



# How Does Functional Constipation Affect Growth Status in Children?

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Received 2018 October 23; Revised 2018 December 12; Accepted 2018 December 27.

## Abstract

**Background:** There are some evidences suggesting functional constipation-related growth retardation in children, especially in early childhood. Considering high prevalence of constipation, early diagnosis and treatment of constipated patients may improve the quality of life in these children. In this study, weight and height of Iranian children aged 2 to 12 years with functional constipation was evaluated compared to healthy children.

**Methods:** A total of 130 Iranian children aged 2 - 12 years, 65 with functional constipation and 65 as healthy children referred to pediatric gastroenterology clinic during Jan to Dec of 2016, were enrolled in this case-control study. Functional constipation was defined as Rome III criteria. The growth status was evaluated using the growth charts, and Z scores of weight and height for age were recorded, with the consent of parents and child willingness.

**Results:** 65 constipated patients (44 boys, 21 girls) with the mean age of  $8.28 \pm 3.24$  years and 65 healthy children (25 boys, 40 girls) with the mean age of  $8.32 \pm 3.42$  years were evaluated. The mean weight of case group was  $23.69 \pm 4.14$  kg and mean height  $126.49 \pm 10.34$  cm. The mean weight of control group with  $31.62 \pm 4.85$  kg and mean height  $153.47 \pm 13.88$  cm, demonstrated significant difference with the case group. The observed mean weight and height were significantly lower in constipated group and the differences of height-for-age and weight-for-age Z scores were statistically meaningful in constipated and healthy children.

**Conclusions:** Functional constipation in children aged 2 to 12 years may retard their weight and height growth, so early diagnosis and treatment of children with constipation is beneficial in their adequate growth status.

**Keywords:** Constipation, Children, Growth Status

## 1. Background

Functional constipation is known as a major problem among children with a prevalence of 3% worldwide (1). Constipation begins in the first year of life in 17% - 40% of the children (2). This disorder is generally accompanied with painful excretion of feces, fecal incontinence and abdominal pain leading to discomfort of the child and family and has impact on their quality of life (3). Although constipation has several etiologies in children, functional constipation is considered when no organic pathology is found (4-11).

Constipation diagnosis is made initially by a careful history and physical examination. Medical history and physical examination are necessary to rule out other causes of constipation. Age of child at the onset of symptoms, success or failure of toilet training, frequency and form of fecal excretion, pain or bleeding during defeca-

tion, withholding habits, food history, changes in appetite, nausea and vomiting, and weight loss are the symptoms that should be noted by physician (12-16).

Physical examination including growth indices, complete abdominal and pelvic examination, lumbosacral area inspection, digital rectal examination, assessment of anal and cremasteric reflex, limb tonicity and neuromuscular function should be carefully done.

Red flags suggesting anatomical cause and organ dysfunction which are against functional constipation include early onset of constipation in the first month of life, meconium excretion after 48 hours of birth and positive family history of Hirschsprung's disease, narrow diameter stool, faltering growth or signs suggestive of hypothyroidism, abdominal distention with biliary vomiting, anatomical abnormality in back, gluteal area, or anus, locomotor delay and weakness in legs.

Growth status is an indicator of public health and nu-

trition in a population of children. A child's growth can be assessed according to growth charts over the time, and Z scores of height and weight for patient's age. Growth delay means insufficient physical growth or inability to maintain expected growth during a period of time, which is defined as deviation of the child's growth curve from the reference value. Functional constipation influences on children growth pattern. Many recent studies have shown significant decreasing impacts of constipation on the children's growth, and some have shown that constipation treatment and elimination of underlying etiologies associated with constipation appears beneficial to constipated children's growth status (7). Paradoxically, many other studies have suggested that a high percentage of children with functional constipation are suffering from obesity. They propound that a high prevalence rate of obesity in children can be observed in both boys and girls, and it is more significant in children with constipation (4). Therefore, evaluation of the growth status and developmental diagrams of children with constipation is of significant importance (17, 18).

