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Can high weight influence motor development of children aged zero to two years?

O peso elevado pode influenciar o desenvolvimento motor da criança de zero a dois anos?

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Abstract

Introduction: Obesity/overweight interferes with motor skill acquisition of children and, to create adapted mechanisms, children may alter their development. **Objectives:** To verify whether high weight interferes with child motor development and identify differences in development between genders. **Materials and Methods:** Forty-three children aged zero to two years participated in the study and were divided into high weight-for--age (GE) and comparison (CG) groups. All children were evaluated using the "Alberta Infant Motor Scale." Data analysis was performed using descriptive statistics (relative and absolute frequencies and mean and standard deviation). Kolmogorov-Smirnov verified data normality and Student's t-test for independent samples was applied. In all cases, we considered a significance level of 5% ($p<0.05$). **Results:** Body Mass Index ($p = 0.000$), weight-for-age ($p = 0.002$), and deficit in motor development ($p = 0.039$) were different between GE and CG. Motor development was not different between genders in both groups. **Conclusion:** High weight interferes negatively with motor development of children aged zero to two years. Monitoring, guidance, and early intervention are needed to minimize and avoid possible alterations.

Keywords: Obesity. Overweight. Infant. Child development.

Resumo

Introdução: A obesidade/sobrepeso pode interferir na aquisição das habilidades motoras do lactente, o qual, na tentativa de buscar mecanismos de adaptações tem o seu desenvolvimento motor alterado. **Objetivos:** Verificar se o peso elevado para a idade interfere no desenvolvimento motor da criança de zero a dois anos de idade e, se há diferença do desenvolvimento entre meninos e meninas. **Materiais e Métodos:** Participaram do estudo 43 lactentes de zero a dois anos, divididos em dois grupos: Grupo com peso elevado para a idade (GE) e Grupo de comparação (GC). Todos foram avaliados por meio da "Escala Motora Infantil de Alberta". A análise dos dados foi realizada por meio de estatística descritiva, com frequências relativas e absolutas, média e desvio padrão. Para verificar a normalidade das variáveis aleatórias utilizou-se o teste *Kolmogorov-Smirnov*, e considerando a normalidade dos dados, foi aplicado o teste *t-Student* para amostras independentes. Em todos os casos, considerou-se um nível de significância de 5% ($p<0,05$). **Resultados:** Verificou-se diferença estatisticamente significativa entre o GE e o GC para as seguintes variáveis: Índice de Massa

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Corpórea (p=0,000), peso para a idade (p=0,002), e déficit no desenvolvimento motor observado nas crianças com peso elevado (p=0,039). Não houve diferença estatisticamente significativa para o desenvolvimento motor entre meninos e meninas em ambos os grupos. **Conclusão:** Os resultados confirmam que o peso elevado, entre zero a dois anos de idade, pode interferir negativamente no desenvolvimento motor. Assim, é necessário monitorar o desenvolvimento dessas crianças, orientar e intervir precocemente para minimizar e prevenir as possíveis alterações.

Palavras-chave: obesidade; sobrepeso; lactente; desenvolvimento infantil

Introduction

Obesity is the oldest chronic metabolic disorder observed in all age groups of underdeveloped and developed countries. It reduces life expectancy[1] and is a current public health problem[2,3].

The prevalence of childhood obesity increased worldwide, while associations between delayed motor skills and risk factors for cardiovascular, orthopedic, psychosocial, and metabolic disorders increase morbidity and mortality in the long-term[4,5]. Therefore, careful monitoring since childhood is important for early detection and intervention to prevent future complications[6].

Changes in eating habits, such as overeating and under-eating, have been observed in Brazil. Thus, obesity is replacing malnutrition due to low-cost, low-quality, and carbohydrate-rich diet[7].

High birth weight is multifactorial (i.e., related to environmental and biological factors) and may contribute to obesity /overweight in childhood and adolescence[8,9]. Obesity /overweight may interfere with motor skill acquisition in children, imposing adapted mechanisms and changes in motor development[4].

Motor development is a continuous process of acquiring motor skills, influenced by age, environmental, social, emotional conditions, and individual biology[10]. Gender also influences motor development[11,12], and activities and expectations experienced by children from birth to adulthood differ between genders. Consequently, gender influences behavior toward attitudes, skills, traits, typification, and stereotypes learned according to what is considered appropriate for the gender. Thus, cultural standards diverge due to different stimuli offered to boys and girls, interfering with motor development and compromising motor skill acquisition[11]. Moreover, child growth and development are influenced by pre-established historical, social, and cultural contexts related to genders[12].

