

Feeding Problems and Nutritional Status Among Children with Cerebral Palsy Attending Early Intervention Centres and ASHA School in Western Maharashtra: A Descriptive Study

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Abstract—Cerebral palsy (CP) is the most common neurodevelopmental disorder of childhood, affecting 1.5–3 per 1,000 live births globally. Children with CP frequently experience feeding difficulties and nutritional compromise due to neuromuscular dysfunction. Despite high prevalence, systematic evidence from Indian settings remains limited. Objectives: To assess nutritional status and explore feeding problems among children with CP; to examine the association between feeding problems and nutritional status; and to determine associations between feeding problems and selected socio-demographic variables. Methods: A descriptive cross-sectional study was conducted among 100 children with CP (aged 2–18 years) attending an Early Intervention Centre and ASHA School in Western Maharashtra. Purposive sampling was employed. Nutritional status was assessed using anthropometric measurements (weight, height, MUAC, BMI) interpreted against IAP growth charts. Feeding difficulties were evaluated using a validated, self-structured domain-based questionnaire (FINE-CP; 25 items; score range 0–75; Cronbach's $\alpha=0.75$). Data were analysed using descriptive statistics and Chi-square test ($\alpha=0.05$). Results: Of 100 children (68% male; mean age 6.09 ± 0.86 years), 86% had normal nutritional status, 13% were underweight (<3rd percentile), and 1% were overweight. Feeding difficulties were prevalent: prolonged mealtime ≥ 30 minutes (72%), excessive drooling (46% moderate–severe), difficulty in self-feeding (30%), and reduced water intake (36%). A statistically significant association was demonstrated between feeding difficulty severity and both weight-for-age and height-for-age percentiles ($\chi^2=20.5$, $p=0.004$). Among children >6 years, BMI was significantly associated with caregiver health status ($\chi^2=12.27$, $p=0.001$) and number of children in the family ($\chi^2=13.94$, $p=0.0075$). Conclusion: Feeding difficulties are significantly associated with nutritional

compromise in children with CP. Prolonged mealtime, drooling, postural instability, and caregiver stress are dominant concerns. Early multidisciplinary assessment, caregiver education, and structured nutritional interventions are essential for optimal outcomes.

Index Terms—Cerebral palsy, Feeding difficulties, Nutritional status, Caregiver, Early intervention, FINE-CP, Anthropometry, Maharashtra

I. INTRODUCTION

Cerebral palsy (CP) represents the most prevalent chronic neurodevelopmental disorder of childhood, characterised by permanent, non-progressive impairments of movement, posture, and motor coordination arising from damage to the developing brain [1,2]. Globally, CP affects approximately 1.5–3 per 1,000 live births, with an estimated 17–20 million individuals living with the condition worldwide. In India, community-based surveys report a prevalence of 2–3 per 1,000 children, translating to nearly 2–2.5 million affected individuals [3].

Feeding is a complex neuromuscular activity requiring coordinated function of the lips, tongue, jaw, pharynx, respiratory system, and postural muscles. Neuromuscular dysfunction in CP disrupts this coordination, producing poor sucking and chewing, delayed swallowing, drooling, choking, prolonged meal duration, food refusal, and inability to self-feed [4]. Additional contributing factors include gastroesophageal reflux, constipation, postural instability, sensory disturbances, and caregiver-related

factors such as limited feeding knowledge and caregiver anxiety [5].

Persistent feeding difficulties place children with CP at high risk of malnutrition, which further worsens motor impairment, delays rehabilitation, reduces immunity, and diminishes quality of life. According to the World Health Organization, children with disabilities are 2–3 times more likely to be undernourished than their typically developing peers. Studies from India report malnutrition rates of 45–60% among children with CP, with higher rates in low-resource settings [6].

Early Intervention Centres (EICs) and special schools such as ASHA School play a vital role in rehabilitation; however, nutritional assessment and structured feeding management are frequently neglected components of care [7]. Region-specific data from Western Maharashtra are scarce, limiting the development of contextually appropriate interventions. This study, therefore, aimed to systematically assess feeding problems and nutritional status among children with CP attending selected EICs and ASHA School in Western Maharashtra, with a view to generating evidence for caregiver-centred nutritional interventions.

