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Food pattern and nutritional status in children with cerebral palsy

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Abstract
Objectives: To assess the nutritional status in children with cerebral pasly.
Methods: Cross-sectional study with 106 children who were known cases of cerebral palsy categorized on basis of hemiplegia, diplegia, quadriplegia. Nutritional status was assessed by weight, height, age and BMI data.
Results: Undernutrition was seen in 33.3% in diplegia, 14% in hemiplegia and 52.6% in quadriplegia. Underweight was seen in 44.4% in diplegia, 11.1% in hemiplegia and 57.2% in quadriplegia.
Conclusion: Severe malnutrition was seen in quadriplegic cerebral palsy followed by diplegic and then by hemiplegic cerebral palsy.

Keywords: Cerebral palsy, hemiplegia, diplegia, quadriplegia

Introduction

Cerebral Palsy is non-progressive, meaning the brain injury or malformation would not progress in severity. However, secondary conditions resulting from the brain damage might develop and change over time. For example, brain injury could cause facial muscle impairment that did not change over time. Chewing, swallowing and aspiration could occur when facial muscles were impaired. Most children with Cerebral Palsy were at risk for secondary undernourishment due to feeding difficulties and oral motor dysfunction. Oral motor dysfunction was the inability to control activities of muscles in the mouth required for proper food intake levels. Children with cerebral palsy could benefit from feeding and nutrition assessments [1]. A study published in 1999 by Elsevier titled "Gastrointestinal manifestations in children with Cerebral Palsy" found the majority (92%) of those with Cerebral Palsy had one or more significant gastrointestinal symptoms, including difficulty swallowing, regurgitation, abdominal pain, chronic pulmonary aspiration, and chronic constipation [2].

Most of the children with cerebral palsy (CP) were at risk of poor nutritional status, predominantly those with severe gross motor impairment and oropharyngeal dysfunction [3-5]. Defining the need for nutrition intervention in children with CP requires the use of multiple methodologies [6, 7]. Indicators might include the following [4, 8]: Such as deviation in weight gain or growth resulting from an established 'pattern', Evidence of low body-fat stores in combination with low weight in respect to height or length, Prolonged or stressful oral feeding or signs of pulmonary aspiration, or dehydration and Evidence of micronutrient deficiencies.

Children and adolescents with CP had decreased energy requirements in comparison with characteristically developing groups and that these differences increase with increasing severity of gross motor impairments [9-11]. Differences were partly because of decreased basal metabolic rate (associated with reduced lean body mass and adaptation to chronic poor nutrition) but mostly because of reductions in physical activity levels [12, 13]. Energy requirements of children and adolescents with severe CP who use a wheelchair for mobility had been reported to be between 60% and 70% of those of healthy typically developing children [10, 12]. There were limited studies on growth assessment and nutrition in children with cerebral palsy in India. This study was done with the aim of assessing food pattern and nutritional status in children with cerebral palsy and malnutrition associated in various types

of cerebral palsy in 2 – 12 years old children with cerebral palsy that attended pediatric outpatient/inpatient department of DR. D Y Patil Medical College, Pune.

Material and methods

Duration of study

The study was carried out over a period from July 2015 to September 2017.

Place of Study

Dr. D. Y. Patil Medical College & Hospital and Research Centre, Pimpri, Pune 18

Type of Study

Descriptive, Cross-Sectional study.

Inclusion Criteria

- Children from 2-12 years of age.
- Both genders
- Known cases of cerebral palsy

Exclusion Criteria

- Children below 2 and above 12 years.
- Children with a history of metabolic or neurodegenerative diseases and other chronic illnesses (i.e. cardiac, renal, gastrointestinal, endocrinological or syndromal) known to effect growth were excluded.
- Children on naso/orogastric tube feeding.

Sample Size

As 51% of malnutrition was observed in children with cerebral palsy according to Mustafa BA *et al*. in 2013 and other studies, so at 95% confidence level and acceptable error of 10% the sample size came out to be 96. Considering 10% dropout the sample size would be 106.

Ethical Clearance

The protocol designed for the present study was submitted to the ethical committee of Dr. D.Y. Patil Medical College, Pune and the study was approved by the ethical committee before commencement of the study.

Discussion

A descriptive study planned in DR. D. Y. Patil Medical College and Hospital in Pimpri, Pune for evaluating the food pattern and nutritional status of children with cerebral palsy. Total 106 patients aged 2 to 12 years, who attended pediatric Outpatient Department or admitted in ward, were enrolled in this study. Food pattern, diet frequency, calories and protein intakes of the patients evaluated.

