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Adaptation, Reliability and Validity of the Behavioural Pediatric Feeding Assessment Scale (BPFAS) in the Bangla Language

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Abstract: Pediatric feeding issues and disruptive mealtime behaviours are evident in neurodevelopmental disorders and included as secondary symptoms of autism spectrum disorders (ASD) in diagnostic and statistical manual of mental disorders-5 (DSM-V). BPFAS is a comprehensive assessment tool which requires active parental engagement in assessing feeding issues which have been adapted to several languages. This study aims to adapt a culturally sensitive Bangla version of the BPFAS scale. A total of 215 children with various neurodevelopmental disabilities (Autism, ADHD and Down Syndrome) aged between 3.2 to 7 years were included in this study. Translation and cultural adaptation were carried out following standard guidelines. Data analysis included descriptives, reliability analysis (consistency and temporal reliability), Exploratory Factor Analysis (EFA) and validity analysis. Reliability analysis revealed acceptable internal consistency and temporal reliability of the scale (Cronbach's alpha .729 total scale, .794 and .769 for subscales; ICC .962). EFA revealed a four-factor solution for the child domain and two-factor solution for parent domain. Average Variance Extracted (AVE) by factors (child domain .68, .54, .67, .63; parent domain .67, .56) suggested acceptable convergent validity of the scale. Between-factor discriminant validity was not obtained (AVE<SV). Mean frequency and problem scores regarding sex and disorders did not differ significantly. It was concluded that the adapted Bangla version of the BPFAS scale proved to be reliable and valid feeding behaviour assessment scale for Bengali population with neurodevelopmental disorders.

Keywords: Behavioural Pediatric Feeding Assessment Scale; Autism Spectrum Disorders; Feeding behaviour; Neurodevelopmental disorders; Selective eating habits; Food refusal; Parental anxiousness.

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1. Introduction

Pediatric feeding issues are commonly occurring in children with ASD (Önal & Uçar, 2024), ADHD (Nickel et al., 2019), Down syndrome (Baumer et al., 2023), and other developmentally delayed diagnoses (Manikam & Perman, 2000), causing stress for parents (Silverman et al., 2021) and contributing to malnutrition (Güngör et al., 2024). Previously, cerebral palsy has long been considered as having feeding difficulties, but increasing studies suggest that other neurodevelopmental disorders also have feeding difficulties (Malak et al., 2024; Rinat et al., 2022; Reilly et al., 1996). Food selectivity, food refusal, limited appetite, slow feeding, food mastication error, and not age-appropriate feeding milestones are some expressions of feeding problems in children (Milano et al., 2019). Neurodevelopmental disorders usually have difficulties in food and eating behaviours such as oral motor movement, swallowing, spitting, keeping food in the mouth excessive gag reflex and vomiting etc. (Sethubharathi & Vishnuram, 2023). Feeding skill development is a complex sensorimotor process which is the result of the integration of neurological maturation, internal motivation and experiential learning (Satter, 1995). Normally children master oral motor milestones and can participate in all kinds of eating by the age of 5 (Morris & Klein, 2000). After 5 years of age, acquiring feeding skills becomes more difficult due to reduced neuroplasticity (Rommel et al., 2003; Illingworth & Lister, 1964). One fourth to 45% of typically developed children represent some form of pediatric feeding issues (Manikam & Perman, 2000; Dharmaraj et al., 2023). The rate reaches every 4 out of 5 children in the case of developmentally challenged children. Eating problems and disruptive mealtime behaviour are included as secondary symptoms of ASD in the DSM-V (American Psychiatric Association, 2013). Pediatric feeding problems contain at least three aspects: medical, oral sensorimotor, and behavioural, which indicate the rationale for including these three domains in the assessment and intervention of pediatric behaviour problems (Manikam and Perman, 2000). Disruptive feeding behaviours can significantly exacerbate mealtime stress for both children and parents. Active parental engagement plays a pivotal role in the comprehensive assessment and management of behavioural issues associated with pediatric feeding problems (Bonsall et al., 2023). Feeding disorders can have a crucial effect on the development and growth of a child and the relationship with the family members and the child (Samara et al., 2010; Howe et al., 2010). So, it is important to understand the negative impacts of feeding difficulties and take necessary steps to lessen the impacts earlier (Sanchez et al., 2015). To diagnose problematic feeding behaviours clinicians widely use observation and caregiver-reported questionnaires that are subjective and not standardised. There are some questionnaire-based standardised tools like the Behavioural Pediatric Feeding Assessment Scale (BPFAS), Children's Eating Behaviour Questionnaire (CEBQ), The Feeding Behaviour Scale (FBS), Mealtime Behaviour Questionnaire (MBQ), Parent Mealtime Action Scale (PMAS) and Oral Motor Assessment Scale (OMAS). Among them, BPFAS is comprehensive, includes both the child and parental factors, qualitative and quantitative measures, behaviour domain focused and widely adapted in different cultures and languages (Sethubharathi & Vishnuram, 2023; Dharmarathna & Perera, 2019; YAZICI et al., 2021).

