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# Anthropometric indicators of obesity such as predictors of high blood pressure in the elderly

## *Indicadores antropométricos de obesidade como preditores de pressão arterial elevada em idosos*

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**Abstract** – High blood pressure is a leading cause of mortality worldwide and a risk factor for several diseases. The aim of this study was to determine the predictive power of anthropometric indicators of obesity and establish their cutoff points as discriminators of hypertension and identify the anthropometric indicator of obesity that best discriminates high blood pressure in the elderly. This is a cross-sectional study with a sample of 300 older adults, 167 (56.5%) women. The following anthropometric indicators of obesity were measured: body mass index (BMI), waist circumference (WC), waist / height ratio (WHtR) and conicity index. Moreover, systolic and diastolic blood pressure measurements were collected. To identify hypertension predictors, the analysis of receiver operating curves (ROC) with 95% confidence interval was adopted. Subsequently, cutoff points with their respective sensitivities and specificities were identified. Analyses were carried out considering 5% significance level. It was observed that some anthropometric indicators of obesity showed area under the curve (AUC) significant with BMI = 0.60 (0.50 to 0.70); WHtR = 0.61 (0.51 to 0.71); conicity index = 0.58 (0.58 to 0.68) in men. The different cutoff points of anthropometric indicators with better predictive power and their respective sensitivities and specificities were identified. The best areas under the ROC curve were for BMI, WHtR and conicity index for men; however, such measures were not satisfactory to predict high blood pressure in women.

**Key words**: Anthropometry; Older adults; Obesity; Arterial Pressure.

**Resumo** – *A pressão arterial elevada é uma das principais causas de mortalidade em âmbito mundial e fator de risco para diversas doenças. Objetivou-se determinar o poder preditivo de indicadores antropométricos de obesidade e estabelecer os pontos de corte como discriminadores de pressão arterial elevada e identificar o indicador antropométrico de obesidade que melhor discrimina a pressão arterial elevada em idosos. Estudo transversal com amostra de 300 idosos, sendo 167 (56,5%) mulheres. Foram avaliados os seguintes indicadores antropométricos de obesidade: índice de massa corporal (IMC), circunferência da cintura (CC), razão cintura/estatura (RCEst) e índice de conicidade. Ademais, coletaram-se medidas de pressão arterial sistólica e diastólica. Para identificação dos preditores de pressão arterial elevada, foi adotada a análise das curvas Receiver Operating Characteristic (ROC), com intervalo de confiança de 95%. Posteriormente, identificaram-se os pontos de corte com as respectivas sensibilidades e especificidades. As análises foram efetuadas respeitando-se o nível de significância de 5%. Observou-se que alguns indicadores antropométricos de obesidade apresentaram Área Sob a Curva (ASC) significativas, sendo o IMC = 0,60 (0,50-0,70); RCEst = 0,61 (0,51-0,71); Índice Conicidade = 0,58 (0,58-0,68), nos homens. Os diversos pontos de corte dos índices antropométricos com melhores poderes preditivos e as respectivas sensibilidades e especificidades foram identificados. As melhores ASC foram para IMC, RCEst e Índice de Conicidade para os homens, porém tais medidas não foram satisfatórias para predizer a pressão arterial elevada em mulheres.*

**Palavras-chave**: *Antropometria; Idoso; Obesidade; Pressão arterial.*

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## INTRODUCTION

High blood pressure (HBP) is the leading cause of death worldwide and the third leading cause of disease-induced disability[1]. It is estimated that high blood pressure causes 9.4 million deaths per year worldwide[2], causing a significant impact on public health.

Blood pressure increases significantly over the years due to the increase in the deposit of calcium in the blood vessels, stiffening the wall of vessels and making them narrower, increasing blood pressure[3].

In this context, the identification of high blood pressure has become a priority action in public health, mainly within the scope of the Family Health Strategy, which has the Diabetes and Hypertension Monitoring Program - HIPERDIA as one of its main actions.

Given the above, the anthropometric indicators of obesity deserve attention due to their ease of production, low cost, applicability in population studies[4] and significant relationship with HBP in different age groups[5,6]. Even with evidence in literature that body fat is related to high blood pressure in the elderly[7-9], a better understanding of fat distribution and the predictive capacity of anthropometric indicators in blood pressure discrimination is necessary.

