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HEALTH SCIENCES

Pediculosis knowledge among schoolchildren parents and its relation with head lice prevalence

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Abstract: Pediculosis mainly affects school-age children worldwide. The aim of this study was to identify and analyze the knowledge of the parents and guardians of children in elementary schools in Niterói, Brazil, regarding pediculosis. Questionnaires were applied to 237 guardians of children at five 1-5 grade municipal schools. The responses were analyzed and correlated with positivity to louse infestation, detected by scalp aspiration. 73.8% of the respondents reported that their child had already been infested with lice. 32.9% presented correct responses about transmission. Incorrect responses were attributed to the air/wind, blood type and the fact that lice jump and fly. 40.1% of the respondents erroneously correlated control over the parasitosis with hygiene. A majority of the participants (58.6%) responded that pediculosis is harmful to health, while a small proportion (20.7%) considered it to be a disease. The prevalence of pediculosis was 19.8% among schoolchildren. Female sex, pruritus on the head and indifference regarding infestation were shown to be risk factors for pediculosis. The lack of perception of pediculosis as a disease may lead to naturalization of this parasitosis. Incorrect responses may add difficulty to implementation of preventive and curative approaches, which highlights the importance of dissemination of correct information about pediculosis.

Key words: children, knowledge, *Pediculus humanus capitis*, prevalence, schoolchildren.

INTRODUCTION

Pediculosis is the name given to infestation by the ectoparasite *Pediculus humanus capitis* (De Geer, 1778), commonly known as the head louse. According to Bonilla et al. (2013) in a mini-review, scientists have argued whether body and head lice represent a single species with two ecotypes or two distinct species. Most of the data using phylogenetic and population genetic methods fail to clearly separate body and head lice, indicating that they are conspecific (Bonilla et al. 2013). This disease affects people worldwide, especially children of school age, because of their habitual closer contact, which contributes towards transmission (Devera 2012).

The insect *Pediculus humanus capitis* parasitizes the human scalp and feeds on blood. It is apterous, i.e. flightless. Its legs have become adapted to be able to walk on strands of hair, but it does not have the capacity to jump (Ko & Elston 2004). Thus, transmission occurs directly through head-to-head contact or indirectly, through sharing of objects such as combs, caps or other headwear. It is not uncommon for people who live close to individuals with pediculosis, to also acquire the disease (CDC 2019).

Pediculosis may be asymptomatic, especially in cases of mild infestation. Symptomatic occurrences are characterized by pruritus, which favors lesions through the act of scratching; along with dermatitis, irritability and insomnia. In addition, secondary infections due to bacteria or fungi may occur consequentially to these lesions, and also myiases. In cases of massive or prolonged infestation, patients may also rarely present anemia, given that the ectoparasite feeds four to five times a day on the host's blood (Catalá et al. 2005, Madke & Khopkar 2012).

According to the World Health Organization (WHO 2017), achieving control over pediculosis is closely linked to education and preventive measures among the population. School-age children should undergo regular scalp inspection, and members of their families who are affected should also undergo treatment. The school environment is a favorable place for this ectoparasitosis to spread in, but according to Pagotti et al. (2012), no educational or control programs regarding pediculosis exist in Brazilian schools. Thus, in combating and preventing this disease, parents have an essential role and should be included in their children's teaching and learning processes (Pinheiro et al. 2017).

In a study conducted in Turkey, the difficulties faced by the families of children affected by pediculosis whose treatment failed were reported from the mother's perspective. That study addressed both social and psychological issues. A variety of problems were highlighted, such as exclusion of the child and family due to the social stigma of lack of hygiene; exposure of the child to verbal or physical violence perpetrated by family members or teachers; and refusal of the child to be treated. Furthermore, difficulty in removal of the lice, lack of family support (while the mother is the only person responsible for diagnosis and treatment) and concern regarding the presence of infestation have also been reported (Ozkan et al. 2012).

Another study, on the parents of schoolchildren living in southern Brazil, showed that knowledge about pediculosis was poor. The participants cited erroneous concepts such as the notion that lice can fly or prefer sweet blood (Goldschmidt & Loreto 2012). On the other hand, in a study in Norway, it was observed that most of the parents informed the school in cases of infestation with *P. h. capitis* and almost all families with a positive diagnosis underwent treatment with pediculicide. In the latter study, more than 90% of the participants responded correctly that transmission occurs from one head to another, that shampoo is not indicated as a means of treatment and that an infested individual is capable of transmitting the disease repeatedly (Rukke et al. 2012).

