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DIETETIC TREATMENT EFFECT ON GROWTH OF CHILDREN WITH CEREBRAL PALSY

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ABSTRACT: The present study aimed at evaluating the effect of three deferent high-energy diets (liquid, soft and semisolid) on the growth development of children with Cerebral Palsy (CP).

Some anthropometric (weight, length / height, head and arm circumferences) and biochemical (haemoglobin, albumin, iron and calcium levels in blood serum) parameters were assessed before and after feeding experiment that extended for two months. One hundred and eight children with CP (68 mails and 40 females) were investigated after they were categorized to three groups according to age ($6 \geq 12$, $12 \geq 24$ and $24 - 36$ months) and sex (males and females). The main eating and drinking disorders of male children were drooling (19.12 % incidence), swallowing (16.18 %) and sucking difficulty (14.70 %). For females, the most frequent problem was swallowing (15.00 %). In both genders, no close of lips around spoon represented the least frequent disorder. Quantity of food / day served to each child was estimated according to his / here weight to ensure receiving of adequate energy requirement (130 Kcal / kg weight / day gradually increased to 200 Kcal / kg weight / day). Anthropometric measures were compared with WHO Growth Standards in order to evaluate the effect of feeding program on children growth development. Also, malnutrition sings were evaluated for each child before and after the feeding experiment. Results reveal the significant improvement effects of applied program on assessed anthropometric and biochemical parameters indicating its effectiveness on growth development of children with CP.

Key words: Cerebral Palsy, Malnutrition, Dietetic treatment.

INTRODUCTION

Cerebral Palsy (CP) is chronic motor disorder of a lesion of the upper neurons of the developing brain; it also characterized by the affected region of the body and based on severity. **Kirkham *et al.* (2011)** cited that CP is one of the most common causes of physical disability in child-hood. Prevalence of CP represent 2.0 – 2.5 / 1000 live births as assumed by **Del Buono *et al.* (2006).**

Thomson *et al.* (2002) pointed out that children with CP often have eating and drinking difficulties. **Stevenson and Allaire (1996)** added that those children suffer from low birth weight and degree of mental retardation that were associated with 1.4 – 3 fold increasing risk in mortality, they also lacks of self-feeding skill that was associated with 6 fold increased mortality risk. Children with CP have lower mean weight and height and were more malnourished than healthy children **(Hoda Tomouma *et al.* 2010).** In developed countries, stunting was prevalent in children with CP **(Okeke and Ojinnaka, 2010).**

The nutritional status of children with CP is poor due to summation of several factors as decided by **Gangil *et al.* (2001). Henderson *et al.* (2007)** added that poor growth and nutrition in children with CP is a prevalent, important and complex problem. Therefore, they should be thoroughly assessed for feeding problems and nutritional status in order to start nutritional rehabilitation which can improve their nutritional status and quality of life.

The present study was focused on assessing the effect of three different diets used in feeding experiment (for two months) on growth development of 108 children with CP through measurement of some anthropometric and biochemical parameters.

SUBJECTS AND METHODS

Subjects:

One hundred and eight children (68 mails and 40 females) aged 6 – 36 months suffering from CP were chosen from pediatric Department of Bab-

Al- Shareya Hospital, Al-Azhar University Cairo and Faculty of Physical Therapy, Cairo University, Giza. They were divided into three groups according to age and sex.

Methods:

a) Dietetic treatment :

Each investigated child was fed for two months on one or two of the three recommended diets : (1) liquid diet **(El-Mougi, 2005)** consisted of 100 ml full fat cow milk, 5g sucrose, and 2 ml refined sunflower oil (acid value 0.33 ± 0.03 % as oleic acid, iodine value 128 ± 8,61 and peroxide value 3.99 ± 0.18 meq.o_2 / kg oil). This diet gives 79 K cal. of energy. (2) Soft diet **(El-Mougi, 2005)** consisted of 100g yoghurt, 5 g sucrose and 2 ml refined sunflower oil, its energy was reached to 110 K cal. (3) Semisolid diet, recommended by **Ministry of Health and Population (1996)** consisted of 1600 ml full fat cow milk, 100 ml guava juice, 60 g blanched rice, 20 g blanched lentil, one boiled egg of approx. 50g, 60 g skinless chicken thigh meat and 30 g balady bread (¼ loaf); it provides 1355 K cal. of energy. During feeding experiment (2 months), each patient received 130 K cal / kg weight / day then gradually increased to reach to 200 K cal./ Kg weight / day as suggested **(El-Mougi, 2005)**.

b) Analytical methods :

Fresh, Cooked and processed food items utilized in diet formulations for children feeding were analyzed for their gross chemical components (moisture, crude protein, fat and ash) following official procedures described in **A. O. A. C. (2005)**. According to **Merrill and Watt (1973),** protein factors of 6.25, 6.38, 5.83 and 5.95 were used for egg, chicken, meat and lentil; milk and yoghurt; bread and rice respectively. Carbohydrate content was calculated by difference. A Gerber method **(James, 1995)** was followed for determination of fat content of milk and yoghurt. Total energy of studied foods and diets was calculated as cited in **Codex Alimentarius (1991) and FDA (1985).**

c) Malnutrition sings :

Following Welcome classification (depends on body weight) outlined by **Hamill et *al.* (1979)** and **Waterlow classification (1972 and 1973)**

depending on length or height, investigated children were subjected to malnutrition assessment. Also, they were classified according to their feeding problems and / or difficulties.

d) Anthropometric parameters :

Four anthropometric parameters (namely body weight, length / height, head and arm circumferences) were assessed for each studied children before and after dietetic treatment. Following procedures outlined by **Jelliffe et *al.* (1989),** body weight (kg), length / height (cm), head and arm circumference (cm) were measured. A beam balance (to the nearest 0.01 kg) was used for weight assessment; length board (infanometer) and height boards (stadiometer) were used for measuring recumbent length (for $6 \geq 24$ months) and standing height (for children aged 24 – 36 months) respectively. Arm circumference was measured using flexible non-stretch tape. Head circumference was measured using laminated tape (**Britton et *al.* (1993)**. Obtained data were recorded to the nearest 0.01 cm.

e) Biochemical parameters :

Haemoglobin level in blood (g / dl) of the investigated patients was measured by fully automated cell counter coulter (Cell Dyn 1700 and Symex KX21N) at wave length 450 nm **(Lewis and Osei-Bim Ponge, 2003)**. Albumin concentration in blood serum (g / dl) was determined by colorimetric assay at 628 nm **(Doumas, *et al.* 1997).** using appropriate kits for human incorporation. Using haemoglobin-free blood serum samples, iron level (μ / dl) was assayed following the procedure of **Cook et *al.* (2003)** by colorimetric measurement at 595 nm. According to **Nicholson and Pesce (2004),** calcium concentration in blood serum (mg /dl) was estimated using COBAS Integra-400 analyses at wave length 600 nm.

f) Statistical analysis

The data collected were analyzed on an IBM-PC computer which was used to get the statistical tests. The statistical analysis was carried out according to SPSS version 10 software program 1999. Means and standard deviation (S.D.) measure by use paired samples T test.

