ORIGINAL ARTICLE

NUTRITIONAL STATUS AND ITS ASSOCIATION WITH CONSTIPATION IN SPASTIC CEREBRAL PALSY

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Background: The children with cerebral palsy (CP) are at risk for malnutrition. In CP bowel dysfunction is very common. As a result of the pelvic autonomic dysfunction, constipation becomes one of its clinical manifestations. The objective of this study was to determine the association of nutritional status and spasticity with constipation in cerebral palsy (CP) children. **Methods:** Sixty spastic CP children were included in the cross-sectional correlational study. Children with spastic CP on oral feeding with constipation between ages 2–12 years of both genders, spasticity score above 1^{+} grade on modified Ashworth scale of spasticity, functional activity level between 2–5 grades on gross motor functional classification scale were included. Along with demographic detail defecation frequency and constipation severity through constipation assessment scale was documented. To calculate average nutritional status, fluid and meal history for the last three days was taken from parents. Pearson product-moment correlation coefficient was used to find association between continuous variables and chi-square test was used for categorical variables. **Results:** Spasticity showed significant association with defecation frequency (p<0.001) and inability to pass stool (p<0.001). The spastic CP children had on average low nutritional intake. Low sodium intake was negatively associated with rectal pain during defecation (p=0.04) and overall constipation severity (p=0.03). Low monounsaturated fats and sugar was also negatively associated with inability to pass stool (p=0.04) and oozing of stool in spastic CP children (p=0.03), respectively. **Conclusions:** Spastic CP children were malnourished. Spasticity was negatively associated with the defecation frequency in CP children. Increased monounsaturated fat intake may reduce difficulty in passing stool, increase sugar intake could reduce oozing of stool and increase sodium intake could reduce rectal pain and constipation severity.

Keywords: Spasticity, Daily dietary intake, Defecation frequency, Micronutrients, Nutrition, Children,

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INTRODUCTION

Cerebral palsy (CP) is a non-progressive disorder manifested by impairment in movement and posture.[1] Regardless of the degree of motor impairment; all children with CP are at risk for malnutrition. Malnutrition in children with CP is often due to the poor oro-motor control, which reduces the consumption of calories and nutrition to support growth in CP children.[2] The malnutrition during early development may have devastating effects on children's physiology, neurological and psychological function.[3] In patients with neurological diseases including CP, bowel dysfunction is very common. As a result of the pelvic autonomic dysfunction, constipation becomes one of its clinical manifestations.[4] The prevalence of constipation in CP ranges from 26–62% as compared to normal children where constipation is prevalent (0.3–37%). In children with disabilities, the cause of chronic constipation is comparatively low fluid intake and low-fibre intake.[5,6]

The lack of mobility in children with CP due to spasticity is one of the reasons for constipation because it alters the movements of visceral organs. Constipation in these children has been shown to benefit from stretching exercises in terms of both the constipation severity and defecation frequency.[7] Children having drooling problem and the cases where fluid is lost through sweating, struggle to retain the required fluid level.[5]

Constipation can also be caused by intake of large amounts of cheese, milk and bananas so they should be avoided. Fibre plays an important role in softening of stool. However, increased fibre intake as intervention is only effective and safe when it is taken in combination with fluid. Sometimes increasing fibre intake without fluid makes constipation worse due to dehydration of GIT, leads to hardening and difficulty in passing stool and may warrant medical management.[6]

Bowel and bladder problems in CP children negatively affect children and their families. Constipation along with other problems like reduced

mobility decreases the quality of life by causing depression, anxiety and affecting social participation of children.[5–7]

It was observed that no research was conducted to explore nutritional status among CP children. Cerebral palsy (CP) children have been reported to have inappropriate dietary and nutritional status. The diet was found to be one of the contributing factors in developing constipation in spastic CP children along with spasticity and immobility. The current study explored the nutritional status and its association with constipation in children with spastic CP.

METHODOLOGY

Cross-sectional correlational study was approved by Director of National Institute of Rehabilitation Medicine (NIRM) and data were collected from August 2016 to February 2018. Out of the 90 children with spastic CP assessed for inclusion criteria 73 were found eligible for the study. Data were collected and analysed for 60 participants. Guardians/caregivers of the 13 children declined to participate in the study.

Children, of both genders, on oral feeding with constipation between ages 2–12 years, spasticity score above 1^+ grade on modified Ashworth scale of spasticity, functional activity level between 2–5 grades on gross motor functional classification scale (GMFCS) were included in the study. CP children with systemic co-morbidities, physical deformity in gastrointestinal tract and intellectual disability were excluded from the study.

