

Oral Motor Difficulties and Speech Intelligibility in Bangla-Speaking Children with Cerebral Palsy: A Cross-Sectional Study

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Abstract

Cerebral palsy (CP) commonly impairs oral motor function and speech intelligibility. This cross-sectional study assessed oral motor difficulties and speech intelligibility in 90 parents of children with CP (aged 6–14 years) at two specialized centers in Dhaka, Bangladesh, using a structured questionnaire, the Intelligibility in Context Scale (ICS), and a Likert-type oral motor rating scale. Most children were male (61.1%; mean age 8.79±2.92 years). Oral motor difficulties were identified in 68.9% of participants; 80% had speech delay and 55.6% had a slow speech rate. The mean ICS score was 3.01±1.21, indicating children were only sometimes understood by communication partners. Oral motor difficulties were significantly associated with lip, tongue, and jaw movements and with speech intelligibility ($p<0.05$), but not with age ($p=0.104$). Oral motor difficulties are common among Bangla-speaking children with CP and adversely affect speech intelligibility, supporting the need for early speech therapy and Bangla-specific assessment tools.

Keywords: Cerebral palsy, speech intelligibility, oral motor skills, children, Bangladesh.

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INTRODUCTION

Cerebral palsy (CP) is a group of permanent disorders affecting movement and posture due to non-progressive disturbances in the developing brain [1]. It is one of the most common childhood disabilities worldwide and frequently leads to impairments in motor function, speech, and communication abilities [2]. In developing countries such as Bangladesh, the burden of disability is substantial due to limited health resources and rehabilitation services.

Bangladesh is one of the most densely populated countries in the world, with a population exceeding 160 million people. According to estimates from the World Bank, approximately 15% of the

population lives with some form of disability [3]. Among these conditions, cerebral palsy represents a major cause of motor disability in children.

Speech production involves a complex interaction between respiration, phonation, resonance, and articulation [4]. Articulation refers to the coordinated movement of the jaw, tongue, lips, and other oral structures to produce speech sounds. For intelligible speech, these structures must operate with high precision and coordination. However, children with cerebral palsy often experience impaired motor control due to neurological damage affecting the central nervous system [5].

Reduced control of the soft palate may result in hyper nasal speech, while difficulties in controlling the lips and tongue can cause imprecise articulation [6]. Consequently, speech intelligibility—the degree to which speech is understood by listeners—may be significantly compromised in children with CP.

Speech intelligibility refers to the clarity of speech and the extent to which a listener can accurately understand the speaker's message [6]. It is influenced by several factors, including the speaker's linguistic competence, the listener's familiarity with the speaker, environmental conditions, and acoustic clarity of speech signals [7].

Children with CP who have speech and communication difficulties are at increased risk of social isolation, reduced participation in educational activities, and lower overall quality of life [8]. Communication limitations can also affect emotional development and social interaction.

One of the major contributing factors to speech impairment in CP is oral motor dysfunction. Oral motor skills refer to the movement and coordination of muscles involved in speech production, including those of the lips, tongue, jaw, and soft palate [9,10]. Deficits in these movements may lead to imprecise articulation, reduced speech clarity, and abnormal speech rhythm.

Another important factor influencing speech intelligibility is oral motor planning. Oral motor planning involves the ability to sequence and coordinate speech movements to produce words and sentences. Deficits in motor planning are often associated with childhood apraxia of speech, characterized by inconsistent speech errors, difficulty sequencing sounds, and impaired speech rhythm [11].

In clinical practice, speech intelligibility can be assessed using standardized tools such as the Intelligibility in Context Scale (ICS). The ICS is a parent-reported questionnaire designed to measure how well a child's speech is understood by different communication partners, including family members, teachers, friends, and strangers [11].

Despite the global recognition of speech impairments associated with CP, limited research has been conducted in Bangladesh focusing on oral motor function and speech intelligibility among Bangla-speaking children. Furthermore, there is currently no widely established Bangla assessment tool for evaluating speech intelligibility.