The indirect identification of high blood pressure through anthropometric indicators of obesity can be an important strategy in public health as a screening tool, favoring the identification of blood pressure changes.

In addition, evaluating the discriminatory power and establishing cutoff points, that is, critical values of anthropometric indicators of obesity associated with high blood pressure in the elderly may be a good strategy for monitoring and screening these risk factors.

In Brazil, few studies have investigated the ability of anthropometric indicators of obesity to detect high blood pressure in the elderly, especially in small towns, thus, the best predictor of high blood pressure remains controversial due to possible confounding factors including ethnicity, gender and economic status and place of residence (rural or urban).

The aims of this study were: 1) To determine the predictive power of anthropometric indicators of obesity to predict high blood pressure in the elderly; 2) To establish cutoff points as discriminators of high blood pressure and Identify the anthropometric indicator of obesity that best discriminates high blood pressure in the elderly.

## METHODOLOGICAL PROCEDURES

This cross-sectional study was carried out in the municipality of Ibicuí, southwestern state of Bahia.

The population of the present study was composed of individuals aged 60 years and older registered by the Family Health Strategy (FHS) of the municipality. To determine the sample size, the criteria proposed by Luiz[10] for finite populations were used, with 5% significance level, 95%

confidence interval and 2.5% tolerable error. In addition, 10% were added to compensate for possible losses and refusals.

After applying the exclusion criteria (bedridden individuals, those with Alzheimer's disease or other neurological diseases that affect cognition) and accounting for losses (moved from the municipality, not found more than three times in the FHS or domicile and refusals), the final sample consisted of 300 older adults (201 living in urban and 99 in rural areas), values above the minimum number required for the sample (n = 290). The response rate was 91.2% with 8.8% (n = 31) of refusals and 9.2% (n = 29) of exclusion.

Individuals signed the ICF, were interviewed and evaluated at Family Health Units, and those who were not found or did not attend the FHU after three attempts were automatically replaced by means of a draw.

## Data Collection Procedures

Variables age, gender, marital status, schooling level, ethnicity / color, monthly income, alcohol and tobacco consumption were included. Variables alcohol and tobacco use were evaluated through the following questions: Do you consume alcoholic beverages? Yes No; Do you smoke? Yes No. Systolic and diastolic blood pressure, body mass, height and waist circumference measurements were also evaluated.

Digital device (OMRON ®, model HEM - 742 INT) was used to measure blood pressure. A portable digital scale (OMRON®) and a stadiometer (Sanny®) were also used, both duly calibrated and a flexible anthropometric tape (Cardiomed®).

Blood pressure was measured with a digital device (OMRON®) with cuff suitable for the arm circumference. The measurement was performed on the right arm at the height of the heart. Three blood pressure measurements were performed, the first one after individual remaining five minutes at rest and seated; the second after two minutes; and the third two minutes after the second (the mean of the three measures was used).

All anthropometric measurements were performed three times (the mean of these measures were verified) by a Physical Education professional to reduce intra and inter-rater error and recorded by a scorer. Individuals were measured according to standardized procedures[11].

Waist circumference was measured with a flexible anthropometric tape at the midpoint between the last rib and the iliac crest and the procedure was to leave the waist free of clothing and arms crossed in the chest[11].

The waist-to-height ratio was determined by equation[12], which uses WC (cm) and height (cm). The C index was estimated by body mass, height and waist circumference measures[13].

## Statistical Procedures

Data analysis used procedures of descriptive statistics expressed by mean, standard deviation, number of observations and percentage of variables evaluated. The difference between genders in the continuous variables was analyzed by the Student's t-test for independent samples, since variables presented normal distribution and the chi-square test was used to compare proportions (qualitative variables) among elderly males and females.

The predictive capacity (sensitivity and specificity) of anthropometric indicators to evaluate the presence of HBP was defined through the analysis of the ROC curves. The ROC curves are a tool used to obtain cutoff points for diagnostic and / or screening instruments[14].

The area under the ROC curve (AUC) is a resource used to determine the predictive capacity of the indicator for the presence or absence of HBP. The best AUC score is the value equal to 1.0 and values equal to or less than 0.5 indicate that the predictive capacity is not better than by chance.

Sensitivity was defined as the proportion of older adults correctly classified and specificity as the proportion of individuals with normal blood pressure scores correctly classified. The cutoff points to identify the best predictive capacity for HBP were defined as the location where the sensitivity and specificity curves of each variable intersect.

