



ORIGINAL ARTICLE

Anthropometric measures and blood pressure in school children[☆]

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KEYWORDS

Anthropometry;
Students;
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Abstract

Objective: To investigate the association of blood pressure and body mass index, waist circumference, waist-to-height ratio and triceps skinfold, in children and adolescents in Curitiba, state of Paraná, Brazil.

Methods: Cross-sectional study with a random sample of 1,441 students from public schools, aged from 10 to 16 years (655 boys and 786 girls). The following indicators were assessed: weight, height, waist circumference, triceps skinfold, systolic and diastolic blood pressures, pubertal stage, and socioeconomic status. Pearson correlation tests and multivariate logistic regression were used, considering $p < 0.05$.

Results: We found weak correlations among all the anthropometric parameters and systolic and diastolic levels, with coefficients values ranging from 0.18 to 0.28 ($p < 0.001$). In multivariate analysis, only body mass index [odds ratio (OR) = 2.9; 95% confidence interval (95%CI) 1.9-4.5] and triceps skinfold (OR = 1.9; 95%CI 1.3-3.1) were found as predictors of high blood pressure, regardless of abdominal adiposity, sexual maturation and socioeconomic status.

Conclusion: Total body adiposity seems to be a better predictor of high blood pressure risk than abdominal fat in this population.

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PALAVRAS-CHAVE

Antropometria;
Estudantes;
Pressão arterial

Indicadores antropométricos e pressão arterial em escolares**Resumo**

Objetivo: Investigar a relação entre pressão arterial e índice de massa corporal, circunferência abdominal, razão cintura/estatura e dobra cutânea tricípital em crianças e adolescentes.

Métodos: Estudo epidemiológico transversal, do qual participaram 1.441 escolares de 10 a 16 anos de idade (655 meninos e 786 meninas), selecionados por amostragem aleatória sistemática. Avaliaram-se a massa corporal, a estatura, a circunferência abdominal, a espessura da dobra cutânea tricípital, as pressões arteriais – sistólica e diastólica – o estágio maturacional e a classe econômica. Utilizaram-se os testes de correlação parcial de Pearson e a regressão logística multivariada, considerando-se $p < 0,05$.

Resultados: Todos os indicadores antropométricos demonstraram fracas correlações com os níveis sistólicos e diastólicos, com coeficientes (r) variando de 0,18 a 0,28 ($p < 0,001$). Na análise multivariada, os únicos preditores antropométricos associados ao risco de pressão arterial elevada foram o índice de massa corporal (OR = 2,9; IC95%: 1,9-4,5) e a dobra cutânea tricípital (OR = 1,9; IC95%: 1,3-3,1), independentes da adiposidade abdominal, maturação sexual e nível econômico.

Conclusão: Nesta faixa etária, a adiposidade corporal total parece ser melhor determinante do risco de elevação da pressão arterial do que a adiposidade abdominal.

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Introduction

Obesity and excessive central fat are changes that precede the increase in blood pressure in children and adolescents, according to epidemiological investigations that used high-precision technologies for estimating body adiposity.¹ However, due to the high cost, limited feasibility and the risks of radiation exposure provided by these resources, researchers investigate the predictive ability of anthropometric indicators, aiming to use methods that are simpler, practical, and cost effective in assessing the risk of high blood pressure in children and adolescents.

Since the 70s, several studies showed body mass index (BMI) as the best predictor of high blood pressure in childhood and adolescence.¹⁻⁴ Further investigations also considered BMI an important marker in the relationship between blood pressure and central adiposity indicators.^{5,6} On the other hand, the accumulation of adipose tissue in the central region of the body has been considered as a better determinant for the development of high blood pressure than total adiposity.⁷

Currently, however, there is no consensus on the choice of anthropometric predictor of high blood pressure in this population. Anthropometric indicators such as BMI, waist circumference, triceps skinfold and, more recently, the waist-to-height ratio, have been investigated for validity in predicting the risk for high blood pressure in the pediatric population.^{3,8} Therefore, this study aimed to investigate the best anthropometric determinants of high blood pressure in children and adolescents.

Methods

This cross-sectional epidemiological research was conducted in 2008 and 2009, after a pilot study. The sample was extracted from school children attending 5th to 8th grades

distributed into five regionals administered by the Municipal Secretariat of Education of Curitiba ($n = 8,140$), and was selected by systematic sampling, in two stages:

- 1) Selection (draw) of one school in each regional;
- 2) Invitation of all school children and explanations about the study.

The sample size calculation (Epi-Info version 3.5.1) resulted from the sum of the samples calculated for each regional ($n = 1,523$), for which we considered: number of students enrolled in each regional; unknown prevalence (50%); level of confidence of 95% (95%CI); and sampling error of 5%. The evaluations were performed only on students who agreed to participate and who presented the informed consent signed by parents/guardians ($n = 1,497$). Out of these, 46 individuals were excluded for the following reasons:

- 1) age different from 10 to 16 years;
- 2) not having performed all assessments;
- 3) use of drugs and/or presence of disease that could alter the levels of blood pressure.

The final sample was composed of 1,441 children and adolescents, 655 boys and 786 girls. The sampling error in each regional, calculated a posteriori, ranged from 1.2 to 1.5, below the level established a priori (5%).

The assessments were performed during the school period, by trained evaluators and using calibrated equipment. The techniques to measure body mass and triceps skinfold were obtained according to international norms,⁹ considering valid the average of three measurements. Height was measured with a wall stadiometer (Wiso®, Brasil) with a resolution of 0.1 cm, and body mass was measured in digital scale, (Plenna®, Sport, Brazil) with a maximum capacity of 150 kg and a resolution of 100 grams. The

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