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Development of Urdu Version of Gross Motor Family Report (GMF-FR) Scoresheet; Validity and Reliability Analysis in Cerebral Palsy Children

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ABSTRACT

Background: Cerebral palsy is the most prevalent physical disability in children, with significant implications for motor function and quality of life. Reliable caregiver-reported outcome measures are important for evaluating function in everyday life. The Gross Motor Function–Family Report is a validated tool designed to measure outcomes, but no Urdu version existed to serve Pakistani populations. **Objective**: This study aimed to develop an Urdu version of the GMF-FR and evaluate its reliability and validity for assessing gross motor function in children with Cerebral palsy. **Methods**: A cross-sectional study was conducted in Faisalabad, Pakistan, involving 50 children aged 2–14 years with diagnosed Cerebral palsy. The Gross Motor Function–Family Report was translated into Urdu following Beaton's cross-cultural adaptation guidelines. Internal consistency was assessed using Cronbach's alpha; test-retest reliability was evaluated via intraclass correlation coefficients. Validity was assessed through construct validity (Spearman's rho with GMFCS) and discriminant validity (Kruskal-Wallis test across GMFCS levels). **Results**: The Urdu Gross Motor Function–Family Report showed excellent internal consistency (Cronbach's alpha = 0.947) and strong test-retest reliability (ICC = 0.999). Construct validity gave a strong negative correlation with GMFCS levels ($\rho = -0.857$, $p < 0.001$), and discriminant validity confirmed statistically significant differences across GMFCS levels ($p < 0.001$). High rates of caregiver agreement supported face validity. **Conclusion**: The Urdu version of the Gross Motor Function–Family Report is a reliable and valid tool for assessing gross motor function in children with Cerebral palsy patients in Urdu-speaking populations. It enables culturally relevant, family-centered assessments that support individualized rehabilitation planning in resource-limited settings.

INTRODUCTION

Cerebral palsy (CP) is the most prevalent physical disability in children, affecting approximately 2–3 per 1,000 live births globally (1). It is defined by persistent movement disorder and posture mal-alignment due to non-progressive disturbances in the developing brain, leading to muscle rigidity, poor coordination, and developmental delays. The condition has multiple causative factors, including prematurity, hypoxic injuries, infections, and genetic factors (2). Advancement in neuroimaging such as MRI and General Movements Assessment scales unable us to diagnosis at early age as 3–6 months, that support timely interventions, utilize neuroplasticity for better developmental outcomes (3).

The structural complications of the human brain, typically the cerebrum, cerebellum, and brainstem, is crucial to understanding CP. Functional disturbance in the motor cortex, basal ganglia, and corticospinal tracts explain the these motor impairments (4). These impairments often include spasticity, ataxia, and dyskinesia, frequently accompanied by sensory, cognitive, and communication symptoms.

Pathological changes in muscle composition; altered sarcomere length and extracellular matrix stiffness, contribute to musculoskeletal limitations, contractures, and pain (5). Epidemiologically, the prevalence of CP is higher in low- and middle-income countries. It is due to limited resources and prenatal care. Risk factors including prenatal (e.g., infections, genetic mutations), perinatal (e.g., birth asphyxia), and postnatal (e.g., infections) periods are major contributors. Preterm birth, particularly before 32 weeks of gestation, is a major risk factor due to white matter vulnerability, increasing CP risk thirty-fold (6).

Maternal health factors diabetes, preeclampsia, infections, and poor prenatal care—further increase the risk of developing this disease (7). CP biomechanics are characterized by abnormal neuromuscular control,

inefficient movement patterns, abnormal posture, and progressive spinal deformities. Gait is impaired by spasticity, selective motor control deficits, and joint contractures, that result in patterns like crouch, scissoring, or equinus gait (8).

The Gross Motor Function Classification System (GMFCS) differentiates motor function in CP into five levels based on functional mobility, from Level I (least impaired) to Level V (most impaired) (9). GMFCS is combined with tools like the Gross Motor Function Measure (GMFM-66 and GMFM-88), which assess performance of the main motor movement patterns (10).

