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## FUNCTIONAL CONSTIPATION IN ADOLESCENTS: ASSOCIATION WITH BEHAVIORS RELATED TO HEALTH AND PHYSICAL APTITUDE

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### ABSTRACT

The aim of this study was to estimate the prevalence of functional constipation in adolescents and to analyze associations with behaviors related to health and physical aptitude. Cross-sectional and analytical study, with adolescents from public schools. Constipation was investigated using the Rome III criteria. Adolescents were assessed for demographic factors, health-related behaviors and physical aptitude. After bivariate analysis, associated variables up to a level of 25% ( $p \leq 0.25$ ) were analyzed jointly, through logistic regression, with an assumed final significance level of 5% ( $p \leq 0.05$ ). In the final model, the variables that were associated with functional constipation were inadequate consumption of food sources of dietary fiber (OR = 2.28; 95% CI = 1.89-2.76), sedentary behavior (OR = 1.30; 95% CI = 1.09-1.58), not actively participating in physical education classes (OR = 2.94; 95% CI = 2.54-3.40), overweight (OR = 1.36; 95% CI = 1.17-1.60) and be in the risk zone for abdominal resistance (OR = 1.38; 95% CI = 1.19-1.60). The adoption of healthy life habits, with regular consumption of fibers, reduction of sedentary behavior, regular practice of physical activity and weight control, can be useful in the prevention and management of functional constipation in adolescents.

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## INTRODUÇÃO

Functional constipation (FC) is an important health problem worldwide [1-3], affecting all ages, with prevalence ranging from 0.5% to 32.2% in children and adolescents [4]. The pathophysiology of constipation is complex and multifactorial, with research focused on

environmental factors, behavioral problems and genetic predisposition [4, 5]. It exhibits a chronic pattern of evolution in children, which can extend into adolescence and adulthood [5,6]. In adolescence, FC symptoms are difficult to recognize or are diagnosed late [7]. The adolescent feels embarrassed to discuss his bowel habit or simply ignores the fact that his defecation habits may not be considered normal [7]. FC is often associated with infrequent and / or

painful defecation, fecal incontinence and abdominal pain occasioning a negative impact on quality of life [8, 9], causing distress to the adolescent and the family, decreased school performance and social interactions [8, 10]. It represents a frequent reason for medical appointments, constantly requiring hospital care and increased spending on health [9, 11]. Few studies have demonstrated the role of sedentary behavior, defined by the time of activities performed in the sitting or lying position with minimal energy expenditure [12, 13], as a factor associated with FC in adolescents [7, 14]. Although some authors have evaluated the relationship between FC and physical activity [7, 14], no studies evaluating the association between physical aptitude and FC in adolescents have also been identified. Health-related physical aptitude is composed of cardiorespiratory aptitude, abdominal resistance, flexibility and body composition [15]. Satisfactory levels of physical aptitude can favor the improvement of functional capacity and reduce the likelihood of the development of chronic-degenerative disorders [15]. FC Development is related to several factors throughout life. Previous studies of the relationship between FC and eating habits, obesity and physical activity have produced inconsistent results [4, 16-19]. The identification of modifiable factors related to FC is necessary to assist in prevention, diagnosis and early treatment [9]. This study aimed to estimate the prevalence of functional constipation in adolescents and to analyze associations with behaviors related to health and physical aptitude.