II. METHODS

A. Study Design and Setting

A descriptive cross-sectional study design was adopted. Data were collected from the Early Intervention Centre of a selected tertiary care hospital in Maharashtra and ASHA School, Western Maharashtra, between [data collection period]. Institutional Ethics Committee approval was obtained prior to commencement (Ref. No: [IEC Ref No]). Written informed consent was obtained from all primary caregivers in English and Hindi.

B. Participants

The target population comprised all children aged 2–18 years with a confirmed diagnosis of CP attending the identified institutions, along with their primary caregivers. Inclusion criteria: (i) children with CP aged 2–18 years; (ii) attending the EIC or ASHA School for ≥ 3 months; (iii) primary caregiver willing to provide consent. Exclusion criteria: (i) children receiving exclusive enteral tube feeding; (ii) children undergoing

alternative therapies specifically targeting feeding problems; (iii) caregivers unwilling to participate.

C. Sample Size and Sampling

Sample size was calculated using Cochran's formula: $n = Z^2 P(1-P)/d^2$, assuming 95% confidence ($Z=1.96$), expected prevalence of 50%, and 10% margin of error, yielding a minimum of 96, rounded up to $n=100$. Purposive sampling was employed to ensure inclusion of children meeting the defined eligibility criteria.

D. Data Collection Instruments

Section A – Socio-Demographic and Anthropometric Profile: Fifteen structured items capturing child and caregiver demographics. Anthropometric measurements (weight, height, MUAC for children < 6 years, BMI for children > 6 years) were recorded using calibrated instruments and interpreted using IAP growth charts (0–18 years).

Section B – FINE-CP Questionnaire: A self-structured, domain-based feeding assessment tool (Feeding Inventory for Nutritional Evaluation in Cerebral Palsy – FINE-CP) comprising 25 items across four domains: (I) General Nutritional & Intake Profile (items 1–7; max score 21); (II) Feeding Mechanics & Physical Limitations (items 8–12; max score 15); (III) Oral-Motor & Swallowing (items 13–21; max score 27); (IV) Behavioural & Feeding-Related Stress (items 22–25; max score 12). Each item scored on a 4-point Likert scale: 0=No/Never, 1=Mild/Rarely, 2=Moderate/Sometimes, 3=Severe/Often. Total score range: 0–75. Interpretation: 0–18=Minimal/no problem; 19–37=Mild; 38–55=Moderate; 56–75=Severe.

E. Validity and Reliability

Content validity was established through expert review by six professionals spanning paediatrics ($n=2$), paediatric nursing ($n=1$), clinical psychology ($n=1$), nutrition & dietetics ($n=1$), and nursing research ($n=1$). A Content Validity Index (CVI) > 0.80 was achieved for all items. Reliability was assessed using Cronbach's alpha ($\alpha=0.75$), indicating acceptable internal consistency.

F. Statistical Analysis

Data were entered in Microsoft Excel and analysed using appropriate statistical software. Descriptive statistics (frequencies, percentages, mean, standard deviation) were used to characterise the study

population and summarise feeding difficulty scores. The Chi-square test was applied to examine associations between feeding difficulty categories and nutritional status indicators, and between feeding difficulty scores and selected socio-demographic variables. Statistical significance was set at $\alpha=0.05$.

III. RESULTS

A. Socio-Demographic Characteristics

One hundred children with CP (68 males, 32 females; mean age 6.09 ± 3.86 years) participated. Fifty-four percent were aged below 6 years. All children belonged to nuclear families. The majority (97%) belonged to the upper-middle socio-economic class (modified Kuppuswamy Scale). Mothers were the sole primary caregivers for all children (100%). Most caregivers were graduates (49%) or had secondary education (35%), and 97% were in good health. Seventy-three percent of children had a prior hospitalisation history; however, only 5% were hospitalised for feeding-related reasons. Detailed socio-demographic characteristics are presented in Table 1.