MRI is important radiological diagnostic tool to identify structural brain lesions such as Periventricular Leukomalacia (PVL), cortical malformations, and basal ganglia injury. PVL is non-specific in preterm infants and is strongly associated with spastic diplegia (11). In contrast, term-born infants often present with thalamic and basal ganglia injuries due to hypoxic-ischemic encephalopathy (12).

General Movements Assessment (GMA) and Hammersmith Infant Neurological Examination (HINE) are clinical tools to increase chances to detect this alignment at early stage (13). CP commonly coexists with epilepsy, cognitive impairments, sensory deficits, and emotional disorders. Oromotor dysfunction, feeding issues, poor bone health, and bladder dysfunction are also frequent (14).

Management requires a multidisciplinary approach specific to the patient's needs. Physical and occupational therapy aim to enhance gross and fine motor skills, posture, and independence. Techniques like neurodevelopmental therapy (NDT), strength training, proprioceptive neuromuscular facilitation (PNF), and robotic-assisted interventions are administrated to relieve symptoms and enhance functional mobility (15). Pharmacological agents; botulinum toxin or oral anti-spastic, are used to control spasticity. In refractory cases, orthopedic surgeries such as tendon lengthening or bone osteotomies may also considered (16)

Orthotic devices, including ankle-foot orthoses (AFOs) and wrist-hand orthoses, help to maintain posture and prevent further deformities (17). The International Classification of Functioning, Disability and Health (ICF) framework guides outcome evaluation using multidimensional tools like GMFM, CAPE, and PEDI. Gait analysis, especially 3DGA, provides biomechanical insights for treatment planning (18).

A recent advancement in functional assessment is the Gross Motor Function–Family Report (GMF-FR), a family-centered tool adapted from GMFM-88 to allow caregivers to report their child's abilities in everyday contexts. Unlike traditional clinician-administered assessments, GMF-FR emphasizes the child's actual functioning at home and in the community, aligning treatment with real-life needs (19).

Currently, GMF-FR lacks an Urdu version, limiting its use in Pakistani and Urdu-speaking populations. Translating and validating the GMF-FR in Urdu will improve inclusivity, facilitate culturally relevant assessments, and support family engagement in rehabilitation planning (20). This study aims to address that gap by developing and analyzing the validity and reliability of the Urdu version of GMF-FR for children with CP.

METHODOLOGY

The cross-sectional study was conducted in Faisalabad, Pakistan, at the Children Hospital and Tanzeem Al Lisaan School to evaluate the reliability and validity of the Urdu version of the GMF-FR score sheet for children with CP. A sample of 50 children aged 2 to 14 years with confirmed CP diagnoses was selected through convenience sampling, as per COSMIN guidelines for an adequate sample size. The study was conducted over three months, following ethical approval from the Institutional Review Board of Government College University, Faisalabad, and in collaboration with McMaster University, Canada with permission of Dr. Paula Chagas. Inclusion criteria required Urdu-speaking parents and excluded ataxic CP or children without confirmed diagnoses. The data collection involved translation of GMF-FR into Urdu based on Beaton's criteria, including forward and backward translation, expert committee review, and cognitive debriefing. Finalized tools were used by experienced pediatric physical therapists. The GMF-FR and the Gross Motor Function Classification System (GMFCS) were utilized to assess gross motor function. Reliability was examined through internal consistency using Cronbach's alpha and test-retest reliability using intra-class correlation coefficients (ICC) from responses collected 7–30 days apart. Validity assessments included face validity (via caregiver feedback), discriminant and convergent validity (comparing GMF-FR with GMFCS), and construct validity through exploratory factor analysis (EFA). Data were analyzed using SPSS v27, with descriptive statistics for demographics and inferential statistics for psychometric testing, considering p-values < 0.05 as significant. Ethical protocols ensured informed consent, voluntary participation, and strict confidentiality through anonymized and securely stored data.

