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ORIGINAL ARTICLE

Anthropometric indicators of obesity in the prediction of high body fat in adolescents

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KEYWORDS
Anthropometry;
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Abstract
Objective: To determine the anthropometric indicators of obesity in the prediction of high body fat in adolescents from a Brazilian State.
Methods: The study included 1,197 adolescents (15-17 years old). The following anthropometric measurements were collected: body mass (weight and height), waist circumference and skinfolds (triceps and medial calf). The anthropometric indicators analyzed were: body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR) and conicity index (C-Index). Body fat percentage, estimated by the Slaughter et al equation, was used as the reference method. Descriptive statistics, U Mann-Whitney test, and ROC curve were used for data analysis.
Results: Of the four anthropometric indicators studied, BMI, WHtR and WC had the largest areas under the ROC curve in relation to relative high body fat in both genders. The cutoffs for boys and girls, respectively, associated with high body fat were BMI 22.7 and 20.1kg/m^2, WHtR 0.43 and 0.41, WC 75.7 and 67.7cm and C-Index 1.12 and 1.06.
Conclusions: Anthropometric indicators can be used in screening for identification of body fat in adolescents, because they are simple, have low cost and are non-invasive.

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PALAVRAS-CHAVE
Antropometria;
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Estudantes

Indicadores antropométricos de obesidade na predição de gordura corporal elevada em adolescentes

Resumo

Objetivo: Determinar os indicadores antropométricos de obesidade na predição da gordura corporal elevada em adolescentes de um estado brasileiro.
Métodos: O estudo incluiu 1.197 adolescentes (15-17 anos). Foram coletadas medidas antropométricas: massa corporal e estatura, perímetro da cintura e dobras cutâneas (tríceps e perna medial). Os indicadores antropométricos analisados foram: índice de massa corporal (IMC), perímetro da cintura (PC), razão cintura-estatura (RCE) e índice de conicidade (ÍndiceC). A gordura corporal elevada, estimada pela equação de Slaughter et al que foi usada como método de referência. Estatística descritiva, teste U de Mann-Whitney e curva ROC foram utilizadas para a análise dos dados.
Resultados: Dos indicadores antropométricos estudados, o IMC e RCE e o PC tiveram as maiores áreas sob a curva ROC em relação ao gordura corporal relativa elevada em ambos os sexos. Os pontos de corte para os rapazes e moças, respectivamente, associados com gordura corporal elevada foram IMC 22,7 e 20,1kg/m^2, RCE 0,43 e 0,41 e PC de 75,7 e 67,7cm e ÍndiceC de 1,12 e 1,06.
Conclusões: Os indicadores antropométricos podem ser usados como ferramenta para identificação da gordura corporal em adolescentes, por ser um método simples, de baixo custo e não invasivo.

Introduction

Overweight has been considered an important public health problem worldwide.[1] Evidence consistently reports that there is a greater likelihood of overweight and obese adolescents to become obese adults.[2] In this context, obesity in childhood and in adolescence is considered an independent risk factor in the development of cardiovascular diseases in adulthood.[3]

Numerous methods have been used to assess body composition.[4] Among indirect methods, hydrostatic weighing and dual energy X-ray absorptiometry (DEXA) stand out; however, they are more difficult to be used in large samples due to the high cost and the need for a qualified technical team for assessing the measurements.[5] Among double indirect methods, anthropometry is considered a simple, rapid, inexpensive method that can be applied to a great number of individuals.[6]

Many anthropometric indicators have been proposed to diagnose the health risks taking into account the increased body fat.[7] The most widely used is still the body mass index (BMI), but it has some limitations.[8] However, other indicators have been recommended. Waist circumference (WC) is one of the measures proposed to achieve results closer to reality, since abdominal fat deposits also cause, alone, various health problems.[9] The waist-to-height ratio (WHtR)[10] and the conicity index (C-Index) have also been used as indicators to diagnose body fat.

Some studies have been conducted with children and adolescents in order to analyze the performance of anthropometric indicators (BMI, WC, WHtR) in the diagnosis of excess body fat.[11-14] In Brazil, few studies have investigated the ability of each indicator to detect excess body fat in adolescents,[15,16] however, studies using anthropometric indicators to predict high blood pressure[17] and hypertension stand out.[18] Both in Brazil and in other countries, no studies investigating the C-Index for the prediction of high body fat were found. In this sense, there are discussions about what would be the best anthropometric index for predicting high body fat, regardless of sex, age and total body fat. Therefore, more empirical evidence is needed, especially in adolescence. Thus, this study aims to verify the diagnostic performance of anthropometric indicators of obesity in the prediction of high body fat in adolescents.

Methods

This cross-sectional epidemiological study included schoolchildren aged 15-17 years enrolled in public schools (state and federal) in the Brazilian state of Santa Catarina. The study was approved by the Ethics Committee on Human Research of the Federal University of Santa Catarina (protocol number 372/2006) and University of Western Santa Catarina (protocol number 079/08).

To conduct the survey, two regions were considered: 1) a survey was conducted in 2007 in Florianópolis, capital of the state of Santa Catarina, located in southern Brazil. Florianópolis has a population of approximately 420,000 inhabitants,[19] and is considered one of the Brazilian cities with the highest human development index (HDI=0.875).[20] The other region considered was the western region of