For all statistical tests, the threshold of significance is fixed at the 5% level (P-value).

RESULTS AND DISCUSSIONS

Table (1) shows the distribution of the investigated children with CP, their total number was 108 children. They were categorized into three groups according to age representing 31.48, 37.04 and 31.48 % of the total number respectively. Males belonging to the three groups comprised 62.96 % of the total number (68 children), while the corresponding figures for females were 37.04 % (40 children).

Table (1) Distribution of investigated children (according to age and sex)

Group	Age (month)	Males		Females		Total	
		No.	%(*)	No.	%(*)	No.	%(**)
1	6 ≥ 12	23	67.65	11	32.35	34	31.48
2	12 ≥ 24	24	60.00	16	40.00	40	37.04
3	24 – 36	21	61.76	13	38.24	34	31.48

(*) % of each group (**) % of total number

Table (2) reveals that 60.2 % (65 cases, 42 males and 23 females) of the investigated children were born at hospital, while 39.8 % (43 children, 26 males and 17 females) were delivered at home.

Table (2) Distribution of investigated children (according to birth place)

Group	Age (month)	Birth place							
		Home				Hospital			
		Males		Females		Males		females	
		No.	%(*)	No.	%(*)	No.	%(*)	No.	%(*)
1	06 ≥ 12	7	20.59	5	14.71	16	47.06	6	17.65
2	12 ≥ 24	10	25.00	8	20.00	14	35.00	8	20.00
3	24 – 36	9	26.47	4	11.76	12	35.29	9	26.47

(*) percentage was calculated for each age group

Many problems and risks occurred during delivery at home (as concluded from questionnaire sheet fulfilled for each case before conducting to dietetic treatment), and these problems could be considered as the main cause of the relative high number of children born at hospital.

During delivery at home, many pregnant mothers suffered from such problems facing many risks, therefore, they were transfered to hospitals where child delivery was accomplished.

Campanozzi et *al.* (2007) reported that home birth is an indicator of low economical status which is likely to have higher risks associated with the delivery operation performed predominantly by untrained midwives. As observed in the questionnaire sheet, correlation between home birth and families of low economical status was concluded; also CP cases were found more frequently in children belongs to such families.

As previously declared children with CP often suffered from many eating and drinking disorders and / or difficulties. Table (3) illustrates the nine main disorders / difficulties of the investigated children.

Table (3) Main feeding and drinking disorders / difficulties of children with CP

Disorder / difficulty	Males		Females		Total	
	N0.	%(*)	N0.	%(*)	N0.	%(**)
Chewing problem	8	11.76	4	10.00	12	11.11
Swallowing problem	11	16.18	6	15.00	17	15.74
Cough / choking during feeding	5	7.35	5	12.50	10	9.26
Drooling	13	19.12	5	12.50	18	16.67
Hypertonic tongue	5	7.35	5	12.50	10	9.26
Inability to take solid food	7	10.29	5	12.50	12	11.11
Sucking problem	10	14.70	5	12.50	15	13.89
Vomiting / regurgitation	5	7.35	3	7.50	8	7.41
No closure of lips around spoon	4	5.88	2	5.00	6	5.55

(*) Incidence % was calculated per each sex group (males and females).
(**)Incidence % was calculated for total number (108 children).

Drooling exhibited the highest incidence % in males (19.12%) followed by swallowing disorders (16.18%) and sucking problem (14.70%). For females, swallowing disorder occupied the first position (15.00%) followed by Cough / choking during feeding, drooling, hypertonic tongue, inability to take solid food and sucking problem as they showed the same incidence % (12.5%). On the other hand the disorder of no closure of lips around spoon

showed the least frequent disorder / difficulty as its incidence % was 5.88 and 5.00% for meals and females respectively followed by vomiting / regurgitation disorder (7.35 and 7.5% respectiv-ely).Comparable findings with different percentages of incidence were reported by **Reilly *et al.*,(1996), Gangil *et al.*,(2001),Sullivan *et al.*,(2002) and Sara Motion et *al.* (2002).**

Concerning the gross chemical composition of food items utilized in formulation of diets served to investigated children during feeding program for 2 months, results in table (4) points out that moisture represents the predominant component among all analyzed food items (with exception of sucrose and sunflower oil).It constitutes 35.67 – 88.78 % of the chemical components (balady bread and blanched green beans respectively). Blanched skinless chicken meat showed the highest marked protein content (28.56%) followed by boiled chicken egg (12.61%), while the least values were exerted by blanched carrots (0.7%) and guava juice (0.8%). Also, boiled chicken egg contained appreciable high fat content (10.82%) while the lowest corresponding figures were showed by blanched carrots and green beans (0.14 and 0.22% respectively). Balady bread comprises the highest source of carbohydrates (except sucrose)among the analysed items since its content was reached to 47.00% followed by blanched rice (29.83%) and blanched lentil (25.21%),while blanched skinless chicken meat contained the least amount (0.28%). According to their varied chemical composition, analysed food items showed different caloric values (table 4). With the exception of sucrose and sunflower oil, balady bread gave the highest energy value (271 kcal / 100g) followed by boiled chicken egg, blanched rice, blanched lentil and blanched skinless chicken meat (152, 146, 141 and 138 kcal./100g respectively). Results reported by many workers **(Eckles and Combs, 2004; Ceballos *et al.*, 2009, Seckn, 2004; khan *et al.*, 2008; Alian *et al.*, 1997; Hussein, 2001; Ebuehi and Oyewle, 2007; Ali *et al.*, 2008; Abd El- Razik, 1997; Nadia Al-Hajo, 2008; Matt *et al.*, 2009; porres *et al.*, 2003; Silva-Gistobalet *et al.*, 2009; Kala and Prakash, 2004; Sara Arscoot and Sherry Tanumihardjo, 2010; Al-Jedah and Robinson, 2002;Cheng *et al.*, 2007 and Osorio *et al.*, 2011)** were in general agreement with the forementioned results (table 4).