In Iran, a positive effect regarding reduction of louse infestation among schoolchildren was observed after an educative healthcare intervention. This result was attributed to the use of simple and instructive informative material and a relevant educative method. Use of local mediators, reinforcement work done by teachers and involvement of the parents or guardians were indicated as important for the positive effect (Shirvani et al. 2013).

Different authors (Heukelbach & Ugbomoiko 2011, Goldschmidt & Loreto 2012, Rukke et al. 2012, Duarte & Santos 2017, Pinheiro et al. 2017) have shown that the knowledge of pediculosis among the parents and guardians of schoolchildren is fragmentary. This emphasizes the importance of adopting educational measures that provide knowledge that leads to acquisition of protective conduct, diagnosis and correct treatment (Goldschmidt & Loreto 2012). Given these gaps in information, the objective of the present study was to identify and analyze the knowledge of

pediculosis among the parents of children in elementary schools in Niterói, RJ, Brazil.

MATERIALS AND METHODS

This study was approved by the research ethics committee of the medical school of the Universidade Federal Fluminense, under opinion report no. 3,472,323, in July 2019. Through indication from the municipal education foundation and authorization from the school principals, 1140 parents and guardians of children in years 1-5 of five municipal schools in Niterói were invited to participate in the study. The participants were made aware of this study through meetings at which the project was presented, with confirmation of their participation through signing a free and informed consent statement.

Each participant filled out a questionnaire that comprised three open questions and 13 closed questions, among which eight related to the family's socioeconomic characteristics and the child's clinical characteristics and the remainder related to knowledge regarding pediculosis. The socioeconomic questions dealt with the number of people living in the home, number of children in the home, occurrences of bed-sharing, the educational level that the mother and father had reached, the family's monthly income, the child's sex and age, previous infestation with lice and, if affirmative, the treatment administered. The questions relating to knowledge were based on what was proposed by Goldschmidt & Loreto (2012). These had the aim of identifying knowledge about transmission, treatment, stigma due to infestation and perception of pediculosis as a disease. The questionnaires were applied to the parents or guardians of each child, such that if they had more than one child enrolled at the school, they would fill out more than one questionnaire.

The responses to the questions were analyzed descriptively using the method of elaboration of categories, within content analysis (Minayo 2009). From identification of categories among the responses to each question, the responses were classified as correct, partially correct, incorrect or no response. Table I presents the reference framework for classifying the responses.

Table II presents the categories that were recovered from the open questions of the questionnaire, classified according to their correctness.

Together with the questionnaires, diagnoses of pediculosis were made among the schoolchildren whose parents had signed the free and informed consent statement. For this, the head aspiration technique was used (Lustosa et al. 2020), with viewing of the aspirated content under a stereoscopic microscope. Aspirations containing adults, nymphs or closed nits were considered active pediculosis.

The responses to the questions in the questionnaire and their absolute and relative frequencies were tabulated in Microsoft® Excel (2019) and analyzed descriptively. The univariate relationships between positivity for the presence of lice and the possible risk factors associated with infestation were analyzed by means of Fisher's exact test, with a significance level of 5%. The results that presented p-values less than or equal to 0.25 in Fisher's exact test were recategorized and subjected to logistic regression analysis (Bursac et al. 2008), to identify factors that might together be considered good predictors of positivity for pediculosis. From this analysis, odds ratios (OR) were presented with their 95% confidence intervals. In interpreting the results, it was considered that if OR = 1 (value of 1 within the 95% confidence interval),

Table I. Expected responses for each question contained in the questionnaire on knowledge that was applied to the parents and guardians of children in years 1-4 of elementary school, in Niterói, RJ, 2020.

Open questions	Expected responses
Do you know how you "get" lice?	Through direct contact between people or contact with recently contaminated objects.
What should be done when a person has lice?	Seek assistance from a doctor or from a primary care unit.
Closed questions	Expected responses
Is having lice considered to be a disease? Possible responses: yes; no; depends on the quantity of lice.	Yes.
Is the presence of lice on a child's head considered to be...? Possible responses: normal; common; a sign of disease.	It is a sign of disease.
Is the presence of lice on a child's head considered to be...? Possible responses: not harmful to health; harmful to health; harmful to health if there is a large quantity.	Harmful to health.
The presence of lice on the head: Possible responses: is not due to lack of hygiene; is due to lack of hygiene; occurs naturally.	Is not due to lack of hygiene.
When a child has lice, he or she: Possible responses: feels ashamed; does not feel ashamed; is indifferent.	Feels ashamed.
Which is the easiest place for a child to get lice? Possible responses: at home; at school; on the streets; at school and on the streets.	At school.

