Evaluation of the Growth Parameters in Children with Chronic Functional Constipation

Seyed Mohsen Dehghani [1, 2, *], Hamdollah Karamifar [3], Mohammad Hadi Imanieh [1, 2], Elham Mohebbi [2], Abdorrasoul Malekpour [2], Mahmood Haghighat [2]

[1] Colorectal Research Center, Shiraz University of Medical Sciences, Shiraz, IR Iran
[2] Gastroenterohepatology Research Center, Nemazee Teaching Hospital, School of Medicine, Shiraz University of Medical Sciences, Shiraz, IR Iran
[3] Department of Pediatric Endocrinology, Nemazee Teaching Hospital, School of Medicine, Shiraz University of Medical Sciences, Shiraz, IR Iran

Corresponding author: Seyed Mohsen Dehghani, Colorectal Research Center, Shiraz University of Medical Sciences, Shiraz, IR Iran. Tel.: +98-7116125849, Fax: +98-7116474298, E-mail: dehghanism@sums.ac.ir

Background: Chronic functional constipation is an epidemic problem in children that has effects on the growth status.
Objectives: The aim of this study is to evaluate the growth parameters in children with chronic functional constipation and compare them with healthy individuals.
Patients and Methods: One hundred children with chronic functional constipation (defined as Rome III criteria) referred to Pediatric Gastroenterology Clinic enrolled in this study. Control group was consisted of 100 children who referred for well-child visits, without constipation. Weight, height, body mass index (BMI) and Z-score weight, Z-score height and Z-score BMI was calculated for each patient and control group.
Results: Both case and control groups were consisted of the same age (P = 0.725) and gender (P = 0.777) individuals. The BMI (P < 0.0001) and BMI Z-scores (P < 0.0001) of constipated children was significantly higher than the control group. Also, weight (P = 0.004) and weight Z-scores (P < 0.0001) were significantly higher in the study group. There was no significant difference in height between two groups (P = 0.1), but constipated children had higher height Z-scores than control group (P = 0.027). The rate of obesity (define as BMI Z-score > 2) in children with chronic constipation was 40% that was significantly higher than normal control group (11%) (P < 0.0001).
Conclusion: We found a higher obesity rate and also higher BMI and weight Z-scores in functionally constipated children compared with healthy control group. The reasons for the association between obesity and constipation are not clear and multifactor including diet, activity level, or hormonal influences, are involved that required additional studies.

Keywords: Children; Constipation; Growth parameters; Obesity

1. Background

Chronic constipation is one of the most common complaints of children in many countries. It is associated with several adverse outcomes in children throughout life (1-3). There are a few data with controversy on the growth status of children with chronic constipation. Chao et al. (4) reported the impact of chronic constipation on nutritional and growth status in children. They concluded that chronic constipation may negatively affect the children growth, but after long-term treatments due to the significant increase of appetite, restoration of normal growth was obtained and significant increase of Z-scores of height, weight, and body mass index (BMI) were observed (4). Fishman et al. (5) reported a significantly higher prevalence of obesity among children with constipation compared with controls. This high prevalence is reported in both genders that is not related to the presence of fecal incontinence among constipated children (5). In another study Misra et al. (6) observed an association between chronic severe constipation and overweight. The present study was undertaken to investigate the growth status of children with chronic functional constipation.

Implication for health policy/practice/research/medical education:
There is controversy on growth status in children with chronic constipation but we found higher prevalence of obesity and also higher BMI and weight Z-scores in children with functional constipation in comparison with healthy control group.

2. Objectives

The aim of this study is to evaluate the growth parameters in children with chronic functional constipation and to compare them with healthy individuals.

3. Patients and Methods

All 100 children younger than 18 years old with chronic functional constipation referred to Pediatric Gastroenterology Clinic of Shiraz University of Medical Sciences from July 2009 to August 2010 were enrolled in this study. We used Rome III criteria for definition of chronic functional constipation (7). "Two or more of the followings in a child aged four or older with insufficient criteria for diagnosis of inflammatory bowel syndrome:

- Two or fewer defecations in the toilet per week
- At least 1 episode of fecal incontinence per week
- History of retentive posturing or excessive volitional stool retention
- History of painful or hard bowel movements
- Presence of a large fecal mass in the rectum,
- History of large diameter stools that may obstruct the toilet.

- Criteria fulfilled at least once per week for at least two months before diagnosis, and one month of at least two of the following items in infants up to four years of age:

- two or fewer defecations per week
- at least one episode/week of incontinence after the acquisition of toileting skills
- history of excessive stool retention
- history of painful or hard bowel movements
- presence of a large fecal mass in the rectum
- history of large diameter stools which may obstruct the toilet (7)."