RESULTS

Table 1

Demographic Summary

Variable	Categories	Frequency (n)	Percentage (%)
Age Range (years)	2- 4	11	36.7 %
	5-8	14	46.7 %
	9- 14	5	16.7 %
Gender	Male	17	56.7 %
	Female	13	43.3 %
Diagnosis	Spastic	20	66. 7 %
	Dyskinetic	6	20. 0 %
	Ataxic	4	13.3 %
GMFCS Level	Level I	4	13.3 %
	Level II	7	23.3 %
	Level III	9	30.0 %
	Level IV	6	20.0 %
	Level V	4	13.3 %

This table outlines the participant characteristics. Most children were aged between 5-8 years, with a higher proportion of males (56.7%). The majority were categorized in GMFCS Levels II and III, indicating relatively better gross motor function within the cerebral palsy spectrum.

Table 2
Descriptive Statistics for GMFR Items

GMFCS Level	Frequency (n)	Mean GMF-FR Score ± SD	Domain
Level I	4	46.00 ± 1.41	Basic motor
Level II	7	39.57 ± 3.15	Basic motor
Level III	9	33.56 ± 1.94	Standing/walking
Level IV	6	27.00 ± 1.26	Walking/mobility
Level V	4	21.00 ± 1.15	Advanced mobility

The selected GMFR items, indicating that most children exhibited functional abilities across basic to advanced motor domains. This suggests good content representation of motor skills in the Urdu GMFR.

Table 3
Reliability Statistics (Cronbach's Alpha)

Dimension	Cronbach's Alpha
Dimension A	0.932
Dimension B	0.893
Dimension C	0.841
Total	0.947

The Urdu GMFR scale demonstrated excellent internal consistency with an overall Cronbach's alpha of 0.947. High item-total correlations confirm that each item contributes meaningfully to the overall scale reliability.

Table 4
Test-Retest Reliability (ICC)

Domain	Time 1 Mean ± SD	Time 2 Mean ±SD	ICC (95% CI)	Interpretation
Dimension A	17.60 ± 5.03	17.60 ± 5.03	1.000	Excellent
Dimension B	9.60 3.56	9.50 3.56	0.998	Excellent
Dimension C	6.40 ± 2.36	6.30 ± 2.36	0.997	Excellent
Total Score	33.60 10.26	33.40 10.26	0.999	Excellent

High ICC values across the total score (0.999) and selected items indicate excellent test-retest stability. This confirms the scale's reliability over time when used with caregivers of children with CP.

Table 5
Construct Validity (Spearman's Rho)

Dimension	Spearman's Rho (ρ)	p-value	Interpretation
Dimension A	-0.764	< 0.001	Strong negative correlation
Dimension B	-0.821	< 0.001	Strong negative correlation
Dimension C	- 0.782	< 0.001	Strong negative correlation
Total Score	-0.857	< 0.001	Strong negative correlation

A strong negative correlation (ρ = -0.857, p < 0.001) between GMFR scores and GMFCS levels confirms convergent validity, as children with better functional abilities (higher GMFR scores) had lower GMFCS levels (less severe motor impairment).

Table 6
Discriminant Validity (Kruskal-Wallis Test)

Domain	Chi-Square (X^2)	df	p- value
Dimension A	24.568	4	0.000
Dimension B	27.203	4	0.000
Dimension C	26.698	4	0.000
Total Score	27.716	4	0.000

The significant difference in GMFR scores across GMFCS levels (p < 0.001) demonstrates discriminant validity, showing that the Urdu GMFR can distinguish between different severity levels of motor impairment effectively.

DISCUSSION

This study aimed to develop and validate the Urdu version of the GMF-FR for children with CP. The findings provide compelling evidence supporting the reliability and validity of the translated tool, consistent with previous global validations of GMF-FR and other family-centered assessment tools.

