

# Dietary fiber intake for children and adolescents with chronic constipation: influence of mother or caretaker and relationship with overweight

*Consumo de fibra alimentar por crianças e adolescentes com constipação crônica: influência da mãe ou cuidadora e relação com excesso de peso*

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## ABSTRACT

**Objective:** To evaluate the influence of the mother or caretaker on the consumption of dietary fiber by children and adolescents with chronic constipation and its relationship with the occurrence of overweight.

**Methods:** This cross-sectional study enrolled 38 children and adolescents with functional constipation and their respective caretakers. A three-day food register was used for the analysis of the dietary fiber consumption. Weight and height were measured to verify the nutritional status. Familiar history of constipation was investigated.

**Results:** Most patients with constipation (89.5%; 34/38) presented insufficient fiber consumption (less than age+5g). Out of 38, only 1 (2.6%) caretaker presented fiber ingestion greater than the minimum recommendation (20g/day). Overweight was found in 11/38 (28.9%) patients and 23/38 (60.5%) caretakers. An association between overweight and the presence of constipation was verified among caretakers ( $p=0.046$ ). For female children and adolescents there was an association between overweight and lower fiber ingestion ( $p=0.011$ ). This association was not observed for male patients. The consumption of fiber by caretakers with overweight was lower than those without overweight ( $p=0.027$ ). There was correlation between the consumption of fiber in constipated children and their caretakers for male ( $r=+0.561$ ;  $p=0.005$ ) and female patients ( $r=+0.782$ ;  $p<0.001$ ).

**Conclusions:** There was a relationship between the consumption of dietary fiber by children and adolescents with chronic constipation and their caretakers. In females, the insufficient consumption of fiber was associated with overweight and with the presence of constipation.

**Key-words:** dietary fiber; constipation; overweight; child; adolescent; mother-child relations.

## RESUMO

**Objetivo:** Avaliar a influência da mãe ou da cuidadora sobre o consumo de fibra alimentar por crianças e adolescentes com constipação crônica bem como sua relação com a ocorrência de excesso de peso.

**Métodos:** Estudo transversal com 38 crianças e adolescentes com constipação funcional e suas respectivas cuidadoras. Para análise do consumo de fibra alimentar, foi utilizado o registro alimentar de três dias. Peso e estatura foram aferidos para verificar o estado nutricional. A história familiar de constipação foi investigada.

**Resultados:** A maioria dos pacientes com constipação (89,5%; 34/38) apresentava consumo insuficiente de fibra (inferior à idade +5g). Das 38 cuidadoras, apenas uma (2,6%) apresentou ingestão de fibra superior à recomendação mínima (20g/dia). Excesso de peso foi encontrado em 28,9% (11/38) dos pacientes e em 60,5% (23/38) das suas

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responsáveis. Associação entre excesso de peso e presença de constipação foi verificada entre as cuidadoras ( $p=0,046$ ). As crianças e adolescentes do sexo feminino com excesso de peso apresentaram menor ingestão de fibra, comparadas às sem excesso de peso ( $p=0,011$ ). Nos pacientes do sexo masculino, essa associação não foi observada. O consumo de fibra pelas cuidadoras com excesso de peso foi inferior ao das demais ( $p=0,027$ ). Observou-se correlação entre consumo de fibra pelas crianças com constipação e suas cuidadoras, nos sexos masculino ( $r=+0,561$ ;  $p=0,005$ ) e feminino ( $r=+0,782$ ;  $p<0,001$ ).

**Conclusões:** Observou-se relação entre o consumo de fibra alimentar por crianças e adolescentes com constipação crônica e suas respectivas cuidadoras. O consumo insuficiente de fibra associou-se ao excesso de peso e à presença de constipação no gênero feminino.

**Palavras-chave:** fibras na dieta; constipação intestinal; sobrepeso; criança; adolescente; relações mãe-filho.

## Introduction

The role of dietary fiber in the prevention and treatment of constipation is discussed with frequency by a number of authors. However, few studies have been published that assess the relationship between low dietary fiber intake and constipation within the pediatric population and those that do exist are relatively recent and their results are conflicting<sup>(1-5)</sup>.

