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## REVIEW ARTICLE

# Physical activity and biological maturation: a systematic review

Eliane Denise Araújo Bacil<sup>a,\*</sup>, Oldemar Mazzardo Júnior<sup>a</sup>, Cassiano Ricardo Rech<sup>b</sup>,  
Rosimeide Francisco dos Santos Legnani<sup>a</sup>, Wagner de Campos<sup>a</sup>

<sup>a</sup> Universidade Federal do Paraná (UFPR), Curitiba, PR, Brazil

<sup>b</sup> Universidade Federal de Santa Catarina (UFSC), Florianópolis, SC, Brazil

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### KEYWORDS

Puberty;  
Motor activity;  
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### Abstract

**Objective:** To analyze the association between physical activity (PA) and biological maturation in children and adolescents.

**Data source:** We performed a systematic review in April 2013 in the electronic databases of PubMed/MEDLINE, SportDiscus, Web of Science and LILACS without time restrictions. A total of 628 potentially relevant articles were identified and 10 met the inclusion criteria for this review: cross-sectional or longitudinal studies, published in Portuguese, English or Spanish, with schoolchildren aged 9-15 years old of both genders.

**Data synthesis:** Despite the heterogeneity of the studies, there was an inverse association between PA and biological maturation. PA decreases with increased biological and chronological age in both genders. Boys tend to be more physically active than girls; however, when controlling for biological age, the gender differences disappear. The association between PA and timing of maturation varies between the genders. Variation in the timing of biological maturation affects the tracking of PA in early adolescent girls. This review suggests that mediators (BMI, depression, low self-esteem, and concerns about body weight) can explain the association between PA and biological maturation.

**Conclusions:** There is an association between PA and biological maturation. PA decreases with increasing biological age with no differences between genders. As for the timing of biological maturation, this association varies between genders.

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\*Corresponding author.

E-mail: elianebacil@hotmail.com (E.D.A. Bacil).

**PALAVRAS-CHAVE**

Puberdade;  
Atividade motora;  
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Adolescentes

**Atividade física e maturação biológica: uma revisão sistemática****Resumo**

**Objetivo:** Analisar a associação entre atividade física (AF) e maturação biológica em crianças e adolescentes.

**Fontes de dados:** Realizou-se uma revisão sistemática em abril de 2013 nos bancos de periódicos eletrônicos da PubMed/MEDLINE, SportDiscus, Web of Science e LILACS, sem restrição de período de tempo. Foram identificados 628 artigos potencialmente relevantes e dez preencheram os critérios de inclusão, ou seja, eram estudos transversais ou longitudinais, publicados em português, inglês ou espanhol e envolvendo escolares de 9 a 15 anos, de ambos os sexos.

**Síntese dos dados:** Apesar da heterogeneidade dos estudos, foi possível identificar uma associação inversa entre AF e maturação biológica. A AF diminui com o aumento da idade cronológica e biológica em ambos os sexos. Os meninos tendem a praticar mais AF do que as meninas. Contudo, controlado o efeito da idade biológica, estas diferenças entre sexos desaparecem. A associação entre AF e timing da maturação biológica varia entre os sexos. A variação no timing da maturação biológica parece ter efeito no tracking da AF em meninas adolescentes precoces. Os artigos desta revisão sugerem variáveis mediadoras (IMC, depressão, baixa autoestima e preocupações com o peso corporal) como potenciais explicativos da associação entre AF e maturação biológica.

**Conclusões:** Observou-se que existe uma relação inversa entre AF e maturação biológica. Com relação ao tempo da maturação biológica, a AF diminui com o aumento da idade biológica não apresentando diferenças entre os sexos e com relação ao timing da maturação biológica esta relação varia entre os sexos.

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**Introduction**

Regular physical activity (PA) brings benefits in the short and long-term to the cardiovascular, bone, muscle and psychological health of children and adolescents.<sup>1,2</sup> During childhood and adolescence, boys tend to perform more PA than girls.<sup>3</sup> In both genders, PA levels decrease with age, especially during adolescence. The decrease is greater among younger girls (9-12 years) and older boys (13-16 years),<sup>4</sup> and it manifests in many contexts, including active transportation, physical education classes and leisure PA, and may extend into adulthood.<sup>5-7</sup>

The decline in PA among adolescents seems to be more associated with biological age than with chronological age.<sup>8</sup> Biological maturation is a factor that can change the pattern of PA in children and adolescents. Biological maturation refers to the progression toward the state of maturity, and can be analyzed by two components: timing and time. "Timing" is considered the moment when a given maturation event occurs. For instance, the age of menarche, the growth spurt period, the appearance of secondary sexual characteristics, among others. When identifying the timing of biological maturation of an individual, it is possible to classify this individual as early-maturing, on time or late-maturing. "Time" is the rate at which this event is expressed, i.e., how fast or slow these changes manifest themselves.<sup>9,10</sup>

Individuals become less physically active as they progress toward the state of maturity, regardless of chronological

age.<sup>10</sup> The different timing of sexual maturation and the growth spurt related to age and gender may be relevant to this decrease in PA.<sup>8</sup> In girls, the onset of secondary sexual characteristics, such as breast development, may contribute to perceptions of discomfort and lower self-esteem, which favors a decreased participation in PA.<sup>11</sup> Additionally, hormonal changes and changes in body composition, such as increased body fat, which are characteristic of this phase, may be related to reduced PA.<sup>12</sup> In boys, the age of the early peak height velocity (PHV) can positively influence the behavior of PA due to increased muscle mass and strength, which tends to occur after the peak height velocity (PHV) point.<sup>13</sup> These changes in body composition and physical fitness promote better sports performance. Individuals who regularly participate in sports during adolescence tend to perform more daily PA, and are more likely to perform PA in adulthood.<sup>14</sup> The understanding of the biological maturation process influence on the practice of PA may allow the identification of adequate maturation time for intervention and behavior modification, in which the decrease in PA is more prominent in children and adolescents.

However, the association between timing of biological maturation (early, on time or late) and participation in PA is still controversial in literature. Studies have indicated that the risk of insufficient PA is twice as high in boys who matured earlier than in their peers who matured on time.<sup>15</sup> However, other studies suggest that boys who mature early have significantly higher values of vigorous PA compared to boys who matured on time or late.<sup>16</sup> Regarding girls, studies

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