## METHODS

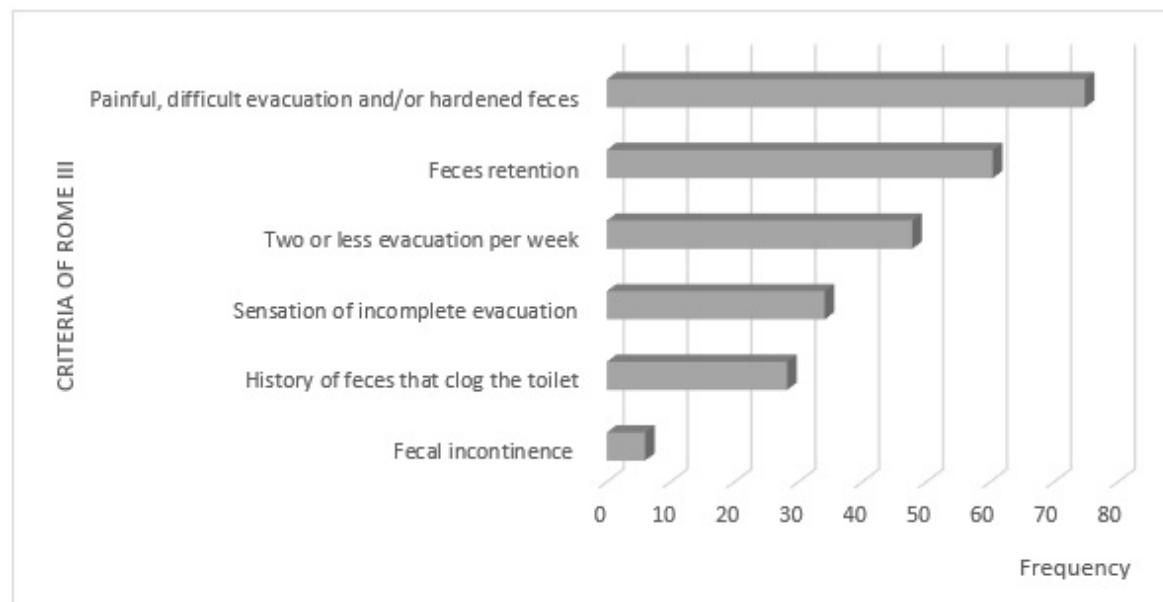
This is a cross-sectional and analytical study with adolescents, students of the second cycle of elementary education in public schools, carried out in 2017. The sampling was probabilistic, by clusters in two stages. Initially, schools were drawn by probability proportional to the sample size. Then, classes were selected by simple random sampling, proportional to the number of students enrolled in each school. In the selected classes all students were eligible for study. Adolescents with debilitating chronic diseases (declared by the adolescents themselves, parents or teachers) were excluded from the sample. For logistical reasons, schools in the rural area were excluded, and those in which they did not have all the years / complete grades. The sample size was calculated considering the following parameters: estimated prevalence of 12.0%, confidence level of 95% and margin of error of 3%, and correction for the design effect (*deff*) equal to two, which defined a minimum sample number of 844 adolescents. Prior to data collection, training of evaluators was carried out and then a pilot study, allowing adjustments in the physical tests related to the application order. FC was investigated according to the Rome III criteria, developed based on published evidence and by consensus among gastroenterologists, to diagnose functional gastrointestinal disorders (including constipation, considered the most common disorder in adolescence) [20]. The Pediatric Gastrointestinal Symptoms Questionnaire - Rome III (QPGS-RIII) is an instrument with applicability in clinical practice and proven efficacy for research purposes [20]. It is a self-administered tool, consisting of multiple choice questions, which encompass specific behavioral aspects of the FC condition and the characteristics of the adolescents intestinal habits, in a total of six criteria: (1) painful, difficult evacuation and/or hardened feces; (2) feces retention at least once a week or more frequently; (3) two or less evacuation per week; (4) feeling of incomplete evacuation; (5) history of large diameter feces that clog the toilet; (6) fecal incontinence, at least one episode per week or more frequently. The presence of two or more of these criteria, in the last two months, characterized the existence of FC [21].

Structured instruments were used for independent variables to collect demographic factors and health-related behaviors. Demographic factors included age group ( $\leq 12$  and  $\geq 13$  years) and sex (male and female). Variables related to health-related behaviors were: consumption of food sources of dietary fiber (adequate and inadequate), sedentary behavior (yes and no) and active participation in physical education classes (yes and no). The consumption of fiber-based foods was estimated by assessing the weekly frequency of