Table (4) Gross chemical composition of utilized food items (% on wet-weight basis)

Food item	moisture	Crude protein	Crude fat	ash	carbohydrate	Energy (Kcal/100g)
Full-fat cow milk	88.41±0.20	3.40±0.28	3.13±0.15	0.73±0.03	4.35±0.03	61
Yoghurt	86.33±0.89	3.30±0.19	3.90±0.20	0.64±0.09	5.81±0.79	72
Guava juice	86.30±0.04	0.80±0.20	0.60±0.01	0.52±0.01	11.78±0.04	56
Blanched green bean	88.78±0.23	1.78±0.05	0.22±0.01	0.32±0.03	8.90±0.03	45
Blanched carrot	88.03±0.01	0.70±0.01	0.14±0.01	0.25±0.01	10.88±0.02	48
Blanched rice	65.11±0.40	3.14±0.39	1.53±0.04	0.39±0.01	29.83±0.47	146
Blanched lentil	64.38±2.59	9.18±0.16	0.38±0.01	0.85±0.01	25.21±3.41	141
Boiled chicken egg	74.84±0.03	12.61±0.03	10.82±0.03	0.57±0.01	1.16±0.02	152
Blanched skinless chicken meat	68.26±0.02	28.56±0.03	2.47±0.28	0.43±0.02	0.28±0.01	138
Balady bread	35.67±2.14	11.30±0.33	4.23±0.10	1.80±0.14	47.00±2.63	271
Sucrose	01.20±0.01	-	-	-	98.80±2.91	395
Refined sunflower oil	-	-	99.90±1.20	-	-	899

Feeding is one of the most important activities for maintenance of health and well being for all individuals, and is of particular importance for children with CP **(Strauss *et al.*, 1998).** It has been concluded by **Eileen (2004)** that energy requirements of children and adolescents with CP appear to be disease-specific and different from the current recommendations for healthy children varying upon several factors. Feeding problems are prevalent many of these children and can result in inadequate energy intake. Therefore, quantity of food / day served for each investigated children was estimated according to his / her weight to ensure that the child receives his / her adequate energy requirements. **El-Mougi (2005)** suggested that each patient was fed 130 kcal / kg weight / day and gradually increased to 200 kcal / kg weight / day. Such energy requirements were obviously higher than that recommended for healthy children that ranged between 100 to 120 kcal / kg weight / day depending on child age.

In order to evaluate the effect of feeding program on growth development of investigated children, different anthropometric and biochemical parameters were assessed before and after conducting feeding program for 2 months. Obtained results were recorded in tables (5 and 6).

Anthropometry is the measurement of physical dimensions of the human body at different ages **(Golden and Reilly, 2008).** Children growth status for age can be assessed by comparing this measurement with the appropriate reference chart and / or standards. **Stevenson (2005)** cited that the anthropometric measurement of children with CP has been difficult due to

difficulty in acquiring reliable measurements (particularly for length or height) and having appropriate reference data for comparison.

Results in table (5) reveals that mean values of weight were positively changed from 5.77, 7.10 and 8.66 kg for males belonged to the three age groups respectively to 7.14, 9.10 and 11.20 kg respectively after 2 months of feeding experiment. Similarly, females mean weight was increased from 5.18, 7.12 and 8.75 kg respectively in the beginning of feeding program to 6.79, 8.65 and 10.76 kg respectively at the end of the program. This coincides with **Ollson (2007)** who found that male children were slightly heavier than girls. Compared to **WHO Child Growth Standard (2006),** investigated children showed comparable improvement percentages at the end of feeding program ranged from 79.53 to 84.62% for males and from 82.41 to 84.28% for females.

Concerning malnutrition sings according to **Wellcome classification (1970),** underweight signs were observed in 76 cases, (46 male and 30 female), Marasmus signs were found in 30 cases (20male and 10 female) and Kwashiorkor signs were detected by only two males, while non of the investigated children (108) exhibited the signs of normal weight. After 2 months of feeding program, the malnutrition signs were markedly changed since eighty one child (50 male and 31 female) recorded normal weight signs and the number of children showed underweight signs was drastically reduced to 27 cases (17 male and 10 female). In addition, Kwasirokor signs were completely disappeared among the tested groups of children with CP at the end of feeding experiment. The obtained results agreed with those reported by **Fung, *et al.,* (2002), Rogers (2004), Arrowsmith, *et al.,* (2006), Golden, and Reilly, (2008) and Hoda, Tamouma, *et al.,* (2010).**

Mean values of length / height were slightly increased from 61.68, 65.49 and 72.05 cm for males of three groups respectively to 64.58, 67.58 and 73.07 cm respectively after applying the feeding program for two months (table 5). Females showed similar trend as their mean values were improved from 53.58, 66.09 and 69.81 cm respectively to 54.85, 68.28 and 70.98 cm respectively. According to **WHO Child Growth Standards (2006),** it could be noticed that males showed somewhat higher length / height development % during feeding program (79.68 – 89.09 %) than females (78.26 – 83.22%). Among the three studied age groups, the highest

improvement % was exerted by males belonged to the first group (aged 6 ≥ 12 month). However, comparable development % were noted for both second (aged 12 ≥ 24 month) and third ones (24 – 36 month).

