

Body Mass Index In Children With Cerebral Palsy

Jasmin Diwan*, Shraddha Diwan**, Ankita Bansal***

*Prof. Physiology, GMERS Medical College, Gandhinagar, ** Lecturer In Physiotherapy, SBB College of Physiotherapy, VS Hospital, Ahmedabad, *** 2ndYr, MPT Neurology

Abstracts: Background: Review of literature suggest conflicting presence of undernourishment as well as overweightness in children with cerebral palsy. The purpose of present study is to analyse body mass index of children with different clinical types of cerebral palsy with respect to their gross motor functions using GMFCS. **Methods:** prospective cross sectional observational study was conducted on 50 children with CP (1- 18 yr old) at pediatric rehab centre. BMI (Kg/m²) was calculated. Abilities & limitations in gross motor functions were analyzed using GMFCS -E & R. **Result:** mean BMI of ambulatory & non ambulatory group were 13.82 kg/m² & 13.14 kg/m² respectively. There was no significant difference in terms of BMI between both group with p value 0.187 & level of significance 5%. Pearson correlation test was applied between BMI and GMFCS Level and negative correlation was found with $r = - 0.174$. out of 50 patients 58% were having underweight. Amongst all underweight patients 34.48% were having Spastic quadriplegic CP. **Conclusion:** Underweight is prevalent in children with spastic quadriplegic CP. Therapeutic measures should be taken to prevent malnourishment. [Diwan S NJIRM 2014; 5(1) : 40-45]

Key Words: BMI, cerebral palsy, Gross motor function, Indian study

Author for correspondence: Shraddha Diwan, Lecturer In Physiotherapy, SBB College of Physiotherapy, VS Hospital, Ahmedabad, E- mail: dr_jasmin_diwan@hotmail.com

Introduction A global figure of 335 million individuals with moderate & severe disabilities, of whom 70% are living in the developing world, has been estimated based on the UN population statistics for 2000.¹ In India, the prevalence of disability is estimated at 35 million individuals of whom 15 million are children.² Cerebral palsy is a group of disorders affecting the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behavior, and/or by a seizure disorder.³

Children with cerebral palsy (CP) are generally undernourished and growth retarded than normal children. Conditions like impaired oral-motor function, temporo-mandibular joint contractures, vomiting, and aspiration pneumonia associated with gastro-esophageal reflux, all cause lengthy mealtimes and fatigue, contributing to malnourishment.⁴ It is recognized that children with disabilities can have a poorer nutritional status than their non-disabled peers. Nutritional deficits and growth disorders in children with disabilities have been reported by a number of investigators.^{5,6,7,8}

Although children with CP are often viewed as undernourished and growth impaired,⁹⁻¹¹ a number of studies propose mechanisms that may place children with CP at a high risk of becoming overweight. First, children with CP are often born either small for gestational age or prematurely; both of these are shown to be independently related to obesity.¹²⁻¹⁴ Second, studies of body composition on children with spastic quadriplegic cerebral palsy (SQCP) have shown a decrease in body cell mass and expansion of the extracellular compartment.¹⁵

Also, the rate of accretion of fat-free mass is lower in children with SQCP.¹⁶ Third, in children with SQCP who are of adequate weight for height, energy expenditure as measured by indirect calorimetry and the doubly labeled water method is lower than in healthy children of the same weight or age. Fourth, some children with SQCP who require feeding via gastrostomy tube become overweight even 20% of body weight that are less than their predicted resting metabolic rate by the World Health Organization equations.¹⁷ Fifth, individuals with CP encounter a unique set of medical and social issues specific to their disability that often restricts participation in physical activities.¹⁷ This gives rise to conflict between undernourishment & overweight. So the aim of present study is to analyze body mass index of children with CP with

respect to their GMFCS levels & the type of cerebral palsy.

