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Original Article

Overweight/obesity Prevalence and Clinical Features in Children's Functional Constipation: Descriptive Analysis in a Single Tertiary Center

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Abstract

Background and objectives: Functional constipation (FC) and the overweight/obesity (O/O) association are controversial. This study aims to investigate the prevalence of O/O, demographics, and clinical characteristics between children with O/O and normal BMIs, and establish whether O/O constitutes a clinical subgroup.

Methods: Retrospective observational study of children/adolescents referred for evaluation of constipation. Inclusion criteria: age between 01–192 months; diagnosis of FC according to the Rome Criteria III-IV; Bristol Stool Form 1 or 2.

Results: 450 FC children/adolescents were divided into three subgroups. In total, 34.4% had O/O. The proportion of overweight/obese children increased four times in the 61–192 subgroup (43.1%). Evaluation of subgroups: There was no significant difference in family factors, and there was a high presence of straining and painful defecation in the three subgroups. Evaluating O/O and normal BMI within each subgroup showed no significant difference for most variables. The statistical analysis of the comparisons of bowel movement characteristics between the O/O and normal BMI groups within each subgroup established that the normal BMI group had a higher presence of straining on defecation, blood in stools, and scybalous stools. In comparing BMI z scores, they were higher in the normal BMI group within the 25–60 subgroup than the 61–192 subgroup ($p < 0.01$).

Conclusions: The proportion of overweight/obese children rises after five years old. There was no substantial difference in the clinical characteristics between overweight/obese and normal BMI children. However, the normal BMI group was more symptomatic than the O/O group. This study, therefore, does not document a distinct subgroup of O/O in FC, and probably no difference between developed and developing countries regarding FC and O/O.

Keywords: Obesity; Overweight; Constipation; Children; Adolescent.

Abbreviations: BMI, body mass index; FC, functional constipation; IQR, interquartile range; O/O, overweight/obesity; SUS, Brazilian Public Health System; WHO, World Health Organization.

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Introduction

Functional constipation (FC) is the result of repeated attempts of voluntary withholding of feces by a child who tries to avoid unpleasant defecation and is among the most common chronic disorders in children worldwide, representing a significant reason for health expenditure.[1,2] In a systematic review and meta-analysis on the epidemiology of FC according to the Rome III and Rome IV Pediatric Criteria, the prevalence was 9.5% (95% CI 7.5–12.1).[3] Parallel to FC, childhood obesity is one of the most severe global health challenges of the 21st century, and the prevalence of overweight and obesity has increased alarmingly. In 2016, in 40 years of estimates, the number of school-age children and adolescents

Table 1. Diagnostic criteria to classify overweight and obesity

	Months of age		
	≤24	**25–60**	**61–192**
Criteria for Classification	weight-to-length	BMI	BMI
z score > 1	At the risk of Overweight	At the risk of Overweight	Overweight
z score > 2	Overweight	Overweight	Obesity
z score > 3	Obesity	Obesity	Severe obesity

BMI, Body Mass Index; The 85th, 97th, and 99th percentiles approximate z-scores of + 1, + 2 and, + 3, respectively.

with obesity increased more than 10-fold and nearly 50% between 2000 and 2015.[4,5]

Symptoms of FC can be recurrent or continuous, and almost half of these children continued with constipation into adulthood.[6] In addition, obesity in childhood and adolescence can also persist into adulthood.[7] Indeed, pediatric obesity predicts adult obesity. Approximately, the percentage of obese infants that will become obese children, the percentage of obese children that will become obese adolescents, and the percentage of obese adolescents that will inevitably become obese adults are 20, 40, and 80% respectively.[5]

Recently, two systematic reviews addressed the relationships between FC and overweight/obesity (O/O). First, Koppen *et al*. (2016) included eight studies, and due to the heterogeneity of the study designs, they could not confirm the association between overweight/obesity and FC.[8] However, other studies revealed the possible association between FC and excessive body weight. Second, a more recent systematic review and meta-analysis (Lazarus *et al*., 2022)[9] evaluated eighteen studies involving 33,410 children and concluded that FC is correlated with the prevalence of both overweight and obesity.

