ARTIGO ORIGINAL

Enterobius vermicularis in children at daycare centers

Enterobius vermicularis em crianças de creches

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Abstract

Objective: this study aimed to evaluate the frequency of enterobiasis in children attending daycare centers in Niterói, RJ, Brazil, using different parasitological techniques, and correlating its frequency with socioeconomic factors and clinical manifestations. **Methods:** children from three community daycare centers were asked to fill out a questionnaire and collect perianal region material, using the Graham's technique , and total feces, to be processed using the techniques of Faust et al., Ritchie modified, and fine-mesh screening. **Results:** *Enterobius vermicularis* was detected, exclusively by Graham's technique , in 12% (11/92) of the children. The age of four to six years was a risk factor for acquiring enterobiasis (OR = 1.256). There were no associations between positivity for *E. vermicularis* and family income, number of children in the house, or the parent's education level, among other variables. The use of two slides for the Graham's technique showed substantial/excellent agreement, which indicates that this is an appropriate strategy for diagnosing enterobiasis, thus resulting in lower costs and less discomfort for children and their guardians. **Conclusion**: *E. vermicularis* was the most common parasite among children in Niterói, which indicates the importance of including the Graham's technique in studies on the prevalence of intestinal parasites.

Keywords: enterobiasis; diagnosis; preschoolers; frequency; Graham's technique

Resumo

Objetivo: avaliar a frequência de enterobiose em crianças frequentadoras de creches de Niterói, RJ, Brasil, por meio de diferentes técnicas parasitológicas, e correlacionar sua frequência com fatores socioeconômicos e manifestações clínicas. **Métodos**: crianças de três creches comunitárias foram solicitadas a preencher um questionário e coletar material da região perianal, por meio da técnica de Graham, e fezes totais, para serem processadas pelas técnicas de Faust et al., Ritchie modificada e tamisação em malha fina. **Resultados**: *Enterobius vermicularis* foi detectado, exclusivamente pela técnica de Graham, em 12% (11/92) das crianças. A idade de 4 a 6 anos foi fator de risco para aquisição de enterobiose (OR = 1,256). Não houve associações entre positividade por *E. vermicularis* e renda familiar, número de filhos na casa ou escolaridade dos pais, entre outras variáveis. A utilização de duas lâminas para a técnica de Graham apresentou concordância substancial/excelente, o que indica que esta é uma estratégia adequada para o diagnóstico de enterobiose, resultando em menores custos e menor desconforto para as crianças e seus responsáveis. **Conclusão**: *E. vermicularis* foi o parasito mais comum entre crianças de Niterói, o que indica importância da inclusão da técnica de Graham nos estudos de prevalência de parasitos intestinais.

Palavras-chave: enterobiose; diagnóstico; pré-escolares; frequencia; técnica de Graham.

INTRODUCTION

Enterobius vermicularis, also known as pinworm, is a small nematode that inhabits the large intestine, causing enterobiasis, characterized by intense anal itching[1]. This parasite is the helminth with the greatest geographic distribution on the planet, and more than 30% of children worldwide have the parasite[2].

It is common in people of low socioeconomic status, families with infected individuals, or institutionalized groups such as orphanages, psychiatric institutions, and daycare centers[3]. The highest frequency of this parasite is observed among preschoolers and schoolchildren, associated with the habits of scratching the perianal region and anus-finger-mouth contact, along with practices of unsupervised hygiene care and inadequate hand washing, in addition to placing toys and objects used for writing in the mouth and biting nails[4].

In Brazil, the prevalence of *E. vermicularis* infection varies from 0.1 to 72.1%, and it is associated with age, ethnicity, geographic area, and diagnostic technique[5]. According to Fantinatti & Da-Cruz[5], no national study focusing on enterobiasis has been conducted. The majority of cases have been detected through coproparasitological techniques, which makes determining its prevalence challenging, especially because notification is not

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mandatory.