Understanding the characteristics and factors influencing speech intelligibility in children with CP is essential for developing effective therapeutic interventions. Therefore, this study aimed to explore oral motor difficulties and speech intelligibility in Bangla-

speaking children with cerebral palsy based on parental perspectives.

MATERIALS AND METHODS

Study Design

This study employed a descriptive cross-sectional design to evaluate oral motor difficulties and speech intelligibility among Bangla-speaking children diagnosed with cerebral palsy. The design allowed for the assessment of these characteristics at a single point in time within a defined population.

Study Setting

The research was conducted at two specialized healthcare institutions in Dhaka, Bangladesh: the Institute of Paediatric Neurodisorder and Autism under Bangladesh Medical University, and Ferozabari Shishu and Pongu Hospital. These centers provide specialized care and rehabilitation services for children with neurodevelopmental disorders, including cerebral palsy.

Study Period

Total 18 months from September 2018 to March 2020.

Study Population

The study population comprised parents or primary caregivers of children diagnosed with cerebral palsy who attended the selected institutions during the study period. Parents were considered appropriate respondents as they could provide reliable information regarding their child's speech and oral motor functioning in everyday contexts.

Inclusion Criteria

Participants were included if they were parents or guardians of children with a confirmed diagnosis of cerebral palsy, whose children were aged between 6 and 14 years, and who used some form of verbal communication. Additionally, only those parents who provided informed consent were enrolled in the study.

Exclusion Criteria

Participants were excluded if the parents declined to provide consent or if the child had no form of speech or communication ability, as assessment of speech intelligibility would not be feasible in such cases.

Data Collection Tools

After taking informed written consent from parents or caregiver, data were collected through an interviewer-administered structured questionnaire, which consisted of four sections: socio-demographic characteristics, speech-related information, oral motor movement assessment, and the Intelligibility in Context Scale (ICS).

The ICS is a validated tool comprising seven questions rated on a five-point Likert scale, where a score of 1 indicates that the child is never understood and a

score of 5 indicates that the child is always understood across different communication partners.

Data Analysis

Data were analyzed using SPSS version 22. Statistical analysis included descriptive statistics such as frequency, percentage, mean, and standard deviation. Inferential statistical tests, including the chi-square test and Pearson correlation analysis, were also performed to examine associations and relationships among variables.

RESULTS

Among the 90 children with CP, more than half (55.6%) were aged between 6 and 8 years, with 21.1% in the 9–11 years' age group and 23.3% in the 12–14 years' group. Regarding gender, the majority of participants were male (n=55, 61.1%), while 38.9% were female. Based on religion, almost all participants were Muslim (n=84, 93.3%), and a small proportion (6.7%) were Hindu. Considering family size, most of the respondents (82.2%) reported having 3–5 family members, followed by 12.2% with 5–7 members and 5.6% with more than seven family members (Table 1).

Table 1: Socio-demographic characteristics of children with cerebral palsy and their families

Age group	Number (n)	Percent (%)
Age (in years)		
6-8	50	55.6
9-11	19	21.1
12-14	21	23.3
Mean $\pm$ SD = 8.79 $\pm$ 2.92		
Gender		
Male	55	61.1
Female	35	38.9
Religion		
Islam	84	93.3
Hinduism	06	6.7
Family member		
3-5 person	74	82.2
5-7 person	11	12.2
>7 person	5	5.6
Mean $\pm$ SD = 4.81$\pm$1.217		

Most of children with CP had eating & swallowing problem. About 13.9% children with CP

were reported no difficulty followed by 19.9% in drinking and 19.9% in sucking difficulty (Figure 1).