Material and Methods: Prospective cross sectional observational study was conducted at Pediatrics rehabilitation center of SBB College of Physiotherapy & is approved by Institutional Ethic’s Committee of SBB college of Physiotherapy, VS General Hospital, Ahmedabad AMC MET with letter No : PTC/IEC/93/2012-13.

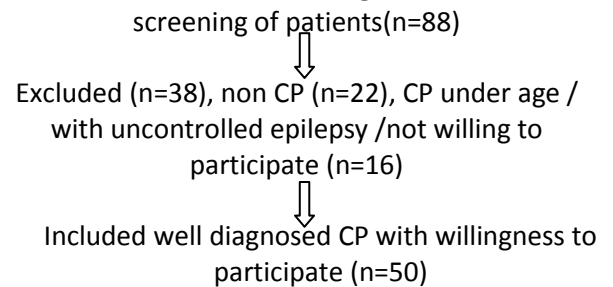
Procedure : Pediatric patients coming for rehabilitation to pediatric physiotherapy department from various OPDs of V S General hospital,Ahmedabad were screened (n=88)for the period of July to September 2013 . Well diagnosed Cerebral Palsy children following in to the inclusion criteria were selected. Children between age range 1 to 18 year of either sex were selected if their parents showed willingness to participate in study. Children diagnosed other than cerebral palsy such as autism, ADHD, Downs Syndrome, congenital disorders or other genetic disorders & CP children with uncontrolled epilepsy were excluded. Out of 88 patients 38 were excluded. Reason for exclusion was (torticollis , n=5; Duchene Muscular Dystrophy, n=1; Autism, n=3; CTEV, n=2; Downs Syndrome, n=1; post diptheric palatal palsy, n=3; post measles encephalitis ,n=2, Cerebral palsy less than 1 year of age n=11; parents not willing to participate in study, n=5)Written informed consent was taken from their parents or legal caregivers & oral consent was taken from children who were cognitively & verbally able. Children were examined clinically for their type of cerebral palsy & GMFCS level was decided based on their chronological age.Vertical height was measured using a height chart in patients who were able to stand. One therapist was kept to correct the hip & knee flexion alignment. In patients who were not able to stand, horizontal length was measured using a tape measure with the patient lying on the tilt table & then it was put vertically. Body weight was measured using a standard weighing machine of mother & child together & then weight of mother was subtractedfrom combined weight to measure weight of child alone. Body mass index (BMI Kg/m²) was calculated. Functional status was assessed through chart review using theGross Motor Functional Classification System (Table 1).

The GMFCS is a validated tool to classify children with cerebral palsy into five distinct levels based on functional limitations, the need for mobility devices (e.g., walkers and crutches), wheeled mobility, and, to a much lesser extent, quality of movement.¹⁸

Table 1 : Gross Motor Function Classification Scale

Level	Description of Functional Status
I	Walks without assistance
II	Walks without assistive devices, limitations outdoors, and in the community
III	Walks with assistive devices, limitations outdoors, and in the community, requiring wheelchair use in these settings
IV	Self-mobility in wheelchair with limitations, transported, or uses power mobility in the community
V	Very limited self-mobility, even with assistive technology

