Is There an Association between Functional Constipation and Excessive Bodyweight in Children?

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Objectives To determine the prevalence of functional constipation, overweight, and obesity in a cross-sectional observational study among children in Colombia and to examine the association between functional constipation and excessive bodyweight in this population.

Study design Demographics, anthropometric data, and questionnaires were collected from 2820 children between 8 and 18 years of age across 4 regions in Colombia. A Spanish translation of the Questionnaire on Pediatric Gastrointestinal Symptoms-Rome III Version was used to determine the prevalence of functional constipation. Anthropometric measurements of weight, height, and body mass index (BMI) were obtained following World Health Organization guidelines; overweight was defined as a BMI z-score (adjusted for sex and age) between 1 and 2, obesity was defined as a BMI z-score >2.

Results A total of 368 children (13.0%) were found to have functional constipation, 542 children (19.2%) were overweight, and 188 children (6.7%) were obese. Functional constipation did not occur more frequently in children who were obese (14.9%) or overweight (13.1%) compared with children with normal weight (12.9%, $P = .73$). The prevalence of functional constipation, overweight, and obesity differed significantly between regions. Functional constipation and excessive bodyweight were significantly more common in children attending private schools compared with children attending public schools.

Conclusions Functional constipation, overweight, and obesity are commonly observed in children in Colombia. No association between functional constipation and overweight or obesity was found. *(J Pediatr 2016;171:178-82)*.

Childhood overweight and obesity are challenging problems faced by pediatricians worldwide.[1] In 2013, in developed countries, the prevalence of overweight and obesity was 23.8% in boys and 22.6% in girls.[1] Although the prevalence of overweight and obesity is traditionally lower in developing countries, it has increased strikingly between 1980 and 2013; from 8.1% to 12.9% for boys and from 8.4% to 13.4% in girls.[1] Obesity in children is commonly known to be a risk factor for a wide variety of severe chronic diseases, including type 2 diabetes and fatty liver disease, and is associated with increased healthcare costs.[2]

In developed countries, several pediatric studies have revealed an association between excessive bodyweight and functional constipation in children.[3-7] Functional constipation is a common pediatric healthcare problem worldwide, with a reported prevalence ranging from 0.7%-29.6%.[8] The diagnosis is based on the Rome III criteria, and symptoms may include infrequent, painful defecation, hard stools, and fecal incontinence.[9] These bothersome symptoms are known to have a significant impact on the quality of life of affected children.[10-13] Despite its common occurrence, the pathophysiology of functional constipation is still incompletely understood.[14] The underlying mechanisms behind the suggested association between functional constipation and overweight also remain unidentified. Factors such as dietary intake, physical activity, the gut microbiota, psychological factors, and socioeconomic status may play a role in the pathophysiology of both disorders and could account for their commonly reported co-occurrence. Studies regarding the association between functional constipation and excessive bodyweight have mostly been conducted in developed countries. Since pathophysiological factors may differ between developing and developed countries, it is of key importance to conduct such studies also in developing countries, to evaluate if results from studies from developed countries are indeed applicable to the pediatric population in developing countries.

The primary aim of this population-based, cross-sectional observational study was to assess the prevalence of functional constipation, overweight, and obesity in children across multiple regions of Colombia and to assess the association between excessive bodyweight and functional constipation. Secondary aim was to

BMI	Body mass index
QPGS-RIII	Questionnaire on Pediatric Gastrointestinal Symptoms–Rome III Version
WHO	World Health Organization

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assess whether other factors such as socioeconomic factors or family composition are associated with functional constipation or excessive bodyweight in children.

Methods

The design of this study was based on previous studies in school children, performed and described by our group.[15,16] In short, between February and October 2014, an invitation package was sent to the families of 4093 children between 8 and 18 years of age attending schools in 4 main regions of Colombia's mainland; the Andean region (the mountains), the Caribbean region (adjacent to the Caribbean Sea), the Pacific region (adjacent to the Pacific Ocean), and the Amazon region (tropical rainforest). Children were invited through the Obesity and Overweight monitoring program (Programa de Seguimiento de la Obesidad y del Sobrepreso) by the Gastrohnup Research Group at the University del Valle (Cali, Colombia) and the Functional International Digestive Epidemiological Research Survey program. Parents gave written informed consent and all children provided assent to participate. A screening questionnaire was completed by the parents to identify and exclude children who had a history of known organic medical conditions. Children who were underweight (body mass index [BMI] z-score <-2) were excluded from further analyses because of the possibility of undiagnosed organic diseases. Children were also excluded from the analyses if they had a diagnosis of another functional gastrointestinal disorder (not functional constipation) and if missing data hindered the calculation of the BMI z-score or determination of the occurrence of functional gastrointestinal disorders. The Ethics Committee of Clinical Investigation from the University del Valle (Cali, Colombia) and local school authorities approved the study.