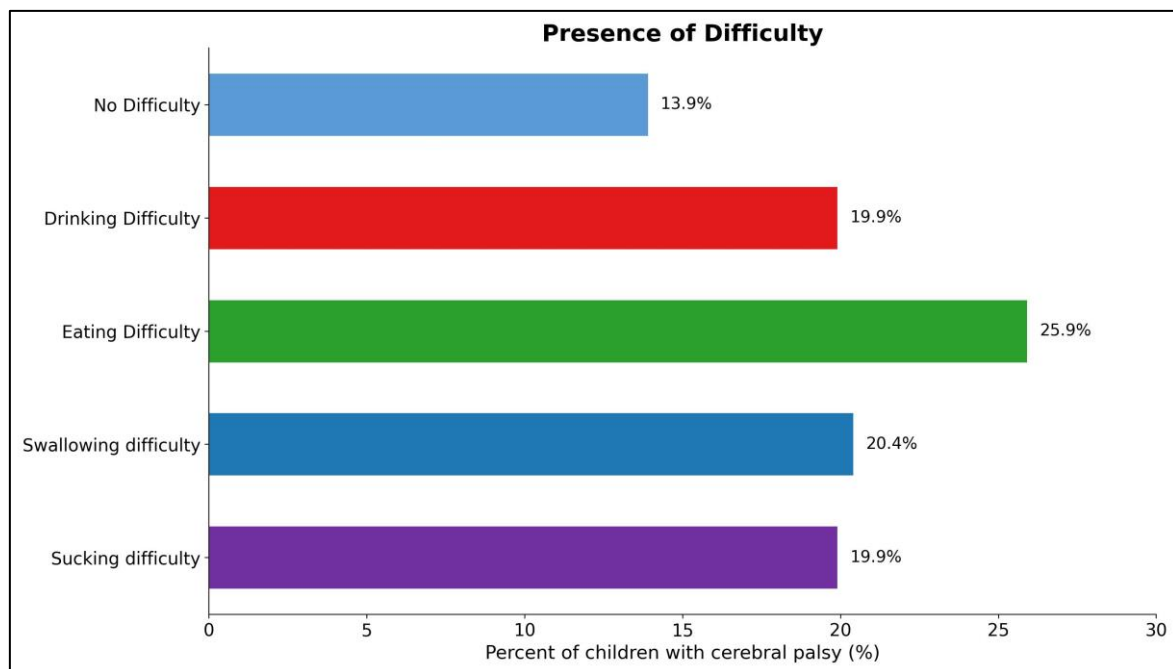


Figure 1: Distribution of children with cerebral palsy by presence of oral feeding difficulty (n = 90)

Among the children with CP (n=90), the majority (n=72, 80.0%) had speech delay, while 20.0% (n=18) had no speech problem. Regarding hearing status, most children (n=73, 81.1%) had no hearing problem, whereas 13.3% (n=12) had hearing impairment and 5.6%

(n=5) were not diagnosed. In terms of speech speed, about half of the participants demonstrated a slow speech rate, one-fourth had a fast speech rate, and approximately 20.0% of the children with CP showed a normal speech rate (Table 2).

Table 2: Speech and Hearing Characteristics of Children with CP (n=90)

Variables	Number (n)	Percent (%)
Speech Delay		
Yes	72	80.0
No	18	20.0
Hearing Problem		
Yes	12	13.3
No	73	81.1
Not Diagnosed	5	5.6
Speech speed		
Fast Speech	22	24.4
Slow Speech	50	55.6
Normal Speech	18	20.0

Among the participants, more than half of the children with CP were treated by speech therapy & about 32.2% (n=29) did not treated by speech therapy & those

who were treated by speech therapy were reported better than before as shown in table 3.

Table 3: Distribution of the children with CP based on taking speech therapy (n=90).

Variables	Number (n)	Percent (%)
Taking speech therapy		
Yes	61	67.8
No	29	32.2
Prognosis of treatment (n=61)		
No Change	22	36.1
Better than before	39	63.9

Considering the ICS scores among children with CP (n=90), the mean total score was 21.10 (± 8.472), with a minimum score of 7 and a maximum score of 35. Regarding the ICS average score, the mean was 3.01,

indicating that the speech of children with CP was sometimes intelligible to others. The minimum average score was 1, while the maximum score was 5 (Table 4).