The adhesive tape technique[6] is universally used for diagnosing enterobiasis[7], although other procedures can also be applied[8]. These include the fine-mesh screening technique, which has the aim of detecting adult parasites in feces. In the Brazilian literature, few studies have focused on diagnosing enterobiasis or the use of the Graham's technique to evaluate the prevalence of intestinal parasites. Using Graham's technique, Tashima & Simões[9] detected *E. vermicularis* in 1.9% of children with clinical complaints in Presidente Prudente, SP. Carvalho, Carvalho & Mascarini[10] found a positivity rate of 10.48% among children aged zero to six years in Botucatu, SP, and *E. vermicularis* was the most common helminth among those children.

Based on this context, the aim of this study was to evaluate the frequency of enterobiasis in preschoolers, with a comparison between different parasitological techniques, and to correlate positivity with socioeconomic factors and symptoms.

METHODS

The study was carried out from March to October 2023 in three community daycare centers located in Niterói, RJ. The study population consisted of children aged two to six whose participation had been authorized by their guardians and, thus, was a convenience sample study. Each participant was asked to complete an epidemiological questionnaire and to provide samples of total feces and perianal material.

Each participant received two new plastic collectors, with a volume of 400 ml, in which to collect total feces on two different days, and a kit consisting of three microscopy slides with pieces (60 X 20 mm) of transparent adhesive tape, on which to collect perianal material on three different days. Guidance was given that the collection of perianal material should be carried out in the morning when the child woke up without prior cleaning of the perianal region.

The biological samples were sent to the Environmental Bioagents Laboratory at UFF. Perianal samples were processed using the Graham's technique [6], and fecal samples were processed using the techniques of Faust et al.[11], Ritchie[12] as modified by Young et al.[13] and fine-mesh screening.

All participants received the test results in an individual report, and those who were found to be positive were treated under medical supervision. The overall results of the study were presented to the community through a feedback meeting.

The results were analyzed descriptively. Statistical analysis between positivity and associated variables was performed using Fisher's exact test, considering P values less than or equal to 0.05 to be significant. Variables with a significant association were subjected to bivariate analysis, with the calculation of odds ratios (OR) to analyze possible risk or protective factors for enterobiasis. Agreement between parasitological techniques was analyzed using the agreement index (Kappa)[14] and McNemar's test.

This study was approved by the Research Ethics Committee of the Faculty of Medicine of the Fluminense Federal University (UFF) under opinion no. 5,930,062, in March 2023.

RESULTS

The overall positivity for enteroparasites was 20% (19/95), and all parasitized children had monoparasitism. Among the 88 children who provided total fecal material, the material from 86/88 (97.7%) was subjected to the fine-mesh screening technique. All of these samples were negative for *E. vermicularis*. Parasitism by *Giardia duodenalis* (2/88; 2.3%), *Entamoeba coli* (5/88; 5.7%), and *Trichuris trichiura* (1/88; 1.1%) was demonstrated using the techniques of Faust et al. and Ritchie as modified by Young et al. In one child, there was no concordant diagnosis using these two coproparasitological techniques (Table 1).

Table 1. Positive results for intestinal parasites using parasitological techniques on fecal and perianal samples from children at three community daycare centers in Niterói, RJ, Brazil, 2023.

Parasite	Parasitological Technique			
	Graham n=92	Faust et al. n=88	Ritchie Mod. n=88	Fine-mesh screening n=86
Enterobius vermicularis	11 (12%)	0 (0%)	0 (0%)	0
Giardia duodenalis	0	2 (2.3%)	2 (2.3%)	0
Entamoeba coli	0	5 (5.7%)	4 (4.6%)	0
Trichuris trichiura	0	1 (1.1%)	1 (1.1%)	0

Ritchie Mod.– Ritchie modified by Young et al.