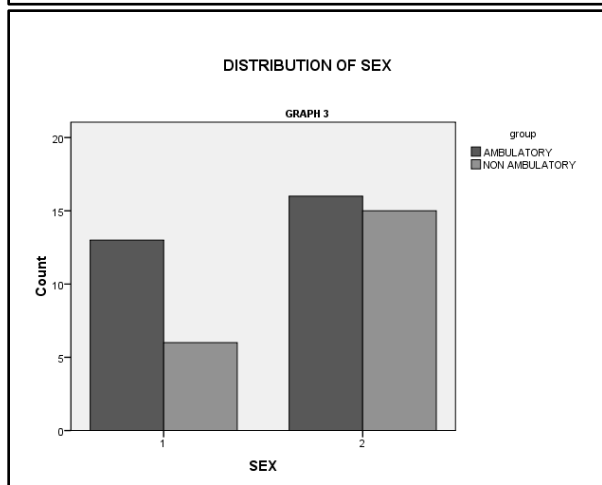
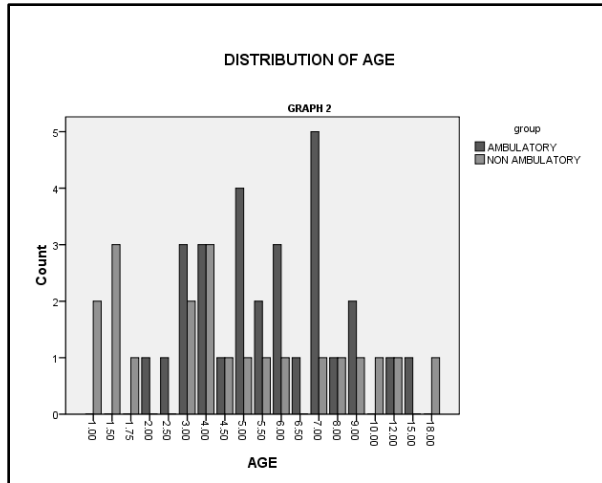
Flow Chart 1 : Screening Of Patients



Result: Data analysis was done using SPSS version 16. Whole data set is grouped in 2 categories.

Children with GMFCS level I ,II, III was considered to be ambulatory & GMFCS level IV , V was considered to be non- ambulatory. Normality curves were plotted for age, gender and BMI with use of Kolmogorov-Smirnov graph and found that data for BMI is normally distributed while data for age and gender is not normally distributed. Median age of ambulatory group is 5.5 years with variance 7.794 yrs (2-15 yrs).

Median age of non ambulatory group is 4.0 yrs with variance 18.098 (1-18yr). Out of total 50 patients 60% were male, while 40% were female.



Mean BMI of ambulatory group is 13.82kg/mt² with SD of 1.66. Mean BMI of non- ambulatory group is 13.14 kg/mt² with SD of 1.93. Unpaired t-Test was applied to find out significant difference between BMI of both groups with level of significance kept at 5%. There was no significant difference in terms of BMI between both group with p value 0.187.

Mann-Whitney test was applied to find out significant difference between age and gender of both the group with level of significance kept at 5%. There was no significant difference in terms of Age or gender between both the group with p value 0.153 and 0.247 respectively. Pearson correlation test was applied between BMI and GMFCS Level and negative correlation was found with r = - 0.174.

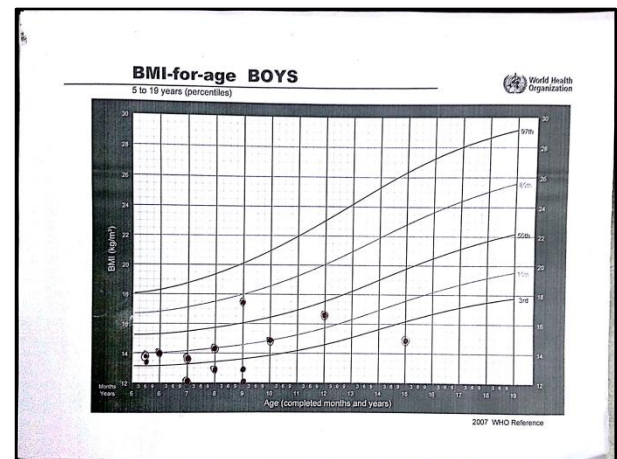
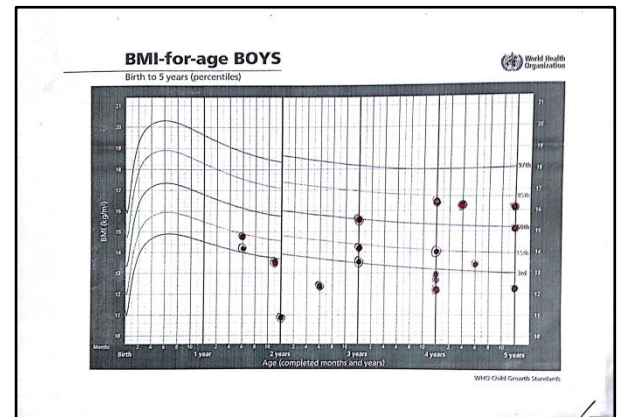
Growth charts for ages 0–19 yrs old were obtained from the world health organization (WHO) to plot BMI and age separately for girls and boys. Then,

each subject was given a percentile and put into one of four categories according to WHO:

Table 2: BMI Percentiles

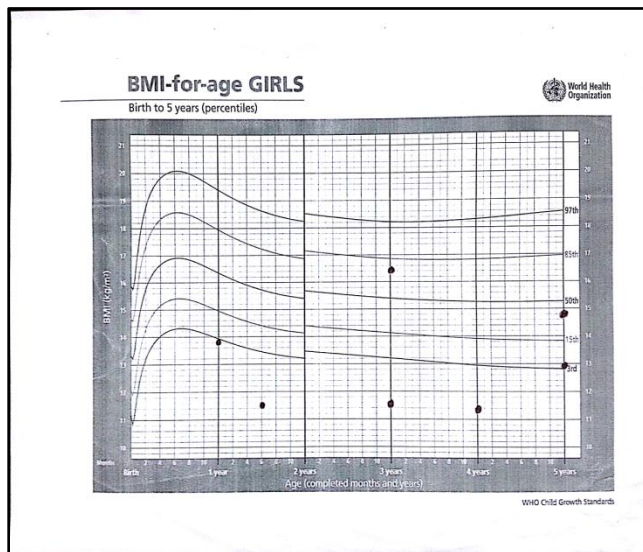
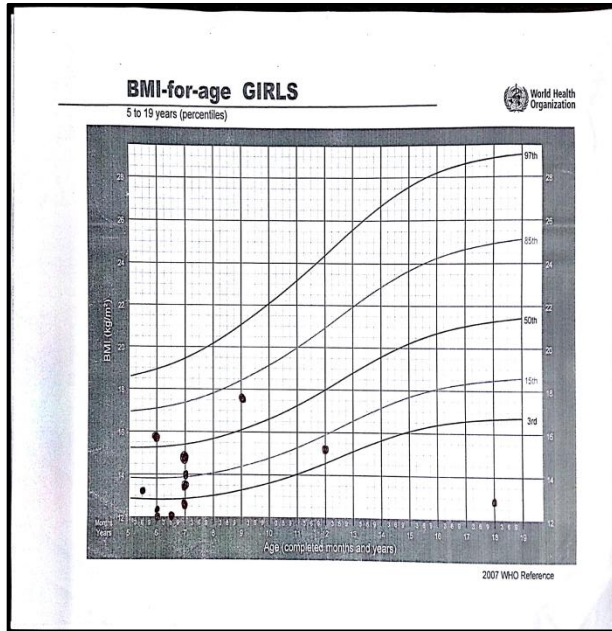
Underweight	: <5 th percentile
Normal	: 5-85 th percentile
Overweight	: 85 – 95 th percentile
Obese	: >95 th percentile

Out of total 50 patients 58% were falling into the category of underweight while 42% were normal.

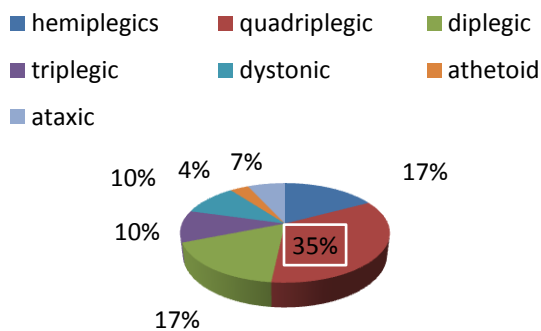


Out of total 29 underweight patients 34.48 % patients were having spastic quadriplegic cerebral palsy. Distribution of underweightness according to different clinical types of cerebral palsy is shown in the graph below.

