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## Trabajo Original

Pediatría

### Eating habits, lifestyle and intestinal constipation in children aged four to seven years *Hábitos alimentarios, estilo de vida y estreñimiento intestinal en niños de cuatro a siete años*

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#### Abstract

**Objective:** to investigate the association between intestinal constipation, lifestyle and eating habits in four to seven year old children.

**Methods:** a cross-sectional study with a sample of 152 children aged four to seven years old. Intestinal constipation was characterized according to the Rome IV criteria. Excess weight was classified by the body mass index. Variables that could be associated with constipation, such as maternal constipation, lifestyle, food and water intake, were selected. In the analysis, the prevalence ratio using Poisson regression, with a robust variance and statistical significance was set at  $p < 0.05$ .

**Results:** the prevalence of intestinal constipation was 32.2% ( $n = 49$ ), of which 34.7% ( $n = 17$ ) of the children were overweight. As for lifestyle, 73% of the children did not practice any regular physical activities and approximately 60% spent more than two hours a day in sedentary activities, such as watching television or playing electronic games. A statistically significant association was found between constipation and daily school time equal to or greater than 4.5 hours ( $p = 0.007$ ), non-consumption of fruits ( $p = 0.003$ ) and greens ( $p = 0.007$ ) and regular intake of fried food ( $p = 0.003$ ).

**Conclusion:** an association between intestinal constipation and unhealthy habits, such as non-consumption of fruits and vegetables, and regular consumption of fried food was observed. Preventing intestinal constipation requires changes in the lifestyle and eating habits of the children and family.

#### Key words:

Constipation.  
Children. Eating habits. Lifestyle.

#### Resumen

**Objetivo:** investigar la asociación entre estreñimiento intestinal, estilo de vida y hábitos alimentarios en niños de cuatro a siete años.

**Métodos:** estudio transversal con muestra de 152 niños de cuatro a siete años. El estreñimiento intestinal se caracterizó según los criterios de Roma IV. El exceso de peso fue clasificado por el índice de masa corporal. Se seleccionaron variables que podrían estar asociadas al estreñimiento, como el estreñimiento materno, el estilo de vida, los hábitos alimentarios y el consumo de agua. En los análisis, la razón de prevalencia mediante regresión de Poisson con una varianza robusta y significación estadística se estableció  $< 0,05$ .

**Resultados:** la prevalencia de estreñimiento intestinal fue del 32,2%, de la cual el 34,7% presentaba un exceso de peso. En cuanto al estilo de vida, el 71% de los niños no practicaba actividad física regular y aproximadamente el 60% pasaba más de dos horas diarias realizando actividades sedentarias, como ver la televisión y jugar a videojuegos. Se pudo constatar una asociación estadísticamente significativa entre el estreñimiento y un tiempo diario en la escuela igual o superior a 4,5 horas ( $p = 0,007$ ), escaso consumo de frutas ( $p = 0,003$ ) y verduras ( $p = 0,007$ ) y consumo regular de frituras ( $p = 0,003$ ).

**Conclusiones:** se pudo observar una relación directa entre el estreñimiento intestinal y los hábitos no saludables, como no consumir frutas y verduras y el consumo regular de frituras. La prevención del estreñimiento intestinal requiere cambios en el estilo de vida y los hábitos alimentarios del niño y la familia.

#### Palabras clave:

Estreñimiento. Niños.  
Estilo de vida. Hábitos alimentarios.

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## INTRODUCTION

Functional intestinal constipation is characterized by the combination of intestinal symptoms such as infrequent, painful bowel movement related to the presence of fecal incontinence or stool retention (1,2). Its etiology is multifactorial (1,3,4), involving familial predisposition, eating habits and lifestyle (1,2). Nowadays, constipation is a regular complaint in infant population (2,5), with a wide global prevalence varying from 0.7 to 29.6% (4) in most cases, appearing in the first years of life, though it is more diagnosed among school age children (6). Due to this high prevalence, it presents a challenge to patients, families and healthcare professionals (1,3).