2. Literature Review

2.1 *Feeding Difficulties and Neurodevelopmental Disorders*

Physiological or psychological inability resulting in either selective or unconscious refusal or disruption in food intake is defined as feeding disorders (Grot et al., 2024). According to longitudinal studies, the association of feeding disorders with an elevated level of risks for inattention as well as emotional-behavioural problems in childhood were observed (Bilgin et al., 2020; Ammaniti et al., 2012). Oral motor and sensory issues observed in children with neurodevelopmental disorders can affect almost 80% of this population by disrupting their nutritional intake, growth as well as development (Getcy Bebayal et al., 2024). According to Grot et al., (2024), neuropediatric children exhibited an increased level of certain types of food refusal and this tendency was significantly observed in neurodevelopmental spectrum disorders including autism and attention deficit hyperactivity disorders. However, the tendency of selective food intake was much lower. According to this study, behavioural and organic feeding difficulties are observed at up to 80% through the course of neurological disorders with diverse age ranges. Interestingly, feeding difficulties or disorders typically emerge earlier than neurodevelopmental disorders suggesting these children to be at a greater risk for social difficulties, developmental delays, behavioural inhibition as well as cognitive deficits (Cerniglia et al., 2020).

2.2 *Feeding Difficulties and Parental Stress*

Negative feelings and anxiety especially from maternal perspective could contribute to issues regarding feeding as a positive relationship between maternal concerns regarding child health and their feeding difficulties are evident in literature (Zlomke et al., 2020). Higher level of parental stress has been documented while parenting children with developmental disabilities (Lee, 2013). Among parents of children with autism, the severity of feeding difficulties as well as gastrointestinal problems among other related markers are associated with parental stress (Johnson, 2019). In a study conducted by Dabrowska and Pisula (2010), parental stress was relatively higher among parents of children with autism than down syndrome and typically developing children. Interestingly, these children are at risk of developing obesity because of parental stress in feeding which exacerbates their natural propensity to experience obesity (Polfuss et al., 2021).

2.3 *Feeding Difficulties and Speech-Language Impairment*

Sucking behaviours and feeding at the earliest stages of life are the earliest demonstrators of motor control utilizing the overlapping and shared neural pathways required for feeding as well as language (McFarland & Tremblay, 2006). History of feeding disorders as a comorbid factor have been documented for various severe neurodevelopmental disorders such as cerebral palsy as well as in premature children and children with language impairment

(Adams-Chapman et al., 2013; Motion et al., 2002). Prevalence of feeding difficulties was found to be greater in children with language impairment than in general population (Malas et al., 2015). 48% of children with language impairment had prior symptoms of feeding and swallowing difficulties (Malas et al., 2017). Accordingly, methods of food intake also impact speech and language development as higher percentages of bottle-fed children developed deviated expressive speech (Milankov et al., 2021).

3. Objectives

The main objective of the study is to culturally adapt a Bengali version of the BPFAS scale. In addition, to determine the reliability and validity of the Bengali equivalent of the scale. Furthermore, to determine the status of the study population in terms of being categorised as clinical cases from both gender and disorder perspective.

4. Rationale

Screening, observation and assessment can help clinicians and parents to understand the feeding difficulties of the children with neurodevelopmental disorders and take appropriate steps. In Bangladesh, where the primary language of the population is Bangla, there is a gap in the availability of validated adaptations of standardised assessment tools for evaluating the feeding problems of the pediatric population. Feeding difficulties can predict further language impairment as well as exist as a comorbid condition with speech-language impairments where respective assessment and intervention is required. This study aims to adapt a Bangla version of the BPFAS scale and to test its reliability and validity.

5. Method

5.1 *Respondents*

This study investigated the adaptation, validation and reliability of the Behavioural Pediatrics Feeding Assessment Scale (BEFAS) in

Bangla language for assessing the feeding behaviours of children with neurodevelopmental disabilities. A total of 215 children with various neurodevelopmental disabilities (Autism, ADHD and Down Syndrome) along with their parents participated in this study as the focus of the study was to adapt the scale to assess feeding behaviours of children with neurodevelopmental disorders. Participants were representative of different geographical location within the country as well as diverse economic and educational status. The mean age of the participants was (5.3) which ranged between (3.2) and (7.0). Demographic information of the participants is summarised in table (1). Three different facilities of a private speech therapy providing organisation were approached to request participation.