Applying **Waterlow classification (1972, 1973),** Sixteen children (14male and 2female) were assessed as wasted cases, 101 children (61 male and 40 female) were classified as stunted cases while 14 children (12 and 2 male and female respectively) were considered as wasted and stunted cases. At the end of feeding program (2 months), children malnutrition signs were obviously improved where wasting and stunting signs were completely disappeared while number of stunted cases was decreased to 96 children (56 male and 40 female). Comparable findings were reported by **Fung, *et al.*, (2002), Arrowsmith, *et al.*, (2006), Sert, *et al.*,(2009), Hoda, Tamouma, *et al.*, (2010) and Okeke and Ojinnaka, (2010).**

The measurement of head circumference at regular intervals in an infant correlates with brain growth and closely reflects the relationship to weight, volume, cellular growth and protein content of the brain **(Cooke *et al.*1977).** Furthermore, **Stoch and Smythe (1976)** concluded that head circumference may be the most sensitive physical index of prolonged undernutrition during infancy and was a satisfactory indirect indicator of brain weight as well as of post nutrition / metabolism classic nutrition. Results in table (5) indicates that head circumference mean values of investigated children were improved (as a result of applying the feeding program for 2 months) form 37.14, 38.90 and 39.80 cm for males belonged to the three age groups respectively to 38.75, 40.10 and 40.13 cm respectively. The same trend was noted for females since their mean values were increased from 36.92, 39.53 and 39.66 cm respectively to 38.18, 40.41 and 39.94 cm respectively after 2 months of feeding program. When the recorded data were compared with **WHO Child Growth Standards (2006),** measured head circumference of tested children at the end of feeding program represents 82.08 – 85.93 and 83.33- 87.24% of the standard values for males and females respectively (table 5). Result of **Sullivan, (2005), Stevenson *et al.*, (2006) and Henderson *et al.*, (2007)** was found in agreement with the present findings.

As shown for other three anthropometric parameters (namely; weight, length / height and head circumference), mean value of arm circumference of tested children was improved after two months of feeding (table 5).

Values were developed from 11.09, 11.71 and 11.33 cm to 11.41, 12.09 and 11.52 cm for males belonged to the three investigated groups respectively, and from 10.71, 11.94 and 11.85 cm to 11.24, 12.33 and 12.08 cm for females respectively. These figures represent 73.66 – 81.73 % (for males) and 77.08 – 84.71 % (for females) of **WHO Child Growth Standards (2006).** Females belonged to the second (aged 12 ≥ 24 month) and third (aged 24 -36 month) groups exerted high percentages compared to males of the same groups, while comparable percentages were noted for children of both genders belonged to the first group (aged 6 ≥ 12 month). General agreement between the recorded data (table 5) and finding of **Fung, *et al.*, (2002), Stevenson, *et al.*, (2006), Arrowsmith, *et al.*, (2006), Sert, *et al.*,(2009) and Hoda tomuma *et al.*, (2010).**

Table (5) Anthropometric parameters of children with CP as affected by feeding program for 2 months

Parameter	Males				Females			
	Before treatment		After treatment		Before treatment		After treatment	
	Mean±SD	%*	Mean±SD	%*	Mean±SD	%*	Mean±SD	%*
Group 1 (6 ≥ 12 month)								
Weight (kg)	5.77±0.79	68.77	7.14±0.52	79.53	5.18±0.80	68.27	6.79±0.50	83.04
Length (cm)	61.68±3.24	88.51	64.58±3.69	89.09	55.58±3.56	79.85	54.85±3.43	78.37
Head cir.(cm)	37.14±1.54	84.24	38.75±1.53	85.93	36.92±0.84	86.37	38.18±0.83	87.24
Arm cir.(cm)	11.09±0.48	77.23	11.41±0.43	78.47	10.71±0.57	77.08	11.24±0.59	79.94
Group 2 (12 ≥ 24 month)								
Weight (kg)	7.10±1.02	66.87	9.10±0.67	82.24	7.12±1.09	70.52	8.65±0.63	82.41
Length (cm)	65.49±2.69	81.04	67.82±4.64	81.84	66.09±2.40	82.62	68.28±3.08	83.22
Head cir.(cm)	38.90±2.39	82.62	40.10±2.25	84.50	39.53±2.19	85.72	40.41±2.19	86.97
Arm cir.(cm)	11.71±0.74	79.18	12.09±0.72	81.33	11.94±0.49	82.60	12.33±053	84.71
Group 3 (24 – 36 month)								
Weight (kg)	8.66±1.07	67.17	11.20±0.79	84.62	8.75±1.17	70.72	10.76±1.09	84.28
Length (cm)	72.05±3.92	79.70	73.07±3.53	79.68	69.81±3.36	78.35	70.98±2.96	78.26
Head cir.(cm)	39.80±1.20	81.75	40.13±1.16	82.08	39.66±1.40	83.15	39.94±1.48	83.33
Arm cir.(cm)	11.33±1.03	73.66	11.52±1.02	74.46	11.85±0.86	78.13	12.08±0.87	79.05

(*) parameters % compared to **WHO Child Growth Standards (2006)**

Statistical analysis reveals that assessed anthropometric parameters of tested children with CP (weight, length / height, head and arm circumference) were significantly ($p \leq 0.05$) improved as a result of applying the dietetic treatment for 2 months with exception of the parameter of height of males of the third group(aged 24 – 36 month) since insignificant improvement was noted. This indicates the effectiveness of feeding program applied for 2 months on 108 children with CP concerning their growth development.

Regarding biochemical parameters, four haematological measures (namely, haemoglobin and albumin levels, iron concentration in haemoglobin-free serum and calcium concentration in blood serum) were assessed before and after feeding program was conducted. Obtained results are shown in table (6).

Haemoglobin is the red pigment protein located in the erythrocytes and consists of four subunits. Haemoglobin mean levels were elevated from 9.60, 9.44 and 10.03 g/dl for males of the three categorized groups respectively to 10.00, 10.03 and 10.82 g/dl respectively at the end of feeding program. The same trend was observed for females (table 6) as their corresponding values were developed from 9.29, 9.49 and 10.56 g/dl at the beginning of feeding experiment respectively to 9.94, 10.09 and 11.34 g/dl respectively after 2 months of feeding. Haemoglobin level was improved for 104 children of 108 studied cases. Comparing with the normal haemoglobin level (table 6), normal levels were detected for 19 cases (10 males and 9 females) of the three group before applying the feeding program that was increased to become 46 cases (28 males and 18 females) after 2 months of feeding. **Hoda tomuma *et al.*, (2010)** reported that hemoglobin level in children with CP was 10.72 ± 1.3 g/dl while **Lisa Samson- fang *et al.*, (2002)** declared that haemoglobin value in children with CP may be reached to 15.3 g/dl. Results of **Seme- Gigleneeki (2003)** were found in general agreement with findings of the present study.

