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Review

Waist circumference percentiles in Hispanics aged 18–102 years

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SUMMARY

Background & aims: The assessment of obesity and of excess through the pattern of total body fat distribution, measured through the waist circumference, and its use as a clinical marker have been recommended. The aim of this study was to classify the waist circumference (WC) percentile values according to age and gender, in a population-based sample of Venezuelan adults.
Materials and methods: The WC values percentile in a sample of 4600 healthy adults (2182 men and 2418 women) aged 18–102, from Caracas. The percentile curves were derived using the Cole's LMS method. The statistical significance between percentile pairs ($p < 0.05$) a Wilcoxon Test was applied.
Results: The existence of significant differences for the WC for the group studied by gender and age groups are evidenced ($p < 0.05$). The mean values for the WC for the total group in men and in women were 82.8 ± 9.8 cm and 74.9 ± 10.8 cm, respectively.
Conclusions: The percentile distribution of the WC in Venezuelan adults can be used to diagnose and assess abdominal obesity, in clinical practice as well as in public health. However, new researches would be necessary to support the definition of the cut-off points separated by age and gender.
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1. Introduction

Nowadays, obesity is considered a public health problem in modern societies, as well as in developing countries. Its prevalence varies according to the ethnic group, social group and gender. The evaluation of total body fat distribution's pattern in obesity – specifically the abdominal perimeter measure – has been recommended as a clinical marker during the last years. Increased waist circumference (WC) has been correlated with the onset of coronary disease due to the excess of visceral fat at intra-abdominal level. This excess of fat increases the lipolytic sensibility and its capacity to release free fatty acids to the portal circulation, which exposes the liver to hyperlipidemia, increases the hepatic production of glucose and decreases the hepatic depuration of insulin.[1–3] These metabolic events cause insulin resistance, arterial hypertension, glucose intolerance and compensatory hyperinsulinemia, which are considered the core factors for development of Metabolic Syndrome and cardiovascular/diabetes mellitus diseases.[1–3]

The technique to measure WC is simple, just requiring a low cost instrument (measurement tape), and following a standard protocol that can be acquired with minimum training. These characteristics place WC measurement as an effective method to be widely implemented in preventive consultations, where identification and screening of risk factors can be easily achieved.

Several international organizations, such as National Heart, Lung and Blood Institute (NHLBI) – Adult Treatment Panel III (ATP III),[4] "Consenso Mexicano sobre el Tratamiento Integral del Síndrome Metabólico" (CMSM),[5] Consensus of the International Diabetes Federation (IDF),[6] European Group for the Study of Insulin Resistance[7] and Sociedad Espanola para el Estudio de la Obesidad (SEEDO),[8] have defined cut-off points to be used when assessing WC values, classifying them by gender, ethnic groups or geographical areas. In 2002, Berdasco et al. were one the first researchers analyzing Hispanic groups, measuring WC percentiles in the Cuban adult population, and associating these values to other indicators related to obesity and morbidity risk.[9]

WC values substantially change from one population to another. One of the factors determining this variability is the heterogeneity found on the body composition with respect to subcutaneous and intra-abdominal adipose tissues. Consequently, the standardization of international WC cut-off points applicable to all age/gender/

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ethnic/race groups has not been determined.[10,11] Carrol et al. have reported differences in the quantity of visceral adipose tissue from several ethnic groups (Hispanic, White and African American), suggesting the need to adapt the WC cut-off points according to the racial group.[12]

The objective of the present research was to classify WC percentile values according to age and gender, in a population-based sample of Venezuelan adults from 18 to 102 years of age. These results could be used to screen central adiposity.

2. Materials and methods

The study is descriptive, cross-sectional and non-experimental. The sample, intentional non-probabilistic, was collected by the subjects measured in a major project "LEN-USB-CINAS II", conducted by three research centres. The participating centres were as follows: Laboratorio de Evaluacion Nutricional from Universidad Simon Bolivar (LEN-USB), Centro de Investigaciones Nutricionales, Antropologicas y de Salud (CINAS) and the Unidad de Estudios Morfologicos y de Salud from Universidad Central de Venezuela (UCV), all situated in Caracas, Venezuela. The total sample of the study used to obtain the percentile values of the waist was 4600 healthy adults (2182 men and 2418 women) aged 18–102, from the city of Caracas, separated by age and gender groups, as well as the variable measurements and the weight anthropometric indicators, size and body mass index (Table 1). The studied subjects were residents of the city of Caracas, mainly urban population whose sanitary conditions and life style have been associated with the appearance of chronic diseases non-transferable to adults, such as cardiovascular diseases which represent the first cause of morbid-mortality in the country. As to specific information on health conditions, these were not asked, as this study was limited to the performance measurement of anthropometric variables.

