ISB 2013 BRAZIL
XXIV CONGRESS OF THE INTERNATIONAL SOCIETY OF BIOMECHANICS
XV BRAZILIAN CONGRESS OF BIOMECHANICS

# BALANCE COMPARISON BETWEEN BOYS AND GIRLS DURING DOUBLE LEG STANCE AND SINGLE LEG STANCE

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## INTRODUCTION

The postural balance is the adjustment between internal and external forces acting on the body during motor actions. It requires coordination and interaction between vestibular, visual and proprioceptive systems. The postural control in healthy children suggests that anticipatory control tasks promote the understanding of the central nervous system maturation process[1], particularly in periods of transition and development at 7 years of age and adolescence[2]. Many evaluations have used the double-leg stance protocol. However, the evaluation in one-leg stance position becomes important because of the greater demands of posture control mechanisms, allowing to identify potential diseases or disorders related to balance. Recent studies indicate that in children aged 8 to 12 years, the boys showed greater postural sway than girls, in more challenging position. Nonetheless there are few studies that describe the values of the displacement of the center of pressure (COP) in the upright quiet one-leg stance in children aged 7-8 years[3]. The comparison between double-leg and one-leg stance positions and between the dominant and non-dominant by analyzing the displacement of the COP may reveal information that will help to understand the strategies or neurosensory mechanisms involved in postural control[4]. The aim of the study was to compare the COP displacement between boys and girls at 7-8 years of age during single leg stance and double leg stance.

## METHODS

The sample was composed of 40 healthy subjects (20 boys and 20 girls). The evaluation of COP was obtained by the force platform AccuSway Plus (AMTI Inc.) at 100 Hz rate acquisition during 30s. The dominant leg was determined after the subjects to kick a ball at a distance of two meters. The positions tested were double-leg stance (closed base) and one-leg stance (dominant and non-dominant) with open eyes. The variables analyzed were: 1) CompCOP; 2) Sdap and SDml; 3) COPap and COPml; 4) VelmCOP; 5) Area95COP. Statistical tests used were ANOVA, Welch and Kruskal-Wallis ($p<0.05$).

## RESULTS AND DISCUSSION

In the analysis between the genders the average values for the boys are larger than girls, for all variables, both double leg stance and single leg stance (Table 1). There is no difference between boys and girls in double leg stance. During non-dominant single leg stance the differences were significant for the CompCOP ($p=0,043$) and VelmCOP ($p=0,046$). In dominant single leg stance, the ANOVA results show significant differences in COPap ($p=0.046$), SDAP ($p=0.024$), CompCOP ($p=0.003$) and VelmCOP ($p=0.003$). The Welch test showed $p=0.024$ for Sdap. The Kruskal-Wallis test obtained $p=0.005$ for COPml and $p= 0.006$ for SDml and Area95COP. In double-leg stance the subjects adopt some motor strategies through more coordinated timing of the muscles involved in postural activity and better integration occurs of neurosensory systems, increasing the postural balance[5]. The postural stability system is extremely complex, and several issues must be raised with regard to compensatory systems for sensory organization in children, when we consider differences in terms of age and gender[6]. Some researchers have demonstrated no differences for the variables Area95COP and VelmCOP during single leg stance in 7 years children, compared to others age groups[7]. The extensor muscles of the trunk and lower limb allow the maintenance of body position in the upright position, and this is the main aspect that influences the velocity of the COP[8]. Children around 7 years control the extensor muscles in a continuous and prolonged way[9]. This suggests that the improvement of the postural balance in one-leg stance can be explained by increased mobilization and integration of sensory systems to maintain the postural control[10]. The results of this study suggest strong evidence for the difference between boys and girls at 7-8 years age during dominant single leg stance. Regarding the influence of gender on changes in postural balance in one-leg stance, with the dominant limb, there is the action of the brain structures involved in lateralization[11]. The evaluation has shown larger variability in measures during single leg than double-leg stance, thus providing better conditions for identification of the mechanisms of posture control[4].

## CONCLUSIONS

According our results girls present better balance control than boys during single leg stance at age 7-8 years. Balance assessment in children in single leg stance may be a useful assessment to determine balance disorders or motor performance, revealing details not found in double-leg stance.

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**Table 1: Mean values and standard deviation of the COP variables in position double-leg stance and single leg stance (mean ± standard deviation)**

| COP Variables | Gender | Double-leg stance | Single leg stance not dominant | Single leg stance dominant |
|---|---|---|---|---|
| **COPml (cm)** | Female (N = 20) | 2,45±1,22 | 4,77±2,47 | **4,49*±1,91** |
| | Male (N = 20) | 2,90±1,04 | 5,57±2,48 | **8,36*±6,67** |
| **COPap(cm)** | Female (N = 20) | 3,28±1,25 | 8,09±4,37 | **7,93*±3,42** |
| | Male (N = 20) | 3,28±,71 | 8,51±3,01 | **11,28*±6,25** |
| **SDml (cm)** | Female (N = 20) | 0,43±20 | 0,76±,22 | **0,77*±,24** |
| | Male (N = 20) | 0,54±,19 | 0,88±,19 | **1,13*±,50** |
| **SDap (cm)** | Female (N = 20) | 0,61±,21 | 1,13±,30 | **1,17*±,37** |
| | Male (N = 20) | 0,60±,14 | 1,20±,31 | **1,50*±,49** |
| **CompCOP (cm)** | Female (N = 20) | 51,89±20,19 | **186,28*±66,25** | **188,52*±71,34** |
| | Male (N = 20) | 54,14±9,23 | **223,12*±41,29** | **268,58*±84,37** |
| **VelmCOP (cm/s)** | Female (N = 20) | 1,73±,67 | **6,21*±2,21** | **6,28*±2,38** |
| | Male (N = 20) | 1,80±,31 | **7,44*±1,38** | **8,95*±2,81** |
| **Area95COP ($cm^2$)** | Female (N = 20) | 5,23±4,22 | 16,77±9,09 | **17,90*±11,78** |
| | Male (N = 20) | 6,09±3,33 | 20,51±8,95 | **35,95*±25,52** |

*** significant differences (p<0, 05) between the male and female groups.**