

Reliability of the Gross Motor Function Measure among children with Cerebral Palsy in India.

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KEYWORDS

Cerebral palsy,
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ABSTRACT

Introduction: Cerebral palsy is the most common motor disability in children which is a neurological disorder, often treated by healthcare professionals. Gross Motor Function Measure (GMFM) is used as a standard measure of gross motor function in children with Cerebral palsy in many countries worldwide, including India.

Objectives: To check reliability of the GMFM-88 in children with cerebral palsy who belongs to Indian society.

Methods: Clinical measurement study design was used. Sixty children with CP (mean age = 27.52 months, SD = ± 17.2) were selected. Purposive sampling method was used based on Gross Motor Function Classification System level. Test-retest and interrater were used for data collection. Children were assessed using pediatric assessment format and GMFM-88 by principal investigator on 1st day and 2nd day morning (retest). Interrater was assessed on 3rd day morning. Correlation analysis of GMFM-88 test-retest and interrater were calculated using Pearson's correlation coefficient. Internal consistency was measured by Cronbach's alpha.

Results: Study shows significant positive correlation between GMFM-88 test scores and GMFM-88 retest scores ($r = 0.590$, $p < 0.01$), indicating there is a moderate test-retest reliability. There is significant positive correlation between GMFM-88 test scores (principal investigator) and GMFM-88 scores (interrater) ($r = 0.890$, $p < 0.01$), indicating there is acceptable interrater reliability. Internal consistency of the GMFM-88 is in excellent ($\alpha = 0.992$) category.

Conclusions: GMFM-88 may be considered as a reliable tool which is suitable to measure gross motor function among children with CP in India.

Introduction:

Cerebral Palsy is the most common childhood disability with prevalence rate 2.95 per 1000 live birth, is a great concern to family and society.¹ "Cerebral palsy is a group of disorders of the development of movement and posture causing activity limitations that are attributed to non-progressive disturbances, that occurred in the developing fetal or infant brain. Motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception and/ or behavior and/or a seizure disorder".²

Advancements in neonatal care have significantly increased survival rates for preterm and low birth weight infants. As a result, there is a growing need to document the incidence, prevalence and intervention of Cerebral palsy (CP) in both developed as well as developing

countries, including India. It is important to determine the effects of therapeutic interventions on motor function for CP children with reliable and valid scale .

Scale reliability, an important characteristic to evaluate, pertains to the consistency of an assessment and its scores. It covers various aspects, including relative and absolute reliability as well as intra-rater and inter-rater reliability.³ Several evaluation measures are available to assess gross motor development in children with CP, such as the Pediatric Evaluation of Disability Inventory, Peabody developmental motor scale II, and the Functional Independence Measure for Children. ^(4,5,6) Among them, to date, the Gross Motor Function Measure (GMFM) is the best known and most frequently used instrument around the world. GMFM is an observational measure to evaluate gross motor function in children with cerebral palsy. Two version of GMFM are GMFM-88 and GMFM-66. Initially developed GMFM-88 has 88 items and later developed GMFM-66 having 22 lesser items than GMFM-88. The test requires a qualified therapist and a standardized environment.⁷

The original version of the GMFM, the GMFM-88, consists of 88 items that have been categorized into dimensions of gross motor function: lying and rolling; sitting; crawling and kneeling; standing; walking, running, and jumping. Because it allows quantitative evaluation of motor function, many studies have used the GMFM to assess the effectiveness of interventions in children with CP.⁸ The psychometric properties of the GMFM-88 also have been evaluated through many studies since its development. To our knowledge, however, previous studies provided relative reliability, and only a few studies have reported on the validity of the GMFM-88. Traditional measurement tools are not much sensitive to document subtle changes in functional motor skill over time for children with C P. Therefore an initiation is being taken to check reliability of GMFM-88 on children with Cerebral palsy who belongs to Indian culture and society.

Methods:

Clinical measurement study design was carried out for the study. 60 children with Cerebral Palsy were selected from the department of Occupational Therapy of Swami Vivekanand National Institute of Rehabilitation Training and Research (SVNIRTAR), Olatpur, Odisha in between the duration from January 2022 to August 2024. Majority of subjects were from nearby cities and villages of Odisha, as well as from neighboring states like West Bengal, Bihar, Jharkhand, Chhattisgarh, Andhra Pradesh. Purposive sampling method was used based on different Gross Motor Function Classification System (GMFCS) level.

The age group was from 5 months to 60 months (Mean + SD = 27.52 ± 17.2). Both male and female children were selected. Subjects included who were clinically diagnosed with Cerebral Palsy. Subjects with different severity level as per GMFCS were included.