Among all the participants, 92 children (96.8%) provided material for the Graham's technique , totaling 255 slides. One slide was provided by 3/92 children (3.3%), two slides by 15/92 (16.3%), and three slides by 74/92 (80.4%). *E. vermicularis* was detected in 12% of these children (11/92) (Table 1). Among these 11 children, in the cases of 3/92 (3.3%) who provided two

slides, only one slide was positive. In the cases of the other 8/92 (8.7%) who provided three slides, in 2/92 (2.2%), all slides were positive in 1/92 (1.1%), two were positive, and in 5/92 (5.4%), only one was positive.

The use of a single slide for diagnosing *Enterobius vermicularis* was less efficient than the use of three slides in combination, which showed substantial agreement (K = 0.641 and K = 0.748). An association between two slides from two different days resulted in an increase in efficiency, with substantial to excellent agreement (K = 0.748 and K = 0.926) (Table 2).

Table 2. Positive results for *Enterobius vermicularis* using the Graham's technique of three different days of 74 children at three community daycare centers in Niterói, RJ, 2023.

Graham	S 1	S 2	S 3	S1/ S2	S1/ S3	S2/ S3	S1/S2/S3
Positive	4	4	5	5	7	7	8
Negative	70	70	69	69	67	67	66
McNemar Test	0.125	0.125	0.250	0.250	1.000	1.000	
Kappa	0.641	0.641	0.748	0.748	0.926	0.926	

Legend: S1/S2, S1/S3, S2/S3, S1/S2/S3 – result based on associated slides of the same child. McNemar Test P<0.05. Kappa value < 0,00 – without concordance, 0.00 – 0.21 – weak, 0.21 – 0.41 - Slightly Weak, 0.41 – 0.61 – Moderate, 0.61 – 0.81 – Substantial, 0.81 – 1.00 - Almost perfect (excellent).

Analysis of the association between socioeconomic information and positivity for *E. vermicularis* showed that there was a statistically significant association with age between four and six years, which thus represented a risk factor for parasitism (OR = 1.256; CI = 1.097-1.437). However, in the present study, there were no significant associations between parasitism and the child's sex, number of residents in the house, number of children in the house, mother or father's education level, mother, family income, or perianal itching (Table 3).

Table 3. Positive results for *Enterobius vermicularis* and socioeconomic information and symptoms of 92 children at three community daycare centers in Niterói, RJ, Brazil, 2023.

Question	Response	N	Positive	%	p-value
		Respondents (N=92)	n=11	12	
Sex	Female	45	4	4.4	0.524
	Male	47	7	7.6	
Age	2-3	38	0	70	0.002*
	4-6	54	11	12	
Number of residents in the house	Up to 3	42	4	4.4	0.656
	4-5	43	7	7.6	
	6 or more	5	0	0	
	Not answer	2	0	0	
Number of children in the house	1-2	79	8	8.7	0.157
	3-4	12	3	3.3	
	Not answered	1	0	0	
Father's education level	Illiterate	5	0	0	0.846
	Fundamental (incomplete/complete)	33	4	4.4	
	High school (incomplete/complete)	38	6	6.5	
	Higher education (incomplete/complete)	16	1	1.1	
Mother's education level	Illiterate	3	0	0	0.789
	Fundamental (incomplete/complete)	24	4	4.4	
	High school (incomplete/complete)	48	6	6.5	

Question	Response	N	Positive	%	p-value
	Higher education (incomplete/complete)	16	1	1.1	
	Not answered	1	0	0	
Monthly family income (R$)	< 300	2	0	0	0.437
	300-600	5	1	1.1	
	600-1000	23	5	5.4	
	1000-2000	26	1	1.1	
	> 2000	19	3	3.3	
	Not answered	17	1	1.1	
Itchy perianal area	Yes	24	0	0	0.061
	No	57	11	12	
	Not answered	11	0	0	

Legend: Positive = number of children positive for enterobiasis. Fisher's exact test: *statistical significance when $p \leq 0.05$.

