ABSTRACT.  

Objective. The rapidly increasing prevalence of obesity in children is the most important problem facing pediatricians today. A recent study suggested an association of obesity and constipation in children but lacked a control group for comparison. The objectives of this study were to evaluate the prevalence of obesity in a large cohort of children with functional constipation and to compare it with a control group representative of the general population.

Methods. Retrospective chart review was performed on 719 children, between the ages of 4 and 18 years, with chronic functional constipation seen in the general pediatric and pediatric gastroenterology clinics between July 2002 and June 2004. Data collected included age, gender, BMI, and signs and symptoms of constipation including fecal incontinence. Obesity was classified as a BMI of >95th percentile and severe obesity as a BMI of ≥5 kg/m² above the 95th percentile for age and gender. The control group consisted of all 930 children (4 to <18 years of age) presenting to the pediatric clinic for a well-child visit between January and June 2004. The χ² and t tests were used for analysis.

Results. Overall prevalence of obesity was significantly higher in constipated children (22.4%) compared with control children (11.7%), and this higher prevalence was also seen for severe obesity. The prevalence rates of obesity were significantly higher in constipated males (25%) than in constipated females (19%) and were significantly higher compared with the control males (13.5%) and control females (9.8%). Constipated boys in all 3 age groups had significantly higher rates of obesity than the control boys; the constipated girls had significantly higher obesity rates for the age groups between 8 and <18 years. Fecal incontinence (encopresis) was present in 334 of 719 (46%) constipated children. The prevalence of obesity was similar in constipated children with and without fecal incontinence.

Conclusions. There is a significantly higher prevalence of obesity in children with constipation compared with age- and gender-matched controls. This higher prevalence is present in both boys (4 to <18 years of age) and girls (8 to <18 years of age) with constipation and is not related to the presence of fecal incontinence among constipated children. The higher prevalence of obesity may be a result of dietary factors, activity level, or hormonal influences and needs additional evaluation. Pediatrics 2005;116:e377–e380. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2005-0490; obesity, constipation, fecal incontinence, children.

The rapidly increasing prevalence of obesity among children is one of the most challenging problems for pediatricians today. Obesity in children is associated with multiple health problems such as diabetes, hyperlipidemia, hypertension, steatohepatitis, and psychosocial issues.1 However, there are minimal data on obesity and associated gastrointestinal symptoms in children. In adults, higher prevalence rates of chronic gastrointestinal symptoms have been reported in association with obesity.2,3 In a recent pediatric study, a prevalence rate of 23% for constipation was reported in 80 obese children attending a tertiary obesity clinic.4 Because this prevalence rate was higher than historical standards, the authors suggested an association between obesity and constipation. However, their study did not include a control group for comparison, and therefore it was difficult to make firm conclusions about this association.4 We planned a study to test this association by evaluating the prevalence of obesity in a large cohort of children with constipation and to compare them with a control group representative of the general population.

METHODS

Patients

We evaluated all children seen for constipation in the primary and tertiary general pediatrics and tertiary pediatric gastroenterology clinics at the Children’s Hospital of the University of Iowa between July 1, 2002, and June 30, 2004. A computer search was performed using “4 years to 17 years” and “constipation” defined by the International Classification of Diseases codes 564.0, 564.1, 564.2, 564.09, and 787 as search terms to identify children with constipation from the database. We identified 814 children (between the ages of 4 and <18 years) and reviewed all charts to confirm the diagnosis of constipation. Chronic constipation was defined by ≥2 of the following characteristics during the last 8 weeks: frequency of bowel movements of <3 stools per week; ≥1 episode of functional fecal incontinence (encopresis) per week; large stools in the rectum or felt on abdominal examination; passing of stools so large that they obstruct the toilet; retentive posture (withholding behavior); and painful defecation. This definition was agreed on recently by an international group of pediatric gastroenterologists and pediatricians gathered at the 2nd World Congress of Pediatric Gastroenterology, Hepatology, and Nutrition in Paris, France, in July 2004. These criteria also satisfy the definition proposed by the North American Society of Pediatric Gastroenterology, Hepatology, and Nutrition in 1999.5 After chart review, we excluded 88 children from this group of 814 children because they did not meet the definition criteria or had organic causes of constipation such as Hirschsprung’s disease,
chronic intestinal pseudo-obstruction, previous surgery of the colon or anus, or disease states that placed limitations on the act of defecation such as hypotonia, cerebral palsy, and severe mental retardation and excluded 7 children in whom BMI could not be calculated because of missing height data. Thus, 719 children with chronic functional constipation were included in the study. Of these children, 334 children had constipation with fecal incontinence, and 385 children had constipation alone.