Albumin is one of the first biochemical markers of malnutrition and has long been used in population studies as well as in assessment of the hospitalized patient. Results in table (6) shows that the mean values of serum albumin level of investigated children with CP was found to be 3.48, 3.63 and 3.59 g/dl for males belongs to the three age groups respectively that improved, at the end of feeding program, to 4.07, 4.16 and 3.81g/dl respectively. Females exhibited similar trend as they exerted corresponding value of 3.59, 3.76 and 3.72 g/dl before feeding treatment that developed to be 4.02, 4.28 and 3.93 g/dl after 2 months of feeding. It was noted, compared with normal albumin level (table 6), that before dietetic treatment only 51 cases (29 males and 22 females) showed normal levels. After 2 months, the status was obviously improved as the normal level was exhibited by 100 cases (62 males and 38 females). Furthermore, feeding

experiment showed its good effect on albumin level of children belongs to the second age group (12 ≥ 24 month, 24 male and 16 female) since their albumin level reached to the normal level (3.8 – 5.4 g/dl). The obtained results coincide generally with those reported by **Henderson *et al.* (2002) and Riegger *et al.* (2002).** However, **Watanabe *et al.* (2010)** declared that there was no difference between animal and vegetable proteins concerning their increasing effect upon serum albumin level.

Table (6) Biochemical parameters of children with CP as affected by feeding program for 2 months.

Parameter	Males		Females		Normal level
	Before treatment	After treatment	Before treatment	After treatment	
Group 1 (6 > 12 month)					
Haemoglobin (g/dl)	6.90 ± 0.73	10.00 ± 0.37	9.29 ± 1.19	9.94 ± 0.49	10.0 – 12.9[1]
Albumin (g/dl)	3.48 ± 0.34	4.07 ± 0.39	3.59 ± 0.20	4.02 ± 0.37	3.8 – 5.4[2]
Iron (µg/dl)	34.51 ± 1.91	36.20 ± 1.39	34.94 ± 2.94	36.17 ± 2.71	37 – 145[3]
Calcium (mg/dl)	8.53 ± 0.47	8.74 ± 0.44	8.72 ± 0.38	8.94 ± 0.32	9.2 – 11.0[4]
Group 2 (12 > 24 month)					
Haemoglobin (g/dl)	9.44 ± 0.65	10.03 ± 0.50	9.49 ± 0.73	10.09 ± 0.44	11.0 – 14.3[1]
Albumin (g/dl)	3.63 ± 0.25	4.16 ± 0.23	3.76 ± 0.29	4.28 ± 0.24	3.8 – 5.4[2]
Iron (µg/dl)	31.98 ± 2.27	43.02 ± 2.39	31.89 ± 2.27	33.84 ± 2.74	37 – 145[3]
Calcium (mg/dl)	7.53 ± 0.53	8.57 ± 0.63	7.51 ± 0.52	8.40 ± 0.61	9.2 – 11.0[4]
Group 3 (24 – 36 month)					
Haemoglobin (g/dl)	10.03 ± 0.75	10.82 ± 0.49	10.56 ± 0.74	11.34 ± 0.58	11.0 – 14.3[1]
Albumin (g/dl)	3.59 ± 0.26	3.81 ± 0.18	3.72 ± 0.27	3.93 ± 0.19	3.8 – 5.4[2]
Iron (µg/dl)	33.15 ± 2.45	35.54 ± 1.64	34.92 ± 2.24	37.09 ± 2.03	37 – 145[3]
Calcium (mg/dl)	8.76 ± 0.72	9.08 ± 0.51	8.51 ± 0.49	9.02 ± 0.44	9.2 – 11.0[4]

(*) mean value ± S.D.

(1)**Tietz (1990)** (2) **Seltzer *et al.*,(1979)** (3) **Fairbnks and Klee(1987)** (4) **Young (1990)**

Iron deficiency is generally recognized as the most nutritional deficiency world wide **Demaeyer, and Adiels-Tegman, (1985). Boker and Greer**

(2010) concluded that anemia is generally recognized as the major public health concern around the world, approximately 50 % of anemia is due to iron deficiency. Infants and young children are at particular risk for developing iron deficiency due to their rapid growth in the first two years of life as well as using complementary foods with low iron content and / or poor bioavailability. The effect of feeding experiment was shown in table (6). Before applying this program, iron level was found to be 34.51, 31.98 and 33.15 µg/dl for males belonged to the three age groups respectively that were elevated to 36.20, 34.02 and 35.54 µg/dl respectively after 2 months of feeding. For female, cases, science trend was noticed since the corresponding figures were increased from 34.94, 31.89 and 34.92 µg/dl to 36.17, 33.84 and 37.09 µg/dl respectively. In comparison with the normal iron level (37 – 145 µg/dl **(Fairbonks and Klee, 1987),** development was observed although most studied children showed low levels. Only seven cases (2 males and 5 females) showed normal iron levels that increased to 34 cases (19 males and 15 females) at the end of feeding program.

Calcium is the fifth most common element in the body, most of which (98%) is present in the skeloton. One half of remaining calcium is found in extracellular fluid and the rest tissues **(young, 1990).** Calcium concentration in blood serum of 108 children with CP before and after conducting the feeding program was determined and the obtained results are recorded in table (6). Dietetic treatment carried out through the feeding program for 2 months showed little to moderate improvements on calcium concentration in blood serum. Before feeding, mean values of calcium level were found to be 8.53, 7.53 and 8.76 mg/dl for males belonged to the three age groups respectively and 8.72, 7.51 and 8.51 mg/dl for the same groups of females respectively. After 2 months of feeding program the corresponding values were increased to 8.74, 8.57 and 9.08 for males and 8.94, 8.40 and 9.02 for females respectively. As compared with the normal calcium level (9.2 – 11.0 mg/dl), 19 cases (12 males and 7 females) showed normal levels before feeding program that increased after 2 months of feeding to 37 cases (23 males and 15 females).

Statistical analysis of results of assessed biochemical parameters (namely haemoglobin, albumin, iron and calcium) of tested children indicates that

dietetic treatment carried out during feeding program for 2 months had significant improving effects concerning children growth rate ($p \leq 0.05$).

In conclusion, the current study suggests that nutrition is a vital component of managing CP so that individuals achieve their maximum potential in growth and development. Also, successful food service for children with special needs and disabilities should take adequate attention.