The association between diets with low dietary fiber content and the incidence of overweight and obesity has also been the subject of recent studies<sup>(5-7)</sup>, with results highlighting the fact that this dietary profile generally goes hand-in-hand with other undesirable dietary habits. It has been observed that the tendency is for children's food preferences to lead them to consume foods containing high quantities of refined carbohydrates and fats and low levels of dietary fiber<sup>(8-10)</sup>. In turn, the home environment, parents' lifestyle and inter-family relationships can have a major influence on defining the food preferences of children and adolescents<sup>(8-10)</sup>.

On the basis of this possible parental influence on the dietary habits of their children<sup>(8,9)</sup> and in the light of the possibility of a relationship between insufficient dietary fiber intake and both intestinal constipation<sup>(2,4)</sup> and overweight<sup>(5-7)</sup>, the objective of this study was to investigate the influence of the dietary habits of mothers or carers on the dietary fiber

intake of children and adolescents with chronic constipation and the relationship between fiber intake and the incidence of overweight.

## Methods

This cross-sectional study recruited 38 patients aged 2 to 18 years, seen consecutively at the Intestinal Motility Clinic at the Pediatric Gastroenterology Department of the *Universidade Federal de São Paulo* (Unifesp). All patients met the Rome III criteria<sup>(11)</sup> for a diagnosis of chronic functional constipation.

One obligatory inclusion criterion was that all patients be accompanied by their mother or another adult responsible for them and who lived in the same home and was familiar with the patient's diet. All carers also underwent dietary assessment, irrespective of whether or not they had intestinal constipation.

Patients were excluded from the study if they had constipation of organic origin; if they had previously been instructed to change their diet in order to increase dietary fiber intake; if they had metabolic diseases; were breastfeeding; had pathologies that require special diets (for example, cow's milk allergy, celiac disease); their mother or carer was illiterate; or if permission to take part in the study was not given.

The research project was approved by the Research Ethics Committee at the *Universidade Federal de São Paulo* and free and informed consent forms were signed by parents or guardians.

A three-day food diary was used to estimate dietary fiber intake, both for the children and for their carers. They were requested to record all foods eaten for three consecutive days, two weekdays and one day during the weekend.

The mothers or carers were given a standardized form and were instructed on the correct way to record meals and the correct way to describe foods and quantify them with home measures (cups, etc.), being sure to also record the quantity of any food that was left uneaten (leftovers). Children suffering from fecaloma underwent rectal-colonic emptying before observations were made for the food diary, on the basis that fecal impaction could be associated with a reduced appetite<sup>(12)</sup>.

The dietary fiber content of the foods recorded were looked up in the *Tabela Brasileira de Composição de Alimentos* (TACO, Brazilian food composition table)<sup>(13)</sup> which is based on the methodology of the Association of Official

Agricultural Chemists (AOAC) in the United States<sup>(14)</sup>. Normal dietary fiber intake was calculated on the basis of the American Health Foundation recommendation for children over two, which sets the minimum daily dietary fiber intake in grams as age in years plus five (age + 5g)<sup>(15)</sup>. For adults, the recommended minimum daily dietary fiber intake for the Brazilian population of 20 grams was used<sup>(16)</sup>.

After analysis of the food diaries, children and/or carers who had insufficient dietary fiber intakes received instruction at the next clinical consultation. They were taught about the importance of a diet rich in dietary fiber and any other dietary errors that were observed were also explained. Emphasis was put on the importance of eating fiber not only for treating constipation but also for preventing other diseases prevalent in adulthood such as obesity and conditions of the colon.

Weight and height were measured in accordance with traditional recommendations, both for the adults and for the children and adolescents with constipation<sup>(17)</sup>. Epi-Info version 3.3.2 (2005)<sup>(18)</sup>, which uses weight and height figures from the National Center for Health Statistics (NCHS), was used to calculate the body mass index (BMI) of the children and adolescents for nutritional diagnosis. On the basis of BMI<sup>(19)</sup> and of the diagnostic criteria proposed by the World Health Organization<sup>(20)</sup>, overweight was defined as BMI above the 85th percentile of the reference standard, obesity as BMI above the 95th percentile and underweight was defined as BMI below the fifth percentile.

The carers were also assessed using BMI with the following cutoffs<sup>(20)</sup> underweight:  $BMI \leq 18.5 \text{ kg/m}^2$ ; normal weight:  $18.5 < BMI < 24.9 \text{ kg/m}^2$ , overweight:  $25.0 < BMI < 29.9 \text{ kg/m}^2$  and obesity:  $BMI \geq 30 \text{ kg/m}^2$ .