The initial symptoms of constipation may go unnoticed and, though having a simple treatment, if not recognized or treated properly, it can lead to further complications and influence negatively the quality of life of the kid and their family (3,6). In addition, complications from constipation can result in high expenses to the comprehensive health system and, because of that, it has been considered as a public health issue (1,4).

The fluctuation of prevalence among studies occurs on account of the different criteria applied in the diagnosis (1,6). The current recommended guideline to the evaluation and diagnosis of functional constipation in children and adolescents is the Roma IV criteria (7).

Regarding the causes, some authors assign intestinal constipation to inappropriate eating habits such as low fruits and greens intake (8-10), frequent fast food (11) consumption and low fluid intake (5,9,10). In addition, recent studies have shown that lifestyle (10,11) like sedentarism (10) and school environment (many hours seated at school, school stress) (5,9,11) are also factors that contribute to the development of infant constipation. This is due to the fact that researches have shown high prevalence rates of overweight in children with constipation (12,13) and, since lifestyle and feeding are factors that contribute to overweight during childhood, they are thus related to constipation, even though this association seems controversial.

Considering the clinical importance and the impact intestinal constipation can cause during childhood, the present study aims to investigate the association between intestinal constipation, lifestyle and eating habits among children from four to seven years of age.

## METHODS

It is a cross-sectional study with children belonging to a retrospective birth cohort in Viçosa, Minas Gerais (MG). The children were monitored by the PROLAC (Programa de Apoio à Lactação) during their first year and were remeasured at the ages of four to seven years. PROLAC is an extension program from the Federal University of Viçosa (UFV) in partnership with the city's Human Milk Bank and the maternity hospital, being the only one in the region (14).

The data collection took place in 2015 and 2016 at the Federal University of Viçosa Health Division and was made by

graduate and undergraduate Nutrition students, properly trained in advance.

The children were recruited based on the selection of PROLAC care records according to the following inclusion criteria: presence of identification data that could help in locating the children and compatible birth date with the ages of four to seven years at the moment of the study ( $n = 298$ ). Sample size was calculated using OpenEpi software version 3.01, considering the analysis of recent studies on the average prevalence of constipation in children (1,4,7), the sample was calculated based on the prevalence of 15%, error tolerance of 5%, 95% CI, significance level of 5% and estimated loss of 30%, resulting in calculation of 155 children. Thus, the final sample was 152 children. Children which presented endocrine and neurological disorders and intestinal abnormalities were not included in this study.

The presence of functional intestinal constipation was identified according to Roma IV criteria (7). Constipation symptoms involve a low frequency of bowel movements ( $\leq 2$  times per week), episodes of fecal incontinence, history of stool retention, painful or difficult evacuations, presence of large diameter stools in the rectum and elimination of thick diameter stools that can clog the toilet seat. Constipation was considered upon the filling of at least two of the present symptoms in a space of one month and a frequency of once a week. Also, the Bristol Stool Form Scale was used to verify the characteristics of the stools (15,16).

The shape of the stools gets modified at many intestinal disorders, constipation being one of them (17). The scale classifies them in seven categories, ranging from hard (1,2), normal (3-5) and soft stools (6,7) (18). The presence of maternal constipation was verified according to Roma criteria for adults (19).

With regard to lifestyle, the following variables were considered: regular physical activity practice (yes/no), screen time (20), hours spent at school, number of meals per day and time spent in sedentary activities (playing with toy cars, dolls, play house, among others, or doing homework seated) and non-sedentary activities (riding a bike, playing with the ball, running, and other things). The listed variables were categorized according to the average found in the studied population. Nowadays, the use of screen time is being described as a label to sedentary behavior in children and adolescents (20).

The food intake was measured through the application of an intake frequency list of 20 types of food, comprehending the usual frequency, and the results for each food item were: the food consumed by the children during the week (and the number of times) and during the month (and the number of times), foods rarely consumed and foods not consumed. For the analysis, ten healthy and non-healthy types of food were selected, according to the healthy eating labels classification (21). The analyzed healthy foods were: fruits, greens (exclusion of starchy roots and tubers), vegetables, legumes and milk; and the non-healthy food were: sweetened beverages (soft drinks and artificial juices), goodies (candies, bubble gums and sweets), fried food, sausages (hot dog, sausage and ham) and chocolate milks.

