Original Research Paper

Volume - 16 | Issue - 04 | April - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Health Science

COMPARATIVE EVALUATION OF MOTOR SKILLS IN CHILDREN WITH CEREBRAL PALSY USING PDMS-2 AND MABC-2: A CROSS-SECTIONAL STUDY

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ABSTRACT Aim of this study was to compare motor skills in CP children using the PDMS-2 and MABC-2 tools, and to assess the appropriateness of each tool across varying levels of motor impairment. A cross-sectional observational study was conducted on 109 CP children aged 3.0–5.11 years, stratified across GMFCS levels I–V. Motor skills were assessed, and comparisons were drawn using Spearman's rank correlation and Wilcoxon signed-rank tests. Strong correlations were found between the PDMS-2 and MABC-2 for Gross Motor ($r = 0.919$), Fine Motor ($r = 0.844$), and Total Motor ($r = 0.937$) scores ($p < 0.001$). However, significant differences in mean scores were observed across GMFCS levels, especially at higher levels of impairment where MABC-2 failed to capture performance due to task complexity.

KEYWORDS : Cerebral Palsy; PDMS-2; MABC-2; GMFCS

INTRODUCTION

Cerebral palsy (CP) is a non-progressive neurological disorder caused by brain lesions occurring before, during, or shortly after birth, resulting in a spectrum of motor impairments. (1) These include spasticity, dystonia, weakness, and coordination deficits. The global prevalence is estimated at 2–2.5 per 1000 live births, with slightly higher rates reported in India. (1)

Motor function in CP is often stratified using the Gross Motor Function Classification System (GMFCS), which categorizes children into five levels based on their gross motor abilities and dependence on assistive devices. (2) Accurate assessment of motor skills is essential for planning interventions, and tools like PDMS-2 and MABC-2 are widely used by occupational therapists. (3)

While PDMS-2 evaluates developmental motor milestones, MABC-2 assesses motor coordination. However, there is limited guidance on tool selection based on GMFCS levels, necessitating this comparative study.

Purpose of the Study

To determine the appropriateness of PDMS-2 and MABC-2 across different GMFCS levels in children with CP aged 3.0–5.11 years, and provide empirical guidance for tool selection based on severity of motor impairment.

Methodology

This cross-sectional observational study was conducted at a tertiary care center. The aim was to compare the efficacy of two standardized motor assessment tools—Peabody Developmental Motor Scales–Second Edition (PDMS-2) and Movement Assessment Battery for Children–Second Edition (MABC-2)—in children with cerebral palsy, stratified across all five GMFCS levels.

Sampling and Participants

Participants were recruited using a convenience sampling approach. Inclusion criteria consisted of children diagnosed with cerebral palsy (any type), aged between 3.0 to 5.11 years, and capable of understanding and following simple instructions in English, Hindi, or Marathi. Children with recent surgery, uncontrolled seizures in the last 6 months, or comorbid visual or auditory impairments were excluded. Written informed consent was obtained from the guardians of all participants.

Out of 114 initial participants, five were excluded—three due to attrition during follow-up assessments and two due to parental withdrawal. The final sample included 109 children.

Assessment Procedure

Each participant underwent assessment with both PDMS-2 and MABC-2 in a counterbalanced order to control for fatigue and practice effects. Evaluations were conducted in one or two sessions depending on the child's stamina and engagement, with short breaks provided as necessary.

- PDMS-2 evaluates early motor development, categorizing performance into gross and fine motor skills (stationary, locomotion, object manipulation, grasping, and visual motor integration).
- MABC-2 is designed to assess practical performance in manual dexterity, aiming and catching, and balance, making it more suitable for identifying coordination-based impairments.

Statistical Analysis

Data were coded and entered into MS Excel and analyzed using IBM SPSS version 26. Descriptive statistics summarized age, gender, and GMFCS levels.

- Spearman Rank Correlation was used to assess the strength of association between PDMS-2 and MABC-2 scores.
- Wilcoxon Signed-Rank Test was applied to compare paired differences in scores between tools across GMFCS levels.
- Kruskal–Wallis ANOVA was used for intergroup comparisons.

A significance level of $p < 0.01$ was considered highly significant.

RESULTS

Participant Demographics as shown in Table 1, the majority of children were between 3.0–3.11 years, with male participants outnumbering females in all GMFCS levels. This age distribution reflects early diagnosis and initiation of therapy, while the gender distribution is consistent with known higher prevalence of CP in males.