Studies have frequently revealed a significant association between O/O and the risk of FC in developed and underdeveloped countries. Accordingly, the potential association between FC and O/O in childhood is controversial. Therefore, given that both conditions are prevalent and assuming that O/O and FC are interconnected, it may be challenging to establish an actual association, suggesting the necessity of future studies to assess this causal relationship. Consequently, the complete description of the epidemiological profile and the evaluation of the demographic, socioeconomic, and clinical features related to these disorders is an essential future step in additional clinical studies. On the other hand, studying their relationships could provide adequate information for appropriate care of these children/adolescents.

Thus, this study aimed to investigate in children with FC: (1) the prevalence of O/O, (2) differing demographic and clinical characteristics between children with O/O and a normal body mass index (BMI), and (3) whether overweight/obese children with constipation constitute a distinct clinical subgroup.

Methods

Study design, setting, and selection of participants

The current study is a retrospective observational including consecutive cases of children/adolescents referred from the Brazilian Public Health System (SUS) who presented at a single Pediatric Gastroenterology Outpatient Clinic of Botucatu Medical School, Botucatu, São Paulo, Brazil, for initial evaluation of resistant or complicated constipation. All children and adolescents were from the same geographic area. Inclusion criteria: ages between 1 and 192 months (16 years) with a diagnosis of FC defined according to the Rome Criteria III between January 2012 and August 2016 and Rome IV criteria between September 2016 to December 2018, and scale 1 or 2 of the Brazilian version of the Bristol Stool Form.[10–14] Exclusion criteria: organic or constipation associated with chronic problems such as neurological, genetic, mental/psychiatric, and developmental disorders.

This retrospective cohort study was approved by the Ethics Committee of Botucatu Medical School (CAAE 90158218.0.0000.5411) and was conducted and reported following the guidance from the Committee on Publication Ethics (COPE) and practices according to the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals from the International Committee of Medical Journal Editors. The individual consent for this retrospective analysis was waived.

Data collection

All data was collected on a standardized pre-designed protocol to ensure uniform collection on demographics, clinical findings, alarm symptoms, signs for the diagnosis of organic constipation, laboratory information, radiological exams, and treatment. Data was stored in a database of Excel spreadsheets (Microsoft, Redmond, Washington), and a Databank was constructed. This study's sociodemographic, clinical, and anthropometric data were extracted following the study's objectives. Age groups and BMI stratified patients according to the characteristics of functional constipation: under 24 months, between 25 and 60 months, and over 60 months. This division, associated with the definitions of the Rome Criteria, would probably build homogeneous groups. The final diagnoses of FC were determined after four months of follow-up by two experienced pediatric gastroenterologists (MAC, NCM).

Anthropometric data

Experienced pediatric nurses obtained the following anthropometric measurements: body weight (kilograms) and height (centimeters) according to the World Health Organization (WHO) guidelines (World Health Organization, 1995), WHO AnthroPlus-evaluated BMI (kg/m^2), and *z* score.[15–17] Diagnostic criteria for overweight and obesity were defined according to the Italian Society of Pediatrics.[18] In brief, in children up to 24 months, the diagnosis of overweight and obesity is based on the weight-to-length ratio, using the WHO reference curves.[19] After two years, it is based on the Body Mass Index (BMI), using the WHO reference system up to 5 years and the WHO 2007 reference system, as shown in Table 1.[16,19] All data were adjusted for sex and age. Underweight children were excluded from the analyses. Obesity and severe obesity were combined for analysis. Furthermore, the patients were divided into O/O and normal BMI groups.

Table 2. Comparison of children's baseline characteristics at the first visit according to the three age subgroups

