ORIGINAL RESEARCH PAPER
Volume-9 | Issue-5 | May-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MALNUTRITION IN CHILDREN WITH CEREBRAL PALSY

Pediatrics

Dr. Kiran Gaikwad* SR in Department Of Paediatrics, NKP Salve Institute of Medical Sciences, Digdoh Hills, Hingna Road, Nagpur *Corresponding Author

Dr. Meenakshi Girish Professor of Paediatrics, AIIMS Hospital, Nagpur

Dr. Sandesh Bhangare MO. Rural Hospital Sahur, Sangamner, Ahmednagar

ABSTRACT

Nutrition plays a very important role in growth and development of all children. Poor nutritional state in children with cerebral palsy compounds the effect of primary brain injury. The aim of our study was to assess growth and nutrition in children with cerebral palsy and frequency of associated common nutritional disorders.

Methodology: It was a cross sectional study conducted from 1st January 2013 to 1st July 2014 (eighteen months).
Growth was measured by weight, stature and head circumference and common nutritional disorders were determined by clinical & laboratory examination. Serum vitamin D levels were done in first 30 subjects. Growth of children diagnosed with cerebral palsy (age 2 to 18 years) was assessed by Life Expectancy charts.

Observation and Results: Majority (80.50%) of children with growth parameters 5th centile belonged to GMFCS (Gross motor functional classification system) II & III. Nutritional deficiencies commonly found were vitamin D in 73.3%, iron deficiency anaemia (41.90%), & megaloblasticanemia(3.20%).

Conclusion: Malnutrition is common in children with cerebral palsy from Central India and attention should be paid to nutrition of these children to minimise their handicap.

KEYWORDS

Growth, Nutrition, Cerebral Palsy, Vitamin D

INTRODUCTION

Nutrition plays a very important role in the growth and development of all children. Growth pattern in children with cerebral palsy differs from children in general population and thus it is better to use growth charts normed for children with cerebral palsy.(1,2,3) Deviation from normal growth is mainly attributed to disease severity(4), malnutrition, feeding problems(dental problems, mastication and alimentation difficulties (5,6), decreased weight bearing, altered energy requirements, age & gender. Socio - economic status and provision of good health care facilities also play a key role. Deviation from the normal growth parameter values increases with increasing levels of gross motor dysfunction. Poor nutritional state may compound the effect of primary brain injury in children with cerebral palsy.

Overweight and obesity have also been reported but mostly in developed countries. It is more prevalent in spastic bilateral CP than spastic unilateral CP. (8)

Malnutrition is a major health issue in India andchronic malnutrition being very prevalent in this part of the country we designed a study to assess for nutritional status in children with cerebral palsy and malnutrition as co- morbidity affecting the quality of life in children with cerebral palsy. (7)

AIM AND OBJECTIVES

Aim

To assess growth and nutritional disorders in children with cerebral palsy.

Objectives

Primary

1. To assess growth in children with cerebral palsy.
2. To determine the association between gross motor function and nutritional status in children with cerebral palsy.
3. To determine frequency of specific nutritional disorders.

Secondary

To quantify vitamin D levels in children with cerebral palsy.

METHODOLOGY

Children with cerebral palsy between the ages of 2 to 18 years who came to hospital for Paediatric outpatient care or hospitalized at NKPSIMS and RC, Nagpur during the period from 1st January 2013 to 1st July 2014 (eighteen months) were enrolled.

Institutional Ethics committee approval and written consent from each parent/legal guardian was obtained.

Study design: Cross sectional study.

Exclusion criteria: Children with cerebral palsy suffering from chronic systemic illnesses like heart diseases, or genetic, metabolic, neurodegenerative or acquired chronic non neurologic disease were excluded from the study.

Children diagnosed as cerebral palsy fulfilling the inclusion criteria were directly recruited in the study and then categorised based on functional classification GMFCS, CFCS, MACS. Demographic profile was recorded

Anthropometric parameters measured were: Weight, Stature and Head circumference. Weight was measured by using electronic weighing machines calibrated to standard (upto two decimal places.) Height was measured by SHINE stadiometer of 10 millimeter division. Length was measured with a narrow and non-stretchable measuring tape in those who could not stand. Segmental measures of upper arm length; lower leg length and knee height was taken as proxies for stature in children with cerebral palsy having limb contractures.