Statistical analyses were conducted using the Statistical Product and Service Solutions (SPSS) ® 13.0 software. All analyses were performed adopting 5% significance level. The study was approved by the Ethics Research Committee of the State University of Southwestern Bahia, under protocol (CAAE: 22969013.0.0000.0055).

## RESULTS

Overall, 167 women (56.5%) and 133 men (43.5%) participated in the study. The mean age was 70.78 ± 8.2 years for females and 72.59 ± 7.8 years for males. The variables that characterize the samples are presented in Table 1.

Table 2 shows the anthropometric and blood pressure characteristics of individuals.

Table 3 shows that some anthropometric indicators of obesity presented significant area under the ROC curve. However, WHtR and BMI assumed larger areas with significant differences for men. The cutoff points of anthropometric indicators of obesity as predictors of HBP, and their respective sensitivity and specificity, are also presented in this table and it was observed that WHtR had a better sensitivity and specificity value to discriminate high blood pressure in men.

**Table 1.** Characterization of samples composed of older adults from a municipality in northeastern Brazil (n = 300).

| | Women (n=167) | | Response rate | Men (n=133) | | Response rate | |
|---|---|---|---|---|---|---|---|
| | n | % | % | n | % | % | P |
| Ethnicity / color | | | 98.9 | | | 99.1 | |
| White | 45 | 27.2 | | 47 | 27.2 | | |
| Black | 71 | 42.2 | | 26 | 19.4 | | 0.001* |
| Brown | 47 | 28.3 | | 55 | 40.7 | | |
| Does not know | 4 | 2.3 | | 10 | 7.4 | | |
| Schooling | | | 100.0 | | | 100.0 | |
| Illiterate | 92 | 54.9 | | 82 | 62.2 | | |
| Elementary school | 69 | 41.1 | | 46 | 34.0 | | 0.001* |
| High school | 4 | 2.9 | | 5 | 3.7 | | |
| Higher education | 2 | 1.1 | | - | - | | |
| Marital status | | | 97.1 | | | 99.1 | |
| married/stable union | 73 | 42.3 | | 76 | 57.7 | | |
| Single/divorced | 31 | 18.86 | | 36 | 26.6 | | 0.001* |
| Widow | 61 | 36.00 | | 20 | 14.8 | | |
| Monthly Income | | | 99.1 | | | 100.0 | |
| ≤ 1 MW | 158 | 94.2 | | 122 | 91.1 | | |
| 1.1 to 2 MW | 8 | 5.3 | | 9 | 7.4 | | 0.001* |
| 2.1 a MW | 1 | 0.5 | | 2 | 1.4 | | |
| Alcoholism | | | 99.4 | | | 100.0 | |
| Yes | 4 | 2.3 | | 9 | 6.6 | | 0.001* |
| No | 162 | 97.7 | | 124 | 93.3 | | |
| Smoking | | | 100.0 | | | 100.0 | |
| Yes | 15 | 8.6 | | 21 | 15.5 | | 0.001* |
| No | 152 | 91.4 | | 112 | 84.4 | | |
| Blood pressure Arterial | | | 100.0 | | | 100.0 | |
| Normal | 93 | 55.7 | | 79 | 59.4 | | 0.011* |
| Hypertension | 74 | 44.3 | | 54 | 40.6 | | |
| Nutritional status | | | 100.0 | | | 100.0 | |
| Low weight | 24 | 14.4 | | 40 | 30.1 | | <0.0001* |
| Normal weight | 59 | 35.3 | | 58 | 43.6 | | |
| Overweight | 84 | 50.3 | | 35 | 26.3 | | |

* Chi-square test

**Table 2** - Mean values and standard deviation of variables analyzed.

| Variables | Women (n=167) | Men (n=133) | p-value |
|---|---|---|---|
| | M ± SD | M ± SD | |
| Age (years) | 70.78 ± 8.21 | 72.59 ± 7.86 | 0.055* |
| Body weight (kg) | 60.20 ± 12.23 | 63.84 ± 12.50 | 0.012* |
| Height (cm) | 148.75 ± 6.16 | 160.80 ± 7.82 | <0.0001* |
| BMI (kg/m$^2$) | 27.15 ±5.05 | 24.58 ± 3.90 | <0.0001* |
| WC (cm)† | 87.34 ± 11.26 | 88.94 ± 10.10 | 0.208 |
| WHtR | 0.57 ± 0.11 | 0.55 ± 0.06 | 0.086 |
| C index | 1.23 ± 0.21 | 1.29 ± 0.06 | 0.001* |
| SBP | 140.96 ± 22.18 | 137.35 ± 22.51 | 0.166 |
| DBP | 76.71 ± 10.91 | 76.97 ± 11.79 | 0.846 |