REFERENCES

1. **A.O.A.C. (2005):** Official Methods of Analysis, 18th Ed., Pub. Association of Official Chemist, Washington D.C.Y. U.S.A.
2. **Abd El-Razik. M. M. (1997):** Studies on the Application of Hazard Analysis Critical Control Points "HACCP" Programs in Poultry Meat. M. Sc. Thesis, Fac. of Agric., Ain Shams Univ., Egypt.
3. **Ali, M. A. ; Hasan, S. M. K. and Islam, M. N. (2008):** Study on the period of acceptability of cooked rice. J. Bangladesh Agric. Univ. 6(2): 401–408.
4. **Alian, A. M; Abdel-latif, A. R. and Yaseen, A. A. (1997):** Chemical and biological evaluation of whole meal wheat bread. Egypt J. Food Sci. 25: 121-138.
5. **Al-Jedah, J. H. and Robinson. R. K. (2002):** Nutritional value and microbiological safety of fresh fruit juices sold through retail outlets in Qatar. Pakistan J. of Nutr.1 (2): 79-8.
6. **Arrowsmith, F. E. ; Allen, J. R.; Gaski, K. J. n. ; Gruca, M. A. ; Clarke, S. L. ;, Briody, J. N. ; Howman-Giles, R. B.; Somerville, and O'Loughli, E. V. N. (2006):** Reduced body protein in children with spastic quadriplegic cerebral palsy. Am. J. Clin. Nutr. 83(3):613– 618.
7. **Boker, R. D. and Greer, F.R.(2010):** Diagnosis and prevention of iron deficiency anemia in infants and young children (0 -3 years of age). Pediatrics 126: 1040 – 1050.
8. **Britton, J. R.; Britton, H. L.; Gaines, J. and Daily, W. T. (1993):** Weight, length, head and chest circumference at brith in phoenix, Arizona. J. Repord Med., 38: 215-222.
9. **Campanozzi, A. ; Capano, G. ; Miele, E. ; Romano, A. ; Scuccimarra, G. ; Del Giudice, E. ; Strisciuglio, C. ; Militerni, R. and Staiano, A. (2007):** Impact of malnutrition on gastrointestinal disorders and gross motor abilities in children with CP. Brain and Development 29: 25–29.
10. **Ceballos, L. S.; Morales, E. R.; Adarve, G. ; Castro, J. D.; Martinez, L. P. and Sampelayo, M. R. S. (2009):** Composition of goat and cow milk produced under similar conditions and analyzed by identical methodology. J. Food Comp. & Anal. 22(4): 322–329.
11. **Cheng, L .H.; Soh, C.Y.; Liew, S.C.; and The, F.F.(2007):** Effects of sonication and carbonation on guava juice quality. Food Chem. (104):1396–1401.

12. **Codex Alimentarius (1991):** General Standards for the Labelling of Prepackaged Foods. Codex Stan. 1-1985 (rev. 1-1991).

13. **Cooke,R. W.; Lucas, A.,Yydkin, P.L. and Pryse-Davis, J.(1977):** Head circumference as an index of brain weight in fetus and newborn. Early Hum. 1: 145 – 149.

14. **Cook, J.D.; Flowers, C.H. and Skikne, B.S. (2003):** The quantitative assessment of body iron. Blood 101(9): 3359 – 3364.

15. **DEL, Buono, R.; Wenzl, T. G.; Rawat, D. and Thompson, M. (2006):** Acid and non-acid gastro esophageal reflux in neurologically impaired children. J. Pediatric Gastroenterology and Nutr. 43 (3): 331 -335.

16. **DeMaeyer, E. M. and Adiels-Tegman, M. (1985):** The prevalence of anaemia in the world. World Health Stat. Q. 38: 302–316.

17. **Doumas, B.T.; Watson, W.A. and Biggs, H.G. (1997):** Albumin standards and the measurement of serum albumin with bromcresol green. Clinica Chimica Acta 258-: 21-30.

18. **Ebuehi, O. A. T. and Oyewole A. C. (2007)**: Effect of cooking and soaking on physical characteristics, nutrient composition and sensory evaluation of indigenous and foreign rice varieties in Nigeria. African Journal of Biotechnology 6 (8): 1016-1020.

19. **Eckles C. H. and Combs W. B. (2004):** Milk and Milk Products, 4th ed. New Delhi.

20. **Eileen, S. H. (2004):** Energy Requirements of Children with CP. Canadian J. of Dietetic Practice and Res. 65(3):124-130.

21. **El-Mougi, M. (2005):** Nutritional deficiency disorders. In Basic pediatrics pp 130 – 138.

22. **Fairbonks, V. F. and Klee, G. G. (1987):** Biochemical aspects of hematology. In: Tietz N.W., ed. Fundamentals of clinical chemistry. 3rd ed. Philadelphia: WB Saunders, pp 789 – 824.

23. **FDA (1985):** Nutrient requirements for infant formulas (107.100) Nutrient specifications. U.S.A.

24. **Fung ,E. B. ; Samson-Fang, L. ; Stallings, V. A. ; Conaway, M. ; Liptak, G. ; Henderson, R. C. ; Worley G. ; Odonnell, M. ; Calvert, R. ; Rosenbaum, B. ; Chumlea, W. and Stevenson, R. D. (2002) :** Feeding dysfunction is associated with poor growth and health status in children with cerebral palsy. J Am. Diet Assoc. 102:361-73.

25. **Gangil, A.; Patwari, A. K.; Aneja, S.; Ahuja, B. and Anand, V. K. (2001):** Feeding problems in children with CP. Indian Pediatrics 38: 839-846.

26. **Golden B. and Reilly. j (2008):** Anthropometric nutritional assessment. In: **Mc- intosch *et al.,*** "Textbook of Pediatrics".7th ed. Elsevier limited pp. (16):513-529.

27. **Hamill, p.; Drizd, T.; Johnson, C.; Reed, R.; Roche, A. and Moore, W. (1979):** physical growth, National center for Health statistics percentiles, Write state university school of medicine. Am. J. Clin. Nutr. 32(607) 629-979.

28. **Henderson, R. C. ; Lark, R. K. ;Gurka, M. J. ; Gordon, Worley C. ;Fung, E. B.; Conaway, M. ; Stallings, V. A. and Stevenson, R. D. (2002):** Bone density

and metabolism in children and adolescents with moderate to severe CP. Pediatrics. 110 (1):1-10.

29. **Henderson, R.; Grossberg, R.; Matuszewski, J;, Menon, N.; Johnson, J; Heidi, H. Kecskemethy, Vogel, L.; ravas, R.; Wyatt, M.; Steven, J. and Dtevenson, R. (2007):** Growth and Nutritional Status in Residential Center Versus Home-Living Children and Adolescents with Quadriplegic CP. J. of Pediatrics 151(2): 161 – 166.

