



A Cross-Sectional Study on Growth and Nutritional Status of Children with Cerebral Palsy

Rangamykrishna Moorthi¹, R.LakshmiDeepika², Vinoth Kumar.A.V³, *R.Saranya⁴, K.Dinesh⁵

¹Professor and Head, Department of Paediatrics, Vinayaka Missions Kirupanandavariyar Medical College and Hospitals, Salem, Tamilnadu, India

²Postgraduate, Department of Paediatrics, Vinayaka Missions Kirupanandavariyar Medical College and Hospitals, Salem, Tamilnadu, India

³Senior Resident, Kamakshi memorial hospital, Pallikaranai, Chennai, Tamilnadu

⁴Associate Professor, Department of Paediatrics, Vinayaka Missions Kirupanandavariyar Medical College and Hospitals, Salem, Tamilnadu, India

⁵Assistant professor, Department of Paediatrics, Vinayaka Missions Kirupanandavariyar Medical College and Hospitals, Salem, Tamilnadu, India

Email: ramrangsdr@yahoo.com

ABSTRACT

To compare the growth patterns of cerebral palsy children with their peers and to find the prevalence of malnutrition in children with different types of cerebral palsy using WHO and IAP charting. Cross-sectional observational study done in 90 cerebral palsy children aged between 6 months to 7 years. Anthropometric indices like Weight/Age, Height/Age and Weight for Height were plotted using WHO charts and malnutrition was classified as per both WHO and IAP grading. Parameters like weight for age, height for age and weight for height showed a SD of < 2 for more than 50% of cases. Over 90% cases had a calorie deficit of more than 20% and 67.50% cases had a protein deficit of more than 20%. As per IAP Nutrition scale 90% of cerebral palsy children had malnutrition among which 8.89% had severe malnutrition with a 'P' value of 0.0002. According to WHO Nutrition scale, 87.7% of cerebral palsy children had malnutrition among which 27.7% had severe malnutrition with a 'P' value of 0.0001. This study concludes that cerebral palsy is strongly associated with poor growth and malnutrition.

Keywords: Malnutrition, Cerebral palsy, Anthropometric indices, IAP nutrition scale, WHO growth charts.

Received 21.02.2022

Revised 10.03.2022

Accepted 29.03.2022

INTRODUCTION

Cerebral Palsy (CP) comprehends a group of permanent disorders related with movement and posture, causing several limitations. It is the result of a non-progressive disturbance that occurs during the fetus or infant's developing brain [1]. It is the most common physical disability in children affecting 3.6 of 1000 live births [2]. Cerebral palsy is associated with many deficits such as spasticity, muscle weakness, mental retardation, speech, language, oromotor dysfunction, visual impairments, epilepsy, and cognitive disorders.

Feeding is a common developmental and health challenge for children with cerebral palsy. The human feeding cycle is dependent on an integrated sequence of events requiring the co-ordination of over 20 different muscles for the movement of saliva or ingested foods from the mouth to the stomach. Four distinct stages have been identified in feeding cycle : the preparatory or anticipatory phase which involves getting food and anticipatory reactions; the oral stage involving bolus management and transfer, sucking, munching, and mastication; the pharyngeal phase during which swallowing occurs and finally esophageal phase which begins with relaxation and opening of the upper esophageal sphincter. There may be dysfunction of this highly complex process at any one or more levels resulting in feeding difficulties [3]. Hence, poor nutritional status and poor growth are reported frequently in children with cerebral palsy impacting physical, cognitive development and quality of life in later childhood [4]. These patients need a complex multidisciplinary care [5] in which the nutritional treatment is fundamental, since they present with high prevalence of malnutrition [6] as well as deficits of micronutrients [7].

In this part of India, no studies have been done to find the correlation of growth and nutritional status of children with cerebral palsy which can be tackled to enhance the rehabilitation process. So the need arises to find the growth and nutritional status of cerebral palsy children.

MATERIAL AND METHODS

Cross-sectional observational study done in Vinayaka Mission's Kirupanandha Variyar Medical College & Hospital, Salem from August 2019 to July 2020. 90 cerebral palsy children were enrolled in this study.

Inclusion criteria: Children with cerebral palsy aged between 6 months to 7 years.

Exclusion criteria: Child on Ryle's tube or gastric tube. Congenital malformations of oral cavity like cleft lip and/or palate. Patients admitted in ICU.