M - mean; SD - standard deviation; BMI - body mass index; WC - waist circumference; WHtR - waist-to-height ratio; C Index - Conicity Index; SBP - systolic blood pressure; DBP - diastolic blood pressure; † Loss variables (n = 163 women); * Student's t test for independent samples.

**Table 3.** Area under the ROC curve, 95% CI, cutoff points, sensitivity and specificity of the anthropometric indexes for predicting HBP in the elderly.

| | Women | | | | Men | | | | |
|---|---|---|---|---|---|---|---|---|---|
| High BP | AUC | Cutoff point | Sensitivity (%) | Specificity (%) | AUC | Cutoff point | Sensitivity (%) | Specificity (%) | p |
| BMI (kg/m$^2$) | 0.53 (0.44-0.62) | 26.79 | 52.7 | 54.8 | 0.60 (0.50-0.70)* | 24.20 | 52.7 | 54.8 | <0.0001† |
| WC (cm) | 0.57 (0.48-0.66) | 87.50 | 57.7 | 45.7 | 0.58 (0.48-0.68) | 86.50 | 59.3 | 53.2 | <0.0001† |
| WHtR | 0.56 (0.47-0.65) | 0.59 | 56.8 | 43.0 | 0.61 (0.51-0.71)* | 0.54 | 64.8 | 45.6 | <0.0001† |
| C index | 0.58 (0.49-0.66) | 1.26 | 54.1 | 45.2 | 0.58 (0.58-0.68)* | 1.29 | 57.4 | 45.6 | <0.0001† |

AUC: Area under the ROC curve; BMI - body mass index; CC - Waist circumference; WHtR - waist / height ratio; C Index - conicity index; ROC - Receiver Operating Characteristic; 95% CI - 95% confidence interval; * Area under the ROC curve presenting discriminatory power for high blood pressure (Li-IC ≥ 0.50); † Chi-square test.

## DISCUSSION

This study aimed to determine the predictive power of anthropometric indicators of obesity to predict high blood pressure in older adults, to establish cutoff points as high blood pressure discriminators and to identify the anthropometric indicator of obesity that best discriminates high blood pressure in the elderly.

The aim was to enable a discussion about the use of these indicators, especially in the primary health care context. The results of the present study are in no way intended to exclude other possibilities for the diagnosis of blood pressure, but rather, the proposal is to present simple and low-cost alternatives that can be used as a screening tool for large populations.

Even with the evidence in literature on the relationship between overweight / obesity and high blood pressure, epidemiological studies conducted with the aim of identifying and discriminating the capacity of anthropometric indicators of obesity for high blood pressure in the elderly population, mainly using the C index and the WHtR[5], are still scarce.

The results of the present study showed that only few anthropometric indicators of overweight / obesity (WHtR, C index and BMI for males) presented adequate predictive capacity to discriminate high blood pressure in the elderly.

Evidence regarding body fat distribution and high blood pressure in adults is inconclusive. A study conducted with 316 older adults living in a small city[5] found that BMI and body fat index were the best anthropometric indicators of arterial hypertension in the elderly in both genders, regardless of other factors such as age, smoking, alcohol consumption and physical activity.

A systematic review study showed that WHtR was the best performance indicator for discriminating cardiovascular diseases when compared to indicators such as BMI or WC[15].

Regarding the identification of cutoff points of anthropometric indicators to discriminate HBP, the best cutoff point for WHtR in women was 0.59, 56.8% of sensitivity and 43.0% of specificity. In Brazil, some researchers[16] have recommended WHtR of 0.53 as the best cutoff point with sensitivity (67%) and specificity (58%) for adults. Another cutoff point similar to that observed in Brazil, but with Mexican women, ranged from 0.53 to 0.53 for WHtR, in this case to discriminate type 2 diabetes, high blood pressure and dyslipidemia[6].

