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## ORIGINAL ARTICLE

# Influence of flexibility and gender on the posture of school children<sup>☆</sup>

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### KEYWORDS

Range of articular  
motion;  
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Child;  
Adolescent

### Abstract

**Objective:** To evaluate whether flexibility and gender influence students' posture.

**Method:** Evaluation of 60 female and male students, aged 5 to 14 years, divided into two groups: normal flexibility (n=21) and reduced flexibility (n=39). Flexibility and posture were assessed by photogrammetry and by the elevation of the lower limbs in extension, considering the leg angle and the postural evaluation. Descriptive statistics (mean and standard deviation) were used for data analysis. Analysis of variance (ANOVA) was applied to assess the joint influence of flexibility and gender on the posture-dependent variables. After verifying an interactive effect between the variables of gender and flexibility, multiple comparisons using the t test were applied.

**Results:** Flexibility influenced the symmetry angle of the knee ( $p<0.05$ ) and anteroposterior body tilt ( $p<0.05$ ). Gender did not influence postural angles ( $p>0.05$ ). There was an interactive effect between the variables of gender and flexibility on the knee symmetry angle ( $p<0.02$ ). Male students with reduced flexibility had greater asymmetry of the knee when compared to the other subgroups.

**Conclusion:** Posture was influenced by an isolated effect of the variable of flexibility and by an interactive effect between gender and flexibility.

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**PALAVRAS-CHAVE**

Amplitude do movimento articular;  
Sexo;  
Postura;  
Criança;  
Adolescente

**Influência da flexibilidade e sexo na postura de escolares****Resumo**

**Objetivo:** Verificar se a flexibilidade e o sexo exercem influência sobre a postura de escolares.

**Método:** Foram avaliados 60 escolares de ambos os sexos, com idade entre 5 e 14 anos, divididos em dois grupos: flexibilidade normal (n=21) e flexibilidade reduzida (n=39). A flexibilidade e a postura foram avaliadas, respectivamente, por meio da fotogrametria e do teste de elevação dos membros inferiores em extensão, considerando o ângulo da perna e a avaliação postural. Para o tratamento de dados, foi feita a estatística descritiva (média e desvio padrão). A análise de variância univariada (ANOVA) foi utilizada para verificar a influência conjunta dos fatores flexibilidade e sexo nas variáveis dependentes posturais. Após verificar efeito interativo entre esses dois fatores, procederam-se as comparações múltiplas, utilizando o teste *t*.

**Resultados:** A variável flexibilidade exerceu efeito sobre o ângulo de simetria do joelho ( $p < 0,05$ ) e da inclinação corporal ântero-posterior ( $p < 0,05$ ). O sexo não apresentou influência sobre os ângulos posturais ( $p > 0,05$ ). Houve interação entre as variáveis flexibilidade e sexo no ângulo de simetria do joelho ( $p < 0,02$ ). Escolares do sexo masculino e flexibilidade reduzida apresentaram maior assimetria de joelho, comparados aos outros subgrupos.

**Conclusão:** A postura sofreu efeito isolado da variável flexibilidade e efeito interativo entre o sexo e a flexibilidade.

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**Introduction**

Human posture is a result of the association between gravity and the body's limbs<sup>1</sup> and may undergo changes over time. Alterations commonly begin during the school age, as bodily growth and development occur in that period.<sup>2</sup>

Age, gender, school backpack weight, anthropometric parameters,<sup>3</sup> position at the computer,<sup>4</sup> time spent in the sitting position,<sup>5</sup> decreased flexibility,<sup>6</sup> and less active life style,<sup>7-9</sup> are some of the factors that generate discomfort, musculoskeletal changes, and influence posture. It is known that adolescents may have scoliosis, body asymmetries, spinal misalignment,<sup>10</sup> and pains, which eventually have long-term consequences,<sup>11</sup> clinically impairing health and influencing the quality of adult life.

The prevention of musculoskeletal injuries and improvement in muscle movement and performance depend on body flexibility.<sup>12</sup> Flexibility is defined as the passive mobility of the body part, whose restriction lies in its own structure,<sup>13</sup> which is closely associated to muscle extensibility, range of motion, and plasticity of ligaments and tendons.<sup>6</sup> When there is limitation of the latter, the body undergoes a number of counterbalances, in order to establish an adaptive response to a set of disharmonies,<sup>14</sup> which may influence the adopted posture.

In addition to flexibility,<sup>12</sup> gender can also have an effect on posture, especially on spinal abnormalities, such as cervical lordosis and thoracic kyphosis in boys,<sup>15</sup> and lumbar hyperlordosis in girls.<sup>16</sup> The literature is scarce regarding the influence of gender on postural changes in the lower limbs. Most of the studies that assess posture evaluate angles that indicate rotation, valgus or varus knees, and positioning of the pelvis.<sup>17-19</sup>

However, the analysis of body symmetry is considered important, since it provides clinical subsidies for flexibility and postural changes to be developed considering the patient as a whole. Clinically, medical assistance is only sought when alterations in children and adolescents are already visible. Therefore, it is necessary to perform postural screening in primary health care to identify these alterations, in order to make timely interventions aimed to minimize and correct inappropriate behaviors.<sup>10</sup>

When considering the importance of evaluating the posture in children and adolescents and identifying factors that cause postural changes, the authors formulated the hypothesis that flexibility and gender may influence posture. Thus, this study aimed to verify whether flexibility and gender influence the posture of school children and adolescents.

**Method**

This was a cross-sectional study of a convenience sample, conducted with 60 school children and adolescents in the city of Florianópolis, state of Santa Catarina, Brazil. To characterize the sample, medical history files containing data on the child, such as age, anthropometric measures (body mass and height), and questions that addressed the inclusion and exclusion criteria for this study were used. Inclusion criteria were school children and adolescents aged 5 to 14 years, of both genders. Students with special needs, those undergoing orthopedic treatment and/or physical therapy, or presence of other pathologies associated with posture or congenital malformation were excluded.

This study was approved by the Ethics and Research Committee of Universidade do Estado de Santa Catarina,

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