



FEEDING, GROWTH AND NUTRITION DISORDERS IN CEREBRAL PALSY

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Abstract

Objective: To evaluate the growth, physical development and nutrition status for a sample of cerebral palsied children with spastic, dyskinetic and ataxic type.

Material and methods: A total of 81 children with CP, who were rehabilitated in the pediatrics rehabilitation clinic between 2005 - 2008 years, were included. Children's assessments included: anthropometric measures (height H, recumbent length L, weight W), anthropometric indicators (weight for length WL, body mass index BMI) and was calculated the Z score, ZWL (Z score of weight for length) and ZBMI (the Z score for BMI related to the age). The oral-motor dysfunction were quantified on a scale developed for the evaluation of feeding disorders in this population. SCPE classification was used in CP typing.

Results: 30% subjects presented mild alimentary disorder, 12% moderate and 5% severe alimentary disorders. 2/9 cases (for the child younger than 2 years) showed a ZWL under -2SD. 4/72 (5.5%) subjects from the group of children older than 2 years were overweight and 7 (10%) have presented an altered nutritional status (ZBMI under -2SD).

Discussion and Conclusion: Nutrition evaluation is important and should be done early and periodically to ensure proper growth for the child, it is important also in rehabilitation and child development, societal participation and motor abilities.

Key words: *child, cerebral palsy, growth, Z score, BMI*

Introduction

Cerebral palsy (CP), the most common childhood physical disability, represent a group of conditions with heterogeneous symptoms which are characterized by deficient motor control, spasticity, paralysis, and other neurological disturbances that emerge before, during or in short time after birth [1]. Cerebral palsy, with all its different clinical spectra, have a high prevalence despite the advances in investigation methods, maternal and neonatal care, and development of intervention techniques and treatment. In USA the frequency of children with CP is between 1-2 per 1000 live births [2]. In Romania does not existing yet a statistic concerning the real number of affected children, but, from our experience, we believe that their average out amply elevated.

Because of the alimentation difficulties (dental problems, mastication and deglutition conditions), children affected by cerebral palsy can have a malnutrition risk associated with a variable degree of retard, the highest severe deficit being on the child with quadriplegia, rigidity and atonia [3]. In this disease, secondary can appear a deficit for the central motor control for muscles of face, mouth, neck that can affect the food intake and the energetic metabolism [4].

Researchers have showed that the feeding difficulties and the malnutrition are commune among the disabled children, the intake being reduced by anorexia, mastication and deglutition difficulties or by the occurrence of regurgitations or emesis. Dahl and all [3] have found an altered nutrition status for 52% of the children with severe or moderate cerebral palsy, 43% of children were underweight and 9% were overweight comparing with the standard values for healthy children.

The disabled children with nutrition disorders manifest in a considerable percent decrease of the weight and height. A cross study on a high number of disabled children showed that the energetic and nutritional intake was

smaller comparing with the normal recommended values for their age group [5]. This poor nutritional status has a negative impact on the child's wellness, worsen their status and also their immunity.

Objective

The purpose of our study was the evaluation of growth, physical development and nutrition status for a representative sample of cerebral palsied children with spastic, dyskinetic and ataxic type. We hypothesized that the identification and the understanding of growth disturbance can conduct to a more rapid and efficient rehabilitation of the child with PC.

Material and methods

81 children diagnosed with cerebral palsy (table 1), that have received by the type of disorder and associated impairments, various complex therapeutically programs at the Center of neuromotor rehabilitation for the severe disabled child from Craiova and at the Training Center for health care, prophylactic and rehabilitation services of Faculty of Physical Education-Kinetotherapy, University of Craiova, between 2005 - 2008 years, were invited to participate to our study; the assessments were made with the parents and caregivers agreement, during the general clinical examination.

The subject's clinical classification and framing was realized using the classification system described by the *Reference and Training Manual of the Surveillance of Cerebral Palsy in Europe (SCPE)* [6], that divides the cerebral palsy in three groups based upon the predominant neuro-motor disability – spastic, dyskinetic or ataxic (table 2).