DISCUSSION

A positivity rate for enteroparasites of 20% (19/95) was obtained among the three participating community daycare centers. This rate was lower than previous findings from community daycare centers in Niterói, RJ: 55% (120/218) by Uchôa et al.[15] and 51.6% (192/372) by Uchôa et al.[16]. Thus, a marked reduction in the frequency of intestinal parasitism was observed in the present study, in relation to these previous results.

This reduction may be due to anthropic changes in the urban environment, such that there may have been a reduction in the extent of areas of bare soil with the humidity and shading necessary for geohelminths, and also improvement in basic sanitation measures with adequate sewage disposal and treatment of drinking water, possibly in association with antiparasite treatment. According to information from Instituto Trata Brasil[17], the city of Niterói occupies the 23rd position in the 2022 Sanitation Ranking of the 100 largest cities in the country. Water supply is provided to 100% of the population; 95.6% of the population is connected to a sewage disposal system, and 100% of sewage collected is treated.

In studies that have used the Graham's technique for diagnosing enterobiasis among children at daycare centers in Brazil, the frequencies of parasitism have ranged from 1.9% in Presidente Prudente, SP9, to 15% in Santa Isabel do Rio Negro, AM[18]. The frequency of positivity found among preschool children in Uberlândia, MG (13.87%), was similar to that found in Niterói[19]. Among the children at community daycare centers in Niterói, *E. vermicularis* was the most common helminth, as also reported in other studies[9,10,18], and in Niterói, it was also the parasite between protozoa and helminths, with the greatest frequency.

Among all the parasitological techniques used in the present study, only the Graham's technique resulted in positivity for enterobiasis. It can be explained by the fact that females of *E. vermicularis* deposit their eggs in the anal and perianal regions[4]. This result may also have been due to low parasite load. Findings of eggs in feces were identified by Fantinatti & Da-Cruz[5] as responsible for the majority of records referring to parasitosis in Brazil, thus resulting in underreporting of cases of parasitosis. Although the fine-mesh screening technique was considered to be adequate and easily feasible for diagnosing enterobiasis, it was not effective in the present study.

Age was significantly associated with *E. vermicularis* infection in the present study, such that children aged four to six years were more parasitized. Similarly, Bunchu et al.[20] in Thailand and Huang et al.[21] in China also showed that the positivity rate was higher in the four to six-year-old age group, but only Bunchu et al.[20] showed that this difference was statistically significant. Carvalho et al.[10] observed a significant association between enterobiasis and the age group of three and four years and correlated this with the stage of consolidation of hygiene habits. Huang et al.[21] suggested that the greater positivity in the age group of four to six years in China was related to children's entry into preschool, which increases the risk of infection since children aged three years or younger are generally at home or only attend daycare centers intermittently.

From the present study, it can be suggested that in addition to consolidation of hygiene habits, the greater frequency of positivity among children aged four or over may be related to the complete removal of the diaper, which, according to Meneses[22], occurs from the age of four onwards. Without wearing a diaper at night, children would have easier access to their perianal region during sleep, coinciding with female parasite oviposition.

In the present study, it was seen that the use of two slides in combination, compared with the use of three slides, for diagnosing parasitosis was efficient and showed substantial to excellent agreement (K = 0.748-0.926). Silva et al.[19] also correlated repeated sample collection for Graham's technique with increased sensitivity. The results obtained in the present study suggest that the use of two slides is indicated for diagnosing

enterobiasis, with lower cost and less embarrassment for the child and their guardian.

CONCLUSION

To the best of our knowledge, the present study presents the first results on the frequency of enterobiasis among children in Niterói, RJ, using the Graham's technique . It can be suggested that in order to solidly expand information on this parasitic disease, the Graham's technique will need to be included in prevalence studies on intestinal parasitic diseases. Furthermore, the results of the article are a starting point to direct future public policies to specifically combat this parasitic disease in order to better direct control measures, mainly in the community daycare centers included in this study.

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