Demographic data were obtained through questionnaires. Anthropometric measurements of weight, height, and BMI were obtained following World Health Organization (WHO) guidelines[17]; weight (in kilograms) was measured with the child standing on an electronic scale, height (in centimeters) was measured using an adjustable stadiometer. BMI was calculated as weight in kilograms divided by the square of the height in meters (kg/m^2). BMI z-scores were corrected for age and sex and used to define weight categories according to the WHO cut-off values[18]; BMI z-scores below -2 were considered underweight, between -2 and $+1$ as normal weight, between $+1$ and $+2$ as overweight, and above $+2$ as obesity.

A Spanish translation of the Questionnaire on Pediatric Gastrointestinal Symptoms–Rome III Version (QPGS-RIII) was used to diagnose functional constipation and other functional gastrointestinal disorders. The QPGS-RIII is a validated questionnaire for diagnosing functional gastrointestinal disorders in children. The use of the Spanish translation of the QPGS-RIII has been previously described.[19] To ensure children's comprehension, the investigators reviewed the questionnaire with the children during a presentation before administration and a member of the research team was available for questions while the participants completed the questionnaire.

Data were analyzed using independent samples t test, Pearson χ^2, and Fisher exact test where appropriate using IBM SPSS Statistics for Windows v 22.0 (IBM Corporation Armonk, New York). When comparing the means of multiple groups, 1-way ANOVA with post-hoc analyses applying Bonferroni corrections was used when there was the assumption of homogeneity of variance, the Games-Howell test was used when homogeneity of variance was not assumed. P values of $<.05$ were considered statistically significant.

Results

In total, 2820 children (51.7% boys) between 8 and 18 years of age were included; a flowchart of the inclusion process is depicted in the **Figure** (available at www.jpeds.com). The mean age was 12.1 years (SD 2.3); 1660 (58.9%) were school children between 8 and 12 years of age, and 1160 (41.1%) were adolescents between 13 and 18 years of age. The majority of children (88.4%) attended public schools. The mean age of children in public schools was 12.3 years (SD 2.3) compared with 10.41 years (SD 1.6) in children attending private schools ($P < .01$). The mean age of children differed significantly between regions ($P < .01$); children in the Amazon region had a mean age of 13.5 years (SD 2.2), and they were significantly older than the rest of the children in the Andes (11.8 years of age, SD 2.4), the Atlantic region (12.0 years of age, SD 1.9), and the Pacific region (11.9 years of age, SD 2.4).

Based on their BMI z-scores, 542 children (19.2%, 95% CI 17.8-20.7) were overweight, and 188 children (6.7%, 95% CI 5.8-7.7) were obese. There were significant differences in the prevalence of overweight and obesity between boys and girls; overweight occurred more frequently in girls and the prevalence of obesity was higher in boys (**Table**). Overweight and obesity were significantly more prevalent in school children compared with adolescents; 21.7% vs 15.6% and 8.7% vs 3.7%, respectively ($P < .01$). There were significant differences in the prevalence of overweight and obesity among regions across the country (**Table**). In accordance with these results, the mean BMI z-score differed significantly between regions; the mean BMI z-score was lowest in the Amazon (0.0, SD 1.0) and highest in the Pacific region (0.5, SD 1.1).

Based on the questionnaire, 368 children (13.0%, 95% CI 11.9-14.3) were found to have functional constipation according to the Rome III criteria. There was no significant difference in prevalence of functional constipation between boys and girls. Functional constipation was significantly more prevalent in school children compared with adolescents (14.9% vs 10.4%) and was significantly more prevalent in children attending private school compared with children attending public school (20.4% vs 12.1%; **Table**). The prevalence of functional constipation differed significantly