The prevalence of constipation among the patients' relatives was also evaluated. The adults were diagnosed with functional constipation if they exhibited at least one two of the following symptoms: effort and difficulty with evacuations, large caliber feces, feelings of incomplete evacuation, feelings of anorectal obstruction, less than 3 evacuations per week and/or evacuation rare without laxatives<sup>(21)</sup>.

Sample size was estimated on the basis of the expected correlation between the dietary fiber intakes of the child and their mother or carer. According to the sample size calculation module of Sigma Stat, at least 20 patients would be needed for a 5% alpha error, 80% power and a minimum correlation coefficient ( $r$ ) of 0.6.

Numerical variables are given as medians and 25th and 75th percentiles. Two independent groups were compared using the Mann-Whitney test where variables were continuous and the chi-square or Fisher's exact tests were used for categorical variables. Pearson's coefficient was used to describe the degree of correlation between the dietary fiber intakes of the children with chronic functional constipation and their carers' intakes. Sigma Stat version 3.1 was used to perform calculations and the cut off for rejection of the null hypothesis was set at 0.05, or 5%.

## Results

Forty-three patients with chronic functional constipation were initially enrolled on the study after meeting all inclusion criteria. However, five child-carer pairs were later excluded because they had not completed their food diaries correctly.

Twenty-three of the 38 children who completed the study were male (60.5%) and 15 (39.5%) were female. The median age at consultation was 7.0 years, varying from 3.0 to 11.0. With relation to age at onset of constipation, 23 (60.5%) had had symptoms since their first year of life, with 15 (39.5%) reporting constipation since birth. Thirty-one of the 38 patients had a family history of constipation (81.6%). Of these 31 family cases, in 18 cases only the mother had constipation (58.1%), siblings were constipated in 3 cases (9.7%) and in 1 case the father was constipated (3.2%). In nine (23.7%) of these cases the family history involved more than one family member and in one of these the mother had constipation.

Eleven of the patients were overweight (29.0%), 40.0% (6/15) of the boys and 21.7% (5/23) of the girls ( $p=0.390$ ). Three boys were underweight for height ( $BMI < P5$ , 7.9%). The remaining patients all had weight and height within the range of normality. Just four (10.5%) patients had a dietary fiber intake above the minimum recommended by the American Health Foundation (age + 5g). The median (25th and 75th percentiles) intake of the 38 children was 60.6% (43.3 and 85.2%) of the minimum recommended intake. There was no difference between the boys [6.91g (4.18 – 9.30)] and girls [6.52g (5.07 - 9.44)] in terms of dietary fiber intake in grams.

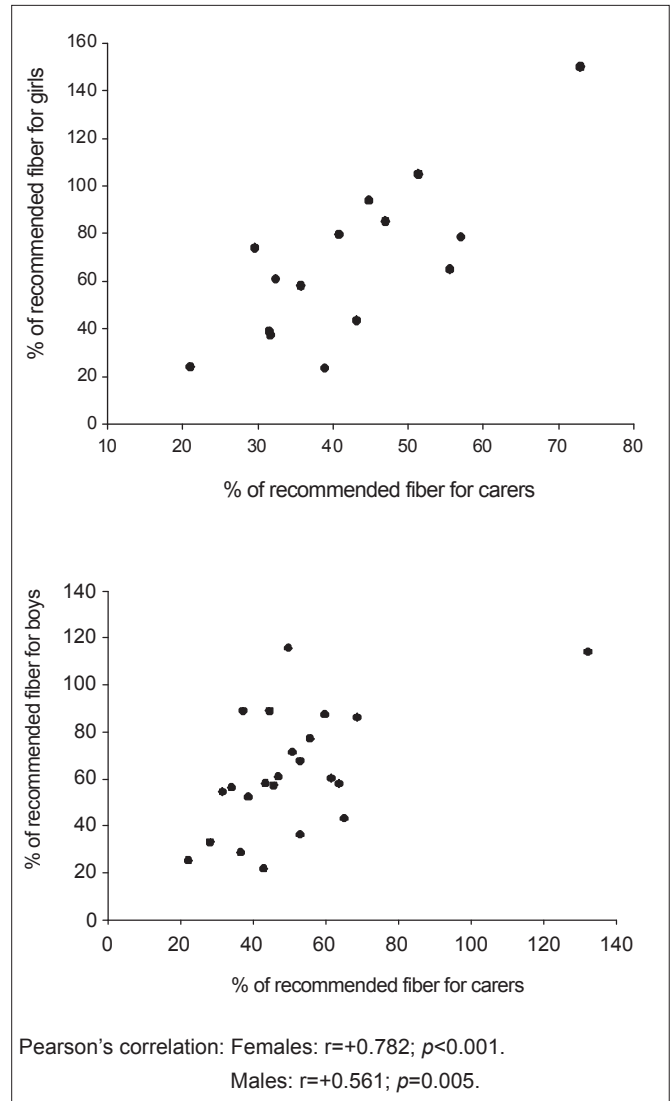
In 36 (94.8%) cases the carer was the mother, an aunt in one case (2.6%) and a grandmother in another (2.6%), i.e. all carers were female. The carers' nutritional status breaks down as follows: 23 (60.5%) were overweight or obese, 14 (36.9%)