The exclusion criteria were anatomical causes of constipation (e.g. Hirschsprung's disease, spinal cord disease), prior perianal and anal surgery, use of medications that can cause constipation, and constipation caused by another disorder (e.g. hypothyroidism, psychomotor retardation). The Control group was consisted of 100 healthy children who referred for well-child visits (6 month to 18 years) without any constipation manifestations. After weight and height measuring the BMI was calculated. Z-score weight, z-score height and z-score BMI were also calculated for both groups using SPSS software (PASW Statistics 18) according to World Health Organization (WHO) Multicenter Growth Reference Study Group (2006) for up to 5 years old children and WHO Reference 2007 and SPSS macro package for older children. BMI z- scores between -2 and 2 assumed as normal, > 2 as obese and <-2 as underweight.

The obtained data were analyzed using SPSS software version 15.0. Symptoms and data were evaluated for each group. Results were expressed as the mean ± SD or percentage. The statistical analysis included t-tests and Chi-square tests with accepted significance level of 5%.

4. Results

Fifty one boys and 49 girls compromised thein constipated group with a mean age of 61.9 ± 40.5 months (ranged 6 months-18 years). The Control group included 53 boys and 47 girls with a mean age of 60.1 ± 30.5 months (ranged 6 months to 18 years). These two groups of case and control were age: (P = 0.725) and gender: (P = 0.777) matched.

In case group, the mean duration of constipation was 22 ± 20 months (range: 3 months-8 years) and the mean interval between the defecations was 4.3 ± 2.4 days (range: 1.5 - 14.5 days). Eighteen percent of toilet trained children with chronic constipation had at least one episode of fecal incontinence per week and all of them had history of withholding behaviors and excessive stool retention. The rate of painful defecation or hard stool was 88%, and 50% of patients had large fecal mass in the rectum. Other symptoms were included 36% abdominal pain, 34% anorexia, 33% anal pruritus, 29% blood streak on stool surface, 14% perianal erythema, 8% palpable fecal mass, 7% anal fissure, and 5% fresh rectal bleeding.

BMI (16.75 ± 1.56 vs. 15.18 ± 1.76; P < 0.0001) and BMI z-scores (0.55 ± 0.85 vs. -0.42 ± 1.2; P < 0.0001) of constipated children were significantly higher than the control group. The weight (20.13 ± 9.03 vs. 16.76 ± 7.35; P = 0.004) and weight z-scores (0.30 ± 0.91 vs. -0.63 ± 1.16; P < 0.0001) were also significantly higher in case group. no significant difference in height of children was observed between two groups (107.47 ± 22.05 vs. 102.82 ± 17.53; P = 0.1), but constipated children had higher height z-scores than control group (-0.15 ± 1.20 vs. -0.57 ± 1.45; P = 0.027).

The BMI (P = 0.001) and BMI Z-scores (P < 0.0001 male, P = 0.007 female) were significantly higher in males and females with constipation than the control group. There was no significant difference in height of children between two groups (P = 0.114 male, P = 0.588 female), but constipated male had higher height z-scores than control males (P = 0.003), while this score was not shown and difference in females (P = 0.995). there was no significant difference between females in two groups (P = 0.128), but constipated males had higher weight than control ones (P = 0.011). Weight Z-scores were significantly higher in case group (P < 0.0001 male, P = 0.008 female), (Table 1 and Table 2).

The rate of obesity (define as BMI Z-score > 2) in children with chronic constipation was 40% that is significantly higher than control group (11%) (P < 0.0001).

Table 1. Weight, Height and BMI in Children with (Cases) and Without (CControls) Chronic Constipation

	Cases			Controls			P value
	Min	Max	Mean ± SD	Min	Max	Mean ± SD	
Weight, kg							
Male	9.4	40.0	19.1 ± 7.2	7.0	44.0	15.5 ± 7.0	0.011
Female	8.4	56.5	21.2 ± 10.6	9.0	45.6	18.2 ± 7.7	0.128
Height, cm							
Male	69	155	106 ± 20	74	153	100 ± 16	0.114
Female	71	164	109 ± 24	75	156	106 ± 19	0.588
BMI*							
Male	14	20.7	16.6 ± 1.3	11.4	19.0	14.8 ± 1.5	0.001
Female	14	23.1	16.9 ± 1.8	10.4	22.4	15.6 ± 2.0	0.001

* Abbreviation: BMI; body mass index

Table 2. Z-score weight, Z-Score Height, and Z-Score BMI of Children with (cases) and without (controls) Chronic Constipation