The procedures of this study conformed to the Declaration of Helsinki guidelines. Informed consent was obtained from the parents/caregivers of study participants prior to data collection. General demographic data including age, gender, body mass index, spasticity level, gross motor functional level, defecation frequency (<3 week) and constipation severity through constipation assessment scale were collected.

To calculate average nutritional status of spastic CP children, fluid and meal history was taken from parent for the last three days. The nutritional status was calculated through online software Self Nutrition Data by entering the meal recipe and Nutrition Facts label was generated according to the nutrition labelling standard maintained by the FDA.[8]

SPSS-21 was used to analyze the data. The results of study are presented as frequency, percentages, Mean±SD. Pearson product-moment correlation coefficient and chi-square tests were used to determine association between continuous and categorical variables, respectively. The level of significance was set at $p<0.05$.

RESULTS

The demographic detail of study participants including Frequency distribution of study participants according BMI, Spasticity (MAS) & Functional Independence (GMFCS) are shown in Figure-1 and Table-1.

The association of demographics characteristics with defecation frequency and constipation severity is shown in table-1. The results showed that age was positively associated with spasticity (r=0.39, p<0.001), negatively associated with defecation frequency (r= -0.32, p=*0.01*) and positively associated with constipation severity (r=0.25, p=0.04).

Spasticity showed significant association with defecation frequency (r= -0.40, p<0.001) and inability to pass stool of stool (r=0.39, p<0.001) but did not show significant association with constipation severity and other individual items of constipation assessment scale.

The results of study also showed that spastic CP children had on average low nutritional intake and did not have significant association with defecation frequency and overall constipation severity.

Low sodium intake was found negatively associated with rectal pain during defecation (r= *-0.26,* p=0.04) and overall constipation severity (r= -0.26*,* p=0.03). The results also showed that low intake monounsaturated fats in diet was negatively associated with inability to pass stool (r= -0.28*,* p=0.04). Low sugar intake was also negatively associated with oozing of stool in spastic CP children (r= -0.27, p=0.03). (Table-2, 3).

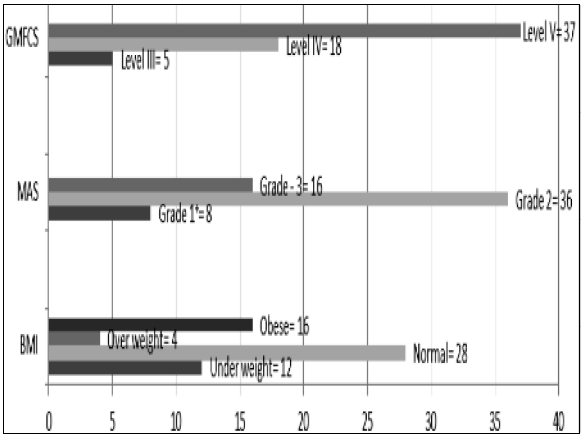

Figure-1: BMI, Spasticity (MAS) and Functional Independence (GMFCS)

Table-1: Characteristics of study participants (n=60) and their correlation with DF and CAS

			DF: 2.37±0.48 Once a week: n=38 (63.3%), Twice a week: n=22 (36.7%)		CAS: 8.21±2.27 Some: n=38 (63.3%), Severe: n=22 (36.7%)	
Parameters		**Mean±SD, n (%)**	χ^2/r	*p*	χ^2/r	*p*
Age (Year)	-	4.88±2.15	-0.32	0.01*	0.25	0.04*
Gender	Male	39 (65)	1.66	0.19	12.62	0.24
	Female	21 (35)				
Height (Cm)	-	82.45±15.29	45.07	0.23	0.10	0.44
Weight (Kg)	-	11.42±3.29	36.45	0.36	0.19	0.12
Body Mass Index (Kg/m^2)	-	17.33±4.28	-0.11	0.39	0.04	0.72
	Underweight	12 (20)	-	-	-	-
	Normal	28 (46.7)				
	Overweight	4 (6.7)				
	Obese	16 (26.7)				
Spasticity (Modified Ashworth Scale)	-	2.20±0.51	-0.40	0.00	0.16	0.20
	Grade-1$^+$	8 (13.3)	-	-	-	-
	Grade-2	36 (60)				
	Grade-3	16 (26.7)				
Gross Motor Function Classification System	-	4.53±0.65	0.01	0.91	0.11	0.38
	Level III	5 (8.3)	-	-	-	-
	Level IV	18 (30)				
	Level V	37 (61.7)				