Table 1 - The demographic and socio-economic characteristics of the studied subjects

Table 2 - The distribution by clinical type of the studied subjects

Researched characteristic	CP group (n = 81)
Sex (girls/boys), n	43/38
Age (years: 1-2/2-6/6-12/12-16), n	9/44/25/3
Average age (years),(SD)	5.45 (3.43)
Residence (urban/rural), n	63/18
Birth weight (gr: <999/1000-1499/1500-2499/>2500), n	3/7/25/46
Economic status (good/poor), n	48/33
GMFCS level (I/II/III/IV/V)	20/23/16/12/10

Diagnostic		Number (%) of subjects	
CP spastic type	Hemipareză	27 (33%)	69 (85%)
	Parapareză	26 (32%)	
	Tetrapareză	16 (20%)	
CP dyskinetic			7 (9%)
CP ataxic			5 (6%)
Total			81 (100%)

There were acquired *anthropometric measures*: the child's height (H) defined as the distance between vertex and plantar extremity; until 2 years of age we are using the term of *recumbent length* (L) because the measurement is done horizontally while the child is lying down, over 2 years it is measured the height or stature, while the child is standing with a fixed wall stadiometer. The weight (W): in children with severe physical and neurodevelopmental retardation was measured by an infant beam weight scale, the child being naked, over 1 year using a digital weight scale (in kilograms to two decimal places).

The oral-motor dysfunction, deffined as difficulties in feeding the child as a result of oral-motor dysfunction were quantified on a scale developed for the evaluation of feeding disorders in this population [7]. The scale is based on a classification whether the child has no problems with a regular diet (score 0, no feeding difficulty), slight difficulty swallowing or feeding and requires some modification of foods (score 1, mild category), moderate feeding difficulties, some difficulty swallowing liquids and requires moistened, mashed, or chopped foods (score 3, moderate category), or has a diet limited to well-moistened solid foods, thickened fluids, and/or tube feedings (score 3, severe category).

For the *nutrition assessment* were calculated the following anthropometric indicators: for the child under 2 years of age were calculated the percentiles of Weight for recumbent Length *WL* (*weight fot length*). *WL* compare the weight of studied child with the weight of a child from a reference population by sex and length (in centimeters). It is reflecting the corporal proportion and equilibrated growing. A small weight for height signifies, in almost cases, a recent severe process of weight loss, possible associated to an „acute food deprivation” and/or severe chronic illness, usually in poor economic conditions. For the child over 2 years old it was calculated the BMI (*body mass index*). The BMI is an anthropometric index that appreciates the weight and height and is defined like the corporal weight in kilograms divided by square of height measured in meters. For the child BMI is function of age and gender. Because BMI modify substantial when the child advance in age, BMI by group of age is an evaluation used for the children aged between 2 and 20 years old. The formula for calculating BMI is: $BMI =$

$Weight (kg)/Height(m)^2$. The interpretation of the percentiles for anthropometric indicators is: underweight, under the 5th percentile, normal weight between 15th and 85th percentile, overweight from 85th at less than 95th percentile, obesity for equal or over 95th percentile (*CDC growth reference*) [8].

For all the children was calculated the *Z score* for the two mentioned indicators, *ZWL* (*Z score of weight for length*) and *ZBMI* (the *Z score for BMI related to age*). The *Z score* expresses the anthropometric value, in number of standard deviations inferior or superior to reference median value. The formula to calculate the *Z score* is:

$$Z = \frac{((X/M)**L) - 1}{LS}, L \neq 0$$

sau $Z = \ln(X/M)/S, L=0$

where *X* is the clinical evaluated indicator (ex. weight, length, head circumference, stature or calculated BMI) and *L*, *M* and *S* are the values from the charts corresponding to the child age in month (or length/stature). $(X/M)**L$ represents the increasing of ratio (X/M) at the *L* power. The LMS parameters are the median (*M*), variation generalized coefficient (*S*), the power from the Box-Cox (*L*) transformation [8].

The results interpretations by *Z score* present the following advantages: (1) the *Z score* scale is linear and, for this reason, an interval of *Z scores* present a fixed difference in heights or weight for all the children's of the same age. *Z scores* present, at all ages, the same statistical relation regarding the reference distribution from the value around the median, and that make the results comparable, no matter the age and the indicator type. (2) The *Z scores* are no sex dependent, so the evaluation of growing status is permitted combining the sex and age groups. (3) *Z score* can be use in a summary statistic analysis of average and standard deviations. The average *Z score* attended is 0, with a standard deviation of 1. It is analysed the prevalence of the children's with *Z score* under -2DS and -3DS, that must be more reduced (the prevalence of the children under -2SD in the reference population is 2.3%) and that of the children with a *Z score* over +2DS [9]. The reference population was the Global data base regarding the children grow and malnutrition of the World Health Organisation NHCS/WHO/CDC.