Table 1: Socio-demographic characteristics of children with cerebral palsy (n=100)

Variable	Category	n	%
Gender	Male	68	68.0
	Female	32	32.0
Age Group	< 6 years	54	54.0
	≥ 6 years	46	46.0
Birth Order	First	72	72.0
	Second	27	27.0
	Third	1	1.0
Schooling	No schooling	59	59.0
	Pre-primary	16	16.0
	Primary	24	24.0
	High school	1	1.0
Caregiver Education	Secondary	35	35.0
	Higher secondary	8	8.0
	Graduate	49	49.0
	Post-graduate	8	8.0

Variable	Category	n	%
Prior Hospitalisation	Yes	73	73.0
	No	27	27.0
Hosp. due to Feeding	Yes	5	5.0
	No	95	95.0

B. Nutritional Status

Assessment of nutritional status using weight-for-age and height-for-age percentiles (IAP growth charts) revealed that 86% of children had normal nutritional status (3rd–97th percentile), 13% were underweight (<3rd percentile), and 1% were overweight (>97th percentile). Among children <6 years, MUAC categorisation showed 57% normal (>14 cm), 34% mild malnutrition (12.5–14 cm), and 9% moderate malnutrition (11.5–12.5 cm). Among children >6 years, BMI assessment classified 80% as normal, 13% as underweight, and 4% as severely underweight (Table 2).

Table 2: Nutritional status of children with cerebral palsy (n=100)

Nutritional Indicator	Category	n	%
Weight/Height Percentile (n=100)	< 3rd percentile (Underweight)	13	13.0
	3rd–97th percentile (Normal)	86	86.0
	> 97th percentile (Overweight)	1	1.0
MUAC < 6 years (n=56)	> 14 cm (Normal)	32	57.1
	12.5–14 cm (Mild malnutrition)	19	33.9
	11.5–12.5 cm (Moderate malnutrition)	5	8.9
BMI > 6 years (n=44)	Normal	36	81.8

Nutritional Indicator	Category	n	%
	Underweight	6	13.6
	Severely underweight	2	4.5

C. Feeding Problem Assessment (FINE-CP)

Table 3 summarises the distribution of responses across feeding difficulty domains. Prolonged mealtime (≥ 30 –40 minutes) was the most prevalent concern, with 38% moderate and 6% severe burden. Excessive drooling was rated moderate by 32% and severe by 14%. Reduced water intake/dehydration signs were rated moderate (27%) and severe (9%). Difficulty in self-feeding due to motor disability was moderate in 22% and severe in 8%. Food retention in the mouth was moderate in 22% and severe in 6%. Caregiver feeding-related stress was moderate in 15% and severe in 2%. Choking, aspiration, food aversion, and vomiting were rare ($\leq 3\%$).

Table 3: Distribution of feeding difficulty responses across FINE-CP domains (n=100)

Feeding Problem Domain / Item	No/Never %	Mild %	Moderate %	Severe %
DOMAIN I: General Nutritional & Intake				
Poor/stagnant weight gain	88	11	1	0
Poor appetite	70	27	2	1
Constipation affecting eating	83	8	8	1
Reduced water intake / dehydration	31	33	27	9
Visible signs of undernutrition	71	20	5	4
Takes less food than expected for age	60	36	1	3
Limited food variety	76	22	2	0

Feeding Problem Domain / Item	No/Never %	Mild %	Moderate %	Severe %
DOMAIN II: Feeding Mechanics & Physical Limitations				
Requires special seating support	79	10	5	6
Mealtime > 30–40 minutes	28	28	38	6
Leaves food unfinished	77	19	4	0
Motor disability prevents self-feeding	50	20	22	8
Improper sitting makes feeding unsafe	75	12	7	6
DOMAIN III: Oral-Motor & Swallowing				
Difficulty chewing/biting	73	16	6	5
Keeps food in mouth for long time	47	25	22	6
Coughs/clears throat while swallowing	97	1	2	0
Chokes while eating/drinking	97	2	1	0
Excessive drooling	36	18	32	14
Vomits/regurgitates after meals	99	0	1	0
Refuses textures due to difficulty	86	11	3	0
Frequent chest infections (aspiration)	97	2	1	0