Table-2: Nutritional status and its association defecation frequency

			DF: 2.37±0.48) Once a week: 38 (63.3%), Twice a week: 22(36.7%)	
	n	**Mean±SD**	*r*	*p*
Fluid Intake (ml)	60	764.13±293.43	-0.096	0.464
Calories Intake (Kcal)	60	1034.56±497.68	-0.091	0.492
Calories from fat (Kcal)	60	201.95±106.56	-0.031	0.814
Total Calories (Kcal)	60	1236.51±586.37	-0.082	0.531
Total fat (gm)	60	22.15±11.75	-0.028	0.831
Saturated fat (gm)	59	10.35±23.38	0.129	0.329
Polyunsaturated fat (gm)	58	0.32±0.20	0.042	0.752
Monounsaturated fat (gm)	50	0.45±.38	0.056	0.699
Overall Fat (gm)	60	33.04±28.84	0.084	0.525
Cholesterol (mg)	48	53.81±37.42	0.010	0.948
Sodium (mg)	60	260.85±158.22	0.025	0.848
Potassium (mg)	60	1244.46±1029.17	-0.129	0.325
Carbohydrate (gm)	60	177.75±98.32	-0.179	0.172
Fibre Intake (gm)	60	12.45±7.54	-0.083	0.530
Sugar (gm)	58	45.77±33.12	-0.042	0.753
Protein (gm)	59	28.97±15.36	-0.103	0.438
Vitamin A (%DV)	38	6.55±12.98	0.188	0.259
Vitamin C (%DV)	41	125.48±149.39	-0.065	0.685
Calcium (%DV)	49	13.04±22.01	-0.028	0.846
Iron (%DV)	39	47.58±56.25	-0.084	0.611

