Brazilian Journal of Medical and Biological Research (2003) 36: 753-759
ISSN 0100-879X

Dietary fiber, energy intake and nutritional status during the treatment of children with chronic constipation

P.G.L. Speridião[1], S. Tahan[2], U. Fagundes-Neto[2] and M.B. Morais[2]

[1]Programa de Pós-Graduação em Nutrição and
[2]Disciplina de Gastroenterologia Pediátrica, Departamento de Pediatria, Escola Paulista de Medicina, Universidade Federal de São Paulo, São Paulo, SP, Brasil

Correspondence
M.B. Morais
Rua Loefegreen, 1596
04040-032 São Paulo, SP
Brasil
E-mail: mbmorais.dpep@epm.br

Publication supported by FAPESP.

Received October 2, 2002
Accepted May 5, 2003

Abstract

The present prospective study was carried out to determine dietary fiber and energy intake and nutritional status of children during the treatment of chronic constipation. Twenty-five patients aged 2 to 12 years with chronic constipation were submitted to clinical evaluation, assessment of dietary patterns, and anthropometry before and after 45 and 90 days of treatment. The treatment of chronic constipation included rectal disimpaction, ingestion of mineral oil and diet therapy. The standardized diet prescribed consisted of regular food without a fiber supplement and met the nutrient requirements according to the recommended daily allowance. The fiber content was 9.0 to 11.9 g for patients aged less than 6 years and 12.0 to 18.0 g for patients older than 6 years. Sixteen patients completed the 90-day follow-up and all presented clinical improvement. The anthropometric variables did not change, except midarm circumference and triceps skinfold thickness which were significantly increased. Statistically significant increases were also found in percent calorie intake adequacy in terms of recommended daily allowance (55.5 to 76.5% on day 45 and to 68.5% on day 90; P = 0.047). Percent adequacy of minimum recommended daily intake of dietary fiber (age + 5 g) increased during treatment (from 46.8 to 52.8% on day 45 and to 56.3% on day 90; P = 0.009). Food and dietary fiber intake and triceps skinfold thickness increased during follow-up. We conclude that the therapeutic program provided a good clinical outcome.

Key words
• Constipation
• Anthropometry
• Nutritional status
• Energy intake
• Dietary fiber

Introduction

Constipation is a common disorder in childhood which accounts for 25% of the visits to pediatric gastroenterology clinics and 3% of referrals to teaching hospital clinics (1,2). The pathophysiology of constipation in children is not completely understood. Multiple factors are probably involved in the genesis of constipation, such as genetic factors, intestinal motility disorders, fecal retention behavior and dietary habits (2,3). Clayden (4) reported that approximately half of his patients with chronic constipation presented anorexia, possibly due to a cycle of poor intake, stool retention and poor appe-

tite. Anorexia among constipated children has also been reported by others (4-8), although only in a few (5,7) was anorexia evaluated through a food inquiry. Increasing dietary fiber is one of the therapeutic measures recommended by many investigators (2,4,9-13) for the treatment of chronic constipation. The recommended ingestion of dietary fiber for normal children over the age of two is either 0.5 g kg^{-1} day^{-1}, or the age in years + 5 g/day (14). However, there have been no prospective studies evaluating energy and dietary fiber intake and nutritional status during the treatment of chronic constipation in children.

Thus, the objective of the present study was to determine dietary fiber and energy intake and nutritional status during the treatment of chronic constipation in children.

Material and Methods

The study was performed at the outpatient clinic of the Division of Pediatric Gastroenterology, Department of Pediatrics, Universidade Federal de São Paulo, Escola Paulista de Medicina (UNIFESP-EPM). The study included 25 children ranging in age from 2 to 10 years who presented chronic functional constipation. Patients with Hirschsprung's disease, spinal or anal anomalies, metabolic disease and/or mental retardation were not included.

Chronic functional constipation was defined as painful and/or difficult elimination of hard stools for a period of at least 3 months associated or not with increased intervals between bowel movements, blood in the stools or soiling (5,14,15). Soiling was defined as the involuntary escape of liquid or semi-formed fecal matter into the underwear (4,10). Patients presenting soiling or less than three bowel movements per week were included in the study irrespective of the elimination of hard stools.

During the admission visit, instructions for the completion of a 72-h food record and a food frequency inquiry were provided. When necessary, rectal disimpaction was performed according to classical treatment (10,11). Mineral oil (Nujol®, Schering-Plough, Rio de Janeiro, RJ, Brazil) at a dose of 1 to 2 ml kg^{-1} day^{-1} was also prescribed.

