



# Functional balance and gross motor function in children with cerebral palsy



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## ABSTRACT

**Aims:** To compare scores of children with cerebral palsy (CP) at different levels of Gross Motor Function Classification System (GMFCS), using the Pediatric Balance Scale (PBS) and to assess whether it can be used to predict GMFCS levels in children with CP.

**Methods:** Fifty-eight children with CP levels I–V of GMFCS were assessed by PBS and grouped according to their GMFCS level.

**Results:** It was observed differences in PBS scores between GMFCS I and II and between GMFCS II and III groups. Discriminant analysis indicated a 67% accuracy for the PBS instrument in assessing the GMFCS level of children with CP.

**Interpretation:** PBS is able to detect differences among GMFCS levels I, II, and III of mild and moderate impairment. Accordingly, PBS can be used reliably in clinical practice to indicate the motor impairment level of such children. The results enable specify the expected tasks that are expected to be accomplished by the children in each GMFCS level, contributing with therapeutic planning and monitoring.

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## 1. Introduction

Postural control demands the capacity to maintain center of mass within the limits of the support base and alignment of body segments (Castilho-Weinert & Forti-Bellani, 2011). Therefore, the performance of daily tasks such as self-care and mobility require postural control (Duarte & Freitas, 2010).

Children with cerebral palsy (CP) besides presenting spasticity, muscular weakness, and adaptive modifications of muscle length (Assumpção, Piucco, Corrêa, & Ries, 2011), show a compromised capability to respond to loss of balance (Barela et al., 2011). Deficits in postural control in CP result from altered sensory processing and biomechanical alignment, which determine modified neuromuscular responses (Assumpção et al., 2011; Burtner, Qualls, & Woollacott, 1998; Woollacott et al., 1998). As these balance deficits impact the performance of daily activities (Ostensjo, Carlberg, & Vollestad, 2004), the assessment of postural control in children with CP is crucial to quantifying postural deficits, measuring rehabilitative progress, and also guide therapeutic interventions (Fig. 1).

Several instruments have been validated for postural control evaluation including force plates (Ju, Hwang, & Cherng, 2012), electromyographic (Girolami, Shiratori, & Aruin, 2011) and joint angles analysis (Assumpção et al., 2011). The

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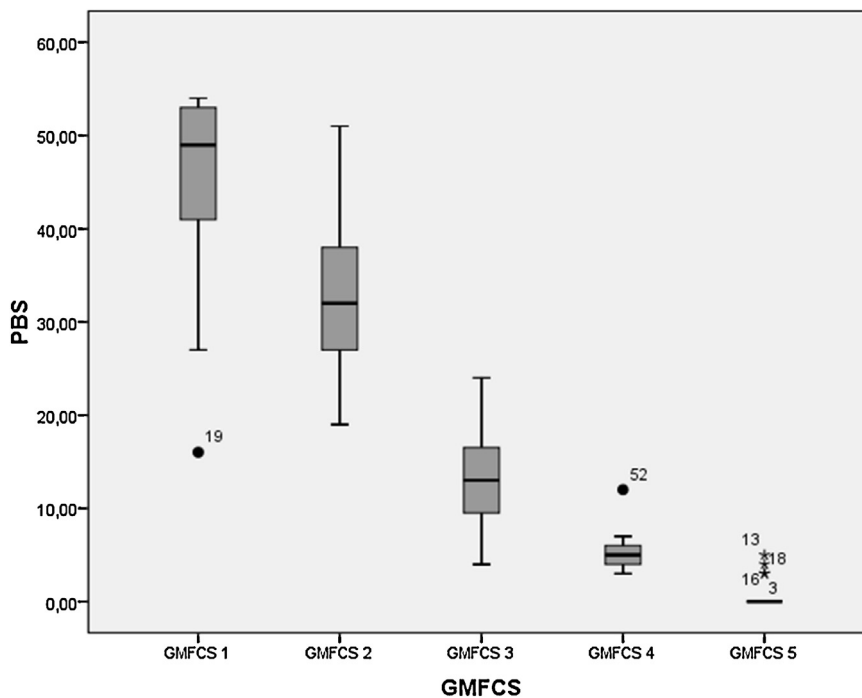


Fig. 1. Box plot of the total score of the Pediatric Balance Scale (PBS) among Gross Motor Function Classification System (GMFCS) groups.

complexity and cost of these instruments, however, significantly limit their use in clinical practice. Thus, the use of clinical scales such as the Pediatric Balance Scale (PBS) (Franjoine, Gunther, & Taylor, 2003; Reilly, Woollacott, van Donkelaar, & Saavedra, 2008) is simpler and may be a less expensive alternative to be used in clinical practice. PBS is a reliable instrument for assessment of functional balance in children with neuromotor impairments and assesses the elements of postural control that enable these children to perform daily activities effectively (Ries, Michaelsen, Soares, Monteiro, & Allegretti, 2012). Although PBS has been validated for use with such children (Franjoine et al., 2003; Ries et al., 2012) few studies have used it to evaluate balance in children with CP (Reilly et al., 2008) or have related PBS scores with GMFCS level in this population (Kembhavi, Darrah, Magill-Evans, & Loomis, 2002).

Accordingly, the current study sought to evaluate the functional balance of children with CP using PBS, to identify differences in PBS total scores at distinct Gross Motor Function Classification System (GMFCS) levels, to set confidence intervals of PBS in each level of GMFCS and to assess whether PBS scores could be used as predictors of the GMFCS level in children with CP.

Studying the differences in PBS total scores at distinct GMFCS levels, as well as assessing the PBS scores as predictors of the GMFCS level in children with CP will provide a broader understanding of balance abilities in each GMFCS level, specifying the expected tasks that are expected to be accomplished in each level. This approach will also facilitate the rehabilitation planning guiding some balance tasks to be accomplished by the children during physical therapy, as well as the measurement of clinical progress of the patients, since it can also predict the expected balance score the children must present according to their GMFCS level.

## 2. Methods

### 2.1. Participants

The present study has a transversal design. Fifty-eight subjects (36 male, 22 female), with average age of 8.9 years ( $\pm 4.1$ ), were selected at rehabilitation sites. All the included subjects were children with CP between 0 and 18 years old, and were involved in rehabilitation programs at least once a week. Written informed consent from the child's legal guardian was also necessary. The study was authorized by the Ethics Committee for Research with Human Subjects of the Federal University of São Carlos (protocol 363/2010).

### 2.2. Materials and procedure

Children were classified according to GMFCS (Palisano et al., 1997) and divided into five groups according to their GMFCS level. GMFCS represents a functional classification of children with CP, which aims to determine the level of the child based

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