Method of Data Collection:

- **Weight measurement:** The weight is measured by a digital weighing machine, if it was not possible to sit, the child was weighed in the arms of the caretaker.
- **Height measurement:** Measured with a rigid pedometer of 1.8m in length, in dorsal decubitus, and full extension. If this was not possible, knee height was measured with Ross anthropometer and the size was estimated using Stevenson's equations.
- **Midarm circumference:** Mid part of the arm is confirmed between the acromion process of scapula and coracoid process of ulna. Using measuring tape, the circumference is measured at this midpoint.
- **Nutritional Diagnosis:** Based on the anthropometric measurements
 - As per WHO charts we calculated indices like Weight/Age (W/A), Height/Age (H/A), and Weight for Height.
 - Malnutrition is graded for all children as per WHO and IAP classification mentioned below

WHO CLASSIFICATION	GRADE OF MALNUTRITION MODERATE	GRADE OF MALNUTRITION SEVERE
Symmetrical edema	no	Yes
Weight for height	SD -2 TO -3	SD < - 3 (severe wasting)
Height for age	SD -2 TO -3	SD < - 3 (severe stunting)

IAP GRADING OF MALNUTRITION	WEIGHT FOR AGE (%)
Normal	>90
Grade 1 (mild)	75 - 90
Grade 2 (moderate)	60 - 70
Grade 3 (severe)	<60

Statistical analysis: Data entry and analysis was done using Microsoft Excel. The association between growth and nutrition status of cerebral palsy children was analyzed by the test of proportions and the chi-square test was used as a statistical test of significance.

RESULTS

48 (53%) of the cases in the study population were males and 43 (47%) were females. Majority of cerebral palsy children in the study group were between 36 months to 47 months of age. 91% of the cases were completely immunized, 8% were partially immunized and 1% were unimmunized. Only 8% of male children and 1% of female children in the study group were found to be normal as per IAP classification.

TABLE 1: DISTRIBUTION OF CALORIE DEFICIT AMONG THE CASES WITH CEREBRAL PALSY ENROLLED IN THE STUDY

% OF CALORIE DEFICIT	No. of Children	Percentage
0-20%	7	8.75%
21-30%	32	40%
31-40%	30	37.50%
> 40%	11	13.75%
TOTAL	80	100%

More than 90% of cases had a calorie deficit of more than 20%.

TABLE 2: DISTRIBUTION OF PROTEIN DEFICIT AMONG THE CASES WITH CEREBRAL PALSY ENROLLED IN THE STUDY

% OF PROTEIN DEFICIT	No. of Children	Percentage
0-20%	26	32.50%
21-30%	41	51%
31-40%	8	10.00%
> 40%	5	6.50%
TOTAL	80	100%

68% of cases had a protein deficit of more than 20%.

TABLE 3: DISTRIBUTION OF GROSS MOTAR FUNCTIONING CLASSIFICATION SCALE AMONG THE CASES WITH CEREBRAL PALSY ENROLLED IN THE STUDY

GMFCS grade	NO.OF CHILDREN	PERCENTAGE
1	5	5.56%
2	46	51.12%
3	31	34.44%
4	4	4.44%
5	4	4.44%
TOTAL	90	100%

Majority of the study population were belonging to the GMFC2 and 3.

TABLE 4: DISTRIBUTION OF WEIGHT FOR AGE, HEIGHT FOR AGE, WEIGHT FOR HEIGHT STATUS AMONG THE CASES WITH CEREBRAL PALSY

	WEIGHT FOR AGE NO.OF CHILDREN	HEIGHT FOR AGE NO.OF CHILDREN	WEIGHT FOR HEIGHT NO.OF CHILDREN
0 TO +2SD	1(1.11%)	1(1.11%)	0(0.00%)
0 TO -2SD	10(11.11%)	14(15.56%)	8(12.30%)
< -2SD	53(58.89%)	48(53.33%)	37(56.93%)
< -3SD	26(28.89%)	27(30%)	20(30.77%)
TOTAL	90 (100%)	90 (100%)	65 (100%)

- Weight for age, height for age and weight for height were found to be <-2 SD in more than 50 % cases. 26 (28.89%) cases had weight for age <-3 SD, 27 (30%) cases had height for age <-3 SD and 20 (30.77%) cases had weight for height <-3 SD.
- The WHO classification for malnutrition has weight for height as a component, but the charting for weight for height has been published for only the age group between 2 years to 5 years. 65(72%) children in the study were between 2 to 5 years. Hence, weight for height was assessed only for 65 children.

TABLE 5: DISTRIBUTION OF MALNUTRITION IN CEREBRAL PALSY (IAP CLASSIFICATION)

IAP charting malnutrition	Spastic diplegia	Hemiplegia	Quadriplegia	Extrapyramidal	Total	P value
Normal	1(1.11%)	8(8.89%)	0(0%)	0(0%)	9(10%)	0.0002
Mild	16(17.78%)	10(11.11%)	4(4.44%)	3(3.33%)	33(36.67%)	
Moderate	16(17.78%)	4(4.44%)	12(13.33%)	8(8.89%)	40(44.44%)	
Severe	4(4.44%)	0(0%)	3(3.33%)	1(1.12%)	8(8.89%)	
Total	37(41.11%)	22(24.44%)	19(21.11%)	12(13.33%)	90(100%)	

- 90% of cerebral palsy children had malnutrition among which 8.89% had severe malnutrition with a 'P' value of 0.0002.