Feeding Problem Domain / Item	No/Never %	Mild %	Moderate %	Severe %
Requires mashed/modified food	74	12	7	7
DOMAIN IV: Behavioural & Feeding Stress				
Food refusal / irritability at mealtime	88	11	1	0
Cries/arches back while being fed	95	4	1	0
Caregiver finds feeding stressful	51	32	15	2
Aversion/fear toward mealtime	99	1	0	0

D. Association Between Feeding Problems and Nutritional Status

Table 4 presents the comparison of feeding difficulty severity with nutritional status. Among underweight children (n=13), 54% had severe feeding problems and 31% had moderate feeding problems. In contrast, among children with normal nutritional status (n=86), 36% had mild and 17% had minimal feeding problems. Chi-square analysis confirmed a statistically significant association between feeding difficulty category and both weight-for-age percentile ($\chi^2=20.5$, df=6, p=0.004) and height-for-age percentile ($\chi^2=20.5$, df=6, p=0.004), supporting rejection of the null hypothesis.

Table 4: Comparison of feeding difficulty severity with nutritional status (n=100)

Feeding Difficulty Category (Score)	Underweight <3rd %ile (n=13)	Normal 3rd–97th %ile (n=86)	Overweight >97th %ile (n=1)	Total
Severe (56–75)	7 (54%)	12 (14%)	0 (0%)	19

Feeding Difficulty Category (Score)	Underweight <3rd %ile (n=13)	Normal 3rd–97th %ile (n=86)	Overweight >97th %ile (n=1)	Total
Moderate (38–55)	4 (31%)	28 (33%)	0 (0%)	32
Mild (19–37)	2 (15%)	31 (36%)	1 (100%)	34
Minimal/None (0–18)	0 (0%)	15 (17%)	0 (0%)	15
Chi-square (χ^2)	20.5	—	—	p=0.004*

* Statistically significant at p<0.05. χ^2 applies to both weight-for-age and height-for-age percentile associations.

E. Association Between Feeding Problems and Socio-Demographic Variables

Table 5 summarises the Chi-square analysis of feeding difficulty scores against selected demographic variables. Age ($\chi^2=0.3$, p=0.88), gender ($\chi^2=4.24$, p=0.12), birth order ($\chi^2=2.85$, p=0.619), birth spacing ($\chi^2=10.02$, p=0.261), school grade ($\chi^2=6.30$, p=0.39), caregiver education ($\chi^2=7.15$, p=0.307), caregiver health ($\chi^2=3.90$, p=0.142), and socio-economic status ($\chi^2=6.57$, p=0.161) were all non-significant. Number of children in the family approached borderline significance ($\chi^2=12.27$, p=0.057). For nutritional status (BMI; >6 years), significant associations were observed with number of children in the family ($\chi^2=13.94$, p=0.0075) and caregiver health ($\chi^2=12.27$, p=0.0011).

Table 5: Association of feeding difficulty and nutritional status with selected demographic variables (n=100)

Demographic Variable	Chi-Square (χ^2)	p-value	Significance
Age (<6 vs ≥6 years)	0.30	0.880	NS

Demographic Variable	Chi-Square (χ^2)	p-value	Significance
Gender (Male/Female)	4.24	0.120	NS
No. of children in family (feeding score)	12.27	0.057	Borderline
Order of birth	2.85	0.619	NS
Birth spacing	10.02	0.261	NS
School grade	6.30	0.390	NS
Socio-economic status	6.57	0.161	NS
Caregiver education	7.15	0.307	NS
Caregiver health (feeding score)	3.90	0.142	NS
No. of children in family (BMI >6 yrs)	13.94	0.008	S*
Caregiver health (BMI >6 yrs)	12.27	0.001	S*

NS=Not Significant; S*=Significant ($p < 0.05$). Feeding score=FINE-CP total score category.

IV. DISCUSSION

The present study provides a systematic characterisation of feeding difficulties and nutritional status among children with CP in Western Maharashtra, a context where region-specific data are scarce.

The sample was predominantly male (68%), consistent with the established male preponderance of CP reported across national and international studies [8]. The mean age of 6.09 years and higher enrolment of younger children (54% below 6 years) reflect early identification patterns characteristic of institutional EIC settings. All caregivers were mothers, mirroring observations by Kumar et al. [9] and Sharma et al. [10], and underscoring the pivotal role of maternal caregiving in CP management.

