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INFLUENCE OF OBESITY ON PLANTAR PRESSURE AND FOOT SENSITITIVY OF CHILDREN

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SUMMARY
Children obesity is a risk factor for several dysfunctions and diseases negatively affecting the locomotor system. It includes changes in plantar pressure and body stability, leading to limited mobility. Obesity generates a negative effect on afferents sensorial from periphery, especially information coming from mechanoreceptors. The increase of body weight can change the cutaneous sensorial capacity, as well as change the foot contact area [1]. Here we addressed the influence of children obesity on plantar pressure and foot sensitivity during quiet standing. Our main results are related to the higher plantar pressure and decreased foot sensitivity in obese children, which may contribute to higher risk of podal lesions as well as can have potential implication for footwear design.

INTRODUCTION
The contribution of sensorial information for postural control is widely recognized. Indeed, there are evidences that foot sensitivity contribute to regulation of posture [2]. The information provided by mechanoreceptors located in the plantar surface contributes to muscular activity modulation [3]. However, there is little known about the effects of children obesity on the use of sensorial information from the foot during standing.

The increase in body mass leads to greater ground reaction forces during walking and standing [4]. The larger mechanical stress promoted can negatively affect the output of sensorial afferences sent from the foot region and therefore impair gait and posture. The impairment in the availability of the proprioceptive signals from the foot in the obese children could explain the deficits observed for walking [5] and postural control [6] in these subjects.

Here we addressed the influence of children obesity on plantar pressure and foot sensitivity during quiet standing. Considering that obesity could negatively influence plantar pressure and foot sensitivity in the children, information on foot sensitivity and plantar pressure would help to minimize risk of podal lesions in children as well as would can have potential implication for footwear design.

METHODS
Forty children were volunteers to participate in this research. A consent form approved by the local ethics committee was signed by the legal responsible of each child. Subjects were divided in two groups according to the individual body mass index (BMI) corrected for age. Twenty obese children composed the experimental group (13 female and 7 male) and twenty normal weight children were assigned to the control group (10 female and 10 male).

Plantar pressure under each foot was recorded using a pressure mapping system (Matscan Versatek, Tekscan Inc., Boston, USA) [7]. The child stayed stood quietly with unipedal support (for both legs, alternately) with eyes open and closed (alternately) during 30 s. Each subject completed 3 repetitions for each leg, with 30 s for rest between each repetition. Plantar pressure was quantified for mean plantar pressure considering forefoot, midfoot and rearfoot and the average for the whole foot.

Foot sensitivity was evaluated by esthesiometry in the plantar surface was evaluated during rest for both the feet The foot sensitivity was graded according to the diameter of the monofilaments used. Sensitivity was averaged considering forefoot, midfoot and rearfoot and the whole foot.

Data normality was checked using Shapiro-Wilk test. Data were compared between groups using Mann-Whitney U test and between feet regions using Friedman and Wilcoxon test. All tests considered significance level set at 0.05.

RESULTS AND DISCUSSION
Obese children presented symmetry in plantar pressure (whole foot, P=0.493; forefoot P=0.329; midfoot, P=0.858 and rearfoot P=0.092). Control group presented an asymmetry for whole foot plantar pressure (P=0.001), but not for others foot regions (forefoot, P=0.092; midfoot, P=0.250; rearfoot, P=0.379). The asymmetry observed for mean plantar pressure in the control group may suggests that normal weight children would have different weight discharge between the legs for stabilization tasks, while for obese a lateral preference is not evident [8].

Experimental group showed greater mean plantar pressure group, with higher pressure on rearfoot (Figure 1).

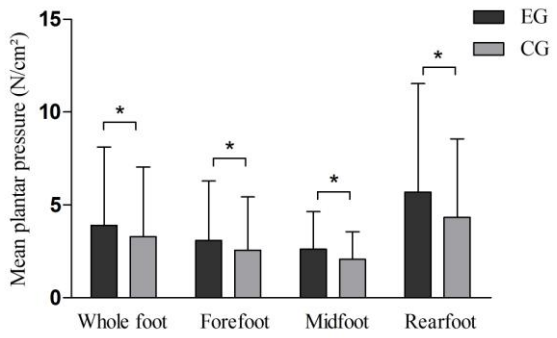

Figure 1: Plantar pressure (N/cm²) for each foot region. Bars represent average values and vertical lines represent standard-deviation. *difference between groups. P<0.05. EG = experimental group; CG = control group.

Plantar pressure was different between foot regions in the experimental group (p<0.001), while for control group midfoot and forefoot presented similar pressure (p=0.528). There were differences between all the other regions (p<0.001).

Obese children experience larger forces, foot contact area and plantar pressure than normal children [9]. It might subject obese children to greater risk of injuries that involves feet and lower limbs [10].

Experimental group had lower foot sensitivity (Table 1). The symmetry on sensibility for both the groups suggests that factors such as leg preference do not influence availability of foot sensorial information to central nervous system. Foot sensitivity differed between foot regions in the control group (P=0.051), but was similar in the experimental group (P=0.006).

Table 1: Foot sensitivity for both the groups (dimensionless). EG: experimental group; CG: control group. Best sensitivity for values close to 1.

Foot regions	EG	CG	p
Whole foot	1.66	1.38	0.002
Forefoot	1.61	1.38	0.046*
Midfoot	1.60	1.20	0.006*
Rearfoot	2.05	1.75	0.242

* significant difference, P<0.05

CONCLUSIONS

Our main results are related to higher plantar pressure and decreased foot sensitivity in obese children, which may contribute to higher risk of podal lesions as well as have potential implication for footwear design.

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