



ORIGINAL ARTICLE

## Sensitivity and specificity of different measures of adiposity to distinguish between low/high motor coordination<sup>☆</sup>



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### KEYWORDS

Adiposity;  
Motor coordination;  
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Cardiorespiratory  
fitness;  
Children

### Abstract

**Objective:** This study aimed to determine the ability of different measures of adiposity to discriminate between low/high motor coordination and to evaluate the relationship between different measures of adiposity and motor coordination.

**Methods:** This study included 596 elementary school children aged 9 to 12 years (218 females – 47.1%). Weight, height, and waist circumference were objectively measured by standardized protocols. Body fat percentage was estimated by bioelectric impedance. Body mass index and waist-to-height ratio were computed. Motor coordination was assessed by the Körperkoordination Test für Kinder. Cardiorespiratory fitness was predicted by a maximal multistage 20 m shuttle-run test of the Fitnessgram Test Battery. A questionnaire was used to assess the maternal educational level.

**Results:** The receiver operating characteristic performance of body fat percentage in females and waist circumference in males presented a slightly better discriminatory accuracy than body mass index, waist circumference and waist-to-height ratio in predicting low motor coordination. After adjustments, logistic regression analyses showed that body mass index ( $\beta = 2.155$ ; 95% CI: 1.164–3.992;  $p = 0.015$  for girls;  $\beta = 3.255$ ; 95% CI: 1.740–6.088;  $p < 0.001$  for males), waist circumference ( $\beta = 2.489$ ; 95% CI: 1.242–4.988;  $p = 0.010$  for girls;  $\beta = 3.296$ ; 95% CI: 1.784–6.090;  $p < 0.001$  for males), body fat percentage ( $\beta = 2.395$ ;

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95% CI: 1.234-4.646;  $p = 0.010$  for girls;  $\beta = 2.603$ ; 95% CI: 1.462-4.634;  $p < 0.001$  for males) and waist-to-height ratio ( $\beta = 3.840$ ; 95% CI: 2.025-7.283;  $p < 0.001$  for males) were positively and significantly associated with motor coordination in both sexes, with the exception of waist-to-height ratio in girls ( $\beta = 1.343$ ; 95% CI: 0.713-2.528;  $p = 0.381$ ).

**Conclusion:** Body fat percentage and waist circumference showed a slightly better discriminatory accuracy in predicting low motor coordination for females and for males, respectively.

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## PALAVRAS-CHAVE

Adiposidade;  
Coordenação motora;  
KTK;  
Capacidade  
cardiorrespiratória;  
Crianças

## Sensibilidade e especificidade de diferentes medidas de adiposidade para diferenciação entre pouca/ampla coordenação motora

### Resumo

**Objetivo:** Este estudo pretende: (i) determinar a capacidade de diferentes medidas de adiposidade para diferenciar pouca/ampla CM; e (ii) avaliar a relação entre diferentes medidas de adiposidade e coordenação motora.

**Método:** 596 crianças em idade escolar fundamental, de 9 a 12 anos (218 meninas - 47,1%) participaram deste estudo. O peso, a altura e a circunferência da cintura foram mensurados objetivamente pelos protocolos padronizados. O percentual de gordura corporal foi estimado pela impedância bioelétrica. Foram calculados o índice de massa corporal e a razão cintura/estatura. A coordenação motora foi avaliada por meio do teste de coordenação corporal para crianças. A capacidade cardiorrespiratória foi predita por um teste *shuttle-run* multinível de no máximo 20 m da Bateria de Testes Fitnessgram. Foi usado um questionário para avaliar o nível de escolaridade das mães.

**Resultados:** O desempenho na curva de característica de operação do receptor do percentual de gordura corporal, em meninas, e da circunferência da cintura, em meninos, demonstrou uma precisão discriminatória levemente melhor que o índice de massa corporal, a circunferência da cintura e a razão cintura/estatura em prever pouca coordenação motora. Após ajustes, as análises de regressão logística demonstraram que o índice de massa corporal ( $\beta = 2,155$ ; Intervalo de Confiança (IC) 95%: 1,164-3,992;  $p = 0,015$  para meninas;  $\beta = 3,255$ ; IC 95%: 1,740-6,088;  $p < 0,001$  para meninos), a circunferência da cintura ( $\beta = 2,489$ ; IC 95%: 1,242-4,988;  $p = 0,010$  para meninas;  $\beta = 3,296$ ; IC 95%: 1,784-6,090;  $p < 0,001$  para meninos), o percentual de gordura corporal ( $\beta = 2,395$ ; IC 95%: 1,234-4,646;  $p = 0,010$  para meninas;  $\beta = 2,603$ ; IC 95%: 1,462-4,634;  $p < 0,001$  para meninos) e a razão cintura/estatura ( $\beta = 3,840$ ; IC 95%: 2,025-7,283;  $p < 0,001$  para meninos) estavam positiva e significativamente relacionados à coordenação motora em ambos os sexos, com exceção da razão cintura/estatura em meninas ( $\beta = 1,343$ ; IC 95%: 0,713-2,528;  $p = 0,381$ ).

**Conclusão:** O percentual de gordura corporal e a circunferência da cintura mostraram uma precisão discriminatória ligeiramente melhor na previsão de pouca coordenação motora para meninas e meninos, respectivamente.

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## Introduction

Childhood and adolescent obesity has become an important public health problem, as its prevalence has increased significantly over the past years in several countries.<sup>1</sup> In Portugal, approximately one-third of children and adolescents are overweight or obese.<sup>2</sup>

An appropriate motor coordination (MC) level is essential for children's healthy growth and development, as well as for psychosocial skills and well-being.<sup>3,4</sup> Although rudimentary forms of movement patterns may naturally be developed, mature forms of motor proficiency are more likely to be achieved with appropriate practice, encouragement, feedback, and instruction.<sup>5</sup> The early childhood

years are a key time for the development of these skills, which are considered the building blocks of more complex movements.<sup>6</sup>

It is reasonably well established in literature that there is an inverse association between adiposity and MC, i.e., overweight and particularly obese children display markedly poorer performance and are less competent in motor tasks requiring support, propulsion, or movement of a great proportion of body mass compared with their normal weight counterparts.<sup>7-9</sup> A recent review<sup>10</sup> on the relationship between MC and health benefits in children and adolescents indicated that MC levels are inversely correlated with weight status both in cross-sectional and longitudinal studies; in that review, weight status was negatively correlated with MC

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