Motor skill acquisition is fundamental for motor learning in early childhood and closely linked to body perception in space and time. Motor development must occur naturally and harmoniously in early childhood to improve acquired motor skills at school age, enabling children to master their bodies in different activities, such as jumping, running, crawling, kicking a ball, balancing on one foot, and writing. By mastering the body, children also acquire intellectual development[10], justifying the importance of monitoring and stimulating child motor development, allowing them to perform motor skills and making sure obesity/overweight do not interfere with performance.

Considering the negative influence of high weight on motor development and the lack of literature on the topic, the present study aimed to verify whether high weight interferes with motor development of children aged zero to two years. Differences in motor development between genders were also verified.

Materials and Methods

This is a cross-sectional study, with descriptive and quantitative approach, and performed with a convenience sample.

The Research Ethics Committee of the Federal University of Triângulo Mineiro (UFTM) approved the study (protocol no. 1,092,682), according to Resolution no. 466/12 for research involving human beings (National Health Council/Brazilian Ministry of Health). Guardians authorized all children by signing the Informed Consent Form.

Children whose gestational age was ≥37 weeks, Apgar score >7 in the first and fifth minutes of birth, adequate head circumference at birth, and not attending daycare or school were included. Exclusion criteria comprised pre- (intrauterine growth restriction), peri- (anoxia, hypoxia, Apgar score <7), or postnatal (diagnosed neurological impairment, hearing, visual, and sensory deficits, genetic syndromes, musculoskeletal and cardiac abnormalities, or according to information collected from the guardian) complications and children whose guardian did not sign the Informed Consent Form.

Forty-four children were evaluated: 22 selected at the Childhood Nutrition Disorders Outpatient Clinic and 22 selected by convenience at the Childcare and Pediatrics Outpatient Clinic, both at Hospital de Clínicas/UFTM/EBSERH. After excluding one child attending daycare (great external stimuli), 43 children were included in the study.

Children were divided into two groups, according to growth curves (weight-for-age and body mass index-for-age [BMI-for-age]) of WHO[13] and the Brazilian Society of Pediatrics[14]. These are High Weight Group (EG) - 21 children diagnosed with high weight and BMI-for-age; and Comparison Group (CG) - 22 children with appropriate weight and BMI-for-age.

Evaluations occurred in the Pediatric Outpatient Clinic of the Hospital de Clínicas/UFTM/EBSERH, at accessible hours to children and parents. Children wore diapers throughout evaluation to avoid interference of clothes during the test.

A medical history form was used to collect personal, developmental, and anthropometric data (weight, height, and BMI). BMI was considered the main index of excess body fat. The Brazilian version of the Alberta Infant Motor Scale (AIMS)[12,15], an observational instrument of infant motor skills, was used to assess motor development and control of antigravitational muscles. It consisted of 58 items divided into subscales, considering four postures: prone (21 items), supine (9 items), sitting (12 items), and standing (16 items). Weight unloading, posture, and antigravitational movements were also observed. Total score was presented in a chart with percentiles corresponding to chronological age.

Weight, height, and BMI were obtained using a scale, anthropometric ruler, and a calculator, respectively.

To evaluate AIMS, mats and stretchers were used to place children and toys and stimulate interaction with therapist. Delayed motor development was observed considering percentiles reached on the AIMS graph, including total score and age. The following scores were considered: below 5th percentile, children with atypical motor development; between 5 and 25th, children with risk of delayed motor development; and above 25th percentile, children with typical motor development for their age.

Data were characterized using descriptive statistics (relative and absolute frequencies, mean, and standard deviation) and analyzed using SPSS software (Statistical Package for Social Sciences, version 20. 0). Kolmogorov-Smirnov test verified normality of random variables (AIMS score and BMI) related to groups (EG and CG) and gender (male and female): AIMS of the EG (KS=0.14), AIMS of the CG (KS=0.12), AIMS of the EG in boys (KS=0.14), AIMS of the EG in girls (KS=0.20), AIMS of the CG in boys

(KS=0.14), and AIMS of the CG in girls (KS=0.16).

Considering data normality, Students' t-test for independent samples was used for AIMS score to verify motor development differences between EG and CG children.