For the control group, we assessed all children (4 to <18 years) seen in the general pediatrics clinics at the University of Iowa from January 1 to June 30, 2004, for at least 1 well-child visit. This clinic is a primary care clinic serving children of university employees and students and the general community of Iowa City and the surrounding area. To identify these children, a computer search using the Current Procedural Terminology codes 99381, 99391, 99382, 99392, 99383, 99393, 99384, and 99394 as search terms for well-child visits was performed. The computer identified 1002 children between the ages of 4 and 18 years, and their charts were reviewed. We excluded 70 children who were suffering from chronic constipation and/or fecal incontinence, cerebral palsy, mental retardation, or other chronic diseases and excluded 2 children in whom the BMI could not be calculated because of missing height data. Thus, 930 children formed the control group.

This study was approved by the University of Iowa Institutional Human Research Review Committee.

BMI
At all clinic visits, weight and height were measured by experienced nursing assistants and entered into the computerized medical records. The computer calculated the BMI, expressed as body weight in kilograms divided by the square of height in meters (kg/m²). Obesity was defined as a BMI of >95th percentile, and severe obesity was defined as a BMI of ≥5 kg/m² above the 95th percentile for age and gender.

Statistical Analysis
The data obtained in the constipated children were compared with similar parameters in the control children. The statistical analysis included the Student’s t test and χ² test, with significance accepted at P < .05. Results were expressed as mean ± SD or percent.

RESULTS
Constipated Children Versus Controls
We evaluated 719 children with chronic functional constipation and 930 children in the control group. These 2 groups were similar regarding the mean age and gender ratio (Table 1). The children with constipation were significantly more obese and severely obese than the control children (P < .001; Table 1).

Influence of Gender
We evaluated 390 constipated boys, 329 constipated girls, 480 control boys, and 450 control girls. A significantly higher prevalence of obesity and severe obesity was seen in both constipated boys and constipated girls compared with the control boys and girls (Table 2). Constipated boys were more obese than constipated girls (25.4% vs 18.8%; P < .03). However, control boys and control girls were not significantly different in rate of obesity (13.5% vs 9.8%; P = .071).

Influence of Age
We assessed rates of obesity (BMI > 95th percentile) in 3 different age groups in boys and girls with constipation and controls (Figs 1 and 2) and found that the 4- to 17-year-old constipated boys were significantly more obese than the control boys (P < .04). The 8- to 17-year-old constipated girls were significantly more obese than the age-matched control girls (P < .01).

Constipated boys and girls, ages 4 to 7 years, were less obese than the 8- to 11-year-olds (P < .03) and 12- to 17-year-olds (P < .04).

Influence of Fecal Incontinence
Constipated children with fecal incontinence were significantly different than those without fecal incontinence for younger age (P < .02) and male gender (P < .001), but there was no difference in the prevalence rate of obesity (P > .5; Table 3). Constipated children with fecal incontinence as well as children with constipation only were significantly more obese and severely obese than the control children (P < .01).