consumption of fruits and vegetables. The questionnaire applied was based on the National School Health Survey [22]. The frequency of consumption of at least one of these food groups in five days or more in the week was used as a diagnostic parameter for adequate consumption of food sources of dietary fiber. The practice of active activity in physical education classes was assessed using the following closed question: "In the last seven days, during physical education classes, how active were you (played intensely, ran, jumped and shot)?" Considering as active participation the response alternatives: "frequently" and "always"; and no active participation in the alternatives: "I don't take classes", "rarely" and "sometimes". Sedentary behavior was obtained through the following open question: On average, how many hours per day do you watch television, use a computer, cell phone, tablet and / or play video games? Excessive sedentary behavior was considered to be the time of exposure to the screen greater than 2h / day [12]. Adolescents were also assessed for health-related physical aptitude (HRPA), and consisted of analyzes of cardiorespiratory aptitude, abdominal resistance and body composition [15]. Physical tests and anthropometric assessments were carried out, following standards used by Brazil Sport Project (PROESP-BR), which is a system for evaluating the HRPA of children and adolescents in the field of physical education and educational sport [15]. For the cardiorespiratory aptitude test (6-minute running / walking test), the teenager was instructed to walk the longest distance possible, in a flat court with a known perimeter, avoiding speed peaks interspersed with long walks. During the test, they were informed of the passage of time at two, four and five minutes. After completing six minutes of testing, the distance covered in meters was recorded. The cutoff points for the classification in health risk zone and healthy zone were based on PROESP-BR [15]. The information produced from the BMI calculation, [weight (kg) / height (m<sup>2</sup>)], was used as indicators of body composition, according to the percentiles recommended by the World Health Organization [23]. The adolescents were weighed, wearing light clothing and barefoot, on a portable scale, Omron brand® (HBF514C, Tokyo, Japan), with 0.1 kg precision. Height was measured with a portable stadiometer, accurate to 0.1 cm. For purposes of analysis, body composition was categorized as: not overweight (marked thinness, thinness and eutrophy) and overweight (overweight, obesity and severe obesity). For the abdominal resistance test (number of sit-ups in one minute), the student was placed in the supine position on a mat with knees flexed at 45 degrees and with arms crossed over the chest. Upon receiving a signal, the student started flexing his torso until he touched his thighs with his elbows for one minute. According to PROESP-BR, the teenager was classified as being in a health risk zone or in a healthy zone [15]. The analyzes were performed using the Statistical Package for the Social Science (SPSS) version 21.0 software. To incorporate the structure of the complex sample plan in the statistical analysis of the data, each respondent was associated with a weight *w*, which corresponded to the inverse of their probability of inclusion in the sample (*f*). Bivariate analyzes were performed using the chi-square test and variables associated with functional constipation, up to a significance level of 25% ( $p \leq 0.25$ ), were included in the multiple logistic regression analysis, using the Backward Wald method. The odds ratios (OR) adjusted with their respective 95% confidence intervals were estimated, remaining in the model only those that presented a descriptive level with ( $p < 0.05$ ). The research was approved by the Research Ethics Committee accredited by the National Research Ethics Commission (Opinion No. 1,908,982), with the ethical principles of resolution CNS 466/2012 being fully observed.

## RESULTS

880 adolescents participated in the research, with an average age of 13 years ( $\pm 1.22$ ), 52% of whom were female. 121 adolescents met the Rome III criteria for FC, reaching a 13.8% prevalence. The intestinal habits of adolescents with constipation are described in Graph 1. Painful, difficult evacuation and/or hardened feces were present in 74.8% of individuals with constipation. Feces retention was found in 60.4%; two or less evacuations per week by 47.8%;



Graph 1. Intestinal habit of adolescents with functional constipation, Montes Claros, MG, Brazil, 2017 (n = 121)

Table 1. Characterization of adolescents for Functional Constipation, according to demographic factors, behaviors related to health and physical aptitude and bivariate analysis in adolescents from municipal schools - Montes Claros - MG, Brazil, 2017 (n = 880)

Demographic Factors		Constipated			Non-Constipated			Total Sample			OR (IC95%)	P Value
		n	%	%a	n	%	%a	N	%	%a		
Age	≥ 13 years	78	14.7	15.0	451	85.3	85.0	529	60.1	60.3	1.16 (1.01-1.33)	0.031
	≤ 12 years	43	12.3	13.2	308	87.7	86.8	351	39.9	39.7	1.00	
Sex	Female	75	16.4	16.2	382	83.6	83.8	457	51.9	52.0	1.41 (1.23-1.61)	<0.001
	Male	46	10.9	12.1	377	89.1	87.9	423	48.1	48.0	1.00	
Health-related behavior Fiber source food consumption	Inadequate	102	16.0	16.5	537	84.0	83.5	639	72.6	74.8	2.38 (1.98-2.88)	<0.001
	Adequate	19	7.9	7.6	222	92.1	92.4	241	27.4	25.2	1.00	
Sedentary Behavior	Yes	99	13.9	14.7	614	86.1	85.3	713	81.0	78.8	1.18 (1.01-1.39)	0.052
	No	22	13.2	12.7	145	86.8	87.3	167	19.0	21.2	1.00	
Active participation in Physical Education classes	No	76	20.5	21.9	294	79.5	78.1	370	42.0	43.9	3.12 (2.72-3.59)	<0.001
	Yes	45	8.8	8.2	465	91.2	91.8	510	58.0	56.1	1.00	
Health-Related Physical Aptitude Cardiorespiratory Capacity	Risk Zone	111	13.4	13.3	719	86.6	86.7	830	94.3	93.1	0.42 (0.34-0.52)	<0.001
	Healthy Zone	10	20.0	26.6	40	80.0	73.4	50	5.7	6.9	1.00	
Body Composition (BMI)	Overweight	30	14.0	17.2	185	86.0	82.8	215	24.4	24.1	1.35 (1.17-1.57)	<0.001
	Non-overweight	91	13.7	13.3	574	86.3	86.7	665	75.6	75.9	1.00	
Abdominal Resistance	Risk Zone	80	15.7	16.5	431	84.3	83.5	511	58.1	59.1	1.60 (1.39-1.84)	<0.001
	Healthy Zone	41	11.1	11.0	328	88.9	89.0	369	41.9	40.9	1.00	