Table-3: Association between nutritional status and constipation severity

	Abdominal distension or bloating		**Change in amount of gas passed rectally**		**Less Frequent bowel movements**		**Oozing Liquid stool**		**Rectal fullness or pressure**		**Rectal pain with bowel movement**		**Small Volume of stool**		**Unable to pass stool**		**Total CAS Score**	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Fluid Intake (ml) (n=60)	0.01	0.90	0.03	0.79	0.11	0.38	-0.04	0.73	-0.12	0.35	-0.14	0.27	-0.05	0.70	-0.03	0.76	-0.15	0.42
Calories Intake (Kcal) (n=60)	-0.04	0.73	-0.11	0.37	-0.11	0.39	-0.10	0.41	0.01	0.90	-0.01	0.93	0.11	0.39	-0.01	0.91	-0.04	0.75
Calories from fat (kcal) (n=60)	-0.05	0.65	-0.03	0.81	-0.06	0.60	-0.10	0.42	0.03	0.82	-0.07	0.56	0.18	0.14	-0.03	0.77	-0.04	0.75
Total Calories (kcal) (n=60)	-0.04	0.70	-0.10	0.42	-0.10	0.41	-0.10	0.40	0.01	0.88	-0.02	0.86	0.13	0.32	-0.01	0.88	-0.04	0.74
Total fat(gm) (n=60)	-0.06	0.64	-0.03	0.80	-0.06	0.60	-0.10	0.41	0.02	0.83	-0.07	0.55	0.18	0.15	-0.04	0.75	-0.04	0.73
Saturated fat (gm) (n=59)	-0.02	0.87	0.12	0.34	-0.14	0.29	0.01	0.89	-0.02	0.83	-0.23	0.07	0.02	0.86	-0.10	0.44	-0.09	0.48
Polyunsaturated fat (gm) (n=58)	-0.02	0.86	-0.23	0.07	-0.16	0.22	-0.03	0.78	-0.16	0.21	-0.23	0.08	0.01	0.94	-0.25	0.05	-0.22	0.09
Monounsaturated fat (gm) (n=50)	0.10	0.46	-0.17	0.23	-0.14	0.31	-0.04	0.75	-0.16	0.26	-0.15	0.28	-0.02	0.84	-0.28	0.04*	-0.20	0.16
Overall Fat (gm) (n=60)	-0.03	0.77	0.08	0.52	-0.14	0.26	-0.03	0.81	-0.01	0.91	-0.23	0.07	0.09	0.47	-0.10	0.42	-0.09	0.46
Cholestrol (mg) (n=48)	0.04	0.78	-0.14	0.33	0.10	0.46	-0.07	0.62	-0.11	0.43	-0.22	0.12	0.16	0.25	-0.11	0.42	-0.08	0.55
Sodium (mg) (n=60)	-0.16	0.21	-0.16	0.20	-0.01	0.93	-0.19	0.13	-0.19	0.14	-0.26	0.04*	0.03	0.81	-0.22	0.08	-0.26	0.03*
Potassium (mg) (n=60)	0.10	0.41	0.22	0.09	0.01	0.91	-0.09	0.45	-0.01	0.90	0.01	0.91	0.10	0.43	0.09	0.09	0.08	0.51
Carbohydrate (gm) (n=60)	-0.14	0.28	-0.12	0.34	-0.09	0.46	-0.11	0.38	0.00	0.98	0.01	0.93	0.05	0.66	-0.01	0.90	-0.06	0.61
Fibre Intake (gm) (n=60)	0.07	0.56	-0.04	0.73	-0.17	0.17	-0.07	0.55	0.06	0.64	-0.01	0.92	0.18	0.15	0.03	0.80	0.01	0.92
Sugar (gm) (n=58)	-0.12	0.35	-0.12	0.33	-0.17	0.18	-0.27	0.03*	0.05	0.70	-0.10	0.43	0.07	0.59	-0.14	0.28	-0.18	0.15
Protein (gm) (n=59)	-0.10	0.41	-0.07	0.55	-0.02	0.82	-0.07	0.58	0.00	0.95	0.04	0.71	0.21	0.11	-0.03	0.79	-0.01	0.93
Vitamin A (%DV) (n=38)	-0.11	0.47	-0.07	0.67	-0.23	0.16	-0.26	0.11	0.00	1.00	-0.00	0.97	-0.03	0.84	-0.17	0.29	-0.18	0.28
Vitamin C (%DV) (n=41)	0.25	0.10	-0.04	0.77	-0.11	0.47	0.09	0.57	0.00	1.00	0.12	0.42	-0.09	0.54	0.02	0.88	0.04	0.79
Calcium (%DV) (n=49)	-0.01	0.90	-0.02	0.88	0.04	0.73	-0.03	0.79	-0.03	0.81	0.11	0.43	-0.00	0.98	0.02	0.87	0.01	0.89
Iron (%DV) (n=39)	0.02	0.86	-0.16	0.32	0.08	0.60	0.00	0.99	-0.06	0.67	0.19	0.24	-0.05	0.72	-0.03	0.84	0.02	0.86

*Significant

DISCUSSION

The aim of the study was to assess nutritional status and its association with constipation in spastic CP children. The results of the study indicated impaired nutritional status of children with spastic CP based on the recommended daily allowance guidelines.[8]

In the current study it was also found that low nutritional intake did not have significant association with defecation frequency and overall constipation severity. But low sodium intake was negatively associated with rectal pain during defecation and overall constipation severity. The results also showed that low intake of monounsaturated fats in diet were negatively associated with inability to pass stool. Low sugar intake was also negatively associated with oozing of stool in spastic CP children.

Constipation along with other complication of CP is result of decreased mobility, difficulty in swallowing and slow gut motility due to increased tone of abdominal muscles that contribute in slow peristalsis and consequently dry faeces.[9] Spasticity in CP increase with age and causes stiffness of the muscle;[10] may affect the gastrointestinal system, most notably oral-motor function and intestinal motility and can cause constipation.[11] The current study showed significant positive association between age and spasticity that also negatively associated with defecation frequency.

Studies have shown negative association between fibre intake and severity of constipation in children with spastic CP but our study did not corroborate the observations.[5,12,13] A study was conducted to find prevalence of constipation and its association with liquid intake and fibre diet in adult population. It was found that in male and female, low liquid intake was negatively associated with constipation instead of fibre intake and exercise. Clinical recommendation to cure constipation with increased fluid intake but not fibre or exercise, were supported by results of this study.[14]

Feeding problems secondary to oral-motor impairment are very common in CP children and they are fed very low-fibre pureed or mashed foods.[15] Severity of constipation is affected by dietary and nutritional factors while defecation frequency is affected by exercises.[11] Skilled practitioners work with primary care physicians to adjust diet, fluid intake, and supplements in ways that greatly contribute to an individual's overall health.[16] Standard energy needs estimates specific to disability are available for CP children but due to small sample size, age limits, and need of accurate measurement of child stature, these estimates have limited use.[17]