	Cases, z-score			Controls, Z-score			P value
	Min	Max	Mean ± SD	Min	Max	Mean ± SD	
Weight, kg							
Male	-3.4	2.6	0.2 ± 1.0	-4.1	2.2	-1.1 ± 1.3	<0.001
Female	-1.4	2.3	0.4 ± 0.8	-3.4	1.8	-0.1 ± 1.0	0.008
Height, cm							
Male	-4.7	2.6	-0.2 ± 1.3	-3.8	3.2	-1.0 ± 1.2	0.003
Female	-3.3	2.0	-0.1 ± 1.1	-4.9	5.4	-0.1 ± 1.7	0.995
BMI*							
Male	-1.3	2.7	0.6 ± 0.8	-3.9	2.1	-0.7 ± 1.2	<0.001
Female	-1.4	2.3	0.5 ± 0.9	-4.6	2.7	-0.1 ± 1.2	0.007

* Abbreviation: BMI; body mass index

5. Discussion

the prevalence of chronic functional constipation is reported to vary from 0.7% to 29.6% in pediatric age group (8). This large variation may be due to the lack of a general definition to classify constipation. We used Rome III criteria for definition of chronic constipation in this study. There are different concepts on the clinical course of constipation in children. Some authors suggest that constipation is a constitutional condition that gradually disappears (9). Others find that despite intensive therapy 30% to 50% of the children persist having severe symptoms even after 5 years follow-ups (10, 11).

In the present study there was no significant difference in the prevalence of constipation in males and females which was similar to Costa et al. (12) study that investigated the overweight and constipation in adolescents.

In this study we compared the growth status in children with chronic functional constipation and healthy control group. We observed a significantly higher prevalence of obesity among children with chronic functional constipation (40%) compared with the control group (11%) (P < 0.001). Also, significant differences were found in BMI z-score and weight z-score . These results are in line with results of a community-based study in Iran that showed about 60% of adult patients with functional constipation were overweight, which was more than the results of this study (13).

In a recent study by Pashankar and Baucke (14) it has been reported that the obesity has significantly higher prevalence in children with chronic functional constipation (22%) compared with healthy control group (12%). This lower rate of obesity in comparison to our study (40%) may be due to different definition of chronic constipation in these studies.

Pashankar and Baucke (14) also reported that the rate of severe obesity was 7.8% in children with chronic functional constipation, which is significantly higher than control. In that study a prevalence rate of 23% for constipation was reported in 80 obese children attending a tertiary obesity clinic.

Also, Fishman et al. (5) recently reported a higher prevalence of constipation in obese children. They reported a prevalence rate of constipation to be 23% and fecal incontinence 15% in obese children. Misra et al. (6) in a retrospective study, an association between chronic constipation and being overweight was indicated by comparing 101 constipated children (mean age, 10.97 ± 3.83 years) with 100 normal controls (mean age, 8.07 ± 2.56 years). The obesity was observed in 44 out of 101 constipated children (43.6%) and 30 out of 100 normal control (30%), that are comparable with our findings, although our patients were younger than those analyzed in Misra et al. study (6). On the other hand, in another study, Chao et al. (4) investigated the growth status of Taiwanese children with constipation, and further evaluated the impact of constipation on growth status during a 12-week and 24-week medical therapy. They reported that near 5% of patients were over weighted (> 90 %) or In obese status, whereas near 25% of patients were underweighted (<10%) or malnourished. That study showed that poper medical control of constipation resulted to the improvement of growth status. The results of that study were in contrast to our findings. Also, in a cohort study conducted by Talley et al. (15) on 980 adults in New Zealand, overweighting was negatively associated with chronic constipation (OR 0.4, 95% CI 0.2, 0.9; P = 0.02).

Children with chronic constipation eat less fiber than other children, and also may have higher energy consumptions, so obesity in children with chronic constipation may be explicable (16, 17) Disordered eating patterns such as bingeing have been shown to be an independent contributor to constipation in adults (18). In addition obese people may eat less fiber or have less physical activity, which could change their defecation pattern (17). We cannot explain the relation of high obesity rate with higher energy intake as more than one third of the patients had anorexia and abdominal pain. On the other hand, development of obesity is clearly related to less physical activity, but there is no proven correlation between lesser physical activity and chronic constipation (17). In contrast a previous study observed that chronic constipation might impair the appetite. In fact, chronic constipation adversely affects nutritional status by causing feelings of mild to severe abdominal discomfort, bloating, and nausea that lead to appetite loss (19, 20). So, the factors leading to the correlation between chronic constipation and growth status, are multiple, including activity level, diet, or hormonal influences.

This study have some limitations as we have not consider the pubertal stages in both groups, also we didn't have adequate data about the nutritional status and activity levels of the subjects. Moreover, lack of post treatment follow -up is another limitation of this study.

The knowledge of the growth parameters in children with chronic functional constipation is essential to pro-vide general practitioners and pediatricians with accurate information, for weigh treatment strategies, and to identify children with high risk and unfavorable outcomes.