Table 4: ICS Total and Average Scores of Children with CP (n=90)

	Minimum Score	Maximum Score	Mean Score	Standard deviation
TS	7	35	21.10	8.472
AS	1	5	3.01	1.211

Study revealed that most (n=37, 74.0%) of the children with CP were reported OMD at age group 6-8 years where male were more prone to OMD than female. More than half (n=62, 70.5%) of the parents had no speech problem. About two third (n=36, 70.6%) of the children was reported OMD who had single family. On the other hand, more than half (n=53, 73.6%) of children with CP were reported speech delay who had OMD. More than half (73.6%) of the children with CP who had OMD were not reported hearing problem as shown in table 5.

Table 5: Association between OMD with age group, gender, parents' speech, family types, & speech delay

Variables	Oral Motor Difficulties		Total	Chi square	Df	P value
	Present	Absent				
Age Group						
6-8 Years	37 (74.0%)	13 (26.0%)	50 (100.0%)	1.379	2	.502
9-11 Years	12 (63.2%)	7 (36.8%)	19 (100.0%)			
12-14 Years	13 (61.9%)	8 (38.1%)	21 (100.0%)			
Gender						
Male	38 (69.1%)	17 (30.9%)	55 (100.0%)	.003	1	.959
Female	24 (68.6%)	11 (31.4%)	35 (100.0%)			

Variables	Oral Motor Difficulties		Total	Chi square	Df	P value
	Present	Absent				
Parents Speech Problem						
None of parents	62 (70.5%)	26 (29.5%)	88 (100.0%)	4.529	1	.033*
Father has	0 (0.0%)	2 (100.0%)	2 (100.0%)			
Family Types						
Single Family	36 (70.6%)	15 (29.4%)	51 (100.0%)	0.159	1	.690
Nuclear family	26 (66.7%)	13 (33.3%)	39 (100.0%)			
Speech Delay						
Present	53 (73.6%)	19 (26.4%)	72 (100.0%)	3.746	1	.053*
Absent	9 (50.0%)	9 (50.0%)	18 (100.0%)			
Hearing problem						
Yes	8 (66.7%)	4 (33.3%)	12 (100.0%)	.321	2	.852
No	50 (68.5%)	23 (31.5%)	73 (100.0%)			
Not Diagnosed	4 (80.0%)	1 (20.0%)	5 (100.0%)			

* indicates a significant association of OMD with parents' speech problem ($p = 0.033$); the association with speech delay was borderline ($p = 0.053$). (Please also remove the asterisk after .053 in the Speech Delay row.)

Considering the lip, tongue, and jaw movement, among the children with CP, about two third of the children with CP ($n=22$, 75.9%) had average lip movement who had also OMD; More than two third of the children with CP had below average tongue movement who had also OMD and about 83.3% of them had average jaw movement who had also OMD. A

significant association was found between oral motor difficulties and lip movement ($p < 0.001$), tongue movement ($p < 0.001$), and jaw movement ($p < 0.001$), as shown in Table 6. No significant correlation was observed between age and the total intelligibility score, as illustrated in Figure 2.