DISCUSSION
In this study, we compared prevalence of obesity in a large cohort of children with constipation to controls. All charts were reviewed to confirm the diagnosis of functional constipation in the study group. The control group included all children who came for well-child visits, and we excluded children presenting with constipation symptoms or other debilitating illnesses. Thus, we believe that this control group is a fairly representative sample of the general population. We report a significantly higher prevalence of obesity in children with functional constipation (22%) compared with the control group (12%). The rate of severe obesity (BMI >5 kg/m² above the 95th percentile for age and gender) was 7.8% in constipated children, which is significantly higher than in controls (2.3%).

The higher prevalence of obesity was present in both boys and girls with constipation compared with the controls. It is interesting to note that constipated males had a higher prevalence rate of obesity than constipated females. Rates of obesity were significantly higher in constipated boys than control boys in all 3 age groups (from 4 to <18 years) and in constipated girls than control girls in 2 age groups (from 8 to <18 years of age). In this study, the presence of fecal incontinence was not related to the higher prevalence of obesity among children with constipation.

Recent studies in adults report a higher prevalence of gastrointestinal symptoms in association with obesity. In 2 recent studies, increasing BMI was associated with vomiting, upper abdominal pain, and diarrhea in adults.2,3 However, it is interesting to note that in both studies there was no association with constipation and higher BMI in adults. Fishman et al4 recently reported a higher prevalence of constipation in obese children. They administered a questionnaire.

| TABLE 1. Obesity in Constipated and Control Children |
|---------------------------------|-----------------|-----------------|---|
| Constipation | Control | P |
| Number | 719 | 930 | |
| Age, y (mean ± SD) | 8.8 ± 3.5 | 9.1 ± 4 | .179 |
| Males, % | 54 | 52 | .289 |
| Obese, % | 22.4 | 11.7 | <.001 |
| Severely obese, % | 7.8 | 2.3 | <.001 |
to assess symptoms of constipation and fecal incontinence to 80 obese children (average age: 11 years old) attending an obesity clinic in a tertiary referral hospital. They found the prevalence rate of constipation to be 23% and of fecal incontinence to be 15% in obese children.4 Our study was different in that we measured obesity in children with constipation with and without fecal incontinence in a much larger sample. Also, our study had a large age- and gender-matched control group for comparison. However, our study has the limitation of a possible referral bias, because we studied children presenting to an academic medical center. Additional epidemiologic studies are required to confirm this association in the community.

The reasons for the association between obesity and constipation are not clear. Children with constipation are known to have decreased intake of fiber.7 It is possible that they may have higher energy intakes, although that remains to be proven. Less phys-

<table>
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<td>Severely obese, %</td>
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Table 2. Rates of Obesity in Constipated and Control Children According to Gender

Fig 1. Rates of obesity (BMI > 95th percentile) in constipated boys and control boys separated into 3 different age groups. N = number of constipated and control boys in the respective age groups.

Fig 2. Rates of obesity (BMI > 95th percentile) in constipated girls and control girls separated into 3 different age groups. N = number of constipated and control girls in the respective age groups.
ical activity is clearly related to the development of obesity, but it does not have any proven association with constipation. Circulating hormones have been implicated in adult constipation and in severe obesity. Therefore, reasons for this association could be multifactorial, including diet, activity level, or hormonal influences, and require additional studies.

CONCLUSIONS

Our study shows an increased prevalence of obesity in children with functional constipation. Obesity and constipation with fecal incontinence have been known to lead to psychosocial issues and behavior problems. Awareness of this association is important for pediatricians, because children with both disorders are at high risk of depression and other psychiatric problems. Also, constipation represents a common problem in children, and practitioners who treat constipation should be aware of this association. Additional studies are required to identify causes of this association, which will improve understanding of the mechanisms involved in functional constipation.

ACKNOWLEDGMENTS

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REFERENCES


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<td>Age, y (mean ± SD)</td>
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<td>Boys</td>
<td>67.4%</td>
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<td>Severely obese, %</td>
<td>8.7*</td>
<td>7*</td>
<td>.590</td>
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* P < .01 from the control group of 930 children.
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Dinesh S. Pashankar and Vera Loening-Baucke
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