had a healthy weight and one (2.6%) was underweight for her height (stature). Just one (2.6%) of the adults studied had a dietary fiber intake above the recommended minimum of 20g/day. Median dietary fiber intake for the carers was 8.9g/day (25th and 75th percentiles: 7.1 and 11.1), which is the equivalent of 44.6% (25th and 75th percentiles: 35.7% and 55.5%) of the minimum recommended. There was an association between constipation and overweight among the carers ( $p=0.046$ ), since 15 (65.2%) of the 23 who were overweight and 4 (26.7%) of the 15 who were not overweight had constipation.

Eight of the 11 overweight children (72.7%) had mothers who were also overweight and 15 (55.5%) of the 27 children with normal weight had overweight mothers. There was no association between overweight among the children and overweight among the mothers or carers (Fisher's test,  $p=0,272$ ).

There was a Pearson's coefficient ( $r$ ) of +0.782 for the correlation between percentage of recommended dietary fiber intake for the 15 pairs of female patients and their carers ( $p<0.001$ ). The coefficient for the correlation between the dietary fiber intake of the 23 male patients and their carers was +0.561 ( $p=0.005$ ). Figure 1 illustrates the distribution of these variables.

Table 1 shows the relationship between dietary fiber intake (expressed as a percentage of the recommended minimum) and presence or absence of overweight (overweight or obesity) among the constipation patients and their carers. Overweight constipated girls and overweight adults had lower dietary fiber intake than those who were not overweight ( $p=0.027$  and  $p=0.011$ ;  $p=0,011$  and  $p=0,027$ , respectively), which was not the case when overweight and not overweight constipated boys were compared ( $p=1.00$ ).



**Figure 1** – Correlation of percentage of minimum recommended dietary fiber intake of patients and their mothers or carers, by sex.

**Table 1** – Relationship between dietary fiber intake (expressed as percentage of recommended minimum intake) and overweight in patients with chronic functional constipation and their mothers or carers, by sex

	Overweight		p value*
	Yes	No	
Boys with constipation (n=23)	71.5% (31.1 – 86.9)	58.1% (52.3 – 77.2)	1.000
Girls with constipation (n=15)	38.2% (24.0 – 58.1)	79.6% (64.0 – 96.7)	0.011
Adults with or without constipation (n=38)	40.8% (32.8 – 46.4)	51.3% (45.8 – 60.9)	0.027

Values shown are medians and 25th and 75th percentiles (in brackets)

## Discussion

The majority of the constipated children enrolled on this study were male and a large proportion of the patients had chronic constipation with onset within the first two years of life, in common with the samples observed in other studies previously conducted at our clinic<sup>(2,12,22)</sup> and at other specialized services<sup>(1,23)</sup>.

In 2002, as part of the new Dietary References Intakes (DRIs)<sup>(24)</sup>, it was proposed that fiber intakes be based on the concept of total fiber, which is the sum of dietary fiber (both soluble and insoluble) and functional fiber. As mentioned earlier<sup>(5)</sup>, this recommendation can not yet be adhered to in clinical practice or in research, since there is no table that provides the total fiber content of foods (soluble + insoluble + functional). Therefore, for this study we adopted the minimum intake recommended by the American Health Foundation (age + 5)<sup>(15)</sup>. We estimated the quantity of fiber in the diet using a composition table for Brazilian foods (TACO)<sup>(13)</sup>, that is based on AOAC methods<sup>(14)</sup>.