There aren't sufficient studies evaluating relationship between functional constipation and growth retardation in Iranian children and the limited conducted studies are associated with paradoxical results. Considering high prevalence of functional constipation in children, can early diagnosis and treatment of this disorder help to improve the quality of life of these patients?

## 2. Objectives

The aim of the present study was to investigate correlation between functional constipation and growth status in Iranian children aged 2 - 12 year.

## 3. Methods

This case-control study was conducted on a total of 130 randomly selected Iranian children aged 2 to 12 years referred to pediatric gastroenterology clinic of Rasoul-e-Akram Hospital in Tehran, Iran, from Jan to Dec 2016.

Authors used Rome III criteria for definition of functional constipation: Two or less than two defecations per week, at least one episode of fecal incontinence per week after the acquisition of toilet training skills, history of excessive stool retention, history of painful or hard bowel movements, presence of a large fecal mass in rectum, and history of large-diameter stool that might obstruct the toilet were diagnostic criteria. Functional constipation is categorized into two groups based on child age, excluding the other etiologies of constipation; In children younger than

4 years, at least two criteria for at least one month and for children older than 4 years, at least two criteria for at least two months is diagnostic. It should be noted that there are a few cases that have all the Rome III criteria for functional constipation; therefore, having defecation difficulties for more than two weeks that cause stress for parents is diagnostic for this disorder (19).

Children under 2 years or above 12 years of age were not included in this study. Furthermore, constipated children presented with any cause of growth retardation including celiac disease, cystic fibrosis, malnutrition, hypothyroidism, hypercalcemia, psychiatric disorders, recent history of infection, prior perianal surgery, use of medications that can cause constipation, and family history of growth disorder were excluded from the study. Children and their parents were interviewed and examined to obtain their clinical history and physical examination to confirm the diagnosis of functional constipation, based on Rome III criteria; these patients were considered as case group of the study. Control group consisted of children referred for well-child visits, without associated constipation. Then, with the consent of parents and child willingness, the growth status of each child according to growth charts and Z scores of height and weight for age was recorded. Statistical analysis for quantitative variables were presented as mean  $\pm$  standard deviation (mean  $\pm$  SD) and for categorical qualitative variables as percentages. The comparison of quantitative variables between two groups was done by *t* test or Mann-Whitney test. The comparison between qualitative variables was also performed by chi-square test or Fisher's exact test. P values of 0.05 or less were considered statistically significant.

## 4. Results

This study was performed on a total of 130 children aged 2 - 12 years, of which 65 were constipated (case group) and 65 (control group) were healthy without constipation. Demographic informations and clinical features of these two groups are summarized in Table 1.

In terms of growth status, the average weight of children in groups with and without constipation was  $23.69 \pm 4.14$  kg and  $31.62 \pm 4.85$  kg, respectively, which demonstrates a significant lower weight in the group with constipation ( $P < 0.001$ ). Furthermore, the mean weight for age Z scores for case and control groups were  $-17.1 \pm 0.66$  and  $0.50 \pm 0.12$ , respectively ( $P = 0.001$ ). The mean height of children in case group was  $126.49 \pm 10.34$  cm and in control group  $153.47 \pm 13.88$  cm, which shows a significantly lower height in the group with constipation ( $P < 0.001$ ) (Table 1).