Acknowledgements

Authors' Contribution

Dehghani SM, Karamifar H, Imanieh MH and Haghighat M were involved in the study concept and design, drafting of the manuscript, critical revision of the manuscript, and study supervision; Dehghani SM, Mohebbi E and Malekpour A were in charge of acquisition of data, analysis and interpretation of data, and drafting of the manuscript.

Financial Disclosure

Funding/Support

References

1. Evaluation and treatment of constipation in children: summary of updated recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. *J Pediatr Gastroenterol Nutr.* 2006;**43**(3):405-7.
2. Baker SS, Liptak GS, Colletti RB, Croffie JM, Di Lorenzo C, Ector W, et al. Constipation in infants and children: evaluation and treatment. A medical position statement of the North American Society for Pediatric Gastroenterology and Nutrition. *J Pediatr Gastroenterol Nutr.* 1999;**29**(5):612-26.
3. Leung AK, Chan PY, Cho HY. Constipation in children. *Am Fam Physician.* 1996;**54**(2):611-8.
4. Chao HC, Chen SY, Chen CC, Chang KW, Kong MS, Lai MW, et al. The impact of constipation on growth in children. *Pediatr Res.* 2008;**64**(3):308-11.
5. Fishman L, Lenders C, Fortunato C, Noonan C, Nurko S. Increased prevalence of constipation and fecal soiling in a population of obese children. *J Pediatr.* 2004;**145**(2):253-4.
6. Misra S, Lee A, Gensel K. Chronic constipation in overweight children. *JPEN J Parenter Enteral Nutr.* 2006;**30**(2):81-4.
7. Rasquin A, Di Lorenzo C, Forbes D, Guiraldes E, Hyams JS, Staiano A, et al. Childhood functional gastrointestinal disorders: child/adolescent. *Gastroenterology.* 2006;**130**(5):1527-37.
8. Mugie SM, Benninga MA, Di Lorenzo C. Epidemiology of constipation in children and adults: A systematic review. *Best Practice & Research Clinical Gastroenterology.* 2011;**25**(1):3-18.
9. Abrahamian FP, Lloyd-Still JD. Chronic constipation in childhood: a longitudinal study of 186 patients. *J Pediatr Gastroenterol Nutr.* 1984;**3**:460-7.
10. Staiano A, Andreotti MR, Greco L. Long term follow up of children with chronic idiopathic constipation. *Dig Dis Sci.* 1994;**39**:561-64.
11. Van Ginkel R, Reitsma JB, B ¼ller, H. A. , Taminiau JAJM, Benninga MA. Childhood constipation: longitudinal follow-up beyond puberty. *Gastroenterology.* 2003;**125**(2):357-63.
12. Costa ML, Oliveira JN, Tahan S, Morais MB. Overweight and consti-

pation in adolescents. *BMC Gastroenterol.* 2011;**11**:40.

13. Pourhoseingholi MA, Kaboli SA, Pourhoseingholi A, Moghimi-Dehkordi B, Safaee A, Mansoori BK, et al. Obesity and functional constipation; a community-based study in Iran. *J Gastrointestin Liver Dis.* 2009;**18**(2):151-5.

14. Pashankar DS, Loening-Baucke V. Increased prevalence of obesity in children with functional constipation evaluated in an academic medical center. *Pediatrics.* 2005;**116**(3):e377-80.

15. Talley NJ, Howell S, Poulton R. Obesity and chronic gastrointestinal tract symptoms in young adults: a birth cohort study. *Am J Gastroenterol.* 2004;**99**(9):1807-14.

16. Morais MB, Vitolo MR, Aguirre AN, Fagundes-Neto U. Measurement of low dietary fiber intake as a risk factor for chronic constipation in children. *J Pediatr Gastroenterol Nutr.* 1999;**29**(2):132-5.

17. Kranz S, Brauchla M, Slavin JL, Miller KB. What do we know about dietary fiber intake in children and health? The effects of fiber intake on constipation, obesity, and diabetes in children. *Adv Nutr.* 2012;**3**(1):47-53.

18. Crowell MD, Cheskin LJ, Musial F. Prevalence of gastrointestinal symptoms in obese and normal weight binge eaters. *Am J Gastroenterol.* 1994;**89**(3):387-91.

19. Van der Sijp JR, Kamm MA, Nightingale JM, Akkermans LM, Ghatei MA, Bloom SR, et al. Circulating gastrointestinal hormone abnormalities in patients with severe idiopathic constipation. *Am J Gastroenterol.* 1998;**93**(8):1351-6.

20. Roma E, Adamidis D, Nikolara R, Constantopoulos A, Messaritakis J. Diet and chronic constipation in children: the role of fiber. *J Pediatr Gastroenterol Nutr.* 1999;**28**(2):169-74.