A standardized dietary therapy was prescribed which took into account the nutritional requirements which were calculated according to the recommended daily allowance for each age group (16), and the patients' capacity for food intake. Diet therapy consisted of regular food normally found in the Brazilian diet and mothers were instructed to prepare several types of meals using different types of these foods. Dietary fiber content was arbitrarily established as follows: 9.0 to 11.9 g for patients aged less than 6 years and 12.0 to 18.0 g for patients older than 6 years, with the aim of reaching at least the minimum recommendation (age in years plus 5 g/day) for fiber intake proposed by the American Health Foundation (14). Fiber-based supplements were not prescribed. Clinical evaluations were scheduled at two-week intervals for mineral oil administration, reinforcement of dietary guidance and follow-up of clinical manifestations.

The anthropometric measurements, the 72-h food record, the food frequency inquiry and the evaluation of the clinical manifestations were repeated after 45 and 90 days of treatment.

Data on food intake obtained from the 72-h food records (15) were analyzed using software developed by the Department of Health Informatics of UNIFESP-EPM (17). The quantity of fiber was estimated using a table based on the methods of the Association of Official Analytical Chemists (18). The food frequency inquiry (19) was applied for the following foods: rice, beans, fruit, vegetables (greens and legumes), bread, and fruit juice.

The anthropometric variables were determined for each patient by one of the investigators (P.G.L.S.). Height was measured

to the nearest 1.0 mm on a vertical measuring rod (stadiometer). Weight was measured with the patient unclothed, using a scale that measured up to a maximum of 150 kg in intervals of 100 g. Triceps skinfold thickness was measured to the nearest 1.0 mm with a Lange skinfold caliper on the back of the arm midway between the acromial and olecranon processes with the arm relaxed. Skinfold thickness was measured three times and the mean of the three readings was recorded. The midarm circumference was measured to the nearest 1.0 mm with a nonstretch measuring tape (20,21). The midarm muscle area was calculated from the midarm circumference and triceps skinfold tickness (20). Weight and height were converted to Z scores (22) using the EPI-INFO software (23). Admission data were analyzed statistically by the Fisher exact test and Mann-Whitney test for comparison between patients who completed and who did not complete the 90-day follow-up. The Friedman test complemented by the multiple comparison procedure of Student-Newman-Keuls and the Cochran G-test were used for evaluation of variables at admission and at 45 and 90 days. Sigma Stat for Windows software was used for statistical analysis (24).

The experimental protocol was approved by the Ethics Committee of UNIFESP-EPM. Written consent was obtained from the parents before the patients were included in the study.

Results

Of the total of 25 children who were admitted to the study, 16 completed the follow-up at 90 days. During the first four weeks of treatment, most of the patients presented improvement of the constipation and the parents of seven patients requested that they be released from the follow-up. Two children moved to another city, making follow-up impossible. Table 1 shows the clinical features and anthropometric variables at admission of the 25 children who were enrolled in the study. The frequency of the various clinical manifestations and the body measurements were similar for children who did and did not complete the 90-day follow-up. Table 2 presents the dietary data. Upon admission, the patients who concluded the 90-day follow-up presented a significantly lower adequacy of calories and daily intake of food, protein and fiber than the children who did not complete the follow-up.

The 16 patients who concluded the 90-day follow-up presented a statistically significant reduction in the frequency of each of the clinical manifestations after both 45 and 90 days of treatment (Figure 1). After 90 days of treatment, 10 patients (62.5%) did not present any clinical manifestation of constipation. The other six patients (37.5%), who still had some symptoms of constipation, presented an evident clinical improve-

Table 1. Clinical features and anthropometric data at admission of patients who completed or did not complete the study.

