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KINEMATIC ANALYSIS OF GAIT AND INFLUENCE OF BACKPACK USE IN OVERWEIGHT CHILDREN

[1,2]Marcus Paulo Araujo, [3]Flávia Porto, [2]Hilbert da Silva Julio [1,2]Gabriel Espinosa, [1]Pedro Paulo Soares, [1,2]Jonas Lírio Gurgel

[1]Stricto Sensu Post Graduation in Cardiovascular Sciences, Medical Science Center, Fluminense Federal University, UFF, Niterói/RJ, Brazil [2]**Biomechanics Research Group** – GPBIO, **Institute of Physical Education**, UFF, Niterói/RJ, Brazil [3]Stricto Sensu Post Graduation in Exercise Sciences and Sports, Gama Filho University, UGF, Rio de Janeiro/RJ, Brazil; e-mail: araujo.marcuspaulo@gmail.com

SUMMARY

The study aimed to analyze the gait kinematics of youth aged 13-17 years, with BMI≥20 and BMI<20, with and without backpack. It was evaluated 15 boys (mean age 13.8±1.19 years, body weight 48.98±9.74 kg, height 1.62±0.09 m, BMI 18.95±2.64 kg/m²). The gait was evaluated by kinemetry based on video and a standardized backpack with load based on an average weight of the backpacks of all tested subjects. Were measured the durations of phases: Swing, Double and Single Support, average speed, average angles of the hip, knee and ankle. There were significant differences in the angles of the hip, knee and ankle in both groups.

INTRODUCTION

Obesity is a chronic disease of multiple mechanisms directly associated with the development of various diseases. [1] Shultz et al. (2010) suggest that obese children move less and with more difficulty than non-obese children, besides they have a greater energetic expenditure to perform the same movement than non-obese childrens[2].

The act of moving is inherent to the human being. The development of strength and flexibility are important in performing daily tasks at school age youth. At this point, the backpack presents itself as an essential accessory for transporting materials, generating discussions regarding changes in gait pattern[3]. Studies indicate that there are differences in the gait of non-obese individuals with and without backpack[4]. Considering that obesity is related to low levels of physical activity, it is possible that overweight young people have more significant changes in gait carrying backpacks.

METHODS

15 boys were evaluated with a mean age of 13.8±1.19 Years, body weight 48.98±9.74 kg, height 1.62±0.09 m, BMI 18.95±2.64 kg/m². These were stratified into two groups: BMI≥20 and BMI<20 from the classification proposed by Conde and Monteiro (2002). The gait was evaluated by kinemetry based on video, using an 60 Hz digital camera to record Sagittal plane. The following variables were measured: duration of the phases Double Support (DS), Single Support (SS) and Swing (SWI), mean velocity (MV), average angles of the hip, knee and ankle (AAH, AAK and AAA) in the three phases of gait.

The subjects have walked on a straight and horizontal path, previously marked of 3.75 meters. All participants were instrumented with reflective markers on joints, to enable the recording of body segments in step scan images. Each subject performed the path three times with different speed auto selected, classified as slow, normal and fast. The subjects repeated the same path under the same conditions using a standardized backpack, which load corresponded to the average mass of the subjects' backpacks. Was used SkillSpector (Video4Coach) software for digitization of images and for calculating the kinematic data.

Statistical analysis was performed by SPSS 17.0 software (for Windows, NY, USA). Was used the Shapiro-Wilk test for normality. We performed an double entry ANOVA for repeated measures to compare the two individuals groups under the conditions with and without backpack and to compare groups BMI≥20 and <20, and adopted the value of P≤0.05 significance level for all tests.

RESULTS AND DISCUSSION

The results presented in Tables 1, 2 and 3 are related to variables with statistical significance: average angles of hip (AAH), knee (AAK) and ankle (AAA) during three phases of gait: double support (DS), single support (SS) and swing (SWI). The results are also presented comparing groups BMI≥20 and BMI<20 (p between groups) and comparing the situations with and without backpack (p between conditions). The results are shown as mean and standard deviation and accompanied by p value.

In relation to the temporal aspects of gait were not found statistically significant differences. In respect to variations in the angles of the joints of the ankle, knee and hip phases DS, SS and SWI, the results observed in this study were similar for the three joints in the three phases of

gait analysis. The joint angles tended to decrease comparing individuals in situations with and without backpack. Such changes may indicate an alteration in gait pattern of individuals, the same results that were claimed by others studies.

CONCLUSIONS

Changes were observed in the average angles of ankle, knee and hip, during all three phases of gait in both groups, showing that the use of backpack could influence these kinematic parameters.

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Table 1: AAA, AAK e AAH (degrees) in DS Phase with and without backpack

Groups	DS-AAA BCP	DS-AAA	p between conditions	DS-AAK BCP	DS-AAK	p between conditions	DS-AAH BCP	DS-AAH	p between conditions
BMI≥20	90.6± 3.20	95.4± 0.00	<0.001*	160.4± 5.20	160.6± 4.53	0.779	176.2± 4.44	176.2± 4.44	<0.001*
BMI<20	94.0± 3.26	98.1± 0.00	<0.001*	164.8± 6.35*	162.2± 6.13	<0.001*	178.4± 5.30	178.4± 5.30	<0.001*
p between groups		0.042**			0.383			0.192	

*Significant difference in the groups BMI≥ 20 and BMI<20 with and without backpack (P≤0.05)
**Significant difference between groups BMI≥20 and BMI<20 (P≤0.05)

Table 2: AAA, AAK e AAH (degrees) in SS Phase with and without backpack

Groups	SS-AAA BCP	SS-AAA	p between conditions	SS-AAK BCP	SS-AAK	p between conditions	SS-AAH BCP	SS-AAH	p between conditions
BMI≥20	88.5± 3.44	94.1± 3.35	<0.001*	166.9± 4.31*	169.7± 4.55*	<0.001*	174.7± 3.32	182.0± 4.00	<0.001*
BMI<20	91.5± 4.11	96.4± 4.18	<0.001*	172.0± 5.89	171.3± 5.76	0.432	178.3± 4.37	182.5± 4.86	<0.001*
p between groups		0.063			0.319			0.711	

*Significant difference in the groups BMI≥ 20 and BMI<20 with and without backpack (P≤0.05)
**Significant difference between groups BMI≥20 and BMI<20 (P≤0.05)

Table 3: AAA, AAK e AAH (degrees) in SWI Phase with and without backpack

Groups	SWI-AAA BCP	SWI-AAA	p between conditions	SWI-AAK BCP	SWI-AAK	p between conditions	SWI-AAH BCP	SWI-AAH	p between conditions
BMI≥20	88.0± 2.75	92.0± 3.08	<0.001*	139.1± 6.01	140.1± 8.72	0.670	161.6± 3.89	164.6± 4.11	0.069
BMI<20	90.6± 2.34	93.8± 4.25	<0.001*	141.6± 6.34	136.7± 4.25	<0.001*	164.2± 4.64	136.7± 5.64	0.352
p between groups		0.142			0.124			0.718	

*Significant difference in the groups BMI≥ 20 and BMI<20 with and without backpack (P≤0.05)
**Significant difference between groups BMI≥20 and BMI<20 (P≤0.05)