Table 1: Distribution of Participants by Age and GMFCS Level

Age Group	GMFCS I (M/F)	GMFCS II (M/F)	GMFCS III (M/F)	GMFCS IV (M/F)	GMFCS V (M/F)	Total Participants
3.0–3.11	7/2	8/3	6/3	4/1	4/4	M- 29 F-13 Total- 42
4.0–4.11	5/1	2/2	4/5	3/4	2/3	M- 16 F-15 Total- 31
5.0–5.11	3/4	2/1	8/2	8/2	5/1	M- 26 F-10 Total- 36
Total	15/7	12/6	18/10	15/7	11/8	109

Correlation Between Tools

As detailed in Table 2, a statistically significant and strong positive correlation was observed between corresponding gross motor ($r = 0.919$), fine motor ($r = 0.844$), and total motor ($r = 0.937$) scores of PDMS-2 and MABC-2 ($p < 0.001$). These correlations suggest that while both tools assess related domains, they capture unique dimensions of motor function.

Table 2: Correlation Between PDMS-2 and MABC-2 Scores

Comparison	Correlation Coefficient (r)	Significance (p-value)
PDMS-2 GM vs MABC-2 GM	0.919	<0.001
PDMS-2 FM vs MABC-2 FM	0.844	<0.001
PDMS-2 TM vs MABC-2 TM	0.937	<0.001

Comparative Scores Across GMFCS Levels

Table 3 demonstrates significant score differences between PDMS-2 and MABC-2 across GMFCS levels. Children in GMFCS I–III showed statistically significant score disparities in gross, fine, and total motor domains. Notably, children in GMFCS V scored zero on MABC-2, while PDMS-2 still yielded quantifiable scores even for severely involved participants.

Table 3: Comparison of PDMS-2 and MABC-2 Scores Across GMFCS Levels

GMFCS Level	GM PDMS-2 Mean	GM MABC-2 Mean	GM Z-value	FM PDMS-2 Mean	FM MABC-2 Mean	FM Z-value	TM PDMS-2 Mean	TM MABC-2 Mean	TM Z-value
I	25.36	44.36	-4.112	19.0	26.86	-4.115	44.36	71.23	-4.109
II	23.06	41.17	-3.726	19.5	28.89	-3.734	42.56	70.06	-3.725
III	12.25	23.07	-4.262	14.64	22.64	-4.468	26.89	45.71	-4.375
IV	6.09	12.68	-3.202	8.14	10.55	-1.08	14.23	23.23	-2.829
V	4.11	0.0	-3.912	2.05	0.0	-4.264	6.16	0.0	-3.912

DISCUSSION

This study reaffirms that both PDMS-2 and MABC-2 are valid tools for evaluating motor development in children with cerebral palsy. However, they differ significantly in sensitivity, task complexity, and applicability across GMFCS levels.

The strong correlation between the tools is expected, given that both assess fundamental motor domains. However, the divergence in scores stems from the nature of tasks:

- PDMS-2 focuses on foundational skills that are achievable even by children with severe motor impairments.
- MABC-2 assesses dynamic, real-world performance tasks requiring balance and coordination, making it less suitable for those in GMFCS IV and V.

Children in GMFCS I and II performed relatively well across both tools. Those in level III showed more pronounced fine motor difficulties despite residual gross motor function. In contrast, children in GMFCS IV and V were often unable to complete MABC-2 tasks due to postural instability, spasticity, involuntary movements and limited motor control. Nevertheless, PDMS-2 allowed granular scoring even in these children through its milestone-oriented approach.

Interestingly, fine motor performance in PDMS-2 remained relatively preserved in some children with diplegia, as their upper limb function was less affected. This was not reflected in MABC-2 due to the complexity and integration demands of its manual dexterity tasks.

This study underscores the importance of selecting assessment tools based on functional classification (GMFCS) rather than diagnosis alone. Therapists should consider integrating both tools or sequentially applying them for a more holistic view—using PDMS-2 for early developmental baseline and MABC-2 to assess real-world functional readiness and therapy outcomes in children with mild to moderate involvement.

CONCLUSION

PDMS-2 is preferable for assessing children with severe CP (GMFCS IV–V) due to its developmental framework. MABC-2 is more appropriate for children with mild-to-moderate motor impairment, emphasizing coordination and balance. A combined use, guided by GMFCS stratification, is recommended for comprehensive evaluation.

Limitations

- Narrow age range (3.0–5.11 years)
- Single-center study
- Cross-sectional design limits insights into longitudinal motor development

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