Anthropometrics indicators were calculated using Epi Info 2002 NutStat, a nutritional anthropometric software that calculate the percentile and *Z score* using reference growth chart 2000 CDC and 1978 CDC/WHO [8].

Results

The evaluation of alimentary disorders. A high percent of children (30%) represented by 24 subjects presented mild alimentary disorder, and for 12% (10 cases) and 5% (4 cases) alimentary disorders were moderate and severe (fig.1).

We find out that the presence of moderate alimentary disturbance was established particularly in children with the spastic type of CP, hemiparesis (3 cases, 4%), paraparesis (2 cases, 2%) and tetraparesis (5 cases, 6%). Severe

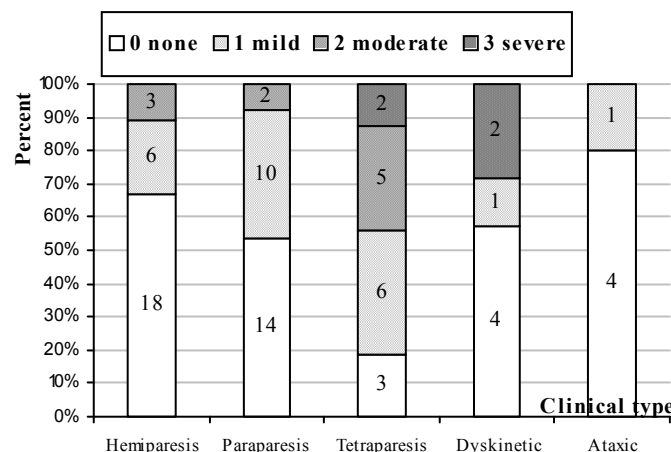


Figure 2 - The distribution of oral-motor dysfunction by CP clinical type

alimentary disorders were revealed at 2 children with tetraparesis and in 2 cases with CP dyskinetic type, as a result of a severe affected oromotor dysfunction (fig. 2).

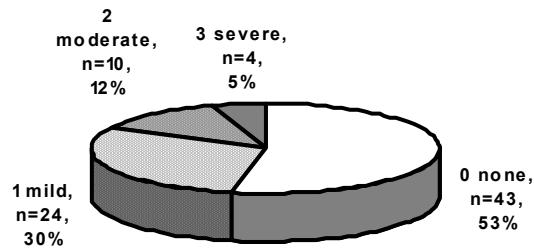


Figure 1 - The distribution of subjects by the degree of oral-motor dysfunction

The assessment of nutritional status of cerebral palsied child by the age 1-2 years old

Weight for length WL and ZWL (Z score of weight for length):

At the children younger than 2 years old (9 children), the assessment of nutritional status was calculated using Z score (weight for length) in order to evaluate the growing status of the child using sex and age group and it was found an average Zscore of -0.5 ± 1.2 (table 3).

The children's prevalence under -2SD for the analysed group was 2 cases, those presenting an altered nutritional status (fig.3).

Table 3 - Weight for length WL and Z score of WL for the child younger than 2 years old

GRoUP < 2ani	SEX	Nr.	Percentile WL (nr. of subjects)			ZWL (average) \pm SD
			<5	5-85	>85	
n = 9	girls	7	1	5	1	-0.5 ± 1.2
	boys	2	1	1	-	

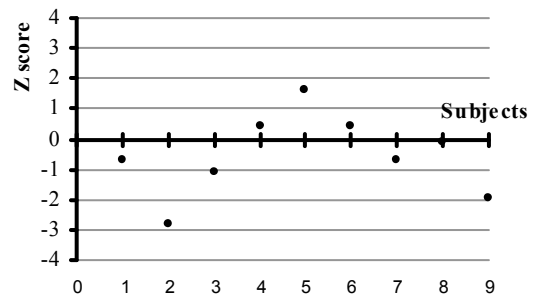


Figure 3 - The Z score weight for length ZWL

The assessment of nutritional status at the child diagnosed with CP age older than 2 years of age

Body mass index BMI and ZBMI (the Z score for BMI related to the age):

The appreciation of nutritional status at the child CP diagnosed older than 2 year (72 cases) using the body mass index BMI and ZBMI (the Z score for BMI related to the age) revealed that the majority of cases had a good nutritional status (tables 4 and 5).

4 (5.5%) subjects from the group of children older than 2 years were overweight and 7 (10%) have presented an altered nutritional status (fig.4).

