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## ORIGINAL ARTICLE

# Waist circumference as a mediator of biological maturation effect on the motor coordination in children



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### KEYWORDS

Biological maturation;  
Physical fitness;  
Anthropometrics;  
Children

### Abstract

**Objective:** The present study aimed to: 1) examine the association of biological maturation effect on performance at a motor coordination battery and 2) to assess whether the association between biological maturation and scores obtained in motor coordination tests is mediated by some anthropometric measurement.

**Methods:** The convenience sample consisted of 73 male children aged 8 years old. Anthropometric data considered the height, body mass, sitting height, waist circumference, body mass index, fat mass and fat-free mass estimates. Biological maturation was assessed by the percentage of the predicted mature stature. Motor coordination was tested by the Körperkoordinationstest für Kinder. A partial correlation between anthropometric measurements, z-score of maturation and the motor coordination tests were performed, controlling for chronological age. Finally, causal mediation analysis was performed.

**Results:** Height, body mass, waist circumference and fat mass showed a slight to moderate inverse correlation with motor coordination. Biological maturation was significantly associated with the balance test with backward walking ( $r=-0.34$ ). Total mediation of the waist circumference was identified in the association between biological maturation and balance test with backward walking (77%).

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**PALAVRAS-CHAVE**

Maturação biológica;  
Aptidão física;  
Antropometria;  
Crianças

**Conclusions:** We identified an association between biological maturation and KTK test performance in male children and also verified that there is mediation of waist circumference. It is recommended that studies be carried out with female individuals and at other age ranges.

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### Perímetro de cintura como mediador da influência da maturação biológica no desempenho de coordenação motora em crianças

**Resumo**

**Objetivo:** O presente estudo teve como objetivos: 1) analisar a associação do estado maturacional com o desempenho nas provas de coordenação motora em crianças e 2) examinar se a relação entre o estado maturacional e o desempenho no KTK é mediada por alguma medida antropométrica.

**Métodos:** A amostra de conveniência foi composta por 73 crianças do sexo masculino com 8 anos. A antropometria considerou a estatura, massa corporal, altura sentado, o perímetro de cintura, índice de massa corporal, as estimativas de massa gorda e massa livre de gordura. A maturação biológica foi avaliada pelo percentual da estatura matura predita. A coordenação motora foi testada pela bateria Körperkoordinationstest für Kinder. Foi feita a correlação parcial entre as medidas antropométricas, z-escore da maturação e as provas de coordenação motora, com controle para idade cronológica. Por último, a análise de mediação causal foi feita.

**Resultados:** Estatura, massa corporal, perímetro de cintura e massa gorda apresentaram correlação inversa de magnitude pequena a moderada com as provas de coordenação motora. A maturação biológica associou-se significativamente à prova de equilíbrio em marcha à retaguarda ( $r=-0,34$ ). Foi identificada mediação total do perímetro de cintura na relação do estado maturacional com o equilíbrio em marcha à retaguarda (77%).

**Conclusões:** Foi possível identificar a associação entre o estado físico maturacional e o desempenho em uma prova da bateria de coordenação motora em crianças do sexo masculino e, ainda, afirmar que há mediação do perímetro de cintura. Recomenda-se que estudos sejam feitos com indivíduos de outras idades e do sexo feminino.

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**Introduction**

The motor coordination of children seems to be associated with health-related physical fitness,<sup>1</sup> physical activity,<sup>2</sup> body composition,<sup>3</sup> sociodemographic characteristics,<sup>4</sup> and consequently the overall health of this population. However, motor development in prepubertal ages appears to influence decisively the motivation<sup>5</sup> and even the involvement in motor practices in adolescence, such as games and sports.<sup>6</sup>

The Körperkoordinationstest für Kinder (KTK) test has been used to evaluate motor coordination in children and adolescents.<sup>7,8</sup> However, there is a lack of studies in the literature describing the multiple factors that may be related to motor development of children, including the biological maturation. The studies performed with the KTK test battery aimed primarily at the association of the anthropometric characteristics of children and youth, especially body mass index (BMI), with test performance.<sup>7,8</sup> However, in a recent systematic review with meta-analysis of studies on the subject, no selected study took into account the

relationship between maturational status and BMI values of individuals, as well as performance on motor coordination tests.<sup>7</sup>

The maturational status has been related to physical activity<sup>9</sup> and physical fitness of young subjects.<sup>10</sup> However, the most popular measures of biological maturation result from sexual maturation stages that are unique to the pubertal years and do not correspond to a continuous scale, likely to be used in a correlational design.<sup>11</sup> Katzmarzyk et al.<sup>10</sup> used the skeletal maturation method and the results showed the complexity of the interrelations between body size, sexual maturation, and physical fitness. Still, the authors stated that the effects of biological maturation in children are mainly expressed through body size and that maturational status was the strongest influence on the physical performance of children.

Therefore, the aim of this study was to evaluate the association of maturational status with performance on KTK tests in prepubertal children and the relationship between biological maturation and performance in KTK mediated by some anthropometric measurement of individuals.

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