Each measurement was taken twice and the average was used for analysis. In children with hemiplegia or notable asymmetry, the uninvolved or less involved side was measured. Otherwise, the left side was always measured. BMI was obtained by dividing the weight in kg by the square of the height in meters.

Growth parameters were assessed by Life expectancy growth charts for height, weight, and BMI for boys and girls with cerebral palsy. Life expectancy charts are stratified by GMFCS levels, the percentile curves in these charts are based on methodology recommended by the WHO. The percentile curves show 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles of weight-for-age and stature-for-age separately for boys and girls and GMFCS levels I–V, with level V further separated according to presence of a feeding tube.(9,10,11).

Laboratory investigations done for detection of nutritional deficiencies were: Hb, CBC, PS for typing of anemia , serum calcium, phosphorous and alkaline phosphatase. For VitD, the 25 OH vitamin D levels were estimated by CLIA (chemiluminescence immunoassay) method in the first 30 subjects recruited in the study. Vitamin D insufficiency is defined as serum 25- hydroxyvitamin D levels below 30 ng/mL& deficiency is serum 25-hydroxyvitamin D levels below 10 ng/mL.

Statistical Analysis: Percentage was used to calculate frequency.

OBSERVATIONS AND RESULTS

During the study period of eighteen months there were 62 children with cerebral palsy fulfilling our inclusion criteria and vitamin D levels was done in first 30.

Table no. 1- Frequency distribution as per functional classification.

	GMFCS		MACS		CFCS	
	No.	%	No.	%	No.	%
I	O6	9.60	10	16.12	12	19.30
II	20	32.20	32	51.6	25	40.30
III	30	48.30	12	19.3	13	20.90
IV	03	4.80	04	6.40	05	08.00
V	03	4.80	04	6.40	07	11.20
TOTAL	62	100	62	100	62	100

In our study majority (59.6%) were more than 6years of age. Children from urban area were 54.8% &58% belonged to upper middle class strata. Spastic hemiplegia was the most common type of CP.(Table 1)

Gross motor functional classification system(GMFCS) focuses on the ability to use lower limbs &48.3% of children were in grade III while 32.2% in grade II. Manual ability classification system(MACS) classifies use of hands when handling objects in daily activities and in our study 51.6% of children were in Grade II, while 19.3% were in Grade III. Communication function classification system(CFCS)is a tool to classify the everyday communication and 40.3% of children werein Grade II and 20.9% were in Grade III. Hence majority of children were in Grade II & III of functional classification (Table 1).

Table no.2Frequency distribution as per weight for age using Life Expectancy. (n=62)

GMFCS Class	<5th	5-50th	50-95th	>95th
I	4(6.45)	2(3.22)	0	0
II	14(22.58)	6(9.67)	0	0
III	21(33.87)	9(14.51)	0	0
IV	3(4.83)	0	0	0
V	1(1.61)	2(3.22)	0	0
Total	43 (69.35%)	19(30.65%)	0	0

Table no. 3- Frequency distribution as per Height for age distributionusing Life expectancy charts. (n=62)

GMFCS Class	<5th	5-50th	50-95th	>95th
I	4(6.45)	1(1.61)	0	0
II	17(27.41)	3(4.83)	0	0
III	25(40.32)	5(8.06)	0	0
IV	3(4.83)	1(1.61)	0	0
V	2(3.22)	1(1.61)	0	0
Total	51 (82.25%)	11 (17.75%)	0	0

The level of motor function was associated with nutritional status as determined by anthropometry parameter of weight for age. Of the total 62 children 69.3% had weight for age <5th centile, 22.58% were in Grade II & 33.87% were in Grade III of GMFCS. (Table 2)