***5.2** Instrumentation*

5.2.1 The Behavioural Pediatrics Feeding Assessment Scale (BPFAS)

The BPFAS is composed of 35 children's mealtime behaviours and parental behaviours and responses regarding them arranged in two subsections. The first 25 questions reflect children's mealtime behaviours, food habits and problems related to them. The other 10 questions reflect parental behaviours and responses to the mealtime behaviours of the children. A 5-point rating scale is administered (0= never and 5= always). One can obtain a maximum of 175 possible points. A second domain of the scale reflects a dichotomous response from parents regarding the mealtime behaviours (yes or no).

5.2.2 Translation and Adaptation

The BPFAS was translated and adapted by following the guidelines suggested by (Sousa & Rojjanasrirat, 2011). The technique of translation and back-translation were used to find the equivalences of the scale materials which included cultural, conceptual, semantic as well as content equivalents. Three different translators (one speech and language pathologist, one occupational therapist and one nutritionist) were assigned who had fluency both in English and Bangla as well as the subject matter. The translators had frequent exposure to children and parents of children with neurodevelopmental disorders as part of their profession. The original and back translated English version of the scale were then compared. This kind of comparison helped in maintaining the different kinds of equivalents mentioned above. A two-member revision task was chosen to revise both translated versions. They analysed the documents, reduced the differences between them and finally reached a consensus to choose expressions that are best fit for the questions. Steps were undertaken such as cognitive debriefing and piloting in choosing the best translation of the questions and the changes were made into terms that are more appropriate in Bangla. Changes reflected the accommodation of understanding of Bengali population.

5.3 *Data Collection*

The final approved Bengali version of the BPFAS scale was administered to collect data. Following the verbal approval provided by the organisation, parents were approached and asked to sign a detailed consent form. Written consent was provided by the parents to participate in the study both for themselves and on behalf of the participating children. All the participants were reassessed at an interval of two weeks to test the temporal reliability of the scale. A total of 10 weeks were spent collecting data.

5.4 *Data analysis*

The collected data were analyzed using SPSS version 20 and Microsoft Excel. Mean, standard deviation, frequency and percentages of the categorical data were calculated for descriptive statistics. The reliability of the scale was measured by calculating Cronbach's alpha score. The temporal or test-retest reliability of the scale was measured by calculating the Intraclass Correlation Coefficient for the total scores. Exploratory Factor Analysis (EFA) was conducted to determine the factor structure of the scale. Convergent and discriminant validity of the scale was measured based on the factors determined by Exploratory Factor Analysis. Internal consistency and reliability of each factor were then measured.

6. Results

6.1 *Descriptive Statistics*

215 participants in total participated in the study of whom 134 (62.33%) were males and 81 (37.67%) were females. 107 participants were with autism, 73 were with ADHD and 35 were with Down Syndrome. The mean frequency score for all the participants was 104.4 with a standard deviation of 8.5 and the mean problem score for all the participants was 22.6 with a standard deviation of 3.4 (Table 1). The mean frequency score and problem score for the child part were 76.52 (Std. Deviation 5.09) and 16.38 (Std. Deviation 3.25) (Table 2). The mean frequency score and problem score for the parent part were 27.96 (Std. Deviation 4.18) and 6.26 (Std. Deviation .72) (Table 2). The mean and standard deviation of the frequency score and problem score for both child and parent part regarding respective disorders and sex are given in table 3 and 4.

Table (1) Demographic Information of the Participants

Disorders	Frequency	Percent	Sex	Frequency	Percent	Statistics	Age	Frequency Score	Problem Score
Autism	107	49.77	Male	134	62.33	Mean	5.3	104.4	22.6
ADHD	73	33.95	Female	81	37.67	Std. Deviation	.98	8.5	3.4
Down Syndrome	35	16.28				Minimum	3.20	84.00	13.00
Total	215	100.0		215	100.0	Maximum	7.00	128.00	29.00

Table (2) Distribution of Frequency and Problem Scores Across Domains

	N	Minimum	Maximum	Mean	Std. Deviation
Frequency-score child	215	64.00	91.00	76.52	5.09
Problem-score child	215	7.00	22.00	16.38	3.25
Frequency-score parent	215	20.00	37.00	27.96	4.18
Problem-score parent	215	5.00	8.00	6.26	.72