Subjects who were severe mental retarded and not be able to understand age-appropriate simple commands were excluded from the study. Excluded the subjects who had congenital anomalies that effect motor development and functional abilities. Subjects who had severe Epilepsy and frequent episode of Seizures were excluded. All caregivers of the children were informed of the procedure and the purposes of this study, and all signed informed consent forms.

Table - 1

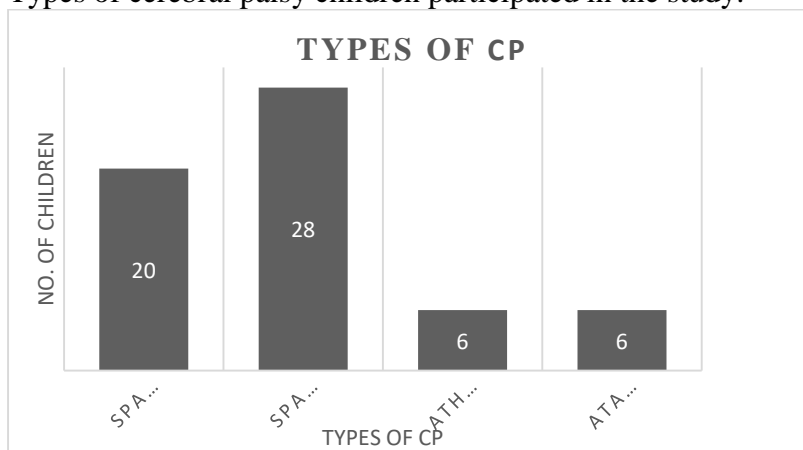
Demographics Characteristics	N (%)	
Age (In months) Mean + SD = 27.52 ± 17.2 (N=60)	5 - 12	16 (26%)
	13 - 36	28 (48%)
	37 - 60	16(26%)
Gender (N=60)	Male	41 (68%)
	Female	19 (32%)
Types of Cerebral Palsy	Spastic Diplegic	20 (33.3%)

(N=60)	Spastic Quadriplegic	28 (36.6%)
	Athetoid CP	6 (10%)
	Ataxic CP	6 (10%)
GMFCS levels (N=60)	Level I	10(16.6%)
	Level II	12 (20%)
	Level III	15 (25%)
	Level IV	14(23.3%)
	Level V	9(15%)

Demographic characteristics of the 60 children used in the study.

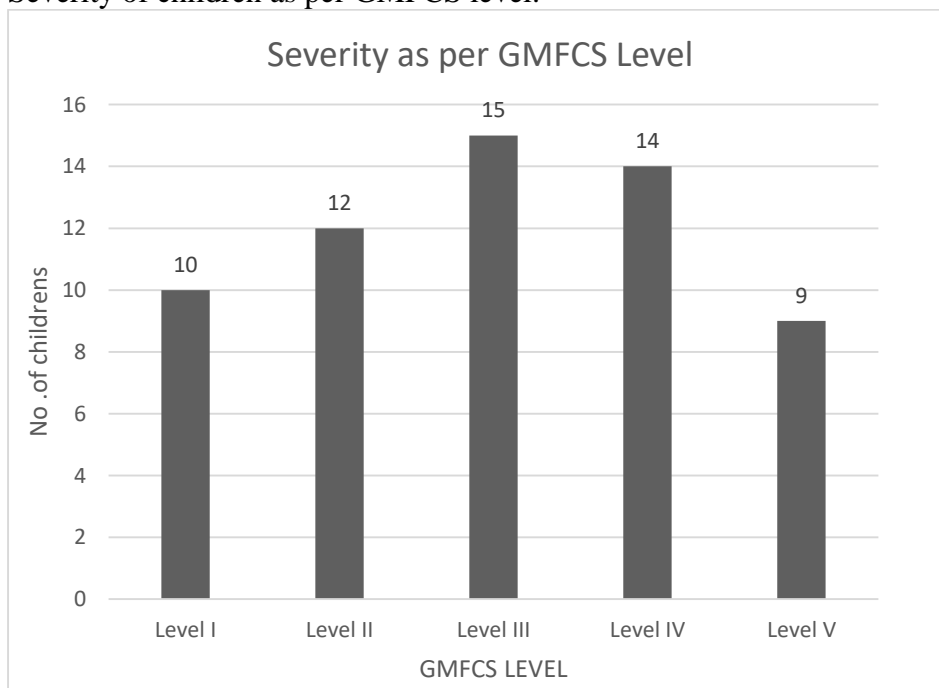
Graph-1

Types of cerebral palsy children participated in the study.



GRAPH-II

Severity of children as per GMFCS level.