Source: adapted from Goldschmidt & Loreto (2012).

this would indicate that exposure to a given factor would not affect the chance of positivity for the presence of pediculosis. The exposure to this factor would be associated with a lower chance of positivity for lice if OR < 1, and a higher chance if OR > 1 (Szumilas 2010). All the statistical analyses were done using the SPSS software (SPSS Inc. 2009).

RESULTS

The adherence rate of this study, through signing the free and informed consent statement, filling out the questionnaire and making the diagnosis, was 20.8% (237/1140) of the individuals who had been invited to participate. In making the head aspiration diagnoses, 47/237 (19.8%) of the children were found to be positive, among whom the majority were female (78.7% - 37/47) (Table III).

The subjects' socioeconomic and demographic characteristics are presented in Table III. Out of the 237 respondents, 135 reported that they were living in homes with 4 to 6 residents (57.0%) and 152 (64.1%) in homes with at least two children; 120 (50.6%) said that the children did not share the same bed. Positivity rates of 59.6% (28) and 70.2% (33) were found

Table II. Classification of the responses to the open questions in the questionnaire applied to the parents and guardians of the schoolchildren in years 1-5, in Niterói, RJ, 2020.

Responses	Questions	
	Do you know how you "get" lice?	**What should be done when a person has lice?**
Correct	"Contact", "Hugging", "Leaning on each other", "Sharing combs", "Lice can walk", "Sharing objects", "Contact through combs and clothes", "Exchanging accessories", "Clothes and bedding", "Contact for a long time", "Sharing a pillow", "Head contact", "Contact with someone who has lice", "Sleeping close together", "Not changing bedding", "Heads together", "Combs and hairbrushes", "Objects in contact", "Caps and hats", "Falling from one head to another"	"Examine the person"; "Communicate this to the group"; "Use a fine comb"; "Use shampoo"; "Give medicine"; "Give medication"; "Take the person to a doctor"; "Pick them out"; "Look at the head"; "Remove them mechanically"; "Remove them chemically"; "Take the person to a doctor for treatment"; "Apply care, medicine and a fine comb"; "Apply care, a fine comb and a product"; "Clean using a fine comb"; "Apply medicine and care", "Use cream with a fine comb", "Look at the head every day", "Check the head", "Use medicine and remove the lice", "Apply care: combing, medications and going to a doctor", "Use special shampoo for lice", "Remove the lice and apply medicine", "Remove the lice", "Apply extra care and medicine", "Go to a doctor, apply treatment and medicine and remove lice every day", "Use lotion and a fine comb", "Go to a doctor and apply treatment and medicine", "Use pills*" *if the child is over 5 years
Incorrect	"Blood", "Head-scratching at school", "You get them if someone has lice", "They go through the air", "Through the environment", "Lice can fly", "In the wind", "Flying", "Dirt", "Scratching", "Sweet blood", "Sweat", "Ventilator", "Rue shampoo", "Lice can jump", "Lack of hygiene", "Excessive sweat", "Dirty head"	"Hair care"; "Use perfume"; "Use vinegar"; "Isolate the child"; "Wash", "Clean the head", "Hygiene", "Use lavender", "Clean"; "Cut the person's hair"; "Isolate the child"; "Do not go to school"; "Wash the head with garlic and onion"; "Apply care and cleaning"; "Apply treatment and washing", "Use almond oil", "Use tobacco leaf tea", "Treat with shampoo and tonic", "Shave the head", "Use alcohol", "Use shampoo", "Keep the head washed and clean", "Use soap", "Wash the head every day", "Boil the clothes, iron them and leave them in the sun", "Use insecticide"
Partially correct	"Playing", "Living together", "Children together", "On the bus", "Contagium", "From one child to another", "In the streets", "Close to another child", "From the head of someone who does not take care", "Being close to someone who has them", "Sitting close together", "From one head to another", "Big hair", "Loose hair", "Contact with other people", "At school", "Via another person", "May be in contact or not", "Together with someone who has them", "Through not taking care"	"Remove them"; "Apply care"; "Apply treatment"; "Apply care, a fine comb and washing"; "Use a comb", "Specific treatment", "Frequent treatment", "Washing with shampoo and removal", "Separation of towel and comb"

among children living in homes with greater numbers of residents and with more than one child, respectively (Table III).

The highest proportions of the fathers and mothers had reached a schooling level of completed high school (30.8% and 36.7%, respectively). However, the highest proportions of the fathers and mothers of the children who were positive had only reached the level of incomplete or completed elementary education (21; 44.7% and 29; 61.7%, respectively) (Table III). The monthly family incomes predominantly reported were R$ 1000 to 2000, in general and among the positive children (Table III).