Table 4 - BMI (body mass index) and ZBMI for the child older than 2 years of age

GRUP	BMI \pm SD	ZBMI \pm SD
> 2 ani		
n = 72	16.4 ± 2.4	-0.1 ± 1.4

Table 5 - ZBMI categories for the children older than 2 years

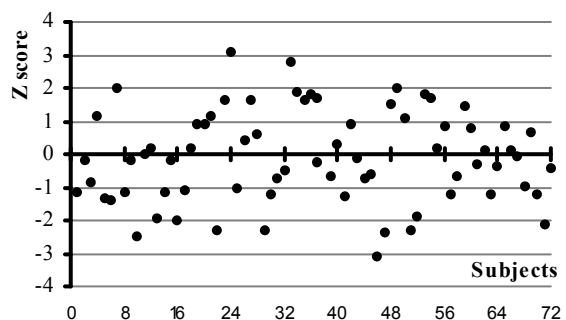


Figure 4 - The Z score of Body mass index ZBMI

ZBMI	Subjects	BMI \pm SD
< -3 SD	1	12.4
< -2 SD	6	13.4 \pm 0.4
< -1 SD	15	14.6 \pm 0.9
-1SD - 0	17	15.7 \pm 1.4
0 - +1SD	16	16.9 \pm 1.4
>1SD	13	19 \pm 1.7
> 2SD	3	20.2 \pm 1.2
> 3SD	1	20.7
TOTAL	72 (100%)	

Discussion

The child diagnosed with cerebral palsy must be evaluated for medical problems during the childhood and the growth and nutritional problems must be also assessed. The child with CP can present growth disturbance due to CP, for example asymmetrical growth in hemiplegia or poor growth of members in diplegia. Alimentary difficulties can conduct to malnutrition; this is an important cause of inadequate growth. Oral-motor dysfunction, the incapacity of feed themselves and asking food because of communication disturbance lead to alimentation problems and to an altered nutritional status. In addition, those children can have a gastroesophageal reflux or to choke and cough while they are eating, that can lean further to an aversion for food [3]. Must be obtained informations about the feeding processes, food texture, if the child choke or cough while is feeding and the time of feeding [4]. Also should be evaluated the child's tongue movements or the tonic bite, hypersensitivity at touch, salivation and dental hygiene [3, 4]. A trained therapist must observe the feeding in order to clarify the oral motor abilities of the child. The CP child has multiple alimentary problems that can affect the caloric intake and these are increased by the lack of knowledge from parents's side.

Conclusion

Nutrition evaluation should be done early and periodically to ensure proper growth. Parents, therapists and medical professionals must keep on top of the potential nutritional difficulties in children with cerebral palsy. Understanding the etiology of poor growth will led to a variety of interventions to improve growth. Poor growth and malnutrition in CP has to be studied because of their impact on health, psychological and physiological status, healthcare utilization, societal participation, motor function, and these children survival.

References

- Bass N., (1999), Cerebral palsy and neurodegenerative disease, *Curr Opin Pediatr*; 11:504-7
- Stanley F, Blair E, Alberman E., (2000), How common are the cerebral palsies? *In: Bax MC, Hart HM, editors. Cerebral palsies: Epidemiology and causal pathways. Cambridge University Press: London, United Kingdom; 22-39.*
- Dahl M, Thommessen M, Rasmussen M, Selberg T., (1996), Feeding and nutritional characteristics in children with moderate or severe cerebral palsy. *Acta Paediatr*; 85(6):697-701.
- Samson-Fang LJ, Stevenson RD., (2000), Identification of malnutrition in children with cerebral palsy: Poor performance of weight for height centiles. *Dev Med Child Neurol*; 42:162-168.
- Thommessen M, Kase BF, Riis G, Heiberg A., (1991), The impact of feeding problems on growth and energy intake in children with cerebral palsy. *Eur J Clin Nutr*; 45(10):479-487.
- Mann K, (2006) Surveillance of Cerebral Palsy in Europe - Reference and Training Manual CD. University Children's Hospital.
- Fung EB, Samson-Fang LJ, Sallings VA, et al., (2002), Feeding dysfunction is associated with poor growth and health status in children with cerebral palsy. *J Am Diet Assoc*; 102:361 -373.
- CDC growth charts and reference. 2000 <http://www.cdc.gov/growthcharts/>. Accessed 12 May 2007.
- Institutul pentru Ocrotirea Mamei și Copilului, UNICEF, (2006), Statusul nutrițional al copiilor în vârstă de până la 5 ani: România – 2005, București: MarLink; 51:60.