Demographic Features and symptoms	Months of age		
	≤24 (n = 27)	25–60 (n = 96)	61–192 (n = 327)
Sex: *Female, n (%)*	12 (44.4)	39 (40.6)	139 (42.5)
Age at the first visit, *mo*	15 (11–20)	46.5 (36–53)	102 (81–130)
Age of mothers, *years*	30 (27–32)	30 (26–35)	34 (31– 38)
Age of fathers, *years*	32 (28–34)	33 (29–37)	38 (32–43)
Mothers' schooling	12 (11–12)	12 (9–12)	12 (9–12)
Fathers' schooling	12 (9–12)	11 (9–12)	10 (6–12)
Number of rooms	5 (4–5)	5 (4–6)	5 (4–6)
Number of people at home	4 (3–6)	4 (3–5)	4 (3–5)
Number of children at home	1.5 (1–3)	2 (1–2)	2 (1–2)
Crowding index *(person/room)*	1.0 (0.6–1.2)	0.8 (0.6–1)	0.8 (0.6–1)
Duration of constipation*, *mo Median (IQR)*	12 (6–15)	24 (12–36)	71 (47–102)

IQR, Interquartile range; mo, months; *$p < 0.0001$.

Statistical analysis

GraphPad Prism version 8.4.0 for Windows (GraphPad Software, San Diego, CA, USA, www.graphpad.com) was used to perform the analysis. The Kolmogorov-Smirnov test was used to verify whether the variables had a normal distribution to differentiate parametric and non-parametric tests. Categorical variables are presented as counts (n) and percentages (%) and analyzed using Fisher's exact test. Continuous variables are expressed as median and interquartile range (IQR) and the comparison between groups was made using the Mann-Whitney or Kruskal-Wallis test. All statistical tests were performed at a significance level of $p < 0.05$. The Ethics Committee from Botucatu Medical School approved the study (CAAE 90158218.0.0000.5411).

Results

Four hundred fifty children/adolescents with FC between 05 months and 16 years were included and divided into three subgroups: ≤24, 25–60, and 61–192 months of age. Table 2 presents the baseline characteristics. There was no statistically significant difference between the three age groups in family factors such as parents and household characteristics, except for the duration of constipation, which was longer in the 61–192 month group. In addition, there were no significant differences in baseline characteristics between the O/O and normal BMI groups. So, there appeared to be no substantial difference in the demographics and clinical characteristics of the O/O and normal BMI groups at presentation.

Figure 1 presents that, in total, 155 children (34.4%) were obese/overweight, and 295 (65.6%) had a normal BMI. The proportion of overweight/obese children increased four times when the subgroups 25–60 (10.4%) and 61–192 months (43.1%) were compared. Figure 2 shows a detailed classification by normal, risk of overweight, overweight, and obesity of each age subgroup. Observe the higher proportion of overweight/obese children in the subgroup 61–192 months.

Table 3 compares BMI z scores between the 25–60 and 61–192 subgroups. The O/O group of the 25–60 subgroup has a higher score than the 61–192 subgroup. The subgroup ≤24 months was excluded, considering the small number of overweight children.

Table 4 shows no difference between the three subgroups in the proportion of bowel movement characteristics and abdominal pain. On the other hand, the comparison between the O/O and normal BMI groups within each subgroup demonstrated a high presence of blood in stool and straining on defecation in the normal BMI group of the 25–60-month subgroup. Also, there is a high presence of straining on defecation and scybalous stools in the normal BMI of the 61–192 subgroup. No difference in the <24 months subgroup.

Discussion

According to a systematic review by Koppen *et al.* (2016), the association between Functional Defecation Disorders and O/O was categorized into three groups:[20] Group 1 assessed the prevalence of FC in obese children; Group 2 assessed the prevalence of O/O in children with FC; and group 3 comprised population-based studies. The current study addressed group 2, assessing many FC children/adolescents to evaluate the prevalence of O/O, family factors, and clinical features in an outpatient clinic of a developing country. Conversely, most studies regarding the association between FC and O/O were conducted in developed countries and speculate that different pathophysiological factors may differ in several settings. Considering a significant lack of literature, the current study evaluates the relationship between FC and O/O.

The main results indicated that the prevalence of O/O quadruples with increasing age, from the toddlers and preschools (25–60 months = 10.4%) subgroup to the school age and adolescents (61–192 months = 43.1%) subgroup, in contrast to the prevalence of around 20% in Southeast Brazil, evidencing an association between FC and O/O.[21] Also, there was no difference in most demographics and clinical features.