30. **Hoda, Y. Tomouma; Nagia, B. Badawy; Nayera, E. Hassan and Khadija, M. Alian (2010):** Anthropometry and body composition analysis in children with cerebral palsy. Clin. Nut. 29:477–481.

31. **Hussein, N. M. (2001):** Studies on improving the nutritional value of some types of bread, Ph D Thesis, Fac. of Agric., Cairo-Univ., Egypt.

32. **James, C. S. (1995):** Determination of the fat content of dairy products by the Gerber Method. IN Analytical Chemistry of Food. Chapman and Hall, Glasgow, U.K. pp: 93–95.

33. **Jelliffe, D. P.; Jelliffe, E. F.; Zerfas, A. And Neumann, G. (1989)**: Community Nutritional Assessment. Oxford University Press.

34. **Kala, A. and Prakash. J. (2004):** Nutritional composition and sensory profil of microwave and conventionally cooked vegetables. Food service Res. Inter.. 15: 1- 12.

35. **Khan, K.; Shabir, R.; Khan. A.; Anwar, F. and Bhadar, S. (2008)**: physical and chemical quality appraisal of commercial yoghurt brands sold at Lahore. J. of Agricultural & Biological Sci. 3(3): 14-21.

36. **Kirkham, F.; Haywood, P.; Kashyape, P.; Borbone, J.; Lording, A.; Pryde, K.; Cox, M.; Keslake, J.; Smith, M.; Cuthbertson, L.; Murugan, V. and Mackie, S.(2011):** Movement disorder emergencies in childhood. Euro. J. of Pediatric Neuro. 15(5):390 – 404.

37. **Lewis, S. M. and Oosei-Bim ponge, A. (2003):** Haemoglobinometry in general practice. Clin. & Lab. Haemotology 25(6): 343-346. **Lisa Samson-Fang; Ellen Fung; Virginia A. Stallings; Onaway M.; Worley G.; Rosenbaum P.; Calvert R.; O'Donnell M.; Henderson R. C.; Chumlea W. C.; Liptak G. S. and Stevenson R. D. (2002):** Relationship of nutritional status to health and societal participation in children with CP. J. Pediatric141:637-43.

38. **Lisa, Samson-Fang; Ellen, Fung; Virginia, A. Stallings; Onaway, M.; Worley G.; Rosenbaum, P.; Calvert, R.; O'Donnell, M.; Henderson, R. C.; Chumlea, W. C.; Liptak, G. S. and Stevenson, R. D. (2002):** Relationship of nutritional status to health and societal participation in children with CP. J. Pediatric141:637-43.

39. **Matt, D.; Veromann, E. and Luik, A. (2009)**: Effect of housing systems on biochemical composition of chicken eggs. Agronomy Res. 7(11): 662–667.

40. **Ministry of Health and Publuation (1996):** General administration for food nutrition programs for disease, lake of energy and protein for children.

41. **Merrill, A. and Watt, B. (1973)**: Energy value of foods: basis and derivation. Agric.Handbook No: 74. Washington, DC. U. S. Dept Agric.

42. **Nadia, N. A. Al-Hajo (2008):** A Comparative Study Between Some of the Local Iraqi Method for Curing Chicken Meat and Typical Methods and Their Effect on Chemical Composition, Sensory Evaluation of Fresh and Storage Meat. Inter. J. Poultry Sci. 7 (12): 1190-1193.

43. **Nicholson, J. F. and Pesce, M. A. (2004):** Reference ranges for laboratory tests and procedures. In. "Nelson Textbook of Pediatrics". Behrman R.; Kliegman R. and Jenson H. (Eds), 17th edition Philadelphia, Saunders: 2396 – 2426.

44. **Okeke, I. B. and Ojinnaka, N. C. (2010):** Nutritional Status of Children with CP in Enugu Nigeria. Euro. J. of Sci. Res. 39 (4): 505-513.

45. **Ollson, J.** (2007): The newborn. In Kliegman, R.; Behrman, R. and Jenson, H. (eds) "Nelson Textbook of Pediatrics" 18th ed., Philadelphia, Saunders 41 – 43.

46. ***Osorio, C.; Diana Forero, P. and Carriazo, G. (2011):*** *Characterization and performance assessment of guava (*Psidium guajava *L.) microencapsulates obtained by spray-drying. Food Res. Inter. (44): 1174–1181.*

47. **Porres, J.; Marı´a Lo´pez-Jurado; Aranda, P. and Gloria, Urbano (2003):** Effect of Heat Treatment and Mineral and Vitamin Supplementation on the Nutritive Use of Protein and Calcium From Lentils (Lens culinaris M.) in Growing Rats. Nutr. 19: 451– 456.

48. **Reilly, S.; Skuse, D. and Poblete, X. (1996):** Prevalence of feeding problems and oral motor dysfunction in children with CP: a community survey. J. Pediatrics 129(6): 877- 882.

49. **Riegger, Lori, Q.; Voepel, L.; Kulik, T.; Malviya, S.; Tait, A.; Mosca, R. and Bove, E. (2002):** Albumin versus crystalloid prime solution for cardiopulmonary bypass in young children. CritCare Med. 30(12): 2649 – 2654.

50. **Rogers, B. (2004):** Feeding methods and health outcomes of children with CP. Dysphagia 9: 60 – 73.

51. **Sara A. Arscott and Sherry A. Tanumihardjo (2010):** Carrots of many colors provide Basic nutrition and bioavilable phytochemicals acting as a functional food. Comprehensive Rev. Food Science & Food Safety 9: 223 – 239.

52. **Sara, Motion; Kate, Northstone; Alan, Emond; Sally, Stucke and Jean ,Golding (2002):** Early feeding problems in children with CP: Weight and neuro-developmental outcomes. Developmental Medicine Med. Child Neurology 44 (1): 40 - 44.

53. **Seckn A. K. (2004):** Nutritional value of strained yoghurt produced by traditional method. Codenmilcad, 59 (1-2): 41-43.

54. **Seme-Cigleneèki P. (2003):** Predictive Value of Assessment of General Movements for Neurological Development of High-Risk Preterm Infants: Comparative Study. Croat Med. J. 44: 721-727.