Similarly height for age distribution was studied as per GMFCS. Of the total 62 children 82.2% were in <5th centile whereas 17.7% were in 5th to 50th centile. Amongst the children <5th centile, 27.41% were in Grade II and 40.32% were in Grade III of malnutrition as per Life Expectancy charts. (Table 3)

Table no. 4] Frequency distribution of subjects according to BMI (n=62)

Class	n=62	%
Healthy weight	38	61.2
Underweight	18	29
Overweight	6	9.6
Obese	0	0

According to BMI 29% of children were underweight, 9.6% were overweight and none were in obese category. (Table 4)

Table no. 5 - Frequency table showing distribution of common nutritional deficiency. (n=62)

Deficiency	No. (n=62)	%
Megaloblasticanemia	2	3.20
Iron deficiency anemia	26	41.90
Dimorphic anemia* (both Megaloblastic /iron)	8	12.90
deficiency anemia		
Total	38	61.20

*RDW raised, normal MCV, & low Hb

In the present study Iron deficiency anemia was the commonest nutritional deficiency followed by Dimorphic anemia. (Table 5)

Table no.6 Frequency table showing distribution according to Vitamin D levels

	No. (n=30)	%
Severe deficiency	0	0
Deficiency	22	73.30
Insufficiency	6	20.00
Sufficiency	2	6.60
Total	30	48.30

Biochemical vitamin D deficiency was seen in 73.3% and insufficiency in 20% of children. None had clinical signs of rickets. (Table 6)

Table no.7 -Frequency distribution of Hypovitaminaosis D according to gross motor functional classification (GMFCS). (n=30)

GMFCS Class	Deficient	Insufficient
	n(%)	n(%)
I	1(3.30)	0(0)
II	9(30.00)	2(6.60)
III	9(30.00)	5(16.60)
IV	0(0)	2(6.60)
V	2(6.60)	0(0)
Total	21(70.00)	9(30.00)

Children who were in Grade II and III of GMFCS, Vitamin D deficiency was present in 60% of children. (Table 7).

Table no. 8- Frequency distribution of Hypovitaminosis D as per Motor syndrome (n=30)

Motor syndrome		Deficient	Insufficient
		n(%)	n(%)
Spasticity	Hemiplegia	11(36.60)	1(3.30)
	Diplegia	4(13.30)	2(6.60)
	Quadriplegia	4(13.30)	0(0)
Dyskinetic		3(10.00)	0(0)
Ataxia		0(0)	2(6.6)
Total		22(73.30)	6(20.00)

Similarly as per motor syndrome 73.30% were deficient in Vitamin D. (Table 8)

DISCUSSION

Majority of children (59.6%) in the study belonged to age group more than 6yrs. Cross-sectional studies evaluating children of different age groups showed greater growth retardation progressing with age among children with CP. By adulthood growth faltered to less than -3 SD. (12, 13)

Growth charts for the general population, whether reference charts from the CDC or standards for healthy children developed by the WHO, are of limited use for children with cerebral palsy (CP), whose weight-for-age and stature-for-age often track below the 5th percentiles on such charts. Plotting weight and height on Life expectancy growth charts may assist care givers in the early identification of nutritional and metabolic difficulties beyond what might be expected for patients with similar functional disabilities. Therefore, there is a need to adopt Life expectancy growth charts for proper evaluation of growth in children with cerebral palsy, just as we

use separate growth charts for children with Down syndrome (14), Turner's syndrome (15) Achondroplasia (16)etc.