In a study[5] with Brazilian older adults living in a small city (with characteristics similar to the city that the current study was conducted), the authors suggested as best cutoff points for BMI values of 24.7 kg / $m^2$ for men and 27.3 Kg / $m^2$ for women to diagnose high blood pressure. These results are similar to the findings of the present study. It could be concluded that such cutoff points can be used in primary care with populations similar to those studies.

In another study conducted with Thai adults (45-80 years), the authors indicated a cutoff point for BMI of 23 kg / $m^2$ in men and 24 kg / $m^2$ in women and 80.0 and 78.0 for WC in men and women, respectively[17] in discriminating at least one cardiovascular risk factor (HBP, dyslipidemia and type 2 diabetes). These values distant from those found in the present study can be justified by the age group (45-80 years), because they are from distinct populations (Thailand - Brazil) and this may confuse possible comparisons.

When analyzing the cutoff points for WC, the values were different between men and women. Dissimilar results were shown in a study[16] conducted with an adult population (30-74 years) of the city of Salvador - BA, where the authors identified higher cutoff points for men (0.88) in relation to women (0.83) to discriminate high cardiovascular risk. Different results were also observed in a study[18] with an adult population (30-74 years) in Japan, where the authors indicated cutoff values for WC in men (0.89) and women (0.86), to discriminate cardiovascular risk.

However, it should be considered that the target population was different and younger than the population surveyed in the present study. Usually, cutoff points are higher for men compared to women, corroborating results of the present study 87.50 (women) and 86.50 (men).

In the analysis of the C index, it was observed in the current research that the suggested cutoff point was 1.26 for women and 1.29 for men, values different from those suggested in a study conducted in Salvador-Bahia with 968 people aged 30-74 years (C index - 1.18 for females and 1.25 for males)[19], such points discriminated high coronary risk. However, they presented cutoff points for this index for different age groups, and for the population aged ≥50 years the best cutoff point indicated was 1.22 to discriminate high coronary risk in women[20].

One should keep in mind that information on the C index is limited regarding the discussion of cutoff points for HBP, mainly because there are few studies on this measure as a reference for the elderly. A possible limitation for the use of the C index in population studies may be the difficulty of calculating the denominator of the equation proposed for its determination[21].

Anthropometric indicators of overweight / obesity present high relation with accumulation of visceral fat[22]. Excess fat is in general associated with the appearance of cardiovascular diseases, high blood pressure and mortality, and the definition of cutoff points for indicators that stand out for their operational simplicity and good accuracy allows the detection of individuals at risk, can be of great usefulness in primary health care services, in addition to enabling the knowledge of the situation of specific population groups in relation to these risks, when used in epidemiological studies.

This study presents some limitations that should be considered. The sample was based only on older adults enrolled in the Family Health Strategy - ES. Despite the excellent coverage of the FHS in the municipality (100%), the sample is not representative of older adults living in the municipality. The use of a digital device to measure blood pressure may be indicative of a possible measurement bias, since this equipment is not a gold standard for BP measurements. The technical error of measurement among anthropometrists was not calculated, there was only standardization of measurements among evaluators.

On the other hand, it should be considered that the study evaluated a considerable contingent of the elderly population living in a small municipality in Bahia, considered the largest state in northeastern Brazil, indicating that some anthropometric indicators of obesity can adequately discriminate high blood pressure in the elderly, contributing to the improvement of health actions directed to this population.

## CONCLUSIONS

Among the anthropometric indicators of obesity for high blood pressure in the elderly, BMI, WHtR and C index were good predictors of high blood pressure in men. The best cutoff point to discriminate HBP was 0.54 for the WHtR index in men, so it is suggested to use this measure in order to detect and perform HBP screening in the elderly with characteristics similar to the sample in this study. It is recommended that the use of two indicators simultaneously results in greater efficiency in screening the risk of high blood pressure in the elderly.

## REFERENCES

1. Ezzati M, Hoorn SV, Rodgers A, Lopez AD, Murray, CJL. Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. Lancet 2002;360(9343):1347-60.
2. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012;380(9859):2224-60.
3. Mitchell GF, Parise H, Benjamin EJ, Larson MG, Keyes MJ, Vita JA, et al. Changes in arterial stiffness and wave reflection with advancing age in health men and women: the Framingham Heart Study. Hypertension 2004;43(6):1239-45.
4. Gomes MA, Beck CC, Duarte MFS, Petroski EL. Ficha Antropométrica no Núcleo de Apoio a Saúde da Família: o que medir e para que medir? Rev Bras Cineantropom Desempenho Hum 2009;11(2):243-53.