We observed that 89.5% of the 38 patients studied had insufficient fiber intake. While this result is slightly greater, it does not contrast greatly with results observed at our clinic in other studies<sup>(2)</sup> or with results from a city in the Northeast of Brazil<sup>(4)</sup>. As has also been mentioned before, although this is a subject that is still under debate, some studies have observed an association between diets with insufficient levels of fiber and constipation<sup>(2,4)</sup>.

In this study, just 2.6% of the 38 carers had a fiber intake greater than 20g/day, and the median daily intake for the whole group was 8.9 grams. This figure value is below the median daily intake (20.2 grams/day) observed among adult women living in a city close to São Paulo<sup>(25)</sup>, which was practically the same as the recommended minimum for adult Brazilians. Such comparisons, however, must be made with caution because of the methodological differences between the two studies in terms of dietary fiber intake estimates.

The elevated frequencies of constipation observed among the relatives of the children in this study may be affected by genetic factors, however the possibility cannot be ruled out that dietary habits common to all family members play a part in defining intestinal habits<sup>(26)</sup>.

The prevalence of overweight (overweight + obesity) observed among the children with constipation was 29.0%, with no statistical difference between the sexes. This result is similar to the results of other studies<sup>(27,28)</sup> with consti-

pated children, which also observed high obesity prevalence rates (22.4 and 43.0%, respectively). Furthermore, 65.2% of overweight adult carers had constipation. One study that investigated the association between obesity and risk of gastrointestinal symptoms<sup>(29)</sup> observed a higher prevalence of constipation among overweight adults, but the difference in comparison with normal weight people did not attain statistical significance. The cause of this association between overweight and constipation remains unclear<sup>(27)</sup>. Consumption of foods with high energy density and low dietary fiber content<sup>(2)</sup>, little physical activity and hormonal changes are all factors supporting the existence of a relationship<sup>(27)</sup>.

In this study we observed that overweight girls and adults (women) had lower dietary fiber intakes, which was not observed among the male children and adolescents. The relationship between fiber intake and nutritional status was investigated in a study of adolescents from public and private schools in the city of São Paulo<sup>(5)</sup>, and an association between insufficient dietary fiber intake and overweight was observed in both sexes at public schools and among males only at the private schools. The same association has been observed by other authors<sup>(7)</sup>, but the relationship between overweight and low dietary fiber intake was only observed among female adolescents. Unsurprisingly, there is not yet a consensus in the literature on the influence of sex on the probable association between low dietary fiber intake and overweight.

Certain mechanisms appear to be involved in the beneficial effects of dietary fiber for body weight reduction: 1) dietary fiber may reduce the availability of energy and other nutrients in the diet; 2) the fiber may reduce the intake of other foods since by increasing production of saliva and gastric juices it encourages earlier satiety; 3) the fiber may reduce the small intestine's efficiency of absorption<sup>(6)</sup>.

In this study, we attempted to correlate patients' dietary fiber intake with the intake of their mothers or carers. Both among females and males we observed a correlation between the fiber intakes of children and their carers ( $r = +0.782$  for girls and  $r = +0.561$  for boys).

Members of the pediatric age group are highly dependent on the environment in which they live and which, in the majority of cases, constitutes their family. Their attitudes and habits are often reflections of this environment and, when unfavorable, the conditions may be present to encourage the development of eating disorders. Once these are established they can be self-perpetuating leading to nutritional disorders

such as, for example, obesity<sup>(9,10)</sup>. At the same time that the role of families in determining the dietary patterns of the younger generation appears to be well known necessary, questions remain about what influence parents are able to have on the dietary intake of their children, particularly with relation to certain foods such as fruit and vegetables and salads<sup>(8,30)</sup>.

On the basis of the results of this study it can be concluded that there is a relationship between the dietary fiber intake of patients with constipation and the intake of their carers, suggesting that children's dietary habits appear to be partially influenced by their mothers' dietary practices. A relationship was also observed between insufficient dietary fiber intake, constipation and overweight among the females.

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