When categorised according to GMFCS, MACS & CFCS, majority of children with growth parameters <5th centile belonged to category II & III. Cross sectional study done by Elizabeth H Anaya et al. at Columbia, studied association of gross motor function and nutritional status in 177 children of age group 2-12 yrs using life expectancy charts. The z scores of weight for age, height for age, BMI for age were low in children with more pronounced motor dysfunction.They also found high proportions of overweight (16.0%) attributed to urbanization, which creates barriers for physical activity, and the nutritional transition related to the growing adoption of processed foods and increased sugar consumption. (17)

In our study 29% children were underweight, while 9.6% were overweight. Similar study by Karagiozolou- Lampoudi et al found prevalence of obesity in 7% of subjects with cerebral palsy in age group of 2-15 yrs. using WHO & NCHS standards and another study which used Life Expectancy charts found a prevalence of 16% (17,18)

Deficient intake of vitamins and minerals (micronutrients) has been reported by several studies.In the present study, Iron deficiency anemia was found to be the commonest nutritional deficiency followed by mixed nutritional deficiency in the form of iron deficiency as well as megaloblasticanemia. This also reflects the trends in general amongst the pediatric population in India, with anemia found in 70% of under five population in India and iron deficiency being the commonest followed by megaloblasticanemia due to folic acid and B12 deficiency (19).

Adequate vitamin D levels are essential for normal skeletal development and mineralization, especially in children with cerebral palsy or any other neuromuscular disorders who are at increased risk of osteoporosis.

In the present study, 73.3% children were found to be deficient in vitamin D. Similar trends were seen in many other studies. (20,21,22,23). The observation of hypovitaminosis D in a large number of study subjects also reflects the general trends in general population of Indian children (24). Our study is limited by its cross sectional design, but there are other literature which state that children with cerebral palsy are particularly vulnerable to hypovitaminosis D and that supplementation helps improve the overall function.(25)

In our study, 93.3% had biochemical hypovitaminosisD, none had clinical signs of rickets. In study by S. Manohar et. al. vitamin D deficiency was observed in 32 (32%) and insufficiency in 61 (61%) of children with cerebral palsy in case group (26).

CONCLUSION

Growth failure and micronutrient deficiency is common in children with cerebral palsy and constitute an important co-morbidity affecting the severity of their disability.

Limitations of study: Limited sample size, Cross sectional study design, & area based research

Financial Support and Sponsorship- Nil
Conflict of Interest- The authors declare that they have no conflict of in terest.

ACKNOWLEDGEMENT

We are extremely grateful to all the participants and their families for cooperation and who took part in this study, and the whole term work in this study, includes interviews, computer data entry operator, clerical works, research scientists, and volunteers. The N.K.P. Salve Institute of Medical Sciences and Lata Mangeshkar Hospital and Research Centre Nagpur Maharashtra provide core support for us.