	90-day follow-up	
	Yes (N = 16)	No (N = 9)
Age[1] (months)	56 (44; 100)	45 (35; 96)
Male/female[2]	4/12	5/4
Age at onset of constipation[1] (months)	6 (3; 12)	12 (4; 17)
Duration of constipation[1] (months)	41 (25; 61)	35 (25; 88)
Pain during defecation[2]	14 (87.5%)	8 (88.9%)
Defecation interval >3 days[2]	12 (75.0%)	5 (55.6%)
Hard stools[2]	13 (81.3%)	9 (100%)
Abdominal or rectal mass[2]	11 (68.8%)	7 (77.8%)
Soiling[2]	13 (81.3%)	9 (100%)
Weight for age[1] (Z score)	-0.52 (-1.46; +0.23)	-0.56 (-0.90; -0.20)
Weight for height[1] (Z score)	+0.14 (-0.50; +1.55)	-0.19 (-0.50; +0.01)
Height for age[1] (Z score)	-0.80 (-1.55; +0.30)	-0.46 (-0.55; -0.11)
Midarm circumference[1] (cm)	16.6 (15.1; 17.7)	15.3 (13.9; 17.7)
Triceps skinfold thickness[1] (mm)	8.5 (7.0; 9.5)	9.0 (7.0; 9.6)
Midarm muscle area[1] (cm^2)	14.4 (13.3; 16.0)	14.6 (13.2; 15.3)

Parameters with superscript 1 are reported as median, and 25th and 75th percentiles are given within parentheses. There were no statistically significant differences between groups by the Mann-Whitney test. Parameters with superscript 2 were not statistically different when groups were compared by the Fisher test.

ment in comparison to admission. Over the 90 days of treatment, the median dose of mineral oil actually consumed was 1.0 ml kg^{-1} day^{-1}. Mineral oil administration had already been stopped in three patients before the 90-day follow-up.

The anthropometric data at admission and at the 45- and 90-day follow-ups are presented in Table 3. No statistically significant variations were observed in weight, height or midarm muscle area. However, midarm circumference and triceps skinfold thickness demonstrated a statistically significant increase after 45 and 90 days of treatment.

Table 4 shows the results for food intake. During patient follow-up there was a trend to greater food, carbohydrate and energy intake compared to admission, although the differences were not statistically significant. However, the adequacy of energy and fiber intake in terms of the minimum recommendation (age in years + 5 g/day) was significantly increased after 90 days. Protein and fat intake also tended to increase but the difference was not statistically significant.

Figure 2 shows the food frequency at admission and at the 45- and 90-day follow-ups. Statistically significant increases in the

Table 2. Dietary data at admission of patients who completed or did not complete the study.

	90-day follow-up	
	Yes (N = 16)	No (N = 9)
Quantity of food (g/day)	838.0 (667.1; 1053.5)	1215.0* (880.3; 1503.7)
Energy (kcal/day)	971.6 (906.8; 1115.5)	1252.6 (1000.3; 1471.6)
Adequacy of calories (%)	55.5 (49.5; 62.5)	83.0* (74.2; 93.7)
Carbohydrate (g/day)	134.5 (121.0; 171.8)	177.0 (138.7; 208.2)
Protein (g/day)	43.0 (36.1; 52.1)	58.0* (44.5; 75.5)
Fat (g/day)	30.1 (27.5; 34.8)	37.0 (30.2; 38.7)
Adequacy of fiber intake according to the AHF recommendations (age in years + 5 g/day) (%)	46.0 (39.5; 84.5)	67.6* (49.4; 79.2)

Daily intake is reported as median, and 25th and 75th percentiles are given within parentheses.
AHF - American Health Foundation.
*P < 0.05 compared to patients who completed the study (Mann-Whitney test).