LeLegend: OR = Odds Ratio; CI 95% = 95% confidence interval; a = percentage corrected by the design effect

**Table 2. Adjusted Functional Constipation Model and associated factors in adolescents from municipal schools - Montes Claros - MG, Brazil, 2017 (n = 880)**

Variables		ORa (CI95%)	P Value
Fiber source food consumption	Inadequate	2.28 (1.89-2.76)	<0.001
	Adequate	1.00	
Sedentary Behavior	Yes	1.30 (1.09-1.58)	0.003
	No	1.00	
Active participation in Physical Education classes	No	2.94 (2.54-3.40)	<0.001
	Yes	1.00	
Body Composition (BMI)	Overweight	1.36 (1.17-1.60)	<0.001
	Non-overweight	1.00	
Abdominal Resistance	Risk Zone	1.38 (1.19-1.60)	<0.001
	Healty Zone	1.00	

Legend: ORa = Adjusted Logistic Regression Model; CI 95% = 95% confidence interval.

sensation of incomplete evacuation 34.1%; history of feces that clog the toilet in 28.2% and fecal incontinence was observed in 6.0% of adolescents diagnosed with FC. As for health-related behaviors, 72.6% of adolescents had inadequate consumption (below the recommended) of foods that are sources of dietary fiber, 81.0% had sedentary behavior and 42.0% reported not actively participating in physical education classes. In the HRP analysis, 94.3% of the adolescents were in the risk zone for cardiorespiratory aptitude, 58.1% were in the risk zone for abdominal resistance and 24.4% of the adolescents were overweight (Table 1). In the adjusted logistic regression model, it was found that the variables that remained associated with FC were inadequate consumption of food sources of dietary fiber (OR = 2.28; 95% CI: 1.89-2.76), sedentary behavior (OR = 1.30; 95% CI: 1.09-1.58), not actively participating in physical education classes (OR = 2.94; 95% CI: 2.54-3.40), overweight (OR = 1.36; 95% CI: 1.17-1.60) and risk zone for abdominal resistance (OR = 1.38; 95% CI: 1.19-1.60). The results of the associated factors are shown in Table 2.

## DISCUSSION

A high prevalence of FC was found among the adolescents evaluated, but lower than the study in São José dos Campos, São Paulo (18.2%) [16]. In other countries, studies carried out in this population of adolescents, who also used Roma III as an instrument to define FC, showed higher prevalences, such as in Indonesia (18.3%) [3], in Nigeria (27%) [24], and in Sri Lanka (15.4%) [2] and slightly lower as seen in adolescents from the Mediterranean - Europe region (13.1%) [25]. The percentage of constipated adolescents' points to the need for the problem to be routinely evaluated and monitored by health professionals, enabling preventive guidance and early intervention. Timely guidance and interventions are of fundamental importance in the treatment of FC, since most of these adolescents with chronic constipation will respond to medical treatment, however, approximately 25% may have symptoms until adulthood [7]. Several conditions contribute to the variation in the prevalence of FC recorded in studies that address adolescents [4,5]. The most evident are the methodological specificities, the differences in the definitions used for FC [2-5], the sociocultural contrasts, such as differences in diet and behavioral patterns for each region, the socioeconomic profile and the local health system, which can interfere health conditions of the population [3, 4, 25]. In addition, there may be a difference in the genetic potential for developing constipation in these populations [3, 10, 25]. Considering the characteristics of the intestinal habits of adolescents with FC, they were more frequent: painful, difficult evacuation and/or hardened feces and feces retention, similar to a study in Iran, although this study found higher values [9]. It should also be noted that fecal incontinence was observed only in adolescents diagnosed with FC. Fecal incontinence is a common consequence of FC and is related to high rates of emotional / behavioral problems and stressful events [8]. Regarding the associated factors, the adolescents evaluated in this study with FC had an inadequate consumption of fruits and vegetables. Similar results have been found in previous studies [14, 17]. Regular consumption of dietary fiber is identified by the World Health Organization as a protection and prevention factor for chronic diseases [26].