1. Feeding difficulties wise distribution of cases with type of cerebral palsy

Table 1: Cross-tabulation based on topographical classification and feeding difficulties

Topographical classification	Feeding difficulties		Total (%)
	Yes (%)	No (%)	
Diplegia	6 (24)	61 (75.3)	67 (63.2)
Hemiplegia	1 (04)	14 (17.3)	15 (14.2)
Quadriplegia	18 (72)	6 (07.4)	24 (22.6)
Total	25 (100)	81 (100)	106 (100)
Chi square test: 45.54, df: 2, p value 0.000			

Chewing and swallowing difficulties that occur in about one-third of all cases were most responsible for the problems with under nutrition [14, 15]. In this study, 23.6% patients had feeding difficulty (n=25). Out of them, 72% patients suffered from Quadriplegia. Relation of topographical classification with feeding difficulties was statistically significant (p<0.05, Table 5). The chief cause of poor growth in children with CP had been attribute to inadequate nutritional intake resulting from feeding difficulties. These comprise weak suckling, poor coordination of the swallowing mechanisms, coughing and choking during feeding, inability to self-feed, vomiting with aspiration secondary to gastroesophageal reflux (GERD) [16, 17]. Motor handicap with associated speech difficulty in children with CP had also been found to limit their ability to access food or talk for hunger [5, 18].

2. Co-Relation between caloric intake with type of cerebral palsy

Table 2: Relation of calories intake with topographical classification

Topographical classification	N	Calories in Kcal (Mean ± SD)	
		2 – 5 Years	6 – 12 Years
Diplegia	23 + 44	1008.9 ± 159.1	1311.2 ± 212.6
Hemiplegia	7 + 8	1044.1 ± 99.5	1201.5 ± 155.3
Quadriplegia	10 +14	808.8 ± 120.9	1091.9 ± 205.5
Total	106	965.1 ± 166.4	1251.4 ± 221.6
F statistics		8.213	6.315
P value		0.001	0.003

Present study found mean calories intake was significantly high in diplegic patients (1311.2 ± 212.6 Kcal) and low in quadriplegic patients (1091.9 ± 205.5 Kcal) in 6 – 12 years old patients.While in 2 – 5 years old patients also mean calories intake was significantly high in diplegic patients (1008.9 ± 159.1 Kcal) and low in Quadriplegic patients (808.8 ± 120.9 Kcal) (Table 2).

3. Co-Relation of protein intake with type of cerebral palsy

Table 3: Relation of protein intake with topographical classification

Topographical classification	N	Protein in grams (Mean ± SD)	
		2 – 5 Years	6 – 12 Years
Diplegia	23 + 44	9.8 ± 1.5	15.3 ± 4.1
Hemiplegia	7 + 8	10.4 ± 0.8	13.3 ± 2.1
Quadriplegia	10 +14	7.8 ± 1.1	12.5 ± 2.9
Total	106	9.4 ± 1.6	14.4 ± 3.9
F statistics		10.44	3.253
P value		< 0.001	0.045

In current study, in 6 -12 years old patients, mean protein intake was significantly high in diplegic patients (15.3 ± 4.1 gm) and low in quadriplegic patients (12.5 ± 2.9 gm).While in 2 – 5 years old patients mean protein intake was significantly high in hemiplegic patients (10.4 ± 0.8 gm) and low in Quadriplegic patients (7.8 ± 1.1 gm) (Table 3).

4. Nutritional Status by anthropometry with type of cerebral palsy

Table 4: Z score comparisons among Topographical classification

Topographical classification	Weight for age In 2-5 years (n=40)	Height for age in 2 -12 years age (n=106)	BMI in 2-12 years (n=106)	WHR in 2-12 years (n=106)
Diplegia	-0.82 ±0.21	0.11 ±0.96	0.14 ±1.1	0.19 ±1.07
Hemiplegia	-0.82 ±0.18	-0.04 ±1.05	-0.02 ±0.7	0.19 ±0.74
Quadriplegia	-1.14 ± 0.26	-0.27 ±1.06	-0.50 ±0.9	-0.49 ±0.87
F statistics	7.627	1.281	3.53	2.083
P value	0.002	0.282	0.033	0.138

Z score of Weight for age in 2 – 5 years age was highest in Diplegia (-0.821 ± 0.21) compared to Hemiplegia (-0.817±0.18) and Quadriplegia (-1.138 ± 0.26) and this was statistically significant by applying one-way ANOVA test (p<0.05).

Z score of Height for age 2 – 12 years was highest in Diplegia (0.106 ± 0.96) compared to Hemiplegia (-0.039±1.05) and Quadriplegia (-0.271 ± 1.06) and this was statistically non-significant by applying one-way ANOVA test (p>0.05).

Z score of BMI in 2 – 12 years was highest in Diplegia (0.14 ± 1.1) compared to Hemiplegia (-0.02±0.7) and Quadriplegia (-0.5 ± 0.9) and this was statistically significant by applying one-way ANOVA test (p<0.05).