5. Leal Neto JS, Souza J, Coqueiro RS, Fernandes MH, Oliveira DS, Barbosa AR. Anthropometric indicators of obesity as screening tools for high blood pressure in the elderly. Int J Nurs Pract 2013;19(4):360-7.
6. Berber A, Gómez-Santos R, Fanghänel G, Sánchez-Reyes L. Anthropometric indexes in the prediction of type 2 diabetes mellitus, hypertension and dyslipidaemia in a Mexican population. Int J Obes Relat Metab Disord 2001;25(12):1794-9.
7. Mariath AB, Grillo LP, Silva RO, Schmitz P, Campos IC, Medina JRP, et al. Obesidade e fatores de risco para o desenvolvimento de doenças crônicas não transmissíveis entre usuários de unidade de alimentação e nutrição. Cad Saúde Pública 2007;23(4):897-905.
8. Ministério da Saúde (Brasil). Diretrizes e recomendações para o cuidado integral de doenças crônicas não transmissíveis: promoção da saúde, vigilância, prevenção e assistência. Brasília: Ministério da Saúde; 2008.
9. Kümpe DA, Sodré AC, Pomatti DM, Scortegagna HM, Filippi J, Portella MR, et al. Obesidade em Idosos Acompanhados pela Estratégia de Saúde da Família. Texto Contexto Enferm 2011;20(3):471-7.
10. Luiz RR, Magnanini MMF. A lógica da determinação do tamanho da amostra em investigações epidemiológicas. Cad Saúde Colet 2000;8(2):9-28.
11. Lohman TG, Roche AF, Martorell R. Anthropometric Standardization Reference Manual. Champaign, Illinois: Human Kinetics. 1988.
12. Pitanga FJG, Lessa I. Razão cintura-estatura como discriminador do risco coronariano de adultos. Rev Assoc Med Bras 2006;52(3):157-61.
13. Valdez R. A simple model-based index of abdominal adiposity. J Clin Epidemiol 1991;44(9):955-6.
14. Erdreich LS, Lee ET. Use of relative operating characteristics analysis in epidemiology: a method for dealing with subjective judgment. Am J Epidemiol 1981;114(5):649-62.
15. Browning LM, Hsieh SD, Ashwell M. A systematic review of waist-to-height ratio as a screening tool for the prediction of cardiovascular disease and diabetes: 0.5 could be a suitable global boundary value. Nutr Res Rev 2010;23(2):247-69.
16. Haun DR, Pitanga FJG, Lessa I. Razão Cintura/Estatura comparado a outros indicadores antropométricos de obesidade como preditor de risco coronariano elevado. Rev Assoc Med Bras 2009;55(6):705-11.
17. Samsen M, Hanchaiphiboolkul S, Puthkhao P, Tantirittisak T, Towanabut S. Appropriate body mass index and waist circumference cutoffs for middle and older age group in Thailand: data of 19,621 participants from Thai epidemiologic stroke (TES) study. J Med Assoc Thai 2012;95(9):1156-66.
18. Kashihara H, Lee JS, Kawakubo K, Tamura, M, Akabayashi A. Criteria of Waist Circumference According to Computed Tomography-Measured Visceral Fat Area and the Clustering of Cardiovascular Risk Factors. Circ J 2009;73(10):1881-6.
19. Pitanga FJG, Lessa I. Indicadores antropométricos de obesidade como instrumento de triagem para risco coronariano elevado em adultos na cidade de Salvador - Bahia. Arq Bras Cardiol 2005;85(1):26-31.
20. Pitanga FJG, Lessa I. Indicadores antropométricos de obesidade como instrumento de triagem para risco coronariano em mulheres. Rev Bras Cineantropom Desempenho Hum 2006;8(1):14-21.
21. Pitanga FJG, Lessa I. Sensibilidade e especificidade do índice de conicidade como discriminador do risco coronariano de adultos em Salvador, Brasil. Rev Bras Epidemiol 2004;7(3):259-69.
22. Oliveira CC, Roriz AKC, Moreira PA, Eickemberg M, Amaral MTR, Passos LCS, et al. Indicadores antropométricos associados com hipertrigliceridemia na predição de gordura visceral. Rev Bras Cineantropom Desempenho Hum 2014;16(5):485-93.

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