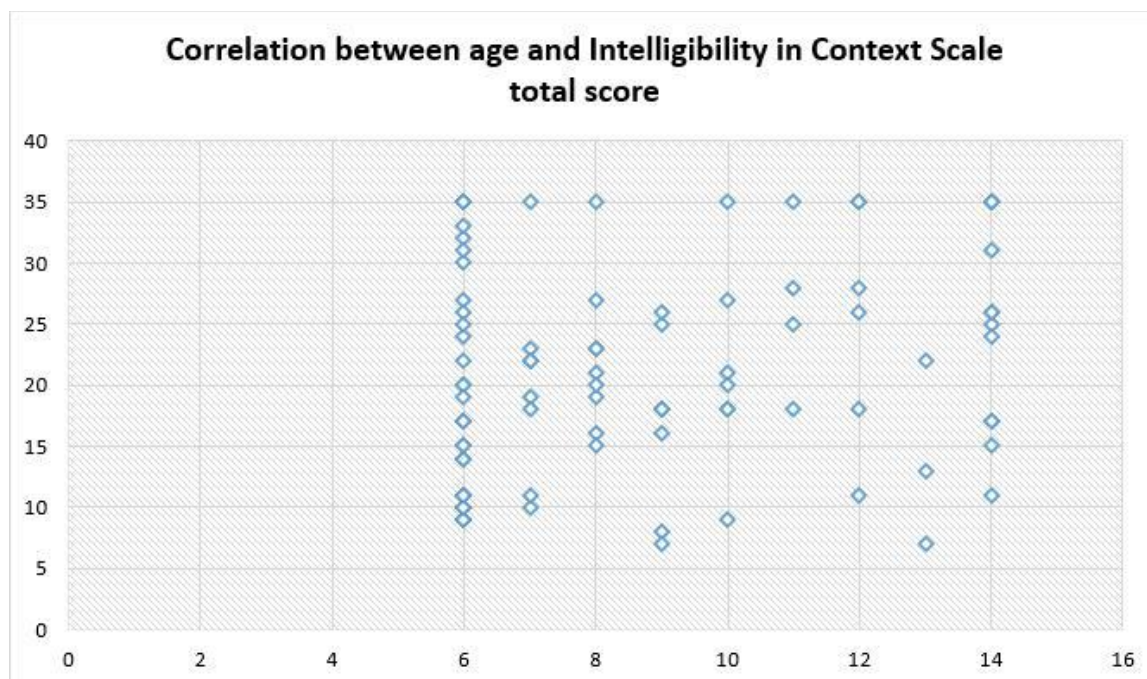


Figure 2: Scatter plot of the association between age and total Intelligibility in Context Scale (ICS) score

Table 6: Association between OMD with Lip, Tongue, and Jaw movement

Variables	Oral Motor Difficulties		Total	Chi square	Df	P value
	Present	Absent				
Lip Movement						
Poor	7 (87.5%)	1 (12.5%)	8 (100.0%)	25.53	4	.000*
Below average	24 (92.3%)	2 (7.7%)	26 (100.0%)			
Average	22 (75.9%)	7 (24.1%)	29 (100.0%)			
Good	8 (38.1%)	13 (61.9%)	21 (100.0%)			
Very Good	1 (16.7%)	5 (83.3%)	6 (100.0%)			

Variables	Oral Motor Difficulties		Total	Chi square	Df	P value
	Present	Absent				
Tongue Movement						
Poor	10 (100.0%)	0 (0.0%)	10 (100.0%)	39.919	4	.000*
Below average	28 (87.5%)	4 (12.5%)	32 (100.0%)			
Average	21 (77.8%)	6 (22.2%)	27 (100.0%)			
Good	2 (13.3%)	13 (86.7%)	15 (100.0%)			
Very Good	1 (16.7%)	5 (83.3%)	6 (100.0%)			
Jaw movement						
Poor	10 (100.0%)	0 (0.0%)	10 (100.0%)	38.71	4	.000*
Below average	21 (87.5%)	3 (12.5%)	24 (100.0%)			
Average	25 (83.3%)	5 (16.7%)	30 (100.0%)			
Good	2 (13.3%)	13 (86.7%)	15 (100.0%)			
Very Good	1 (16.7%)	5 (83.3%)	6 (100.0%)			

P-value reached from chi-square. Mark represents a highly significant association of Oral Motor Difficulties with Lip (*p*-value .000), Tongue (*p*-value.000, and Jaw movement (*p*-value .000).

Table 7: Association between OMD and SI

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Variables	Oral Motor Difficulties		Total	Chi square	Df	P value
	Present	Absent				
Speech Intelligibility						
Yes	55 (83.3%)	11 (16.7%)	66 (100.0%)	24.094	1	.000
No	7 (29.2%)	17 (70.8%)	24 (100.0%)			

P=.000<0.05 indicated as significance which represents that there was significant relation between OMD and SI.

DISCUSSION

The present study explored oral motor difficulties (OMD), speech characteristics, and associated factors among Bangla-speaking children with cerebral palsy (CP). The socio-demographic findings revealed that the majority of children were aged 6–14 years (mean 8.79 ± 2.92), with a predominance of males (61.1%). This male predominance is consistent with previous studies, which suggest a slightly higher prevalence of CP among boys, possibly due to biological vulnerability during early neurodevelopmental stages [1]. The religious and family structure distribution reflects the demographic characteristics of the study setting and aligns with population trends in South Asia [2].