Z score of Weight to height ratio was highest in Hemiplegia (0.191 ± 0.74) compared to Diplegia (0.188 ± 1.07) and Quadriplegia (-0.488 ± 0.87) and this was statistically non-significant by applying one-way ANOVA test (p>0.05).

5. BMI wise distribution of cases with type of cerebral palsy

Table 5: Cross-tabulation based on topographical classification and BMI

Topographical classification	Body Mass Index		Total (%)
	Undernutrition (%)	Normal Nutrition (%)	
Diplegia	19(33.33)	37 (75.5)	56 (52.8)
Hemiplegia	8 (14)	7 (14.3)	15 (14.2)
Quadriplegia	30 (52.6)	5 (10.2)	35 (33.01)
Total	57 (100)	49 (100)	106 (100)
Chi square test: 8.4, df: 2, p value 0.0015			

Undernutrition was present in 33.33% Diplegic patients, 52.6% Quadriplegic patients and 14% Hemiplegic patients, while normal nutrition was present in 75.5% Diplegic patients, 14.3% Hemiplegic patients and 10.2% Quadriplegic patients.

6. Distribution of cases according to weight for age in 2-5 years age group

Table 6: Cross-tabulation based on topographical classification and Weight for Age in 2-5 years

Topographical classification	Weight for height classification (WHO)			Total (%)
	Severe Underweight (%) (< -3SD)	Underweight (%) (-2SD to -3SD)	Normal nutrition (%) (> -2SD)	
Diplegia	1 (20)	4 (44.4)	15 (75)	20 (58.8)
Hemiplegia	0	1 (11.1)	5 (25)	6 (17.6)
Quadriplegia	4 (80)	4 (44.4)	0	8 (23.5)
Total	5 (100)	9 (100)	20 (100)	34 (100)
Chi square test: 17.356, df: 4, p value 0.002				

Underweight (< -2SD, n=4) and Severe underweight (< -3SD, n=4) was more common in Quadriplegia. While majority of Diplegic patients (n=15) had normal nutrition and this relation was statistically significant (Table 6).

Discussion

Most children with Cerebral Palsy were at risk for secondary undernourishment due to feeding difficulties and oral motor dysfunction. Oral motor dysfunction was the inability to control activities of muscles in the mouth required for proper food intake levels. Children with cerebral palsy could benefit from feeding and nutritional assessments [1]. Chewing and swallowing difficulties that occur in about one-third of all cases were most responsible for the problems with under nutrition [14, 15].

In this study, 23.6% patients had feeding difficulty (n=25). Out of them, 72% patients suffered from Quadriplegia. Relation of topographical classification with feeding difficulties was statistically significant (p<0.05, Table 1).

Present study found mean calories intake was significantly high in diplegic patients (1311.2 ± 212.6 Kcal) and low in quadriplegic patients (1091.9 ± 205.5 Kcal) in 6 – 12 years old patients. While in 2 – 5 years old patients also mean calories intake was significantly high in diplegic patients (1008.9 ± 159.1 Kcal) and low in Quadriplegic patients (808.8 ± 120.9 Kcal) (Table 2).

In 6 -12 years old patients, mean protein intake was significantly high in diplegic patients (15.3 ± 4.1 gm) and low in quadriplegic patients (12.5 ± 2.9 gm). While in 2 – 5 years old patients mean protein intake was significantly high in hemiplegic patients (10.4 ± 0.8 gm) and low in Quadriplegic patients (7.8 ± 1.1 gm) (Table 3).

In current study among 2 – 12 years old patients, Z score of BMI was significantly higher in Diplegia (0.14 ± 1.1) compared to Hemiplegia (-0.02±0.7) and Quadriplegia (-0.5 ± 0.9). While Z score of Weight for height ratio was non-significantly higher in Hemiplegia (0.191 ± 0.74) compared to Diplegia (0.188 ± 1.07) and Quadriplegia (-0.488 ± 0.87) (Table 6). Undernutrition was present in 52.6% Diplegic patients, 33.3% Quadriplegic patients and 14% Hemiplegic patients and this relation BMI with topographical classification was statistically significant (p<0.05) (Table 4). Undernutrition was present in 33.33% Diplegic patients, 52.6% Quadriplegic patients and 14% Hemiplegic patients, while normal nutrition was present in 75.5% Diplegic patients, 14.3% Hemiplegic patients and 10.2% Quadriplegic patients (Table 5).

Underweight (< -2SD, n=4) and Severe underweight (< -3SD, n=4) was more common in Quadriplegia. While majority of Diplegic patients (n=15) had normal nutrition and this relation was statistically significant (Table 6).

Conclusion

- Severe malnutrition was found in quadriplegic cerebral palsy as maximum cases had feeding difficulties followed by hemiplegia and diplegia.
- Proper nutritional therapy should be introduced in the early stages of cerebral palsy.

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