Procedures:

Test - retest and interrater were used for data collection by using GMFM - 88 as an outcome measure. Children were assessed by using general pediatric occupational therapy assessment format as well as GMFM-88 by principal investigator. Retest was performed to the subjects next day in morning. Interrater was assessed at 3rd day morning. Line diagram of data collection was followed as below:

1st day morning → 2nd day morning → 3rd day morning by interrater

Data obtained was analyzed by using Statistical Package for Social Science (SPSS) version – 26. Reliability and internal consistency of the tool were measured. Correlation analysis of GMFM-88 Test – retest and interrater were calculated by using non parametric statistics (Pearson’s correlation test).⁹ Cronbach’s alpha was used to assess internal consistency. If Coefficient Alpha value is 0.7 or higher, the tool was considered reliable.¹⁰ Value of Cronbach’s alpha greater than 0.90 is consider as an excellent category.¹⁰

Results : In total, Sixty children with Cerebral Palsy participated in the study.

It was observed that there is significant positive correlation between GMFM-88 test scores and GMFM-88 retest scores ($r = 0.590, p < 0.01$), indicating there is a test-retest reliability for GMFM-88 scale. There was significant positive correlation between GMFM-88 test scores (principal investigator) and GMFM-88 scores (tested by another rater for interrater reliability) ($r = 0.890, p < 0.01$), indicating there is a good interrater reliability for GMFM -88 scale.

Test - retest, interrater reliability and internal consistency of the GMGF-88 were significantly acceptable. Value of Cronbach’s alpha was 0 .992, which is in excellent (> .90) category.

Table – 2

Test - Retest value of GMFM:

		GMFM- Test	GMFM- Retest
GMFM - Test	Pearson correlation	1.00	0.590**
	Sig. (2 – tailed)		0.001
	N	60	60
GMFM - Retest	Pearson correlation	0.590**	1
	Sig. (2 – tailed)	0.001	
	N	60	60

The above table(Table 2) shows the correlation between GMFM test scores and GMFM retest scores. There is significant positive correlation between GMFM test scores and GMFM retest scores ($r = 0.590, p = 0.01$), indicating there is a test-retest reliability for GMFM scale.

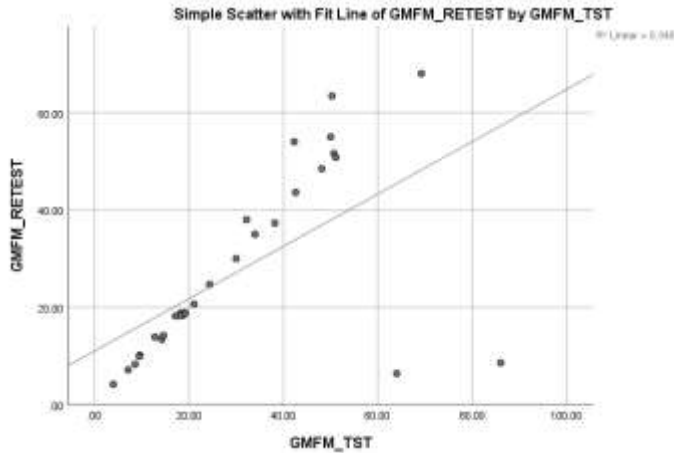


Figure 1. Scattergram shows correlation between GMFM test score and GMFM retest score

Table - 3

GMFM Interrater Reliability:

		GMFM -Average	GMFM - Interrater
GMFM – Average value (Test and Retest)	Pearson correlation	1	0.890
	Sig. (2 – tailed)		0.000
	N	60	60
GMFM – IR(Interrater)	Pearson correlation	0.890**	1
	Sig. (2 – tailed)	0.000	
	N	60	60

** . Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between GMFM test scores (principal investigator) and GMFM scores (tested by another rater). It is observed that there is significant positive correlation between GMFM test scores (principal investigator) and GMFM scores (tested by another rater for interrater reliability) ($r = 0.890$, $p < 0.01$), indicating there is a interrater reliability for GMFM scale.