Feeding-related difficulties were highly prevalent, with eating and swallowing problems being the most common. This finding is consistent with earlier research indicating that children with CP frequently experience dysphagia and oral motor dysfunction due to impaired neuromuscular coordination [3]. The presence of sucking and drinking difficulties further supports the notion that oral motor impairment affects multiple stages of feeding, which may contribute to nutritional deficits and reduced quality of life [4].

Speech delay was observed in 80% of participants, indicating a substantial burden of communication impairment among children with CP. Similar findings have been reported in other studies, where speech and language disorders are common due to motor impairment, cognitive limitations, and associated sensory deficits [5]. Although most children did not have

hearing problems (81.1%), the presence of hearing impairment in a subset of participants highlights the need for comprehensive auditory assessment, as hearing loss can further complicate speech development [6]. Additionally, the predominance of slow speech rate among participants reflects impaired motor control of speech musculature, which is a characteristic feature of dysarthria in CP [7].

Regarding intervention, 67.8% of children received speech therapy, and among them, a considerable proportion showed improvement. This supports the effectiveness of speech therapy in enhancing communication abilities in children with CP, as demonstrated in previous studies [8]. However, the fact that nearly one-third of participants did not receive therapy indicates potential barriers to access, such as limited resources, lack of awareness, or socioeconomic constraints.

The mean ICS total score (21.10 ± 8.472) and average score (3.01) suggest that speech intelligibility was moderate, meaning that children were only sometimes understood by listeners. This finding aligns with prior research showing reduced intelligibility in children with CP due to impaired articulation, respiration, and phonation [9]. The variability in scores also reflects the heterogeneity of CP and its impact on communication abilities.

The association analysis revealed no significant relationship between OMD and age group or gender, which is consistent with some studies suggesting that oral motor impairment is more strongly related to

neurological severity than demographic factors [10]. However, a statistically significant association was observed between OMD and parental speech problems ($p = 0.033$), indicating a possible genetic or environmental influence on speech development. Additionally, speech delay showed a borderline significant association with OMD ($p = 0.053$), suggesting that oral motor impairment may contribute to delayed speech development.

A highly significant association was found between OMD and lip, tongue, and jaw movements ($p < 0.001$). Children with poorer oral motor function were more likely to exhibit OMD, which is consistent with the understanding that coordinated movement of these structures is essential for both feeding and speech production [11]. These findings highlight the importance of assessing specific oral structures when evaluating children with CP.

Furthermore, a significant relationship between OMD and speech intelligibility was identified ($p < 0.001$), indicating that children with OMD were more likely to have reduced intelligibility. This supports previous research demonstrating that oral motor control is a key determinant of speech clarity in CP [12]. No significant correlation was observed between age and ICS total score (Figure 2), suggesting that speech intelligibility in this group was influenced more by oral motor function than by age alone.

Overall, the findings of this study emphasize the high prevalence of oral motor and speech difficulties among children with CP and underscore the importance of early identification and intervention. Multidisciplinary management, including speech therapy, nutritional support, and caregiver education, is essential to improve functional outcomes and quality of life for these children.

CONCLUSION

This study highlights that oral motor difficulties are common among Bangla-speaking children with cerebral palsy and have a significant impact on speech intelligibility. Many children experienced delayed speech development and showed moderate intelligibility, with parents understanding their speech better than unfamiliar listeners. A strong relationship between oral motor function and speech intelligibility was observed, indicating the importance of including oral motor assessment in speech therapy.

Recommendations: The study suggests the need to develop Bangla-based speech intelligibility assessment tools and promote early screening for oral motor dysfunction in children with cerebral palsy. It also emphasizes improving access to speech therapy services across Bangladesh and conducting larger, multi-center studies to further validate these findings.

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Ethical Approval: The study was approved by faculty of Social Science, University of Dhaka

Conflicts of Interest: We do not have any conflict of interest.

Data Availability Statement: We confirm that the data supporting the findings of this study will be shared upon reasonable request.

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