Prior to the study, all the ethical principles stated in de Declaration of Helsinki of 1964, revised in 2000, which define the ethical guidelines for research on humans, were met, fulfilling the informed consent on the part of the participants.

To measure the weight anthropometrical variables (kg), a digital balance was used with an (Detecto, Webb City MO) with an accuracy of 50 g and for size (cm) it was taken with a portable stadiometer (Holtain Limited U.K.) (accuracy 0.01 cm), in underwear and without shoes.

Body mass index (BMI, kg/m) was calculated as weight divided by the square of height in meters. The waist perimeter (cm) was measured with a Rosscraft metallic measuring tape (0.1 cm scale). The measurement was taken at the end of a normal expiration, with the subject standing-up, without clothes and relaxed, at the mid-point between the lower costal margin and upper border of the iliac crest, parallel to the floor and ensuring that the tape is tight but not compressing the skin. These variables were taken by specialized personnel, previously trained and standardized, meeting the protocol of quality control and the ranges internationally established for both the intra-measurer and inter-measurer error and following the regulations of the international biological programme.[13]

2.1. Statistical analysis

To verify the differences of the variables between age and gender of the study group, an Analysis of Variance (ANOVA), significance ($p < 0.001$ and 0.05) was applied.

The values of the percentile curves (Table 3 and Figs. 1 and 2) were built using the LMS method of Cole with the software ImsChartMaker, Light version 2.3.[14] The curves generated by age and gender were normalised from the data and the percentiles chosen as reference values are the following: 5th, 10th, 15th, 25th, 50th, 75th, 85th, 90th, 95th. The statistical analyses were performed with the statistical pack SPSS for *Windows,* version 13 (SPSS, 2004).[15]

3. Results

Table 1 shows the averaged values and standard deviation of the weight values, size and body mass index by age and gender of the total evaluated sample. Independently of age groups, males were heavier and taller than females. This tendency ends with the 60 years old group. At this point, average values showed a progressive reduction through ageing in all the anthropometric variables.

The average and standard deviation for the waist circumference by age range and gender for the total of the Venezuelan adults studied are shown in Table 2. The age ranges were derived from statistically significant by single age ($p < 0.05$). Men showed higher values of WC in comparison to those of women for all age groups, being observed statistically significant differences by gender and by age ($p < 0.05$). Average values for the WC for the total group of men was 82.8 ± 9.8 cm and of women 74.9 ± 10.8 cm. The values of WC increase with the age for both men and women, rising progressively from the 18–24 age group to the 60–79 age group, with higher values for males, and decreasing in the 80+ group.

When assessing the variability of the values of WC in absolute terms, by age groups and by gender (Table 2), it was observed that these differences tended to be higher as age increases, and with negative values only for the group of 80 years and older. This can be explained by the hypothesis that subjects in advance age decades, abdominal perimeter decreases, changing the behaviour showed in the younger groups, where the perimeter tends to increase.

In Table 3 and Figs. 1 and 2, the values for the percentiles 5, 10, 15, 25, 50, 75, 85, 90 and 95 of waist circumference for the group studied are shown, according to gender and age, and it is observed, in general, that when the age range increases, the absolute percentile values of the WC are higher, and more pronounced in the male gender, with the exception of the 80 or more years, the values of which decreased.

Table 1
Mean and standard deviation values of the weight, height and body mass index for Venezuelan adults by age and sex groups.

Age groups (years)	Males							Females						
	(n)	Weight (kg)		Height (cm)		BMI (kg/m^2)		(n)	Weight (kg)		Height (cm)		BMI (kg/m^2)	
		Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD
18–24	1498	68.1	10.8	173.1	7.1	22.7	3.3	1498	56.8	9.0	160.2	6.5	22.2	3.4
25–29	167	73.1	11.6	173.1	7.8	24.4	3.4	138	57.9	10.6	158.8	7.1	22.9	3.7
30–59	130	73.1	12.3	168.8	6.6	25.6	3.7	191	61.4	9.7	157.5	6.0	24.7	3.5
60–79	265	63.9	11.9	164.4	7.1	23.6	3.9	265	61.2	12.3	152.6	6.4	26.3	5.0
80 and more	122	58.0	10.3	161.9	6.6	22.1	3.4	122	51.5	10.4	147.9	6.4	23.6	4.7
Total	2182	67.8	11.5	171.2	8.0	23.1	3.5	2498	57.3	10.1	157.6	7.6	23.1	4.1

(n): Number of adults, SD: Standard deviation, BMI: Body mass index.

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