In this study, a frequency of five or more times in a week was considered as a regular intake, according to Levy *et al.* (21).

In addition, the number of meals done during a day by the child was verified taking into account the following options: breakfast, morning snack, lunch, afternoon snack, dinner and evening snack. The categorization was made according to the average value (five meals) of the variable among the studied population. As for the child's intake of water, the average daily intake of water was considered based on the measure of a 200 ml glass.

During the anthropometric evaluation of the children, their body weight and height were measured (14). The excess weight was considered as score- $z +1$  (22), according to IMC/age (IMC/A), as determined by the World Health Organization (WHO). In the statistical analysis, the variables normality was evaluated through the Shapiro-Wilk test, while the descriptive analysis of the data was done through frequency distribution measures of central tendency and dispersion. The Student's  $t$  test and Chi-square test were applied to compare the variables between the two groups of intestinal constipation. In the bivariate analysis, gross prevalence ratios (PRs) and confidence interval (CI 95%) were estimated following the Poisson regression, in which the variables presenting  $p < 0.20$  were considered to be included in the multiple model with robust variance. Lastly, statistical analysis was made using the software Stata version 13.0; the considered statistical significance was  $p < 0.05$ .

This work was approved by the Ethics Committee on Human Research of UFV (892.476/2014). All people held responsible for the children received and signed an informed consent form to take part in the research.

## RESULTS

The prevalence of intestinal constipation was 32.2%. In the group of children with constipation, 53.1% were female and 46.9% were male. The prevalence of overweight was of 34.7% in the children suffering from constipation and 23.3% in the children that did not present the disorder (Table I).

It was found that a school length time equal or greater than 4.5 hours daily was associated to the presence of intestinal constipation ( $p = 0.001$ ). As for lifestyle, 73% of the children did not practice any regular physical activities and approximately 60% spent more than two hours a day in sedentary activities such as watching television or playing electronic games (Table I).

As for the constipation symptoms, according to the Roma IV criteria, the research revealed that 79.6% of the children with constipation had difficulty to evacuate, 57.1% had pain and their stools were of great diameter with retention traits. The analysis of the stools according to the Bristol scale showed that, among the children with constipation, 40.8% presented stools of types 1 and 2, 51% presented type 3 and 8.2% presented type 4. Regarding the usage of laxatives, 26.5% had already made use of them for stool clearance. There was no association between maternal constipation, evacuation frequency and constipation in the child.

With regard to water intake, an association between a daily intake lower than 600 ml and constipation was observed ( $p = 0.028$ ). As for the eating habits, it was verified that the non-con-

sumption of fruits ( $p < 0.05$ ) and greens ( $p = 0.005$ ) in contrast to the regular consumption of fried food ( $p = 0.011$ ) can contribute to having constipation (Table II).

After adjusting the gender and age variables, time equal or greater than 4.5 hours daily at school (OR = 2.25; CI 95% = 1.25-4.05), non-consumption of fruits (OR = 2.03; CI 95% = 1.27-3.22) and greens (OR = 1.80; CI 95% = 1.17-2.76) and regular consumption of fried food (OR = 2.62; CI 95% = 1.38-4.99) were associated to constipation (Table III).

## DISCUSSION

In the present study, a high prevalence of intestinal constipation was found (32.2%). This result was similar to the prevalence observed in researches done in Brazil (6,23) and higher than the one found in studies carried out in Colombia (9), Hong Kong (11), Japan (2) and Korea (5).

It was learned that the children whose time at school was equal or greater than 4.5 hours daily also presented higher prevalences of constipation. Besides, when evaluating the children's food intake, it was found that it is associated to intestinal constipation. This is affirmed by the fact that the children who did not consume fruits and greens but had a regular consumption of fried food were the ones to present the higher prevalences of constipation. Therefore, besides contributing to the development of obesity (19), non-healthy eating habits are considered as one of the factors that lead to constipation in children (1). As a strategy for sickness prevention, the stimulus to consume healthy food like fruits, greens and vegetables has become a priority in public health (24,25).