Several studies have assessed the relationship between FC and the risk of O/O with controversial results. Pashankar *et al*. (2005) demonstrated a greater prevalence of overweight/obesity in constipated children.[22] Misra *et al*. (2006) revealed that children with constipation were more likely to be overweight than the control group.[23] In a prospective case-control study, Teitelbaum *et al*. (2009) defined that the obesity rate in the FC group was significantly higher than that in healthy controls.[24] Dehghani *et al*.

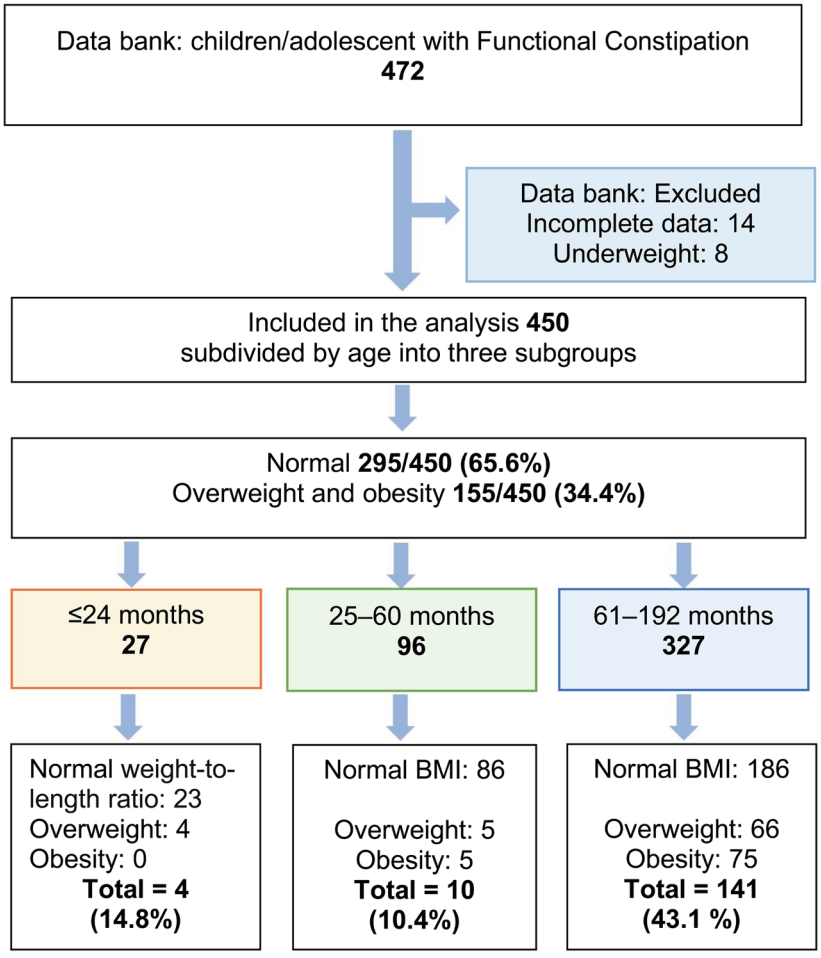

Fig. 1. Flowchart showing numbers and percentages of children/adolescents with functional constipation, subdivided into three age subgroups. BMI, Body Mass Index.