Moreover, the mean height for age Z scores in both groups with and without constipation were  $-0.77 \pm 0.25$

**Table 1.** Demographic Data and Clinical Features in 130 Children with and Without Constipation

	With Constipation	Without Constipation	P Value
Mean age	8.28 ± 3.24	8.32 ± 3.42	0.950
Male prevalence, No. (%)	44 (68.8)	25 (37.9)	0.001
Mean weight	23.69 ± 4.14	31.62 ± 4.85	0.001
Mean height	126.69 ± 10.34	153.47 ± 13.88	< 0.001
Feces incontinence, No. (%)	28 (43.8)	4 (6.1)	< 0.001
Cow's milk allergy, No. (%)	13 (20.3)	9 (13.6)	0.310
Allergy history, No. (%)	8 (12.5)	4 (6.1)	0.205

**Table 2.** Z Scores of Weight for Age in Boys and Girls with and Without Constipation

Gender	With Constipation	Without Constipation	P Value
Total	-0.17 ± 0.16	0.50 ± 0.12	0.001
Boys	-0.25 ± 0.25	0.43 ± 0.17	0.027
Girls	-0.12 ± 0.20	0.67 ± 0.15	0.014

**Table 3.** Z Scores of Height for Age in Boys and Girls with and Without Constipation

Gender	With Constipation	Without Constipation	P Value
Total	-0.77 ± 0.25	0.66 ± 0.10	0.001
Boys	-0.54 ± 0.43	0.70 ± 0.14	0.001
Girls	-0.92 ± 0.31	0.58 ± 0.16	0.002

and  $0.66 \pm 0.10$ , respectively ( $P = 0.001$ ). These differences were observed in both genders. [Table 2](#) and [3](#) demonstrate growth status in constipated and healthy children.

Growth status in boys was significantly better than that in girls in both groups with and without constipation. History of cow's milk allergy and all types of allergies in both groups did not show any impact on the growth status.

According to the multivariate linear regression analysis and in the presence of underlying factors including gender, age, history of allergy, functional constipation was the most effective contributing factor to poor weight gain in children ( $\beta = 0.701, P = 0.002$ ). In the same analytical evaluation, functional constipation was the most effective factor contributing to children's height growth retardation ( $\beta = 1.341, P = 0.001$ ).

## 5. Discussion

Physical and psychological effect of constipation on children and adults is an inevitable fact. Different studies show that the occurrence of chronic and prolonged constipation, not only impairs the daily physical function of children which causes stress in parents, but also has ad-

verse effects on all aspects of life of the children including their social, mental, and even academic performance. Moreover, there is some evidence showing the susceptible effects of functional constipation on the development of children, especially in the early years of life. This study evaluates the correlation between functional constipation and weight and height of the children aged 2 to 12 years.

This study demonstrated that children with symptoms of functional constipation had much less average weight and height than children without constipation. Z scores of height and weight for age were considerably different in two groups. In other words, this study propounded that functional constipation leads to significant impairment of growth, including children's height and weight which is totally independent of the gender of the child. There are various causes for delayed growth in children with constipation. Fecal impaction in these children, may cause abdominal fullness and discomfort, and nausea leading to decreased appetite and food aversion. On the other hand, psychological effects of functional constipation on children and their parents impacts the child's nutrition and growth, too.

Many recent studies have emphasized the significant effects of constipation on the children's alimentary habits and on their developmental parameters, which can return to normal growth by treatment of anorexia or the elimination of organic causes associated with constipation (7). Chao et al. demonstrated the functional constipation of children as the cause of their growth retardation. In this study, significant increase in z scores of height and weight for age, and body mass index for age was observed after 12 and 24 weeks of constipation treatment in children aged 1 to 15 years with constipation. In contrast, some studies have shown a high prevalence of obesity in children with functional constipation (20). In a study by Ilan et al. most of the children with constipation were obese or overweight (21). In a similar study conducted on 100 Iranian children younger than 18 years old with functional constipation Dehghani et al. found a higher obesity rate

and higher BMI and weight Z scores in constipated patients compared to healthy control group (22). Pawlowska et al. demonstrated that pediatric patients with functional gastrointestinal disorders present various growth abnormalities. They found that fat deficiency was more frequent in children with functional constipation; also short stature and stunting was common in patients with functional constipation (23, 24).

Our study recognizes the impairment of appetite, emotional disorders caused by abdominal pain, painful defecation and other diagnostic criteria for functional constipation to be the causes of delay in children's growth and weight gain.