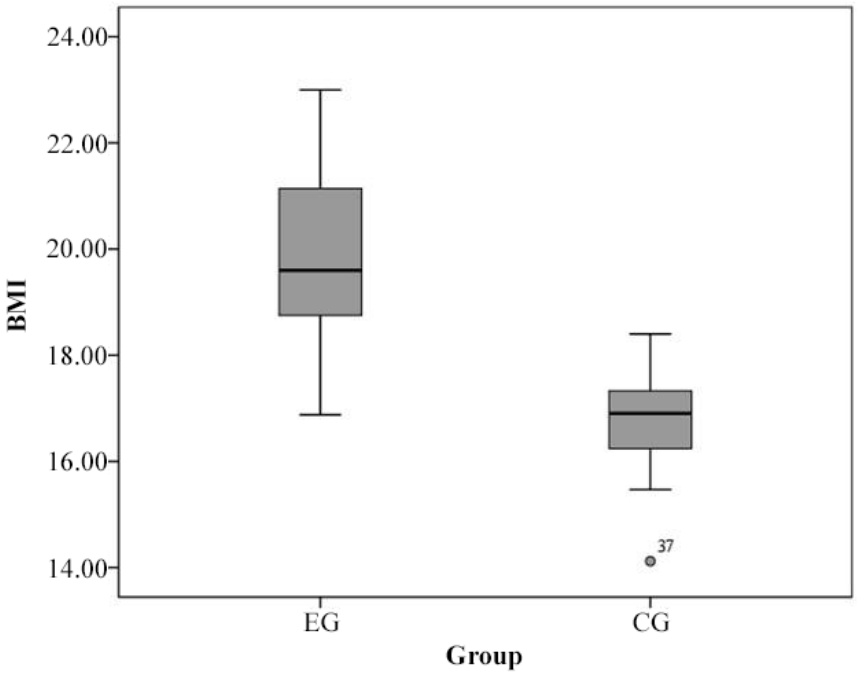
Student's t-test for independent samples was adopted to analyze AIMS scores between genders in both groups. Significance level was set at $p<0.05$.

Results

EG consisted of 12 boys and 9 girls with mean age of 6.95 (± 4.30) months. Mean weight was 9,248.19 grams (± 1,489.15), mean height was 67.42 cm (± 8.45), and mean BMI was 19.93 kg/m^2 (± 1.53). AIMS total score was 22.05 points (± 9.96). In the CG, 14 boys and 8 girls participated in the study, with mean age of 6.23 months (± 2.89). Mean weight was 7,777.95 grams (± 1,394.89), mean height was 67.02 cm (± 8.63), mean BMI was 16.7195 kg/m^2 (± 0.97), and mean AIMS score was 30.91 points (± 16.42).

EG showed higher BMI values (p=0.000) compared with CG (Figure 1). The 95% confidence interval for mean difference between groups was [2.41; 4.02].

Figure 1 - Mean and standard deviation of BMI differences between EG and CG.



EG presented the highest weight (p=0.002) (Figure 2). The 95% confidence interval for mean difference between groups was [582.01; 2358.46].