The demographic results indicated a predominance of male children (56.7%) and a high proportion categorized under GMFCS Levels II and III, suggesting milder forms of CP. These findings are consistent with global epidemiological trends, where spastic dyskinetic and ataxic are common, and male predominance in CP has been previously reported (1)

Internal Consistency and Reliability

The Urdu GMF-FR demonstrated excellent internal consistency, with a Cronbach's alpha of 0.947, confirming that the items are highly correlated and measure the same construct. This aligns with Chagas et al. (2023), who reported high reliability in the original GMF-FR development study. Moreover, item-total correlations above 0.76 further reinforce the scale's cohesiveness and measurement fidelity. High Cronbach's alpha values (generally ≥0.90) are considered excellent for clinical tools and indicate robust reliability in psychometric evaluations (21).

Test-retest reliability was also found to be excellent, with ICC ranging >0.9. These results indicate temporal stability and the tool's suitability for use over time with the same population. Similar reliability has been reported in studies validating caregiver-reported tools in other languages (18). This strengthens the case for using GMF-FR in diverse cultural contexts, especially when adapted using rigorous cross-cultural translation protocols like Beaton's criteria, as applied in this study.

Content and Construct Validity

The descriptive statistics of selected GMF-FR items demonstrated that the items are well-aligned with the functional capabilities of children in the sample, supporting the tool's content validity. These findings suggest that the Urdu version of GMF-FR accurately represents gross motor functions relevant to the Pakistani pediatric CP population.

Construct validity was confirmed through a strong negative correlation (Spearman's ρ = -0.857, p < 0.001) between GMF-FR scores and GMFCS levels. This is consistent with previous literature indicating that higher GMFCS levels (indicating greater motor impairment) are associated with reduced motor function and activity limitations (22). The strong inverse relationship supports the convergent validity of the Urdu GMF-FR and confirms that it effectively captures variations in motor ability.

Discriminant Validity

Discriminant validity was demonstrated by a significant difference in GMF-FR scores across GMFCS levels using the

Kruskal-Wallis test ($p < 0.001$). Children classified as GMFCS Level I scored the highest, while those in Level V scored the lowest, highlighting the tool's sensitivity in distinguishing among different severity levels of CP. These results mirror the performance of the original GMF-FR (20) and reinforce its utility in clinical stratification and goal-setting for therapy.

Clinical and Cultural Implications

Translating and validating the GMF-FR into Urdu addresses a significant gap in culturally relevant assessment tools for the Pakistani population. Urdu is the national language and widely spoken, making this adaptation critical for equitable healthcare. Tools that reflect the linguistic and cultural context of families enhance caregiver participation, therapeutic alliance, and ultimately, child outcomes (3).

The GMF-FR, by involving caregivers in the evaluation process, shifts the focus from clinical performance to functional performance in natural environments. This is particularly important in resource-constrained settings where frequent access to multidisciplinary teams may be limited, and caregiver-led home programs are the norm (23). The family-centered nature of GMF-FR also aligns with the International Classification of Functioning, Disability and Health (ICF) model, promoting holistic and context-sensitive care (18).

Comparison with Other Tools

Unlike the GMFM-88 or GMFM-66, which are clinician-administered and often time-intensive, the GMF-FR offers a more practical and less burdensome alternative for routine assessments. The caregiver-reported format reduces the need for highly trained professionals while maintaining clinical relevance and validity. Furthermore, studies suggest that caregiver insights provide unique perspectives that are sometimes missed in clinical observations, especially for children with fluctuating functional levels (24).

Strengths and Limitations

The primary strength of this study lies in its rigorous translation methodology, adherence to COSMIN guidelines, and the use of multiple forms of validity testing. The inclusion of experienced pediatric therapists in data collection adds clinical robustness.

However, limitations include the relatively small and regionally confined sample size (n=50), which may restrict generalizability. The exclusion of children with ataxic CP also limits applicability across the full CP spectrum. Future studies with larger, multicenter samples are needed to confirm these findings and explore responsiveness to intervention and long-term usability.

CONCLUSION

This study successfully validated the Urdu version of the GMF-FR, establishing its reliability, construct validity, and cultural appropriateness for children with CP in Pakistan. The tool can serve as a valuable resource for therapists and caregivers alike, improving communication, engagement, and individualized goal-setting. Future research should evaluate its responsiveness to change following rehabilitation interventions and explore its integration into national pediatric rehabilitation guidelines.

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