Table (3) Distribution of Frequency and Problem Scores Regarding Disorders

	Frequency-score child		Problem-score child		Frequency-score parent		Problem-score parent	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Autism	77.00	5.06	16.64	2.97	28.14	4.22	6.18	0.72
ADHD	76.27	3.03	16.60	2.75	27.80	3.63	6.40	.51
Down syndrome	75.14	8.45	14.86	5.08	27.57	5.59	6.29	1.11

Table (4) Distribution of Frequency and Problem Scores Regarding Sex

	Frequency-score child		Problem-score child		Frequency-score parent		Problem-score parent	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Male	77.35	5.55	16.13	3.20	28.10	4.52	6.42	.67
Female	75.16	4.00	16.79	3.38	27.74	3.66	6.00	.75

6.2 *Reliability*

6.2.1 Internal consistency and test-retest reliability of the BPFAS

The measurement value of Cronbach's alpha for the 24-item child domain (item 25 did not load due to the absence of variance), 10 item parent domain and 35 item complete BPFAS scale were .794, .769 and .729 respectively. The average measure of the Intraclass Correlation Coefficient (ICC) was .962 ($p<.001$) for the cumulative scores. The Inter-Item correlation of test 1 to 2 was .926, presented in table (5).

Table (5) Reliability Statistics

			ICC (Average)	Inter-Item Correlation		
	Cronbach's alpha	N of Items				
Child domain	.794	24	.962		Test_1	Test_2
Parent domain	.769	10		Test_1	1.000	.926
Total scale	.729	34		Test_2	.926	1.000

6.3 *Exploratory Factor Analysis*

Principal Component Analysis (PCA) along with varimax rotation was used to test the internal structure (Child domain and parent domain) of the Bengali version of the BPFAS scale. The measurement value of the Kaiser- Meyer-Olkin (KMO) index for each domain was .779 (child) and .868 (parent) which exceeded the reference value of 0.6 (Kaiser, 1970). Statistical significance was achieved by Bartlett's test of sphericity ($X^{2=}$ 1115.999, $p< .0001$) for child domain and ($X^{2=}$ 325.617, $p< .0001$) for parent domain which indicated the suitability of the data for factor analysis (Bartlett, 1954). Four factors for the child domain explained 73.911% of the variance and two factors for the parent domain explained 71.104% of the variance with an eigenvalue greater than 1. Communalities exceeded a value of greater than .5 on both domains for each item. Factor loadings of each item on every factor exceeded a value of .6 (Table 6 & 7). However, item 25 of the child domain did not load on any factor due to the absence of variance.

6.4 *Validity*

6.4.1 Convergent Validity

Convergent validity for both domains were measured by calculating the Average Variance Extracted (AVE) of each factor based on Exploratory Factor Analysis. The AVE value of the four factors for the child domain were .68 (factor1), .54 (factor2), .67 (factor3) and .63 (factor 4). The AVE value of the two factors for the parent domain were .67 (factor1) and .56 (factor2). All those values exceeded the reference value of greater than .5 to have an acceptable convergent validity (Fornell & Larcker, 1981).

6.4.2 Discriminant Validity

The AVE and Shared Variance (SV) or squared correlation of factor 1 and 2 of the child domain (8 items each) were .37 and .85 respectively (AVE<SV). The AVE and Shared Variance (SV) or squared correlation of factor 3 and 4 of the child domain (4 items each) were .42 and .86 respectively (AVE<SV). The AVE and Shared Variance (SV) or squared correlation of factor 1 and 2 of the parent domain (5 items each) were .42 and .86 respectively (AVE<SV). All those relations between AVE and SV failed to establish the discriminant validity indicating relationship (AVE>SV) (Fornell & Larcker, 1981).

Table (6) Parent Domain Factor loadings, Item deleted Cronbach's alpha values and corrected item–total correlations

	Component (Factor Loadings)		Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation
	1	2		
pa6	.886		.908	.846
pa1	.861		.910	.838
pa4	.828		.913	.821
pa2	.828		.916	.806
pa5	.687		.923	.766
pa10		.847	.884	.689
pa8		.787	.879	.715
pa3		.782	.860	.798
pa9		.655	.850	.843
pa7		.633	.888	.674