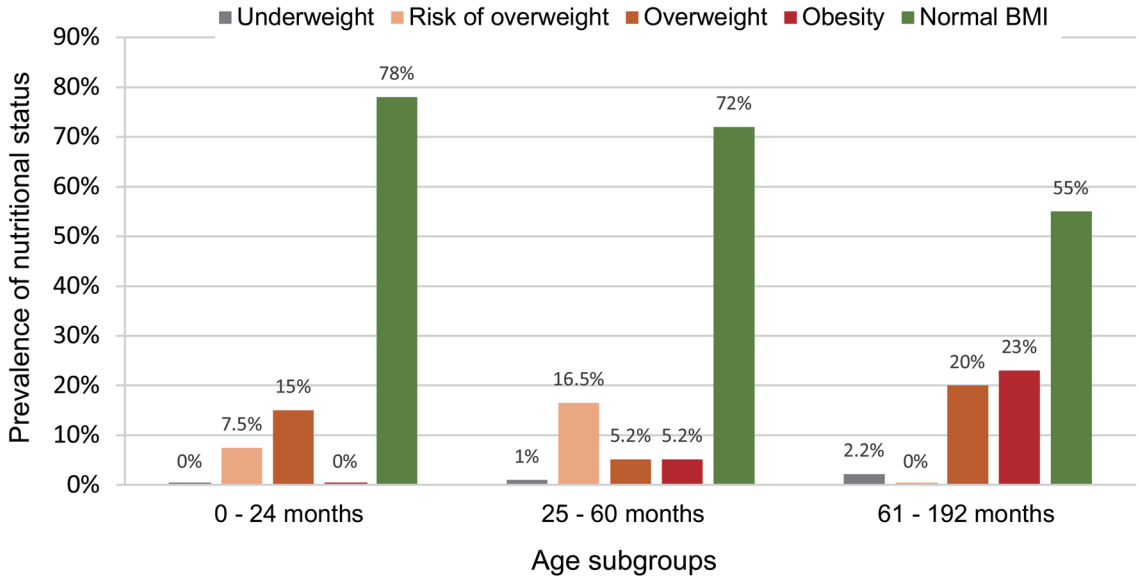

Fig. 2. Prevalence of nutritional status in children/adolescents with functional constipation according to the three age subgroups. BMI, body mass index.

Table 3. Comparison of BMI z scores of overweight/obesity and normal BMI according to the three age subgroups

z score BMI/Age *Median (IQR)*	Months of age		p-value
	25–60 (n = 96)	61–192 (n = 327)	
Normal BMI	0.01 (−0.5–0.4)	−0.17 (−0.6–0.4)	ns
Overweight/Obesity	3.0 (2.3–4.0)	2.0 (1.4–2.8)	0.01

BMI, Body Mass Index; IQR, interquartile range; mo, months; ns, not statistically significant

(2013), on children younger than 18 years old with FC, demonstrated a higher obesity rate in patients with constipation compared to a healthy control group.[25]

Additionally, Tambucci *et al*. (2019), studying the association between functional gastrointestinal disorders and overweight, found an increased and significant prevalence of O/O in children with FC compared to the control group.[26] The results are comparable to the present study, which establishes a significant proportion of overweight/obese children after five years old. Conversely, Kavehmanesh *et al*. (2013) compared 124 children with FC with 135 controls and demonstrated that obesity and overweight were more prevalent in the FC group than in controls, but these differences were not statistically significant.[27] Pawlowska *et al*. (2018) found that children with FC showed no significant difference in body weight/body mass index (BMI) compared to the control population.[28]

On the other hand, in assessing the prevalence of FC in overweight/obese children, Fishman *et al*. (2004) administered a questionnaire to 80 consecutive pediatric patients presenting to an obesity clinic and demonstrated a higher prevalence of FC.[29] Van der Baan-Slootweg *et al*. (2011) assessed the bowel habits of morbidly obese children and 21% had FC.[30] Phatak *et al*. (2014) described that FC was significantly more prevalent in overweight/obese children (23%) than in children with average weight (14%).[31] In Colombian school-age children (Koppen *et al*., 2016) confirmed that FC was not more prevalent in obese (15%) or overweight (13%) compared to normal-weight children (13%).[20] In Brazil, Costa *et al*. (2011) conducted a study on 1,077 adolescents and found no association between overweight and FC.[32] Also, in Brazil, there was observed a higher FC prevalence in overweight children (44.6%) compared with children without FC (34.5%), but the difference was not significant (Dias *et al*., 2023).[33] However, it is suggested that, bi-directionally, a relationship exists between FC and overweight/obese children.

Obesity can cause an increased prevalence of FC in developed countries; however, no significant association was observed in developing countries. Indeed, what are the differences between developed and developing countries? What would the differences stand between normal and obese children/adolescents? The studies suggest that different risk factors, such as eating habits, economic and social conditions, and possibly genetics, play a role in the relationship between FC and excessive body weight (Koppen *et al*., 2016).[20] FC and overweight/obese children may have an excessive caloric food and sugary drink intake associated with high-fat content. Diets low in fiber and lifestyles predisposed to excessive weight gain are associated with children's FC development.[34,35] In a cross-sectional study, Mello *et al*. (2010) enrolled children/adolescents with FC and their respective caretakers.[36] Most patients with FC (89%) presented insufficient fiber consumption (less than age+5 g). Overweight was found in 60% of caretakers, and only 2.6% had dietary fiber recommendations. Thus, in patients with FC and O/O, we would have to propose a diet based on an adequate/enriched dietary fiber concentration and reduced calories—two challenging aspects of a change in eating pattern. These findings strengthen the present study's hypothesis that with advancing age, the prevalence of O/O in FC increases since dietary family habits become more highlighted over time.