REFERENCES

1. Rosenbaum P, Paneth N, Leviton A. A report: the defi- nition and classification of cerebral palsy April 2006. Dev Med Child Neurol 2007; 49(Suppl. 109): 8–14
2. Day SM, Strauss DJ, Vachon PJ, Rosenbloom L, Shavelle RM, Wu YW. Growth patterns in a population of children and adolescents with cerebral palsy. Dev Med Child Neurol 2007; 49:167–71.
3. Stevenson RD, Conaway M, Chumlea WC, Rosenbaum P, Fung EB, Henderson RC et al. Growth and health in children with moderate-to-severe cerebral palsy. Pediatrics 2006;118:1010–8.
4. Arvedson JC. Feeding children with cerebral palsy and swallowing difficulties. Eur J ClinNutr 2013;67:S9–S12
5. Parkes J, Hill N, Platt MJ, Donnelly C. Oromotor dysfunction and communication impairments in children with cerebral palsy: a register study. Dev Med Child Neurol 2010;52:1113–19.
6. Calis EA, Vengelers R, Sheppard JJ, Tibboel D, Evenhuis HM, Penning C. Dysphagia in children with severe generalized cerebral palsy and intellectual disability. Dev Med Child Neurol 2008; 50:625–30.
7. Vitamin D levels should be monitored in all children with cerebral palsy. Rosulescu E, Ilina I, Zavaleanu M, Nanu C. Feeding growth and nutrition disorders in cerebral palsy. Journal of Physical Education and Sport; Vol 22 (1) March 2009: 1-5
8. Dahlseng MO, Finbråten AK, Júliusson PB, Skranes J, Andersen G, Vik T. Feeding problems, growth and nutritional status in children with cerebral palsy. ActaPediatrica 2012;101:92–8.
9. Day SM, Strauss DJ, Vachon PJ, Rosenbloom L, Shavelle RM, Wu YW (2007). Growth patterns in a population of children and adolescents with cerebral palsy. Developmental Medicine & Child Neurology, 49:167-171.
10. Brooks J, Day SM, Shavelle RM, Strauss DJ (2011). Low weight, morbidity, and mortality in children with cerebral palsy: New clinical growth charts. Pediatrics, 128:e299-307. Published online July 18, 2011 (10.1542/peds.2010-2801).
11. Growth Charts. Developmental Medicine and Child Neurology 2006. Available from: URL: http://www.Life Expectancy.org/Articles/ New Growth Charts. Accessed December 30, 2013.
12. SrishtiAggarwal, RavinderChadha, RenukaPathak .Nutritional status and growth in children with cerebral palsy: a review Department of Food and Nutrition, Lady Irwin College, University of Delhi, New Delhi, India. Correspondence to: SrishtiAggarwal, E-mail: srishtia89@gmail.com Received January 15, 2015. Accepted March 26, 2015
13. Stevenson RD, Conaway M, Chumlea WC, Rosenbaum P, Fung EB, Henderson RC et al. Growth and health in children with moderate-to-severe cerebral palsy. Pediatrics 2006;118:1010–8
14. Growth charts for Children with Down syndrome. Available from: URL: hptt:// www.growthcharts.com/charts/DS/charts. Accessed June 21 2014.
15. Care of Girls and Women with Turner Syndrome: A guideline of the Turner Syndrome Study Group. Growth charts for Turners syndrome. Available from:URL: hptt:// pediatrics. aappublications.org/cgi/ content/full/ 111/3/692. Accessed July 23 2014.
16. Charts. A is for Adelaide and … Growth Charts for Achondroplasia. Available from:URL: http://aisforadelaide.worldpress.com/growthcharts.Accessed June 4, 2014.
17. Elizabeth Herrera-Anaya et al, Association between gross motor function and nutritional status in children with cerebral palsy: a cross-sectional study from Colombia Developmental Medicine & Child Neurology pages 893–894, Published online 31st March 2016
18. Karagiozoglou-Lampoudi T, Daskalou E, EuthymiaVargiami E, DimitriosZafeiriou D. Identification of feeding risk factors for impaired nutrition status in paediatric patients with cerebral palsy. ActaPediatrica 2012;101:649–54.
19. Sullivan PB, Juszczak E, Lambert BR, Rose M, Ford-Adams ME, Johnson A. Impact of feeding problems on nutritional intake and growth: Oxford Feeding Study II. Dev Med Child Neuro 2002; 44: 461–7.
20. Hillesund E, Skanes J, Trygg K, Bohmer T. Micronutrient Status in children with cerebral palsy. ActaPaediatrica 2007, 96: 1195-1198.
21. Henderson R , Lark R , Gurka M , Worley G , Fung E , Conaway M et al . Bone density and metabolism in children and adolescents with moderate to severe cerebral palsy. Pediatrics 2002, Available from: URL:http:// www.pediatrics.org/cg1/content/full/110/1/e
22. Stevenson RD, Conaway M, Barrington JW, et al. Fracture rate in children with cerebral palsy. PediatrRehabil 2006a; 9:396–403.
23. Apkon S, Kecskemethy H. Bone health in children with cerebral palsy. Journal of Pediatric Rehabilitation Medicine: An Interdisciplinary Approach I (2008); 115-121
24. Rathi N, Rathi A. vitamin D and child heath in the 21st century. Indian Pediatrics 2011.48:619-6
25. Kilpinen-Loisa P, H. Nenonen, H. Pihko, O. M ä kitie et al. High-Dose Vitamin D Supplementation. Neuropediatrics 2007; 38: 167 – 172.
26. SowjanManohar, RajakumarPonnandaiGangadaran Vitamin D status in children with cerebral palsy International Journal of Contemporary PediatricsManohar S et al. Int J ContempPediatr. 2017 Mar;4(2):615-619