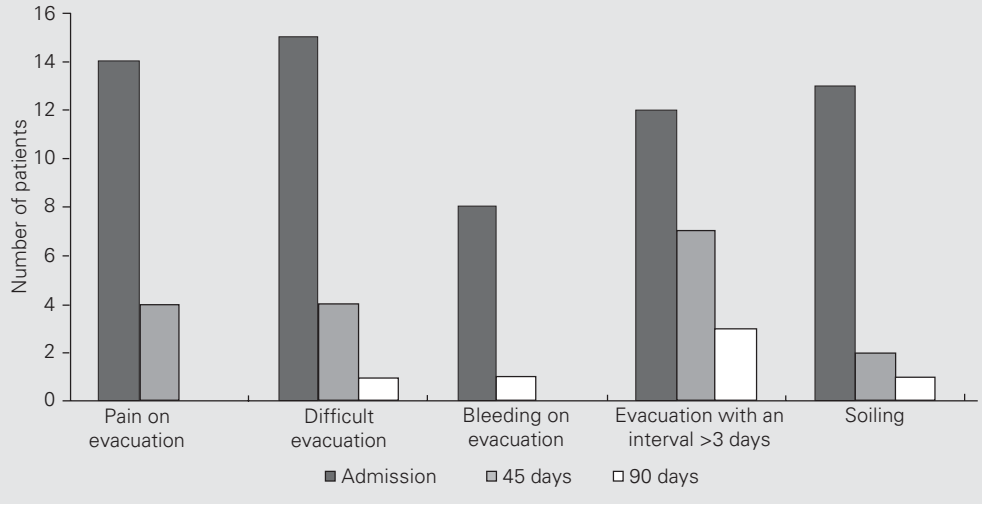

Figure 1. Clinical manifestations of the 16 patients at admission and at the 45- and 90-day follow-ups. P < 0.05 for all clinical manifestations on days 45 and 90 compared to admission (Cochran G-test).

Table 3. Anthropometric data during the treatment of 16 patients with chronic constipation.

	Day 0	Day 45	Day 90
Weight for age (Z score)	-0.52 (-1.46; +0.23)	-0.64 (-1.55; +0.52)	-0.16 (-1.30; +0.52)
Weight for height (Z score)	+0.14 (-0.50; +1.55)	-0.02 (-0.67; +1.30)	+0.56 (-0.73; +1.62)
Height for age (Z score)	-0.80 (-1.55; +0.30)	-0.67 (-1.28; +0.01)	-0.79 (-1.31; -0.02)
Midarm circumference (cm)*	16.6 (15.1; 17.6)	16.8 (15.6; 18.7)	16.8 (16.1; 18.2)
Triceps skinfold thickness (mm)**	8.5 (7.0; 9.5)	10.0 (8.0; 12.0)	11.0 (9.0; 12.5)
Midarm muscle area (cm^2)	14.4 (13.2; 16.0)	14.6 (12.7; 18.8)	14.3 (13.0; 16.4)

Data are reported as medians with 25th and 75th percentiles given within parentheses.
*Midarm circumference: $P < 0.05$, day 0 compared to day 45 and day 90.
**Triceps skinfold thickness: $P < 0.05$, day 0 compared to day 45 and day 90, and day 45 compared to day 90 (Student-Newman-Keuls test).
No other statistically significant differences were detected for the data in the table.

Table 4. Dietary data during the treatment of 16 patients with chronic constipation.

Daily intake	Day 0	Day 45	Day 90
Quantity of food (g/day)	838.0 (667.1; 1053.5)	936.6 (669.2; 1186.3)	1009.6 (728.6; 1411.8)
Energy (kcal/day)	971.6 (906.8; 1115.5)	1296.0 (1009.0; 1565.6)	1163.8 (876.1; 1600.2)
Adequacy of calories (%)*	55.5 (49.5; 62.5)	76.5 (63.5; 82.5)	68.5 (48.5; 82.5)
Carbohydrate (g/day)	134.5 (121.0; 171.8)	169.5 (127.5; 212.9)	160.0 (105.5; 221.5)
Protein (g/day)	43.0 (36.1; 52.1)	55.8 (45.3; 69.0)	56.8 (38.0; 70.7)
Fat (g/day)	30.1 (27.5; 34.8)	39.5 (30.3; 47.6)	33.3 (29.2; 56.2)
Adequacy of fiber intake according to AHF recommendations (%)**	46.8 (36.9; 63.4)	52.8 (50.4; 93.0)	56.3 (38.4; 101.3)

Data are reported as medians with 25th and 75th percentiles given within parentheses.
AHF - American Health Foundation.
*Adequacy of calories: $P < 0.05$ compared to day 45.
**Adequacy of fiber intake: $P < 0.05$, day 0 compared to day 45 and day 90 (Student-Newman-Keuls test).
No other statistically significant differences were detected for the data in the table.