Asakura et al. (2), in a study with five to six year old Japanese children, verified that the increase in fibers, fruits, greens and vegetables consumption in nutrition was associated with a lower prevalence of constipation. In the study by Chien et al. (10) about low defecation frequency, diet, lifestyle and sedentarism in children and adolescents from seven to 12 years, the authors identified that the sedentary lifestyle and the low consumption of liquids, vegetables, fruits and whole grain were associated to the risk of a lower defecation frequency.

Regarding the intake of water, it is worth highlighting that there is a struggle to measure it, and its association with constipation in studies with children is still controversial (26). In this study, the daily intake of water lower than 600 ml was related to constipation in the bivariate analysis, but this association was not kept in the final regression model. In the study by Chan et al. (9), the authors verified that the intake of three to four glasses of liquids (200 ml/glass) contributes to a lower occurrence probability of constipation in children, while in the study by Park et al. (5), it was observed that the daily water intake of 500 ml or less was a predictor of intestinal constipation in children.

As regards the intake of non-healthy food, this study verified a high frequency in the regular intake of goodies, sweetened beverages, chocolate milks and fried food. However, only the regular intake of fried food remained in the final model associated with constipation. Other studies have also found an association

**Table I.** Prevalence of intestinal constipation and gross prevalence ratios according to variables like lifestyle and nutritional status of children from four to seven years of age

Variable	Total (%) n = 152	Constipation		p*	Gross PR (95% CI)	p†
		Yes n = 49	No n = 103			
Age	5.9 ± 0.95	6.0 ± 0.12	5.9 ± 0.09	0.867	-	
<i>Gender</i>						
Male	83 (54.6)	23 (46.9)	60 (58.3)	0.190	1	
Female	69 (45.4)	26 (53.1)	43 (41.7)		1.35 (0.85-2.16)	0.193
<i>Regular practice of PA</i>						
Yes	43 (28.3)	13 (26.5)	30 (29.1)	0.740	-	
No	109 (71.7)	36 (73.5)	73 (70.9)			
<i>Screen time</i>						
< 3	60 (39.5)	21 (42.9)	64 (62.1)	0.556	0.86 (0.54-1.38)	0.555
≥ 3	92 (60.5)	28 (57.14)	39 (37.8)			
<i>Hours at school</i>						
< 4.5	70 (46.0)	13 (26.5)	57 (55.3)	0.001	1	
≥ 4.5	82 (54.0)	36 (73.5)	46 (44.7)		2.44 (1.35-4.41)	0.003
<i>Meals/day</i>						
< 5	36 (23.7)	11 (22.4)	25 (24.2)	0.805	-	-
≥ 5	116 (76.3)	38 (77.6)	78 (75.7)			
<i>Sedentary activities</i>						
< 4	59 (38.8)	20 (40.8)	39 (37.9)	0.727	-	-
≥ 4	93 (61.2)	29 (59.2)	64 (62.1)			
<i>Sedentary activities no.</i>						
< 2	82 (54.0)	27 (55.1)	55 (53.4)	0.844	0.64 (0.36-1.12)	0.121
≥ 2	70 (46.0)	22 (44.9)	48 (46.6)		1	
<i>Constipation mom</i>						
Yes	46 (31.0)	13 (27.6)	33 (32.6)	0.540	-	-
No	102 (69.0)	34 (72.4)	68 (67.4)			
<i>IMC/I</i>						
Overweight	40 (26.3)	17 (34.7)	23 (22.3)	0.106	1.48 (0.93-2.37)	0.095
No overweight	112 (73.7)	32 (65.3)	80 (77.7)		1	

Practice of PA: regular practice of physical activity; PR: prevalence ratio; CI: confidence interval. \*Student's t test or Chi-square test. †Poisson regression.

between the intake of fried food, including fast food, and constipation (10,26). Apart from these researches, others latest studies have also shown that there is a relation between diet, sedentary behavior and constipation in children and adolescents (10,27).