In conclusion, authors' findings demonstrate that functional constipation in children aged 2 to 12 years may have a negative effect on weight and height growth; so, pediatricians should be aware of the risk of decreased growth in children with functional constipation; early diagnosis and treatment of children with constipation is beneficial in their adequate growth status.

#### Footnotes

**Authors' Contribution:** Study concept and design: Azizollah Yousefi; analysis and interpretation of data: Azizollah Yousefi, Parisa Morovati Sharifabadi and Elahe Norouzi; drafting of the manuscript: Shima Mohamadian and Elahe Norouzi; critical revision of the manuscript for important intellectual content: Azizollah Yousefi, Shahrbanoo Nakhaei, Elahe Norouzi and Shima Mohamadian; statistical analysis: Parisa Morovati Sharifabadi, Azizollah Yousefi.

**Conflict of Interests:** None declared.

**Ethical Considerations:** IR.IUMS.REC 1395.9221216318.

**Financial Disclosure:** We have no financial interests related to the material in the manuscript with exception of Growth and Development Research Center, Iran University of Medical Sciences.

**Funding/Support:** This study regarding material and in part financial was supported by Growth and Development Research Center; Iran University of Medical Sciences.

#### References

1. van den Berg MM, Benninga MA, Di Lorenzo C. Epidemiology of childhood constipation: A systematic review. *Am J Gastroenterol*. 2006;101(10):2401-9. doi: 10.1111/j.1572-0241.2006.00771.x. [PubMed: 17032205].
2. Tabbers MM, DiLorenzo C, Berger MY, Faure C, Langendam MW, Nurko S, et al. Evaluation and treatment of functional constipation in infants and children: Evidence-based recommendations from ESPGHAN and NASPGHAN. *J Pediatr Gastroenterol Nutr*. 2014;58(2):258-74. doi: 10.1097/MPG.000000000000266. [PubMed: 24345831].

