ 16.5
Weight (kg)	82.4 $\pm$ 16.4	70.3 $\pm$ 15.5*
Height (m)	1.72 $\pm$ 0.07	1.58 $\pm$ 0.07*
BMI (kg/m^2)	27.9 $\pm$ 5.1	28.4 $\pm$ 6.3
Overweight (BMI 25–29.9 kg/m^2)	40.2%	31.7%
Obese (BMI $\geq 30 \text{ kg}/\text{m}^2$)	31.8%	37.4%
Waist (cm)	98.0 $\pm$ 12.2	92.3 $\pm$ 14.4*
AVAT (cm^2)	131.4 $\pm$ 68.5	123.2 $\pm$ 70.4
AVAT $\geq 100 \text{ cm}^2$	55.3%	47.8%

* $p < 0.0001$ women vs. men.

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