In terms of lifestyle, it was observed that about 60% of children presented sedentary behavior, which can be explained to some extent by the time spent in front of the television and other electronic devices (computer, tablets, cell phones and videogames) for a period greater than three hours a day, and the time expended to sedentary activities. However, association with constipation was not verified. Yet, the results are worrying, because, according to the American Academy of Pediatrics (28), children should watch

television no more than two hours daily. Besides, the WHO, aiming at the prevention of obesity in children and adolescents, proposes other practices, like the development of an active lifestyle with restrictions to the period destined to the screen time (29).

In this context, previous studies (30,31) have already shown the association between sedentary behavior and the adverse effects to the health of children and adolescents, mainly regarding overweight. However, studies that evaluate the relation of intestinal constipation in children with sedentary behavior and lifestyle are scarce (10,11).

With respect to overweight, it is important to note that 34.7% of the children with constipation presented overweight.

**Table II.** Prevalence of intestinal constipation and gross prevalence ratios according to the food consumption frequency and water intake in children from four to seven years of age

Variable	Constipation		p*	Gross PR (95% CI)	p†
	Yes n = 49	No n = 103			
<i>Water</i>					
< 600ml	19 (42.2)	22 (23.9)	0.028	1.71 (1.07-2.72)	0.024
≥ 600 ml	26 (57.7)	70 (76.1)		1	
<i>Fruits</i>					
No consumption	04 (8.2)	01 (01.0)	0.053	2.61 (1.58-4.32)	< 0.001
< 5 days	20 (40.8)	39 (37.8)		1.32 (0.83-2.09)	0.237
≥ 5 days	25 (51.0)	63 (61.2)		1	
<i>Greens</i>					
No consumption	11 (22.5)	06 (05.8)	0.005	2.29 (1.47-3.58)	< 0.001
< 5 days	15 (30.6)	49 (47.6)		0.99 (0.62-1.57)	0.969
≥ 5 days	23 (46.9)	48 (46.6)		1	
<i>Vegetables</i>					
No consumption	05 (10.2)	05 (04.9)	0.348	-	-
< 5 days	15 (30.6)	40 (38.8)			
≥ 5 days	29 (59.2)	58 (56.3)			
<i>Legumes</i>					
No consumption	02 (04.1)	01 (01.0)	0.268	-	-
< 5 days	02 (04.1)	09 (08.7)			
≥ 5 days	45 (91.8)	93 (90.3)			
<i>Milk</i>					
No consumption	01 (2.1)	03 (2.9)	0.484	-	-
< 5 days	08 (16.3)	10 (9.7)			
≥ 5 days	40 (81.6)	90 (87.3)			
<i>Goodies‡</i>					
Yes	11 (22.4)	22 (21.3)	0.879	-	-
No	38 (77.5)	81 (78.7)			
<i>Sweetened beverages‡</i>					
Yes	17 (34.7)	36 (34.9)	0.975	0.99 (0.61-1.61)	0.975
No	32 (65.3)	67 (65.1)			
<i>Fried food‡</i>					
Yes	03 (6.0)	-	0.011	3.23 (2.54-4.12)	< 0.001
No	46 (93.8)	103 (100.0)		1	
<i>Sausages‡</i>					
Yes	03 (6.0)	03 (2.9)	0.342		
No	46 (93.8)	100 (97.1)			
<i>Chocolate milk‡</i>					
Yes	30 (61.2)	47 (45.6)	0.072	1.53 (0.95-2.48)	0.079
No	19 (38.8)	56 (54.4)		1	

PR: prevalence ratio; CI: confidence interval. Water intake/day: maximum percentage of unknown observations 9.86% (n = 15). \*Chi-square test. †Poisson regression.  
‡Non-healthy food regular consumption (≥ 5 days).