3. Liem O, Harman J, Benninga M, Kelleher K, Mousa H, Di Lorenzo C. Health utilization and cost impact of childhood constipation in the United States. *J Pediatr*. 2009;154(2):258-62. doi: 10.1016/j.jpeds.2008.07.060. [PubMed: 18822430].
4. 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. doi: 10.1097/00005176-199911000-00029. [PubMed: 10554136].
5. Bardisa-Ezcurra L, Ullman R, Gordon J, Guideline Development G. Diagnosis and management of idiopathic childhood constipation: Summary of NICE guidance. *BMJ*. 2010;340:c2585. doi: 10.1136/bmj.c2585. [PubMed: 20516006].
6. Tabbers MM, Boluyt N, Berger MY, Benninga MA. Clinical practice: Diagnosis and treatment of functional constipation. *Eur J Pediatr*. 2011;170(8):955-63. doi: 10.1007/s00431-011-1515-5. [PubMed: 21701812].
7. North American Society for Pediatric Gastroenterology H; Nutrition. 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. doi: 10.1097/01.mpg.0000232574.41149.0a. [PubMed: 16954970].
8. Felt B, Wise CG, Olson A, Kochhar P, Marcus S, Coran A. Guideline for the management of pediatric idiopathic constipation and soiling. Multidisciplinary team from the University of Michigan Medical Center in Ann Arbor. *Arch Pediatr Adolesc Med*. 1999;153(4):380-5. doi: 10.1001/archpedi.153.4.380. [PubMed: 10201721].
9. Tabbers MM, Boluyt N, Berger MY, Benninga MA. Constipation in children. *BMJ Clin Evid*. 2010;2010. [PubMed: 21718570]. [PubMed Central: PMC2907595].
10. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, et al. GRADE: An emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336(7650):924-6. doi: 10.1136/bmj.39489.470347.AD. [PubMed: 18436948]. [PubMed Central: PMC2335261].
11. Levy EI, Lemmens R, Vandenplas Y, Devreker T. Functional constipation in children: Challenges and solutions. *Pediatric Health Ther*. 2017;8:19-27. doi: 10.2147/PHMT.S110940. [PubMed: 29388621]. [PubMed Central: PMC5774595].
12. Longstreth GF, Thompson WG, Chey WD, Houghton LA, Mearin F, Spiller RC. Functional bowel disorders. *Gastroenterology*. 2006;130(5):1480-91. doi: 10.1053/j.gastro.2005.11.061. [PubMed: 16678561].
13. Bekkali N, Hamers SL, Reitsma JB, Van Toledo L, Benninga MA. Infant stool form scale: Development and results. *J Pediatr*. 2009;154(4):521-526 e1. doi: 10.1016/j.jpeds.2008.10.010. [PubMed: 19054528].
14. Lane MM, Czyzewski DI, Chumpitazi BP, Shulman RJ. Reliability and validity of a Modified Bristol Stool Form Scale for children. *J Pediatr*. 2011;159(3):437-441 e1. doi: 10.1016/j.jpeds.2011.03.002. [PubMed: 21489557]. [PubMed Central: PMC3741451].
15. Chumpitazi BP, Lane MM, Czyzewski DI, Weidler EM, Swank PR, Shulman RJ. Creation and initial evaluation of a Stool Form Scale for children. *J Pediatr*. 2010;157(4):594-7. doi: 10.1016/j.jpeds.2010.04.040. [PubMed: 20826285]. [PubMed Central: PMC2937014].
16. Ghosh A, Griffiths DM. Rectal biopsy in the investigation of constipation. *Arch Dis Child*. 1998;79(3):266-8. doi: 10.1136/adc.79.3.266. [PubMed: 9875026]. [PubMed Central: PMC1717694].
17. Leung AK, Chan PY, Cho HY. Constipation in children. *Am Fam Physician*. 1996;54(2):611-8. 627. [PubMed: 8701840].
18. 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. doi: 10.1016/j.jpeds.2004.04.022. [PubMed: 15289779].
19. Philichi L. Management of childhood functional constipation. *J Pediatr Health Care*. 2018;32(1):103-11. doi: 10.1016/j.pedhc.2017.08.008. [PubMed: 29229066].

20. 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. doi: [10.1203/PDR.0b013e31817995aa](https://doi.org/10.1203/PDR.0b013e31817995aa). [PubMed: [18414138](https://pubmed.ncbi.nlm.nih.gov/18414138/)].
21. Koppen IJN, Velasco-Benitez CA, Benninga MA, Di Lorenzo C, Saps M. Is there an association between functional constipation and excessive bodyweight in children? *J Pediatr.* 2016;**171**:178-1820. doi: [10.1016/j.jpeds.2015.12.033](https://doi.org/10.1016/j.jpeds.2015.12.033).
22. Dehghani SM, Karamifar H, Imanieh MH, Mohebbi E, Malekpour A, Haghighat M. Evaluation of the growth parameters in children with chronic functional constipation. *Ann Colorectal Res.* 2013;**1**(2):55-9. doi: [10.5812/acr.11979](https://doi.org/10.5812/acr.11979).
23. Pawlowska K, Umlawska W, Iwanczak B. A link between nutritional and growth states in pediatric patients with functional gastrointestinal disorders. *J Pediatr.* 2018;**199**:171-7. doi: [10.1016/j.jpeds.2018.02.069](https://doi.org/10.1016/j.jpeds.2018.02.069). [PubMed: [29709346](https://pubmed.ncbi.nlm.nih.gov/29709346/)].
24. Santucci NR, Hyman PE. Do functional gastrointestinal disorders affect growth and nutrition? *J Pediatr.* 2018;**199**:9-10. doi: [10.1016/j.jpeds.2018.04.006](https://doi.org/10.1016/j.jpeds.2018.04.006). [PubMed: [29731354](https://pubmed.ncbi.nlm.nih.gov/29731354/)].