Discussion: In the present study population, total 50 patients were analyzed for their BMI with respect to clinical types & locomotion ability, it was found that 58% patients were underweight while 42% were having normal BMI as per WHO growth charts.



GRAPH 4 Distribution of UNDERWEIGHT according to clinical type of CP



BMI is the most commonly used clinical assessment of body composition and is the recommended index to identify overweight and obesity in children and adolescents. BMI in childhood has been found to be highly correlated with BMI in young adulthood and inversely correlated with young adult insulin sensitivity as determined by euglycemic insulin clamp. Childhood BMI was also positively correlated with total cholesterol and low density lipoprotein cholesterol¹⁹. Although in studied population none of the patient were having obesity or overweight.

Risk levels for overweight in children and adolescents with CP are likely related, at least in part, to their sedentary behavior. Non ambulatory group of patients would be more likely to develop obesity for the same reason but the result of present study shows more prevalence of malnutrition or underweight in studied population which is not consistent with other studies. Van den berg-Emonset al²⁰ have evaluated daily activity in children with CP, using the ratio of total energy expenditure to resting energy expenditure measured via the doubly labeled water technique, in ten children with spastic diplegia compared with ten children without disabilities. Children with CP were considerably less active than their peers, and, in the opinion of the authors, the type of physical activity that the children engaged in was not at a high-enough intensity level to improve their physical fitness.

Nutritional deprivation in children with CP is summation of several factors which directly or indirectly results in reduced intake. Oro-Motor Dysfunction is one of the most significant factors amongst them. Food was commonly described as vital for the child with disabilities in order for him or her to gain strength and 'get better' or in contrast, that the process of eating was difficult and painful if the child had a disability and parents felt improved feeding would take place once the child was 'stronger'. Families provided the same food for the disabled and non-disabled children, but often described the child with disabilities as having a poorer appetite.

Analysis of study population supports that in the underweight category, children with spastic quadriplegic CP were highest with 34.48% which further supports findings of our previous study²¹ where maximum inadequate feeding skill score was attained by spastic quadriplegic cerebral palsy (SQCP) patients (75%). All spastic quadriplegic CP patients belonged to non-ambulatory group. SQCP patients demonstrate arching of the body compromising alignment of head and neck during feeding; overflow stiffening and posturing; postural instabilities; irradiation of muscle tone in oral structures interfering with range of movement in tongue, jaw, lips and cheeks; improper alignment of oral structures; impaired coordination of breathing and sucking; residual oral reflexes; strong protrusion or retraction; deficient proprioceptive, taste, tactile and temperature awareness²¹.

Previous researchers show that there was a significant correlation between severity of motor impairment reported and a range of feeding problems. Children unable to walk or who required an aid and helper to walk were much more likely to have problems eating and swallowing lumpy food & needed food mashing or liquidizing²². Poor feeding skill score was significantly high in patients of GMFCS V, a severely impaired functional ambulation potential ($p < 0.005$)²¹.

Studies show that there is a significant correlation between the severity of motor deficit and dysphagia^{23,24} and that feeding problems are common in children with cerebral palsy²⁵⁻²⁸. A lack of time for adequate feeding care was a barrier experienced by many mothers of children with feeding problems. In poor communities such as Dharavi, finding free time for additional care activities is complicated by other competing priorities for parents²⁹.

Feeding problems along with limitation of mobility jointly would have contributed to low BMI & underweight in children with spastic quadriplegic cerebral palsy.

Future studies need to address a number of issues relating to this problem, including more accurate measurement of body composition for this population, the medical consequences of

Malnourishment, causal factors, activity level and its relationship with BMI. Smaller sample size would have limited our study finding, future study should be done with larger sample size.

Conclusion : Underweight is prevalent in children with spastic quadriplegic CP. Therapeutic measures should be taken to prevent malnourishment.

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