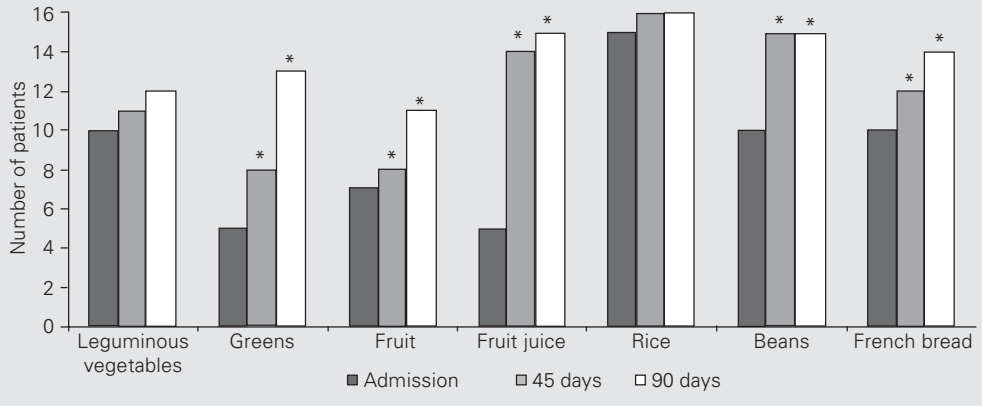

Figure 2. Food frequency of the 16 patients at admission and at the 45- and 90-day follow-ups. *$P < 0.05$ compared to admission (Cochran G-test).

frequency of intake of greens, fruit, fruit juice, beans and French bread in the diet were demonstrable by the Cochran G-test.

Discussion

The median age of the children admitted to the study was 49.7 months. The initial age for the onset of constipation corresponded to the first year of life in 21 of the 25 patients enrolled in the study (84%). The clinical features of our patients with chronic functional constipation were similar to those described in the literature (5,11) except for a predominance of girls. All 16 patients who were followed up to 90 days of treatment presented a marked improvement in clinical manifestations. Thus, the therapeutic program including rectal disimpaction, dietary intervention and ingestion of mineral oil yielded satisfactory results.

The dietary guidance for energy and dietary fiber intake was provided by a nutritionist who attended the patients at the outpatient clinic twice a month. This emphasis on diet therapy could explain why the patients who presented lower energy and fiber intake at admission completed the follow-up (Table 2), since this particular feature of the treatment may have increased family compliance. Patients who did not complete the follow-up presented less severe dietary abnormalities and their parents requested to be released from follow-up as soon as the patients showed improvement of constipation on the second or fourth week of treatment. The clinical severity of constipation at admission was similar in both the patients who completed and did not complete the 90-day period of follow-up (Table 1).

Upon admission, the 16 constipated patients who were followed up for 90 days presented low food intake, especially with respect to the median percentage of caloric adequacy which met only 55.5% of the recommended daily allowance. This agrees with literature data showing that chronic constipation may be accompanied by anorexia or a reduction in appetite (4-6,8). The dietary data revealed that the daily intake of energy and carbohydrates, caloric adequacy, and the quantity of foods ingested were increased during treatment. The dietary therapy consisted of foods which make up part of the normal Brazilian diet but which were not consumed frequently enough or in large enough quantities before the dietary guidance. An arbitrary dosage for fiber therapy was adopted in order to reach the recommendation of the American Health Foundation (age in years plus 5 g/day) (14). It is worth pointing out that no dietary fiber-based supplements, natural or manufactured, were added to the standardized dietary intervention. Despite the fact that most of the patients continued to have a fiber intake lower than the minimum recommendation (age + 5 g/day), they did consume a significantly higher percentage of fiber during treatment. The quality of the diets at the 45- and 90-day follow-ups had changed owing to the acquisition of the habit of eating high-fiber foods more frequently, mainly fruits and vegetables, although beans and bread also contributed to this change (Figure 2).

With respect to nutritional status, the variations in Z score for weight for height, weight for age or height for age did not change significantly. Nevertheless, a significant increase was detected in midarm circumference and triceps skinfold thickness, indicating a change in body composition. Previous studies have demonstrated that triceps skinfold thickness is a sensitive measure (25) which may identify small modifications in body fat prior to weight change. It should be pointed out that the present study is the first report in the literature in which the changes in nutritional status during the treatment of chronic functional constipation have been assessed, demonstrating an increase in midarm circumference and triceps skinfold thickness.

The present therapeutic program which

included rectal disimpaction, mineral oil and dietary therapy led to a satisfactory clinical outcome in this group of children with chronic functional constipation. Furthermore, the dietary therapy promoted a statistically significant increase in the intake of total dietary fiber, as well as in caloric adequacy. This increase in calorie intake may reflect the improved appetite of the children, which initially represented only 55% of the recommended daily allowance. Although weight or height did not present any statistically significant changes during follow-up, midarm circumference and triceps skinfold thickness were increased. Therefore, our results provided evidence that the increase in dietary fiber intake as a therapeutic approach to chronic constipation in children had no negative effect on nutritional status and that the successful treatment of chronic constipation was associated with increases in energy intake.

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