Table III. Results regarding positivity and socioeconomic information on the schoolchildren in years 1-5 at five municipal elementary schools in Niterói, RJ, 2020.

Questions	Responses	N (%)	Positive	p-value
		Respondents (n = 237)	N = 47	
Child's sex	Female	122 (51.5%)	37 (78.7%)	<0.001
	Male	115 (48.5%)	10 (21.3%)	
How many people live in your home?	Up to 3	73 (30.8%)	12 (25.5%)	0.747
	4-6	135 (57.0%)	28 (59.6%)	
	> 6	28 (11.8%)	6 (12.8%)	
	No response	1 (0.4%)	1 (2.1%)	
How many children live in your home?	1	84 (35.4%)	13 (27.7%)	0.366
	2	83 (35.0%)	16 (34.0%)	
	> 2	69 (29.1%)	17 (36.2%)	
	No response	1 (0.4%)	1 (2.1%)	
Do they sleep in the same bed?	Yes	80 (33.8%)	17 (36.2%)	0.381
	No	120 (50.6%)	20 (42.5%)	
	Sometimes	34 (14.3%)	9 (19.1%)	
	No response	3 (1.3%)	1 (2.1%)	
Schooling level reached by the father	Illiterate	8 (3.4%)	3 (6.4%)	0.167
	Elementary incomplete	60 (25.3%)	11 (23.4%)	
	Elementary completed	41 (17.3%)	10 (21.3%)	
	High school	73 (30.8%)	8 (17.0%)	
	Tertiary-level	11 (4.6%)	2 (4.2%)	
	No response	44 (18.6%)	13 (27.7%)	
Schooling level reached by the mother	Illiterate	4 (1.7%)	0 (0%)	0.178
	Elementary incomplete	45 (19.0%)	14 (29.8%)	
	Elementary completed	77 (32.5%)	15 (31.9%)	
	High school	87 (36.7%)	12 (25.5%)	
	Tertiary-level	15 (6.3%)	3 (6.4%)	
	No response	9 (3.8%)	3 (6.4%)	
Does your child frequently scratch his/her head?	Yes	70 (29.5%)	29 (61.7%)	< 0.001
	No	151 (63.7%)	13 (27.7%)	
	Sometimes	14 (5.9%)	4 (8.5%)	
	No response	2 (0.8%)	1 (2.1%)	
How many times has your child had lice?	0	61 (25.7%)	3 (6.4%)	< 0.001
	1-2	79 (33.3%)	14 (29.8%)	
	3 or more	96 (40.5%)	29 (61.7%)	
	No response	1 (0.4%)	1 (2.1%)	
Family income (R$)	< 500	44 (18.6%)	8 (17.0%)	0.732
	500-1000	58 (24.5%)	9 (19.1%)	
	1001-2000	80 (33.7%)	17 (36.2%)	
	> 2000	42 (17.7%)	10 (21.3%)	
	No response	13 (5.5%)	3 (6.4%)	

Positive = number of schoolchildren positive for pediculosis. Fisher's exact test: statistically significant when p ≤ 0.05.

Regarding reinfestation, 73.8% (175/237) of the participants indicated that their children had already been affected by pediculosis one or more than three times during their lives. Among these, 96 reported that this had occurred three or more times, and the majority of the infested children (61.7%) were in this group. There was a significant association between positivity and the number of times that the child had had lice ($p < 0.001$) (Table III). Frequent head-scratching by the child was only mentioned by 70 respondents (29.5%). Among the schoolchildren diagnosed as positive, however, 70.2% (33/47) had complained of itchiness, and this relationship was shown to be statistically significant ($p < 0.001$) (Table III).

The results from the questions relating to knowledge about pediculosis are presented in Table IV. In the question "Do you know how you 'get' lice?", 32.9% responded correctly. Among the incorrect responses, the air/wind, blood type and the "fact" that lice can jump and/or fly were cited as factors relating to transmission. It was observed that the largest proportion of the positive children was in the group whose parents or guardians gave partially correct responses (38.3%). There was a significant association between positivity for pediculosis and the knowledge regarding transmission that the parents or guardians displayed ($p = 0.016$) (Table IV).

With regard to knowledge about treatment, it was found that 45.6% of the responses were partially correct. Most of the positive children were in the group of parents who responded that they knew or partially knew how to treat pediculosis (40; 85%). Among all the participants, 95 (40.1%) correlated controlling the parasitosis with hygiene (Table IV).