In present study Inability to pass stool, rectal pain with bowel movements and oozing stool liquid was negatively correlated with monounsaturated fat, sodium and sugar levels respectively ($p<0.05$). Overall constipation severity was also negatively correlated with sodium level. One possible explanation to this association is that sodium reduces water absorption from stool in rectum, stimulating peristalsis results in increase in defecation frequency, softening of stool and decrease strain during defection.[12,18] Improvement in defecation frequency and consistency also seen in use of non-absorbable sugars but it causes colonic fermentation that in turn leads to abdominal bloating.[12,19] A study reported that Vitamin C is a natural laxative and may help with constipation problem[20] but in current study vitamin C did not show association with constipation severity.

Increasing the fluid intake up to 90% of the requirement can help manage the constipation in children with CP.[21] Fibre recommendations are usually determined by the dietary reference intakes for fibre. Fibre supplements might be helpful in CP children. Adequate fibre intake with increasing fluid intake may also help in preventing additional problems with constipation.[7,21]

A study conducted by Hariprasad *et al*[22] noted multiple micronutrient deficiency among CP children. The study found that 90.2% CP children (n=37) have vitamin B complex deficiency, 31 (75.6%) have vitamin A deficiency, 27 (65.9%) have low level of vitamin D and 9 (22%) had insufficient level of vitamin D.[23] A study reported that major deficiency in CP children was vitamin D deficiency, caused by inadequate exposure to sunlight, use of anti-epileptic drugs and decreased food intake.[24]

A study conducted by Sullivan *et al*[25] reported low energy intake in developmental disabilities. Unbalanced dietary pattern, high fat and low carbohydrate in diet were found in the participants. The low energy intake in children with neurodevelopmental disabilities is also reported by Sullivan *et al*. The studied population showed an imbalanced dietary pattern, high in fat and low in carbohydrates.[25] According to Abanto *et al*[26], reported that CP children low food intake is due to consistency of food.

Castro (2013, cited by Lopes PA[9]) verified that 'low consumption of fibre foods that help bowel function in individuals with CP and observed that 94% of the sample presented low fluid intake'. Sadia *et al*[27] conducted a study in Abbottabad district of Pakistan, and found apparent malnutrition among

healthy school going children that was associated with low socioeconomic status of their parents.

LIMITATIONS OF THE STUDY

The main limitation in current study was the way nutritional status was documented which was highly subjective and conversion was rather unscientific leaving room for error. Another major limitation was reporting about constipation severity by parents/ caregivers as CP children were unable to express their symptoms related to constipation. The nutritional recommendations for CP children are not established yet, in current study recommended nutritional requirement of normal children were used. Other limitations included small sample size and lack of comparison between healthy and CP children having constipation, in-term of nutritional status.

FUTURE PERSPECTIVES

Nutritional status should be documented through more reliable ways. The sample size should be increased to ensure generalizability of study findings. Relationship of nutritional factors and constipation between CP and healthy children should also be compared

CONCLUSION

Increased level of spasticity is associated with decreased defecation frequency in CP children. Spastic CP children were malnourished based on the recommended daily allowance guidelines. Presence of monounsaturated fat in diet reduces difficulty in passing stool and sugar also reduces oozing of stool. Sodium in diet of children with spastic CP could also reduce rectal pain and overall constipation severity.