The fibers have a beneficial effect to prevent constipation as a result of the increase in the fecal bolus, water retention properties, the increase in the production of bacteria and colon gases, with an acceleration of colonic transit [27]. Within the analysis of HRP, a significant number of adolescents had low cardiorespiratory capacity, and this variable was not associated with FC. Cardiorespiratory aptitude is directly related to the level of participation in sports and moderate to vigorous physical activities [28]. Despite extensive knowledge about the health benefits of physical activity, the practice of physical activity in adolescence has decreased over time [13, 29]. On the other hand, there was an association between FC and not actively participating in physical education classes. Being consistent with studies that used self-report, as an indirect measure, to assess the level of physical activity [7, 17, 18]. It is important to note that school Physical Education does not include the level of physical activity recommended by WHO for adolescents [28]. Although, the possibility of reverse causality bias is not ruled out, one of the explanations for this finding may be the fact that classes are an opportunity for social interaction and the formation of friendship bonds, causing a good impact on mental health that can positively influence intestinal functioning [2, 29]. The importance of brain-intestinal interactions in the pathophysiology of functional defecation disorders is increasingly recognized, and psychosocial factors can directly affect the prevalence found [2, 4]. Parallel to the reduction in the level of physical activity, it is also observed that the young population is more exposed to the so-called sedentary behaviors [13, 29, 30]. In this study, the association of FC with sedentary behavior was found, in agreement with studies carried out in other countries [7, 14]. Sedentary behavior is seen as a worldwide problem that causes serious damage to health [13]. In the last decade, the use of digital media by adolescents has progressively increased, with more and more common use of more than one electronic device simultaneously, making them more exposed to sedentary behavior [30].

FC has been shown to be associated with overweight, being compatible with a population-based study conducted in the USA [19]. The pathophysiology of the association between FC and overweight / obesity is little explored. Factors such as food intake, physical activity, intestinal microbiota and socioeconomic factors can play a role in the pathophysiology of both disorders [17]. In addition, adolescence is considered a period of physiological changes and psychosocial changes, which contributes to the adoption of inappropriate eating habits, which may constitute a risk for constipation and overweight [16]. Abdominal resistance was also associated with FC. Confirming what was expected, among adolescents who needed to improve this component of physical aptitude, there was a higher proportion of adolescents with FC. No studies were found to investigate the association between abdominal resistance and FC. It is plausible to suppose that the fact that those who have less abdominal resistance have FC, can occur, due to a weakness of this musculature, interfering with the evacuation. Defecation is a complex process that requires coordinated involvement of the gastrointestinal, nervous and musculoskeletal systems [10]. For evacuation to take place, which is the final part of this process, it is necessary to voluntarily contract the abdominal muscles and simultaneously relax the perineal muscles [10]. From this, the importance of this component of physical aptitude to be

considered in intervention programs that aim to improve FC. The results obtained suggest that the decrease in sedentary behavior and the increase in effective participation in Physical Education classes may be more important for the treatment of constipation than the increase in moderate / vigorous physical activity. It is necessary that the practice of physical activity within the school environment is considered an important measure for adolescents, and an integral part of the education process. The choice of a school environment to promote healthy living habits should be encouraged, as it is a place of intense social interaction, conducive to educational activities and the participation of adolescents in health care. According to these results and following the recommendations of the North American and European Societies of Gastroenterology, Hepatology and Nutrition in Pediatrics (NASPGHAN, ESPGHAN) the maintenance of healthy life habits with an appropriate nutritional intervention, with regular consumption of fibers, weight control and normal physical activity for the age contributes to minimize symptoms of FC among adolescents<sup>[1]</sup>, reducing the need to use invasive and uncomfortable methods for treatment<sup>[14]</sup>. The results observed in the present study must be considered in light of some limitations. The sampling process, although carried out in a probabilistic manner, included only adolescents from the public network, limiting the extrapolation of the findings to adolescents in private education, who may have, for example, different socioeconomic and cultural characteristics that influence, in several aspects, the variables studied. Still, as a limitation, the variables sedentary behavior and active participation in physical education classes were addressed by the self-report, which does not allow these conditions to be precisely established, requiring further studies that use more accurate measurement instruments. It is also noteworthy the fact that the present study made use of the Roma III criteria, since, at the time of data collection, the most recent Roma IV criteria were not yet available and validated in Brazil.

## Conclusion

FC prevalence in adolescents from municipal schools was high. FC was associated with inadequate consumption of food sources of dietary fiber, sedentary behavior, non-active participation in Physical Education classes, overweight and abdominal resistance. The association with cardiorespiratory aptitude was not observed. These results can be an aid to the health planning of adolescents, allowing a better understanding of the various factors that predispose to the development of FC.

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