Upon being asked whether infestation with lice is considered to be a disease, 84 (35.4%) answered that it was not, while 98 (41.3%) only considered it to be a disease depending on the quantity of insects. Positivity among the schoolchildren was associated with these two groups, but without any statistically significant difference ($p = 0.586$) (Table IV). A majority of the respondents (40.5%) also considered that the presence of lice on children's heads was common. Greater positivity was observed among the children of these parents and guardians (23; 48.9%), but without any statistically significant association ($p = 0.095$) (Table IV).

Asked about whether infestation was harmful to health, the majority (58.6%) said that it was. Higher frequency of positive cases of pediculosis was observed in this group (55.3%) (Table IV). Among all the parents and guardians, 40.5% said that the presence of lice on children's heads was due to lack of hygiene and 46.4% (110/237) said that infestations occurred naturally. Higher frequency of positivity (40; 85%) among the schoolchildren analyzed was noted in these last two groups (Table IV). Regarding the place that is most favorable for transmission of lice, the one indicated most often was the school (60.7%) and 204 (86.1%) of the parents and guardians stated that their children felt ashamed when they became infested. In both groups ("school as the most favorable place for transmission" and "children feel ashamed"), there was greater positivity for infestation (61.7% and 78.7%, respectively), but without any statistically significant association between these variables and positivity for pediculosis ($p = 0.972$ and $p = 0.083$) (Table IV).

The variable "schooling level reached by the father" was excluded because although its p-value was minimally significant ($p < 0.25$), it presented high collinearity with the variable "schooling level reached by the mother". This fact made it impossible for these two variables to be evaluated simultaneously. Data on the mother's educational level were included in the analysis because they presented more robust results. Female sex was shown to be a risk factor for this parasitosis, with more than five times greater

Table IV. Results regarding knowledge about pediculosis among the parents and guardians and positivity among their children in years 1-5 at five municipal elementary schools in Niterói, RJ, 2020.

Questions	Responses	N (%)	Positive	p-value
		(n = 237)	N = 47	
Do you know how you "get" lice?	Correct	78 (32.9%)	13 (27.7%)	0.016
	Partially correct	54 (22.8%)	18 (38.3%)	
	Incorrect	70 (29.5%)	9 (19.1%)	
	No response	35 (14.8%)	7 (14.9%)	
What should be done when a person has lice?	Correct	83 (35.0%)	20 (42.5%)	0.533
	Partially correct	42 (17.7%)	7 (14.9%)	
	Incorrect	108 (45.6%)	20 (42.5%)	
	No response	4 (1.7%)	0 (0%)	
Is having lice considered to be a disease?	Yes	49 (20.7%)	8 (17.0%)	0.586
	No	84 (35.4%)	20 (42.5%)	
	Depends on the quantity	98 (41.3%)	19 (40.4%)	
	No response	6 (2.6%)	0 (0%)	
Is the presence of lice on a child's head considered to be...?	Normal	66 (27.8%)	15 (31.9%)	0.095
	Common	96 (40.5%)	23 (48.9%)	
	Sign of disease	64 (27.0%)	7 (14.9%)	
	No response	11 (4.6%)	2 (4.3%)	
Is the presence of lice on a child's head considered to be...?	Harmful to health	139 (58.6%)	26 (55.3%)	0.590
	Not harmful to health	3 (1.3%)	1 (2.1%)	
	Harmful if in large quantity	92 (38.8%)	19 (40.4%)	
	No response	3 (1.3%)	1 (2.1%)	
The presence of lice on the head:	Is due to lack of hygiene	96 (40.5%)	18 (38.3%)	0.741
	Is not due to lack of hygiene	28 (11.8%)	7 (14.9%)	
	Occurs naturally	110 (46.4%)	22 (46.8%)	
	No response	3 (1.3%)	0 (0%)	
When a child has lice, he or she:	Feels ashamed	204 (86.1%)	37 (78.7%)	0.083
	Does not feel ashamed	10 (4.2%)	2 (4.3%)	
	Is indifferent	17 (7.1%)	7 (14.9%)	
	No response	6 (2.6%)	1 (2.1%)	
Which is the easiest place for a child to get lice?*	School	147 (60.7%)	29 (61.7%)	0.972
	Street	2 (0.8%)	0 (0%)	
	Home	5 (2.1%)	0 (0%)	
	School and street	88 (36.4%)	18 (38.3%)	

***N ≠ 237 (respondents indicated more than one response). Fisher's exact test: statistical significance when p ≤ 0.05.**

chance of presenting pediculosis [OR = 5.180; 95% CI = 1.469-18.272] (Table V).