REFERENCES

1. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D, *et al*. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol 2007;109:8–14.
2. Fung EB, Samson-Fang L, Stallings VA, Conaway M, Liptak G, Henderson RC, *et al*. Feeding dysfunction is associated with poor growth and health status in children with cerebral palsy. J Am Dietet Assoc 2002;102:361–373.
3. Kuperminc MN, Stevenson RD. Growth and nutrition disorders in children with cerebral palsy. Dev Disabil Res Rev 2008;14:137–46.
4. Winge K, Rasmussen D, Werdelin LM. Constipation in neurological diseases. J Neurol Neurosurg Psychiatry 2003;74:13–19.
5. Veugelers R, Benninga MA, Calis EA, Willemsen SP, Evenhuis H, Tibboel D, *et al*. Prevalence and clinical presentation of constipation in children with severe generalized cerebral palsy. Dev Med Child Neurol 2010:52(9):e216–21.
6. Yang J, Wang HP, Zhou L, Xu CF. Effect of dietary fiber on constipation: a meta-analysis. World J Gastroenterol 2012;18(48):7378–83.
7. Awan WA, Masood T. Role of stretching exercises in the management of constipation in spastic cerebral palsy. J Ayub Med Coll Abbottabad 2016;28(4):798–801.
8. Nutrition Facts Help. Available at: http://nutritiondata.self.com/help/analysis-help [accessed 27 March 2018]
9. Lopes PA, Amancio OM, Araújo RF, Vitalle MS, Braga JA. Food pattern and nutritional status of children with cerebral palsy. Rev Paul Pediatr 2013;31:344–9.
10. Bell KJ, Ounpuu S, DeLuca PA, Romness MJ. Natural progression of gait in children with cerebral palsy. J Pediatr Orthop 2002;22:677–82.
11. Wittenbrook W. Nutritional assessment and intervention in cerebral palsy. Pract Gastroenterol 2011;35:16–32.
12. Luca G, Domenico P, Caterina P, Sarro D. Constipation Treatment in Neurological Disorders. In: Catto-Smith A, (Ed). Constipation ―Causes, Diagnosis and Treatment [Internet]. InTech; 2012. Available from: http://www.intechopen.com/ books/constipation-causes-diagnosis-and-treatment/constipation-treatment-in-neurological-disorders
13. Tse PW, Leung SS, Chan T, Sien A, Chan AK. Dietary fibre intake and constipation in children with severe developmental disabilities. J Paediatr Child Health 2000;36:236–9.
14. Markland AD, Palsson O, Goode PS, Burgio KL, Busby-Whitehead J, Whitehead WE. Association of low dietary intake of fiber and liquids with constipation: evidence from the national health and nutrition examination survey. Am J Gastroenterol 2013;108:796–803. doi:10.1038/ajg.2013.73
15. Elawad MA, Sullivan PB. Management of constipation in children with disabilities. Dev Med Child Neurol 2001;43:829–32.
16. Bazzano AT, Zeldin AS, Diab IR, Garro NM, Allevato NA, Lehrer D. The Healthy Lifestyle Change Program: a pilot of a community-based health promotion intervention for adults with developmental disabilities. Am J Prev Med 2009;37(6 Suppl 1):S201–8.
17. Walker JL, Bell KL, Boyd RN, Davies PS. Energy requirements in preschool-age children with cerebral palsy. Am J Clin Nutr 2012;96:1309–15.
18. Twycross RG, McNamara P, Schuijt C, Kamm MA, Jordan C. Sodium picosulfate in opioid-induced constipation: results of an open-label, prospective, dose-ranging study. Palliat Med 2006;20(4):419–23.
19. Lee-Robichaud H, Thomas K, Morgan J, Nelson RL. Lactulose versus polyethylene glycol for chronic constipation. Cochrane Database Syst Rev 2010;7:CD007570.
20. Iqbal K, Khan A, Khattak MMAK: Biological significance of ascorbic acid (Vitamin C) in human health ―a review. Pak J Nutr 2004;3(1):5–13.
21. Trumbo P, Schlicker S, Yates AA, Poos M, Food and Nutrition Board of the Institute of Medicine, The National Academies. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. J Am Diet Assoc 2002;102:1621–30.
22. Hariprasad PG, Elizabeth KE, Valamparampil MJ, Kalpana D, Anish TS. Multiple nutritional deficiencies in cerebral palsy compounding physical and functional impairments. Indian J Palliat Care 2017;23(4):387–92.
23. Davis E, Shelly A, Waters E, Boyd R, Cook K, Casey E, *et al*. The impact of caring for a child with cerebral palsy: Quality of life for mothers and fathers. Child Care Health Dev 2010;36:63–73.
24. Lee JY, So TY, Thackray J. A review on vitamin d deficiency treatment in pediatric patients. J Pediatr Pharmacol Ther 2013;18:277–91.

25. Sullivan PB. Gastrointestinal disorders in children with neurodevelopmental disabilities. Dev Disabil Res Rev 2008;14(2):128–36.
26. Abanto J, Bortolotti R, Carvalho TS, Alves FB, Raggio DP, Ciamponi AL. Assessment of dietary habits of dental interest in children with cerebral palsy. Rev Inst Cienc Saude 2009;27:244–8.
27. Siddique S, Ayub M, Shore N, Tariq U, Zaman S. Nutritional status of primary school children in Abbottabad. J Ayub Med Coll Abbottabad 2013;25(1–2):123–6.

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