TABLE 6: DISTRIBUTION OF MALNUTRITION IN CEREBRAL PALSY CHILDREN (WHO CLASSIFICATION)

WHO Charting of malnutrition	Spastic diplegia	Hemiplegia	Quadriplegia	Extrapyram	Total(%)	P value
Normal	1(1.54%)	7(10.77%)	0(0%)	0(0%)	8(12.3)	0.00001
Moderate	24(36.92%)	8(12.3%)	5(7.69%)	2(3.08%)	39(60)	
Severe	4(6.15%)	1(1.54%)	7(10.77%)	6(9.23%)	18(27.7)	
Total	29(44.62%)	16(24.61%)	12(18.46%)	8(12.30%)	65(100)	

- 87.7% of cerebral palsy children had malnutrition among which 27.7% had severe malnutrition with a 'P' value of 0.0001.
- WHO classification covers only 72% of study population (65 children), whereas the IAP malnutrition classification covers 100% of study population.

TABLE 7: DISTRIBUTION OF MALNUTRITION (IAP CLASSIFICATION) IN CHILDREN WHO CAN EITHER SELF FEED OR NOT

TYPE OF MALNUTRITION (IAP CLASSIFICATION)	SELF FEED		TOTAL
	YES	NO	
Normal	9	0	9
Mild	33	0	33
Moderate	33	7	40
Severe	2	6	8
total	77	13	90

All the children who cannot self feed have moderate or severe degree of malnutrition, while the children who can feed are either normal or only have a mild degree of malnutrition.

DISCUSSION

Malnutrition in cerebral palsy children hinders the growth and increases the risk of morbidity and mortality. The nutrition status of children who cannot self-feed is worse compared with those who can self-feed. Estimating the nutritional needs for a child with neurological impairment is not straightforward. Accurate estimations are difficult because of variations in energy requirements related to the heterogeneity of the group, altered body composition and reduced physical activity levels. Various methods have been proposed, all of which are limited by numerous assumptions [8,9,10,11]. The study was undertaken mainly due to the absence of guidelines for an approach towards malnutrition in cerebral palsy children. In this study, 90 cerebral palsy children were enrolled among which 53% were males and 47% as females. It is noted that normal for age and mild malnutrition was present predominantly in males, whereas moderate and severe form of malnutrition was present in females.

Weight for height is a marker of malnutrition, according to WHO charting 37 (56%) were less than 2 standard deviations, 20 (31.11%) were less than 3 standard deviations and 8 (12.30%) cases were between 0 to - 2 standard deviation. The main parameters such as weight for age and height for age were showing less than 2 standard deviation for more than 50% of cases, which implies chronic malnutrition in most cases.

The calorie intake and protein intake in cerebral palsy children were calculated for each case in which, for more than 90% of cases calorie deficit was found to be more than 20% and 67.50% cases with more than 20% protein deficit. By comparing GMFC scale and nutrition status we found that level of gross motor function classification is directly proportional to nutrition status (i.e.) when there is an increase in the GMFC scale severity of malnutrition increases. In this study, the nutrition status of cerebral palsy children by the IAP Nutrition scale revealed that 90% of cerebral palsy children had malnutrition among which severe malnutrition was present in 8.89% of cases with a 'P' value of 0.0002 (< 0.05). According to the WHO Nutrition scale, 87.7% of children had malnutrition of which severe malnutrition was present in 27.7% of cases with a 'P' value of 0.0001 (< 0.05).

A study conducted in Iran on "Growth and minerals status in children with cerebral palsy" during April 2012-April 2013, concluded by saying that in a total of 90 participants, 30% had severe wasting, and 38.9% had severe stunting [12]. On 2016, a study in Chile about the association between malnutrition and feeding difficulties in cerebral palsy children ended with a conclusion, children and adolescents with severe CP and nutritional risk had similar morbidity and mortality during a one-year follow-up, compared to those with acceptable nutritional status [13]. A study conducted in Thrivanandhapuram in the year 2017 on the topic "Multiple nutritional deficiencies in cerebral palsy compounding physical and functional impairments" revealed that more than 90% of the children were found to be suffering from some form of under nutrition and three-fourth of them were suffering from its severest form. Apart from the inadequate intake, this could be due to deficiencies in the release of growth hormone contributing to a delayed rate of increase in height. In this study Quadriplegic CP is more severe in comparison with the other forms of CP, a similar result was observed in our study [14].

On 2018 December, In Saudi Arabian a study was published on malnutrition in cerebral palsy concluded by saying, most of the research in this population has shown that malnutrition is a frequent problem that

primarily affects those who have problems with their motor functions and cannot achieve the growth expected for their age and sex compared with normal children.

CONCLUSION

Cerebral palsy is strongly associated with poor growth and malnutrition. In multidisciplinary approach for managing cerebral palsy, the diet advice for each and every case should be based on percentage of malnutrition and type of cerebral palsy in order to reduce morbidity and movement restriction. Furthermore, guidelines must be formed to reduce the incidence and prevalence of malnutrition in cerebral palsy children.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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CITATION OF THIS ARTICLE

R Moorthi, R.Lakshmi Deepika, Vinoth Kumar.A.V, R.Saranya, K.Dinesh. A Cross-Sectional Study on Growth and Nutritional Status of Children with Cerebral Palsy. *Bull. Env.Pharmacol. Life Sci., Spl Issue [1] 2022* : 354-358