The logistic regression indicated that if a child was indifferent to feelings of being ashamed when infested, this boosted the risk of getting the disease [OR = 12.397; 95% CI = 2.678-57.395] (Table V). Head-scratching was also a risk factor, such that individuals presenting this sign were seven times more likely to be parasitized [OR = 7.735; 95% CI = 3.049-19.624] (Table V). Being female, presenting head-scratching and being indifferent towards lice infestation were the biggest risk factors for acquisition of the parasitosis.

Table V. Association between presence of pediculosis and risk factors relating to information about pediculosis among the patients and guardians of children in years 1-5 at five municipal elementary schools in Niterói, RJ, 2020.

Variables	Categories	p-value	OR (95% CI)
Child's sex	*Female	< 0.001	5.180 (1.469-18.272)**
	Male		-
Do you know how you "get" lice?	*Correct/partially correct	0.094	-
	Incorrect		0.558 (0.211-1.472)
Is the presence of lice on a child's head considered to be...?	*Normal	0.095	-
	Common		0.545 (0.204-1.451)
	Sign of disease		0.358 (0.112-1.145)
When a child has lice, he or she:	*Feels ashamed	0.083	-
	Does not feel ashamed		1.180 (0.197-7.060)
	Is indifferent		12.397 (2.678-57.395)***
Schooling level reached by the mother	*Elementary education	0.130	-
	Middle School		0.453 (0.152-1.357)
	High school or tertiary education		0.409 (0.149-1.122)
How many times has your child had lice?	*None	0.001	-
	At least 1		0.582 (0.155-2.155)
Does your child scratch his/her head?	Yes	< 0.001	7.735 (3.049-19.624)***
	*No		-

Fisher's exact test: p-value is minimally significant when ≤ 0.25. OR – odds ratio. CI – confidence interval. *reference category. Logistic regression: statistical significance when **p ≤ 0.05, ***p ≤ 0.001.

DISCUSSION

Pediculosis is a common ectoparasitosis among children aged 3 to 13 years (Ko & Elston 2004). All the schoolchildren who participated in this study belonged to this age group and 47 of all of them (19.8%) were positive. This prevalence was lower than what has been estimated for all of Brazil (Barbosa & Pinto 2003) and for Nova Iguaçu – RJ (Oliveira et al. 2017). However, it should be emphasized that the adherence rate of this study was only 20.8% (237/1140) and therefore the prevalence recorded might not represent the entire population, as was proposed in another study in which the participation rate was 49.7% (Rukke et al. 2011). Few studies showing participation rate were retrieved in the literature and most of them do not discuss this data. The lack of this information makes it difficult to know about this ectoparasitosis and its impact on public health. The low adherence to this study in Niterói may have been due to the social stigma associated with pediculosis, along with lack of perception of this parasitosis as a disease.

Pediculosis positivity was observed more often among female children in comparison to males, as shown previously in several studies (Bachok et al. 2006, Nazari & Sadijam 2007, Mohammed 2012, El-Khateeb et al. 2014, Costa et al. 2017). Mohammed (2012) reported that female children were 2.2 times more vulnerable to pediculosis than were male children, which may have been related to behavior, give that there is habitually greater physical proximity among girls. Gulgun et al. (2013) stated that longer hair, which is generally more present among girls, could favor infestation because their hair could form a reservoir for lice. It is thought that greater

positivity for lice among females is associated with a set of factors connected to cultural and behavioral issues and not to any single factor.

In the present study, 29.5% of the parents and guardians reported that their children presented head-scratching. Among those who had an infestation, the rate was 61.7%. Presence of pruritus was seen to be associated with presence of lice, such that the children who had this symptom were more likely to be infested. Although pruritus is the main clinical manifestation of pediculosis, the disease may be asymptomatic, especially when the infestation is mild (Madke & Khopkar 2012). An itchy scalp may also be due to other causes that are not necessarily related to pediculosis. This was cited by Cazorla et al. (2007) and Devera et al. (2015), who reported that in their studies, respectively 9.5% and 35.6% of the non-infested children presented pruritus on the scalp.

Reinfestation by lice was frequently reported and 40.5% of the participants had the infestation three or more times, and it had occurred in 29/47 of the positive children, with a statistically significant association. Some authors (Gabani et al. 2010, Heukelbach & Ugbomoiko 2011, Duarte & Santos 2017) reported that more than 70% of their participants declared that they had previously experienced pediculosis. Rukke et al. (2011) showed that more than one third of the families studied (n = 6026) had had previous experience of pediculosis. It can be suggested that persistence of this parasitosis among schoolchildren may be associated with inurement to the disease and difficulty in controlling it because of its ease of transmission and because the social stigma surrounding it leads people not to admit to having it.