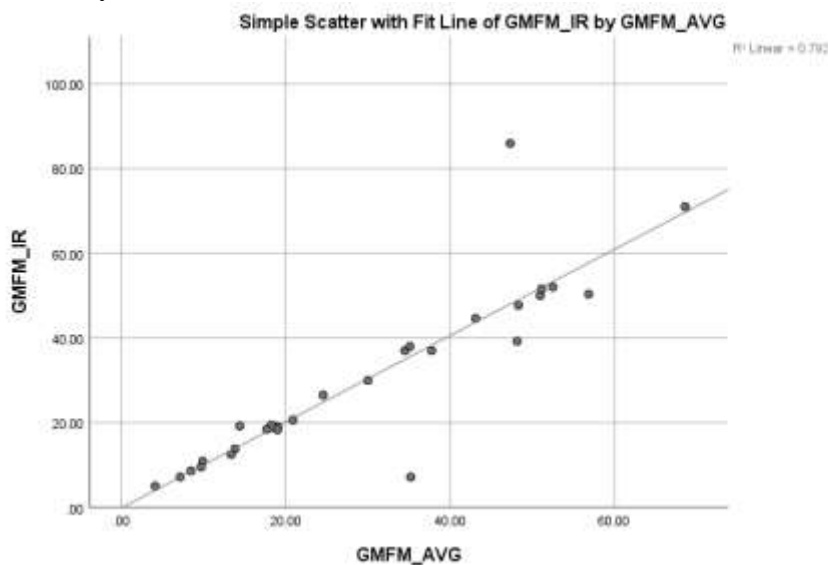


Figure 2. Scattergram shows correlation between GMFM test score and GMFM interrater score

Internal consistency:

Table 4:

Case Processing Summary

Listwise deletion based on all variables in the procedure.

		Number of cases(N)	Percentages(%)
Cases	Valid	60	100.0
	Excluded	0	0
	Total	60	100.00

Table 5

Value of Coefficient Alpha

Cronbach's Alpha	Cronbach's Alpha Base on Standardized items	No of items
0.994	0.994	88

Above table shows value of Cronbach's alpha (0.94) , which is in excellent (> .90) category.

Discussion:

Results of this study, based on the statistics, showed satisfactory levels of responsiveness and of relative and absolute reliability for the GMFM-88 for children with CP, across all GMFCS functional levels.

In the study the demographic data showed (Table-I) that the mean age was 27.52 months and the SD was 17.2 calculated out of 60 CP children within a age range of 5 to 60 Months. So, most of the children were in young age group. Gender distribution shows that male (41.68%) CP children are counted more than females (19.32%).Types of CP included in the data are 20 number of Spastic diplegic (33%) of total population, 28 number of Spastic Quadriplegic (47%), 6 number of Athetoid CP (10%) and 6 number of Ataxic CP (10%) mention in Graph-I. Severity level of GMFCS(Graph-II) shows Level-I found in 10 CP children, Level-II in 12 children, Level-III in 15 children (which is the highest among all levels),14 children in Level-IV and 9 children in Level-V.

The GMFM-88 test - retest scores shows positive correlation between GMFM-88 test scores and GMFM-88 retest scores ($r = 0.590, p < 0.01$), indicating there is a test-retest reliability for GMFM-88 scale(Table-2).The interrater reliability shows that the correlation between GMFM test scores (principal investigator) and GMFM-88 scores tested by another rater for interrater reliability. There is significant positive correlation between GMFM-88 test scores (principal investigator) and GMFM-88 scores tested by another rater (interrater reliability) ($r = 0.890, p < 0.01$), indicating there is excellent interrater reliability for GMFM-88.

These findings are in accordance with the study of Russel et al. on children with Cerebral palsy, in which they found high intra and interrater reliability of GMFM-88 in all dimensions ranging between 0.87 – 0.999.¹¹

Similar to original version, a study of Ko J and Kim MY (Korean version) reported relative reliability of GMFM – 88 in 84 children was excellent in ICC value (ICC = 0.95 – 1.00).¹²

Cross culture adaptation study of Turkish version of GMFM - 88 showed excellent inter-rater reliability (0.997 – 0.999), and intra-rater reliability (0.997 – 0.999) and internal consistency (alpha = 0.997 – 1.00).¹³

The Brazilian Portuguese version study of GMFM-88 reported excellent inter-rater (ICC= 0.97, 95% CI 0.95 – 0.98) and Intra-rater (ICC = 0.99, 95% CI 0.98 – 0.99) for total scores.¹⁴

A study of Persian version of GMFM-88 reported ICC = 0.99 for interrater and intra-rater reliability (95% CI 0.96 – 1.00) total score.¹⁵

A study of Spanish version of intra and interrater reliability of GMFM- 88 were (ICC = 1.00, 95% CI 0.99 – 1.00) in total score.¹⁶

In this study, internal consistency shows the case processing summary (Table-4) includes all the cases i.e. 100% score which considered to be the more consistent value. Reliability statistics (Table-5) indicates Cronbach's Alpha is 0.994 which is considered as reliable score in Indian study.

Conclusion:

All the data generated, variables, dimensions were indicating an acceptable level of reliability for the scale GMFM-88 and the responsiveness was also high even in children with severe Cerebral palsy. Sample was limited to within few states of eastern India only.

Despite of some limitation of this study, GMFM - 88 may be considered as a reliable scale to measure gross motor function for children with cerebral palsy in India.

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