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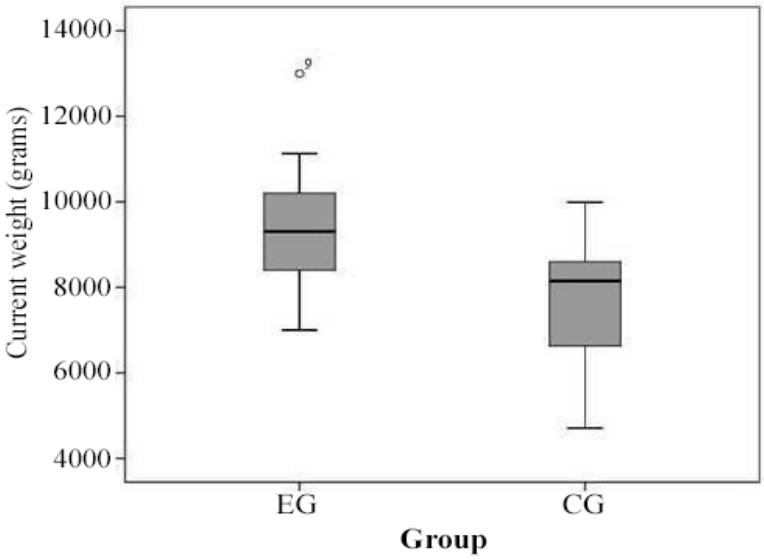
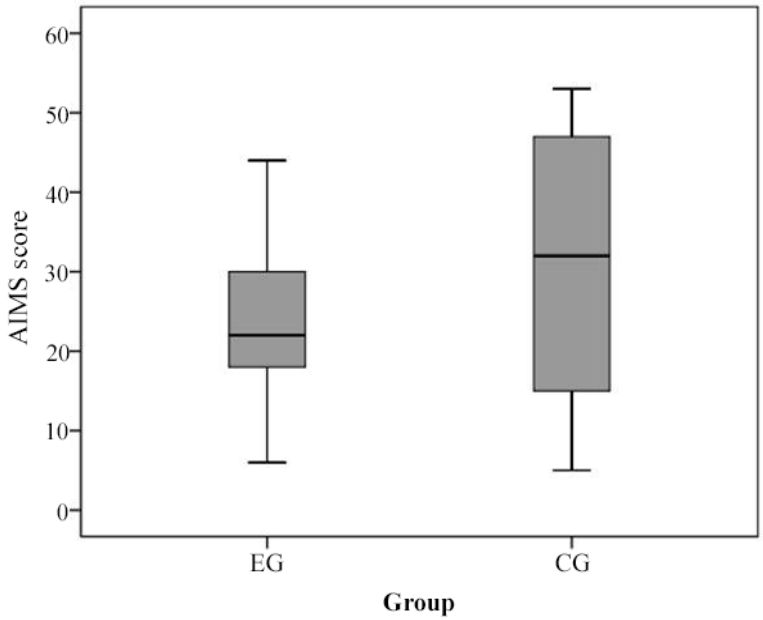
Figure 2 - Mean and standard deviation of current weight differences between EG and CG.



Low motor development was observed for EG compared with CG (p=0.039) (Figure 3). The 95% confidence interval for mean difference between groups was [-17.23; -0.493], showing atypical development in children with high weight- and BMI-for-age.

Figure 3 - Mean and standard deviation of differences in Alberta Infant Motor Scale (EMIA) scores between EG and CG.



Gender-related motor development was not significantly different between EG (p=0.32) and CG (p=0.94).

Discussion

Motor development of children with high weight- and BMI-for-age (EG) was lower than children with appropriate weight and BMI (CG). Further studies on the topic are essential since childhood and adolescence obesity rates are growing. Overweight children aged six months are 50% more likely to become obese adults, reflecting increased cardiovascular and metabolic consequences[16].

According to Freitas et al.[17], motor skill acquisition in motor development is influenced by physiological, neuromuscular, morphological, and environmental characteristics. Also, children need motor coordination to refine and integrate these skills. The same study[17] reported difficulties in motor coordination of children with high BMI, indicating that high weight is a negative development factor, corroborating our findings. As a result, high weight- and BMI-for-age impair motor development acquisition and influence refinement of movement patterns.

An epidemiological study conducted in Brazil indicated that approximately 35% of school-aged children are overweight[18]. The incidence of overweight in children has been increasing in the last 30 years, characterizing a public health problem and influencing short- and long-term child health[19]. Therefore, attention must be given to obesity since, besides systemic complications, it interferes with motor development, as observed in the present study.

Motor development was not different between genders. This finding corroborates a recent study[20] that observed similarities between genders of children aged up to 13 months and a slight change in motor skill acquisition from 14 months onward, emphasizing the need for constant surveillance and adequate stimulation of motor development. Our results were also similar to those found in a study conducted with 90 children[11], which showed no significant motor development differences between genders of children aged up to 18 months. This indicates that environmental stimuli offered in early childhood do not influence motor development.

However, environmental differences[21], experiences, and tasks in early childhood may alter behavior, leading to differences in motor skill acquisition between genders, contradicting our results. Despite this, no studies on development, high weight, and gender in children aged zero to two years were found, limiting the discussion. Further studies are needed to verify whether gender interferes with motor development of children with high and appropriate weight, especially those aged zero to two years.

The present study calls attention to early care of children with high weight or obesity, especially those aged zero and two years since this is the period of greatest motor behavior, skill acquisition, and changes in eating habits. Findings and discussion of this study may help professionals plan and develop multidisciplinary programs according to child needs, enabling early intervention in pediatric primary health care.

Conclusion

Children aged zero to two years with high weight-for-age present atypical motor development compared with children with appropriate weight-for-age. Therefore, motor development must be monitored to minimize and prevent alterations during this critical period.

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