**Table III.** Final model of the Poisson regression analysis with the factors associated with intestinal constipation in children from four to seven years of age

Variables	Adjusted PR	95% CI	Value p*
<i>Hours at school</i>			
< 4.5	-	-	
≥ 4.5	2.25	1.25-4.05	0.007
<i>Fried food</i>			
Yes	2.62	1.38-4.99	0.003
No	-	-	-
<i>Fruits</i>			
Yes	-		
No	2.03	1.27-3.22	0.003
<i>Greens</i>			
Yes	-		
No	1.80	1.17-2.76	0.007

PR: prevalence ratio; CI: confidence interval. Model adjustment: goodness of fit = 0.99. Adjusted per gender and age. \*Multivariate Poisson regression with robust variance.

And though this study did not show a significant association between the nutritional status and intestinal constipation, the rate of overweight is similar to the proven by Kavehmanesh et al. (32), who also identified a high rate of overweight (33%) in children with constipation. Supporting these results, Mello et al. (12) had noted in their study that 29% of the children and adolescents with constipation presented overweight. The association between overweight and constipation in children is still controversial, probably because there are differences in prevalence in the studies, like the pattern, the size of the sample, the methodology and the used diagnostic criteria (33).

Regarding the time that the child stays at school, the occurrence of a relation between constipation and time equal or greater than 4.5 hours was verified, being the prevalence of constipation 2.25 times greater. Long hours of permanence at school, on the account of the environment itself and the limitations related to the usage of the bathroom to evacuate, is associated to constipation and can contribute to the process of stool retention (5,9,11). Another important issue was the high intake of chocolate milks, sausages and fried food by children. These types of food are usually components of the school feeding and are caloric, having high levels of sugar and fat, and are also poor in dietary fibers; thus, they can contribute to the development of constipation (26).

Evaluating the stools characteristics can assist in the identification of the alteration in bowel movements: the use of the Bristol Stool Form Scale jointly with the Roma criteria (15) collaborated to the acquisition of more accurate data in the investigation of constipation symptoms (8). Therefore, the use of the scale to evaluate the stools contributes to the diagnosis and monitoring of infant constipation (10,17). In the present study, it was observed, according

to the Bristol scale, that only 8.2% of the children with constipation presented soft stools (type 4). The child with intestinal constipation presents a vicious cycle that starts with painful defecation and can lead to stool retention behavior and fecal incontinence (5,11).

Feeding practices can influence the emergence of the infant constipation, and families and mainly the mothers have an important role on the children's eating habits (12,27). The high constipation frequency observed in relatives of children with intestinal constipation can be a result of genetic factors and specific eating habits which are common among the members of the family, thus suggesting that the diet followed by the family can cause symptoms origin (27). The prevalence of maternal constipation observed in this study was high (31%), though an association with the constipation in the child was not observed. This result is similar to the one noted by Olaru et al. (27), who also found a high prevalence of positive family history while evaluating risk factors in 4-18 year old children in Romania. As for positive maternal family history, previous studies emphasized the positive association between maternal constipation and the constipation in children (5).

Even though the obtained results in the present study show similarities with international studies relating to factors associated with constipation, like lifestyle (hours spent at school), water intake and consumption of fried food, until this moment there are no studies in Brazil that make the comparison with these factors possible. Besides, caution is necessary while establishing a direct causal relationship with constipation, due to the study design.

Finally, the analysis of food consumption by labels of feeding is a practical method that makes the verification of the intake of healthy and non-healthy food possible, aside from allowing the identification of eating habits. Despite the positive aspects, the food consumption evaluated by means of an eating frequency survey can lead to an understatement and/or overestimation of food consumption, having to be previously oriented before its application, in order to reduce recall bias.

According to the results, it was verified that non-healthy eating habits, like the non-consumption of fruits and greens and the regular consumption of fried food, can contribute to the development of constipation. Moreover, factors related to lifestyle and sedentary behavior are important elements to be investigated while evaluating the intestinal constipation in children. Therefore, actions are suggested in schools involving nutritional education that encourage the practice of healthy feeding embracing the family, since the prevention of intestinal constipation requires changes in the lifestyle from both the child and their family.

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