7. Discussion

This study was conducted to adapt a culturally sensitive Bengali version of the BPFAS scale and to test its reliability and validity. The first step towards adaptation and translation was done following the guidelines of Sousa and Rojjanasrirat (Sousa & Rojjanasrirat, 2011). The internal consistency measure for the total scale was acceptable and consistent with similar study (Sethubharathi & Vishnuram, 2023). Internal consistency measures of the subscales (child .794, parent .769) complied with previous research (>.7) (YAZICI et al., 2021). Temporal reliability was also within acceptable limit (Correlation coefficient .962) and aligned with previous study (>.7) (Sdravou et al., 2018). Exploratory Factor Analysis suggested a 4-factor solution for the child domain and a 2-factor solution for the parent domain. Factor 1 of the child domain included items related to selective eating habits. Factor 2 included items related to sensory and oral motor feeding issues (item 2,4,11,20) as well as food refusal issues (item 13,14,24). Factor 3 included items related to disruptive and avoidance behaviours. Food refusal behaviours were included in factor 4. Factor loadings of the child domain items were consistent with previous study (Sdravou et al., 2018). A 2-factor solution was generated for the parent domain. Factor 1 included items related to parental confidence and anxiousness mostly. Items related to parental response towards the feeding behaviours of children were included in factor 2.

Table (7) Child Domain Factor loadings, Item deleted Cronbach's alpha values and corrected item–total correlations

	Component (Factor Loadings)				Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation
	1	2	3	4		
ch3	.909				.938	.807
ch5	.907				.932	.889
ch10	.862				.932	.902
ch6	.832				.941	.766
ch1	.793				.947	.676
ch18	.777				.933	.880
ch8	.764				.942	.755
ch16	.751				.942	.750
ch24		.837			.881	.739

ch4	.798			.880	.740
ch11	.768			.881	.739
ch2	.763			.895	.587
ch13	.758			.885	.697
ch14	.665			.893	.597
ch12	.654			.893	.612
ch20	.612			.878	.795
ch9		.908		.899	.853
ch17		.846		.913	.816
ch15		.761		.906	.830
ch23		.752		.905	.834
ch22			.867	.902	.664
ch19			.864	.834	.850
ch21			.732	.884	.723
ch7			.678	.829	.863

Convergent validity of the BPFAS scale was achieved for each factor of both domains as it was greater than the reference value of >.5 (Fornell &Larcker, 1981). Due to the absence of any similar tool capturing mealtime behaviours in Bangla language between-factor discrimination validity measurement was undertaken. Discriminant validity of the scale regarding factors was not achieved as AVE shared by factors could not exceed their SV (AVE<SV) for all factors. As the items of the scale collectively capture the mealtime behaviours, they are strongly correlated. This strong correlation led to the failure in achieving discriminant validity. The mean frequency score and problem score for both domains regarding sex were: male (frequency score and mean score child: 77.35, 16.13, frequency score and mean score parent: 28.10, 6.42) and female (frequency score and mean score child: 75.16, 16.79, frequency score and mean score parent: 27.74, 6.00). Aligning with the results of Sethubharathi & Vishnuram (2023), mean frequency and problem scores did not differ significantly regarding sex. The mean child frequency score and child problem score were 76.52 and 16.38 respectively. According to Dovey et al., (2013), the minimum or cut off value for a clinical case is a child frequency and problem score of 61 and 6 respectively and parental frequency and problem scores

were regarded as weaker indicator. This makes all our participants designated as clinical cases. Such an indication in a primary assessment suggests further assessment for the presence of any neurodevelopmental disorders as well as speech-language impairments. The mean scores of child frequency and problem subsection for children with autism were 77.00 and 16.64. According to Önal & Uçar (2024), the mean scores of child frequency and problem subsection for children with autism were 47.48 and 6.14 respectively. This difference in scores was also observed for our participants with ADHD and Down Syndrome also (mean scores: 76.27 and 3.03, 75.14 and 8.45). However, no significant difference was observed regarding the mean scores of children with Autism, ADHD and Down Syndrome. A large-scale study with the adapted version of the BPFAS scale could give us a clearer view of the differences between the mealtime behaviours of children with different neurodevelopmental disorders. However, the adequate convergent validity, internal consistency and temporal reliability makes the Bengali adapted version of the BPFAS scale an effective tool to capture mealtime behaviours of children with various neurodevelopmental disorders.

8. Conclusion

The findings of this study indicated the acceptability of the BPFAS scale in terms of reliability and convergent validity. Significant differences of scoring were not observed between neurodevelopmental disabilities as well as sex. However, scores revealed participants to be nominated as clinical cases requiring further intervention as they exceeded the cut off score. Results can be employed in conjunction with assessment methods to observe the impact of feeding issues on communication of children with neurodevelopmental disorders. This tool can be a valuable addition to assist existing resources in assessing children with neurodevelopmental disorders and can be extended to different age ranges.

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