It was observed that most of the families comprised four to six people living in the same home, with more than one child in the home, being the highest positivity in this group. Similar results were obtained in Turkey (Kokturk et al. 2003) and Iran (Soleimani-Ahmadi et al. 2017). In Jordan, an association between greater numbers of children per home and positivity for pediculosis was identified and related to greater contact between the children and less attention dedicated to each of them (Mohammed 2012). Larger numbers of people per home, especially within a context of lower socioeconomic level, in smaller spaces, favors greater physical proximity, which enables transmission of pediculosis.

Soleimani-Ahmadi et al. (2017) observed that most of the fathers in their study were illiterate, while most of the mothers had studied up to elementary school. This differed from the present study, in which the majority of both the fathers and the mothers had completed high school education. However, greater frequency of parasitism was observed among the children whose parents had only reached lower levels of education, although without any significant difference. The relationship between the parents' education level and occurrences of pediculosis may consist of access to correct information that enables avoidance and treatment of infestation. In Iran, a significant association was seen between the parents' education level and positivity for pediculosis among their children, thus showing that literacy was an important factor in reducing the prevalence of this parasitosis (Nazari & Sadijam 2007). On the other hand, in Korea, no significant differences were observed between the parents' education level and positivity for lice, which indicated that experiences rather than education level may have had greater impact on acquisition or continuing presence of infestation (Sim et al. 2011).

The majority of the participants in the present study reported that their children were not sharing beds. This differed from what was reported by Cazorla et al. (2007), who found that

most of their respondents said that there were at least two people per bed in their homes (Cazorla et al. 2007). Although there were few reports of sharing the same bed among the schoolchildren in Niterói, the frequency of positivity was greater in this group, but without a significant difference. Transmission of pediculosis may occur from head to head or from head to object to head. The latter route is made viable through a variety of other daily activities. Greater concentration of positive cases was observed among the families who reported having monthly incomes of between 1000 and 2000 reais. However, this result did not present statistical significance, thus corroborating other authors' finding that any individual, independent of social class, may present pediculosis (Nutanson et al. 2008, Devera et al. 2015).

Several participants in the present study erroneously stated, when asked about their knowledge of pediculosis, that lice pass from one head to another by jumping or flying, or even that they have a preference for sweet blood. Similar results were presented in previous studies (Gabani et al. 2010, Goldschmidt & Loreto 2012, Duarte & Santos 2017). Even though many of the respondents had already had experience with this ectoparasitosis, it was seen that correct and incorrect knowledge existed side-by-side. A significant association was observed between lack of correct knowledge and positivity. It is possible that erroneous concepts regarding transmission continue to exist because of the small size of the insect, which makes it difficult to observe its morphological and physiological characteristics.

Regarding knowledge about treatment, most of the participants gave partially correct responses, probably through previous experiences with this parasitosis. However, one matter of concern was that many participants reported that they had used poisons or environmental pesticides to combat the infestation. Goldschmidt & Loreto (2012) reported that 2% the schoolchildren's parents were using some type of insecticide as the treatment, while Gabani et al. (2010) reported that, among the employees of a primary school, 16% had considered using pesticides for this purpose. Use of insecticides applied to the environment may be harmful to humans, especially children, and their use is inadvisable. Several parents or guardians stated in their responses to the questionnaire that they had used a substance called "raio mosca" on their children's hair. This is an insecticide product for use in the environment that is not recommended for the human skin because it has toxic components. It can be recommended that the health surveillance authorities should do inspections on the use of this product more intensively, along with educational actions to combat its improper use.

Great number of participants considered that having lice was a disease only if a large quantity of insects was present. Only 20.7% of the respondents considered it to be a disease in all circumstances. Similar results were reported in another study, in which 11% of the participating parents took lice infestation to be a disease (Goldschmidt & Loreto 2012). This result highlights how people have, to some extent, become inured to this parasitosis, which thus impedes control and prevention actions.

From the question on how the presence of lice on children's heads should be regarded, it was seen that 68.3% of the participants considered this to be normal or common. A study among kindergarten teachers showed that the proportion of the participants who believed that pediculosis was normal or common totaled 63.6% (Sangaletti et al. 2018). This may have been because lice were periodically present among the schoolchildren of that survey and because of the social environment that their parents or

guardians lived in. Once again, this related to becoming inured to pediculosis, which was also seen in the result from the logistic regression, which showed an association between positivity and reports from the parents that their children were indifferent to the parasitosis.