In addition, brain-gut neuropeptides, such as leptin, ghrelin, cholecystokinin, and glucagon-like peptide-1, play a role in hunger, satiety, and gastrointestinal motility. Ghrelin could accelerate small intestinal and colonic transit and, accordingly, ghrelin levels are reportedly lower in individuals with obesity.[37] On the other hand, FC and O/O may be changed in the early composition of the gut microbiota, suggesting the development of FC.[38–41]

FC is painful and has uncomfortable symptoms such as abdominal pain, straining on defecation, and fecal incontinence, and negatively impacts patients' health-related quality of life.[42–47] In a systematic review and meta-analysis, Vriesman *et al*. (2019) showed

Table 4. Comparison of the proportions of bowel movement characteristics and abdominal pain between the three subgroups

Clinical Features *n (%)*	Months of age		
	≤24 (n = 27)	25–60 (n = 96)	61–192 (n = 327)
Frequency of defecation, *≤2x/week*	16 (59)	64 (66)	160 (48)
Scibalous	11 (40)	44 (45)	73 (22)*
Large feces	11 (40)	36 (37)	124 (37)
Hard bowel movement	13 (48)	40 (41)	105 (32)
Straining on defecation	24 (88)	88 (91)*	264 (80)*
Painful defecation	19 (70)	71 (73)	213 (65)
Blood in stool	20 (74)	41 (42)*	101 (30)
Fecal incontinence >1/week	00 (00)	41 (42)	171 (52)
Abdominal pain	10 (37)	65 (67)	205 (62)

Mann-Whitney test; *$p < 0.05$

that health-related quality of life scores are lower in children with FC.[48] Thus, children with obesity often have psychosocial conditions such as traumatic disorders, depression, anxiety, and lack of self-esteem, and these factors are proposed to contribute to the pathophysiology of FC and obesity.[37,49,50]

The current study has some limitations: First, patients were recruited from a single tertiary center, and the data cannot be generalized. Second, its retrospective design does not obtain information about possible influencing factors such as early life factors, dietary intake, physical activity, sedentary time, and socioeconomic status. Some strengths: First, all children were diagnosed based on the Rome Criteria and Bristol Scale 1 and 2. Second, the casuistic was distinctly homogeneous. Third, a large number of children were included. Fourth, a small number of underweight children were excluded.

Conclusions

The proportion of obese/overweight children was 34.4% and increased four times when the subgroups 25–60 (10.4%) and 61–192 months (43.1%) were compared. The proportion of overweight/obese children expressively rises after five years old. There appeared to be no substantial difference in the clinical characteristics of FC between overweight/obese and normal children at presentation. FC children/adolescents with a normal BMI were more symptomatic. This study does not document a distinct clinical subgroup of O/O in children with FC, and there is probably no difference between developed and developing countries regarding FC and O/O. The underlying mechanisms of these results are not well-recognized and should be investigated in future studies.

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Conflict of interest

The authors declare no conflict of interests.

Author contributions

Study design (NCM, MAC), acquisition of data (JTD, ACQG), analysis and interpretation of data (NCM, JTD, TKW, ACQG, MAC), drafting of the manuscript (NCM, MAC), critical revision of the manuscript (TKW). All authors have contributed significantly to this study and approved the final manuscript.

Ethical statement

This retrospective cohort study was approved by the Ethics Committee of Botucatu Medical School (CAAE 90158218.0.0000.5411) and was conducted and reported following the guidance from the Committee on Publication Ethics (COPE) and practices according to the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals from the International Committee of Medical Journal Editors (ICMJE). The individual consent for this retrospective analysis was waived.

Data sharing statement

No additional data are available.

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