55. **Sert, C.; Altindag,˘ O. and Sirmatel, F.(2009):** Determination of basal metabolic rate and body composition with bioelectrical impedance method in children with CP. J Child Neurol. 24:237–40.

56. **Silva-Gistobalet, L.; Osorio-Dı´aza, P.; Tovarb, J. and Bello-Pe´reza, L. (2009):** Chemical composition; carbohydrate digestibility, and antioxidant capacity of

cooked black bean, chickpea, and lentil Mexican varieties. Cyta. J. of Food 8(1): 7–14.

57. **Stevenson, R. D. and Allaire, J. H. (1996):** The development of eating skills in infants and young children. In: Sullivan P. and Rosen bloom, L, (eds.) Feeding and Disabled Child. MacKeith Press, London, pp 11-21.

58. **Stevenson, R. (2005):** Beyond growth: gastostromy feeding in children with CP. Developmental Med. Child Neuro. 47(2): 76-81.

59. **Stevenson, R. D.; Conaway, M.; Chumlea, W. C.; Rosenbaum, P.; Ellen, B. Fung; Henderson, R. C.; Worley, G.; Liptak, G.; O'Donnell, M.; Lisa, Fang and Virginia, A. Stallings (2006):** Growth and health in children with moderate-to-severe CP. Pediatrics 118:1010–1018.

60. **Stoch, M.B. and Smythe, P.M.(1976):** The effect of undernurtition during infancy on subsequent brain growth and intellectual development. S. Afr. Med. J. 1027.

61. **Strauss, D.; Shavelle, R. and Anderson, T. (1998):** Life Expectancy of children with CP. Pediatric Neuro. 18(2):143-149.

62. **Sullivan P. B.; Lambert B.; Rose M.; Ford-Adams, M.; Johnson A. and Griffiths P. (2002):** Prevalence and severity of feeding and nutritional problems in children with neurological impairment: Oxford Feeding Study. Developmental Med. Child Neuro. 42: 674–680.

63. **Sullivan, P. B. (2005):** Gastrostomy tube feeding in children with CP: a prospective, longitudinal study. Developmental Med. and Child Neuro. 47: 77–85.

64. **Thomson, M.; Del Buono, R. and Wenzl, T.G. (2002):** Acid and non-acid gastro esophageal reflux in neurologically impaired children. Arch. Dis Child, 86: A 21.

65. **Waterlow, J. C. (1972):** Classifications and definition of protein– calorie malnutrition. British medical J. 3: 566 – 569.

66. **Waterlow, J. C. (1973):** Note on the assessment and Classification of protein – energy malnutrition in children. Lancet i: 87 -89.

67. **Watanabe, M.; Higashiyama, A.; Kokubo, Y.; Ono, Y.; Okayama, A. and Okamura, T. (2010):** Protein Intakes and Serum Albumin Levels in a Japanese General Population. J. Epidemiol 20(3):S531-S536.

68. **Wellcome T. (1970):** Wellcome trust working study. Lancet 2: 302.

69. **WHO (2006):** WHO child Growth Standards, Methods and development, WHO press, Geneva, Switzerland.

70. **Young D. S. (1990):** Effects of drugs on clinical laboratory tests. AACC press, Washington, USA

تأثير المعالجة الغذائية على نمو الاطفال المصابين بمرض الشلل الدماغى

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الملخص العربى

يهدف البحث إلى تقويم تأثير ثلاث وجبات عالية الطاقة (سائلة – لينة – شبه صلبة) على معدل النمو للأطفال المصابين بمرض الشلل الدماغى.

تم إختيار 108 طفلا مصابا بالشلل الدماغى (68 ذكر و 40 أنثى) من قسم الأطفال بمستشفى باب الشعرية الجامعى – جامعة الأزهر و كلية العلاج الطبيعى – جامعة القاهرة ' وتم تقسيم الأطفال تبعا للعمر إلى ثلاث مجموعات (المجموعة الأولى 6 ≤ 12 شهر ' المجموعة الثانية 12 ≤ 24 شهر ' المجموعة الثالثة 24 – 36 شهر) و تبعا للجنس (ذكر و أنثى).

خضع الأطفال محل الدراسة لتجربة تغذية لمدة شهرين مع إجراء بعض القياسات الجسمية (الوزن'الطول / الإرتفاع ' محيط الرأس ' محيط الذراع) و القياسات البيوكيميائية (الهيموجلوبين فى الدم ,سيرم الدم من الألبومين و تركيز الحديد و الكالسيوم) قبل وبعد الإنتهاء من البرنامج التغذوى.

يعانى الأطفال المصابين بالشلل الدماغى من العديد من المشاكل أو الصعوبات فى عمليتى تناول الطعام و الشراب وتمثل ظاهرة سيلان اللعاب أعلى تلك الصعوبات فى الأطفال الذكور (فى 19,12 % من الحالات محل الدراسة) يليها مشاكل الإبتلاع (16,18 %) ثم صعوبة الرضاعة (14,70 %) ' وفى الإناث أظهرت مشكلة صعوبة الابتلاع أعلى الحالات (15,00 %)0 ومن ناحية أخرى كانت مشكلة صعوبة أو عدم غلق الشفاة حول الملعقة أثناء تناول الطعام أقل المشاكل حدوثا فى الجنسين.

تم حساب كمية الطعام المقدمة لكل طفل / اليوم تبعا للوزن و ذلك لضمان حصول كل حالة على إحتياجاتها الكافية من الطاقة (130 كيلو كالورى / كجم وزن الجسم / يوم و يتم زيادتها تدريجيا حتى 200 كيلو كالورى / كجم وزن الجسم / يوم). خضعت قيم المقاييس الجسمية المتحصل عليها للمقارنة مع معايير نمو الأطفال الصادرة عن منظمة الصحة العالمية فى تقويم تأثير البرنامج الغذائى المطبق على تطور و نمو الأطفال المرضى . كما تم تقويم علامات سوء التغذية لكل طفل قبل وبعد تطبيق البرنامج الغذائى.

تشير النتائج إلى حدوث تحسن واضح وجوهرى لجميع القياسات الجسمية و البيوكيميائية للأطفال محل الدراسة عقب تنفيذ البرنامج غذائى لمدة شهرين' و يدل ذلك على كفاءة البرنامج الغذائى على تحسين معدل النمو للأطفال المصابين بالشلل الدماغى