The response options in the questionnaire may have had an influence on the low level of correlation of the parasitosis as a disease. This hypothesis arises from the responses that resulted from the question that correlated pediculosis with harm to health, in which 58.6% considered it to be harmful and 38.8% harmful when associated with a large quantity of insects. It can therefore be suggested that if this questionnaire were to be applied again in studies to identify knowledge, these questions should be restructured.

The divergence among the responses regarding the perception of this parasitosis as a disease and its relationship with harm to the host's health reflects the lack of clarity on this topic within the school environment (Goldschmidt & Loreto 2012). Duarte & Santos (2017) found that 87.5% of the participants in their survey considered lice infestation to be a public health problem, thus diverging from the responses given by the parents and guardians of the schoolchildren in Niterói. In Nigeria, pediculosis was not seen to be a health problem and this was attributed to the presence of other comorbidities posing higher risk that affected that population (Heukelbach & Ugbomoiko 2011). The realities and living conditions of the parents and guardians of these schoolchildren in Niterói, together with the constant presence of infestation may also have contributed to the lack of clarity regarding pediculosis.

Heukelbach & Ugbomoiko (2011) found that people affected by pediculosis do not report any feelings of embarrassment and only one person reported feeling ashamed. Differently, in the present study in Niterói, the majority of the parents said that their children felt ashamed when infested. In Turkey, it was reported that embarrassment among families caused by pediculosis was a problem that gave rise to social distancing from school, neighbors and other members of the family (Ozkan et al. 2012). It can be understood that this feeling of being ashamed had an influence on the explicitness of the presence and circulation of the parasitosis and, consequently on its control.

The social distancing caused by pediculosis came from the stigma of the belief that infestation related to lack of hygiene and dirtiness. In the present study, 40.5% of the respondents indicated that the presence of lice occurred due to lack of hygiene. Similar situation was reported by Duarte & Santos (2017) with more than 60% of participants correlating pediculosis with dirty head and 12.5% that lice feed on dirt. Another study indicated that more than 80% of the respondents believed that lice came from lack of hygiene (Gabani et al. 2010). The majority of the parents and guardians of children at a municipal school in the state of Rio Grande do Sul correlated presence of the ectoparasite with lack of hygiene (Goldschmidt & Loreto 2012). It was suggested in that study that absence of hygiene habits aided in failure to control the parasitosis (Goldschmidt & Loreto 2012), although there is no clear relationship of this nature in the literature. Thus, the presence of this thinking could contribute particularly towards persistence of this parasitism.

The place that the parents and guardians of the schoolchildren in Niterói indicated as providing the easiest transmission of lice was the school environment. Other authors in Brazil observed that 94% of the parents of schoolchildren also indicated that schools were the place with easiest transmission (Goldschmidt & Loreto 2012). From such findings, healthcare

bodies in some countries like Australia and Germany and some schools in Russia adopted the preventive measure of keeping the child out of school until the pediculosis had been treated (Cummings et al. 2018). The American Academy of Pediatrics advocates that children should be kept out of school until treatment has started (Aronson & Shope 2016). In countries like Canada, Spain and the United Kingdom, keeping children with pediculosis out of school is discouraged (Cummings et al. 2018). The lack of consensus regarding the approaches used, along with the social stigma surrounding pediculosis, makes it a matter of urgency to introduce educational programs regarding this disease, addressing it across the curriculum content and involving not only the schoolchildren but also their families.

From the results obtained, it could be seen that correct and incorrect knowledge existed side-by-side. This could favor persistence of infestations and impede appropriate prophylactic measures. Use of incorrect approaches for treating pediculosis might, in some cases, give rise to intoxication processes that could result in higher costs for the public healthcare system. It is therefore recommended that this topic should be introduced into the school environment, thereby involving teachers, schoolchildren and their parents or guardians, with the aims of deconstructing myths, disseminating correct information and strengthening individual and collective control actions.

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Ariela Both de Souza and Claudia Maria Antunes Uchôa designed the study. Material preparation and data collection were performed by Ariela Both de Souza, Patricia Carvalho de Morais, João Pedro Sampaio do Prado Dorea, Flávia Terumi Nakashima, Laís Lisboa Corrêa, Pâmela de Oliveira França and Claudia Maria Antunes Uchôa. Analysis was performed by Ariela Both de Souza, Ana Beatriz Monteiro Fonseca, Otilio Machado Pereira Bastos, Alynne da Silva Barbosa and Claudia Maria Antunes Uchôa. The first draft of the manuscript was written by Ariela Both de Souza and Claudia Maria Antunes Uchôa and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.