Nutritional status was comparatively favourable in the present study (13% underweight; 86% normal), contrasting with higher malnutrition rates (45–60%) reported from public hospital-based samples in India [9,11]. This difference is plausibly explained by the relatively advantaged socio-economic profile (97%

upper-middle class) and high caregiver educational attainment (49% graduates) of the present cohort. Better economic resources facilitate access to healthcare, supplemental nutrition, and therapeutic services, consistent with findings of Patil et al. [11] and Gupta et al. [12]. However, among children <6 years, 34% had mild and 9% had moderate malnutrition by MUAC, signalling the need for early vigilance even in well-resourced families.

Feeding difficulties were prevalent across multiple domains. Prolonged mealtime (72% affected to varying degrees) and excessive drooling (46% moderate–severe) were the most significant concerns, corroborating Diwan and Diwan [13] and Wang et al. [14]. Reduced water intake affecting 36% at moderate–severe levels reflects an under-recognised aspect of nutritional management in CP. Difficulty in self-feeding (30% moderate–severe) and the need for modified food textures (14%) are consistent with the broad literature on oromotor dysfunction [4,14]. Notably, severe swallowing complications such as choking ($\leq 3\%$), aspiration-related symptoms, vomiting, and food aversion were uncommon, suggesting that the study population had milder motor impairment or benefited from early therapeutic intervention.

The statistically significant association between feeding difficulty severity and nutritional status ($\chi^2=20.5$, $p=0.004$) is a central finding of the study. The risk gradient is clinically meaningful: 54% of underweight children had severe feeding problems versus only 14% of those with normal nutritional status. These findings align with Miller et al. [15] ($r=-0.68$, $p<0.01$) and Gupta et al. [12] ($r=0.62$, $p<0.01$), who documented strong inverse correlations between feeding difficulty and nutritional indices. Park et al. [16] similarly reported a 2.3-fold greater risk of malnutrition in children with severe feeding difficulties.

Most socio-demographic variables did not significantly influence feeding difficulty scores, consistent with Miller et al. [15] and Reddy et al. [17], who found functional impairment to be a stronger determinant than biological or social background. The significant associations of BMI (>6 years) with caregiver health ($\chi^2=12.27$, $p=0.001$) and family size ($\chi^2=13.94$, $p=0.008$) highlight caregiver-related and structural family factors as determinants of nutritional status in older children, supporting Taylor et al.'s [18] observations on caregiver burden.

The study has several strengths: (i) systematic use of a validated multidomain tool (FINE-CP; $\alpha=0.75$); (ii) comprehensive anthropometric assessment using both MUAC and BMI stratified by age; (iii) inclusion of a community-based ASHA School alongside an EIC, improving representativeness. Limitations include the cross-sectional design (precluding causal inference), purposive sampling (limiting generalisability), reliance on caregiver-reported feeding data (potential recall bias), and restriction to a single geographic region. Future research should employ longitudinal designs, objective instrumental swallowing assessments, and randomised evaluation of caregiver educational interventions.

V. CONCLUSION

Feeding difficulties are significantly and clinically meaningfully associated with poor nutritional status in children with CP. Prolonged mealtime duration, excessive drooling, reduced fluid intake, postural instability during feeding, and caregiver stress are the predominant challenges in this population. Although overall nutritional status in the present cohort was relatively preserved—likely attributable to favourable caregiver education and socio-economic conditions—the subgroup of underweight children exhibited markedly higher feeding difficulty burdens. Caregiver health and family size emerged as important contextual determinants of nutritional outcomes in older children. These findings underscore the necessity of routine multidisciplinary feeding and nutritional assessment integrated into CP rehabilitation services. Structured caregiver education—informed by locally validated tools such as the information booklet developed in this study—represents a practical, scalable strategy to improve feeding practices, prevent malnutrition, and enhance the long-term health and developmental outcomes of children with cerebral palsy.

DECLARATIONS

Ethics Approval and Consent to Participate: Approved by the Institutional Ethics Committee of the Armed Forces Medical College, Pune (Ref. No: [IEC number]). Written informed consent obtained from all caregivers. Competing Interests: The authors declare no competing interests.

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