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## OCCURRENCE OF HEAD LICE IN CHILDREN AND ADOLESCENTS SEEN AT A HOSPITAL IN UBERLÂNDIA, CENTRAL BRAZIL

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*Leticia Rúbia Silva Cadima<sup>1</sup>, Raquel Borges-Moroni<sup>2</sup>, Júlio Mendes<sup>2</sup> and Fábio T. Moroni<sup>3</sup>*

### ABSTRACT

The purpose of this study was to verify the occurrence of head lice in children at a public hospital in Uberlândia, MG and factors associated with pediculosis such as sex, age, hair characteristics and socioeconomic conditions, as well as obtaining information from their parents/guardians regarding the epidemiology, its transmission, prevention and control. To obtain the data, direct hair inspection and a characterization sheet and questionnaire were utilized. An occurrence rate of 6.1 % was found in 230 children examined in a public hospital, 111 females and 119 males with the highest rates observed in female children aged 4-8 with medium to long hair. Income, level of education, hair washing, hair type, color and thickness did not seem to influence the distribution of pediculosis in the children seen in the hospital in Uberlândia. The questionnaire answered by parents/guardians indicated that the children had had at least one infestation in their lifetime. The use of fine comb and pesticides were the most usual control methods adopted. The most frequent symptom was severe itching on the scalp. Although the occurrence of head pediculosis is declining, it is still a prevalent public health problem in the child population of Uberlândia, MG. Pediculosis may be associated with sex, age and hair characteristics. Variations in the degree of these influencing factors depend on the profile of the population studied. Additional studies are required in population groups over time, particularly in those that are inadequately assisted or lack state education and health assistance.

**KEY WORDS:** Pediculosis; occurrence; Minas Gerais; Brazil.

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1. Universidade Federal de Uberlândia, Instituto de Ciências Biomédicas (ICB), Curso de Biomedicina, Uberlândia, MG, Brazil.
  2. Universidade Federal de Uberlândia, ICB, Departamento Parasitologia, Uberlândia, MG, Brazil.
  3. Universidade Federal de Uberlândia, Faculdade de Medicina, Departamento Clínica Médica, Uberlândia, MG, Brazil.

Leticia Rúbia Silva Cadima – ORCID: <https://orcid.org/0000-0003-0436-0962>, Raquel Borges Moroni – ORCID: <https://orcid.org/0000-0001-5650-1478>, Júlio Mendes – ORCID: <https://orcid.org/0000-0001-5817-5178>, Fábio Tonissi Moroni - ORCID: <https://orcid.org/0000-0002-0573-4084>.

Corresponding author: Raquel Borges-Moroni, Departamento de Parasitologia, Instituto de Ciências Biomédicas, Universidade Federal de Uberlândia. Av. Pará 1720, Campus Umuarama, CEP: 38408-100, Uberlândia, MG, Brazil. E-mail: [raquel.moroni@ufu.br](mailto:raquel.moroni@ufu.br)

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## INTRODUCTION

Pediculosis of the head is an infestation caused by *Pediculus capitis* (De Geer, 1778) in humans, characterized by intense itching, irritation in the affected area, secondary infections and intense infestations that can be associated with social conditions, such as overcrowded living quarters and lack of hygiene (Mirza & Shamsi, 2010). Head lice can be transmitted through contact between infested and non-infested individuals and indirectly through combs, brushes and headwear (Linardi et al., 1988).

The clinical manifestations of pediculosis are caused by a secretion from the insect's salivary glands, which injected into the skin during hematophagism produces a papular, elevated and hyperemic lesion, accompanied by intense itching. Secondary infection from skin lesions can lead to the production of impetigo, furunculosis or eczema (Sittichok et al., 2018).

The recurrence of pediculosis since the 1960s may be due to socioeconomic issues such as an increase in human population, cultural and affective customs that favor greater contact between people, indifference by the authorities regarding infestation, lack of health inspections in certain groups such as pre-school children and lice resistance to treatments (Monheit & Norris, 1986). As hygiene standards have improved due to more frequent bathing, daily changes of clothes and the use of insecticides, lice infestations have become less common (Sim et al., 2011; Marinho et al., 2018; Santos et al., 2020).

In addition, genetic factors may also be associated with the occurrence of pediculosis, such as variations in hair shape, density and strand thickness (Madureira, 1991; Poudel & Barker, 2004; Borges-Moroni et al., 2011).

The most susceptible age group to head pediculosis is the 6 to 13 year-olds, but this may undergo variations (Linardi et al., 1988, Marinho et al., 2018). However, there is no exact age limit for the occurrence of cases (Sinniah et al., 1981; Catalá et al., 2004; Figueira et al., 2019; Adham et al., 2020).

The control measures commonly used are natural (manual lice picking, use of fine comb and head shaving) and chemical (pesticides), the latter being more usual for head pediculosis (Budak et al., 1996; Torquato et al., 2019).

Clinically, this ectoparasitosis does not seem to cause considerable health damage in comparison with other parasitic diseases. However, social and economic impacts are relevant. Epidemiological studies are essential for further understanding the factors that might influence prevalence, and for guidance regarding policies for pediculosis control (Linardi et al., 1989; Mendes et al., 2017; Oliveira et al., 2017; Marinho et al., 2018; Amanzougaghene et al., 2020).

The purpose of this study was, therefore, to verify the occurrence of head pediculosis in children from a public hospital in Uberlândia-MG to analyze whether pediculosis caused by *P. capitis* might be associated to sex, age group, hair characteristics and socioeconomic situation, as well as assessing awareness in those responsible for epidemiological aspects, ectoparasite biology and methods of pediculosis control.

## MATERIAL AND METHODS

The study was carried out in Uberlândia, a city in the Triângulo Mineiro in the Southeast of Brazil. It is 4,115,206 km<sup>2</sup>, with approximately 691,305 inhabitants (IBGE, 2020). Data were collected in the pediatric wing of a public hospital responsible for the care of children and adolescents in Uberlândia and in the surrounding municipalities. This study was carried out from March 2019 to March 2020.

After authorization by parents/guardians, scalp inspection was carried out on 230 children from two to twelve years of age. Table 1 below indicates the number of inspected children according to age group and sex.

*Table 1.* Number of inspected children according to age group and sex at a public hospital in Uberlândia, Minas Gerais.

Age groups/sex	Females (%)	Males (%)
2 ≥ 4	38 (16.5)	36 (15.7)
4 ≥ 8	43 (18.7)	54 (23.5)
8 ≥ 12	30 (13.0)	29 (12.6)

The parents/guardians who answered the questionnaire were aged 18 to 70. The age groups were determined according to the World Health Organization (WHO, 1986). The inference regarding the socioeconomic profile was based on parent/guardian income and schooling data.

The head of each child underwent a three-minute visual inspection, with special attention to the nape, near and behind the ears and on the central surface of the head, according to Borges-Moroni et al. (2011). Children were considered infested when they presented viable nits and nymphs, while non-infested adults and children did not present lice and/or viable nits or else presented dead nits. However, the latter group was considered only after removing the specimens and checking them under an optical microscope.

Lice specimens were collected for identification with the aid of an entomological key (Triplehorn & Johnson, 2011). A characterization sheet for each child was filled in after inspection, containing information such as name (in code), sex and age as well as hair characteristics: length, type, color

and thickness. The classification of hair characteristics was based on visual evidence after previous training according to Borges & Mendes (2002) and Santos et al. (2020) where short hair measured up to 3 cm; medium from 3 cm to 10 cm and long from 10 cm on. The hair color was grouped into two categories: fair (blond) and dark (black or brown). Regarding type, the hair was categorized as straight, wavy and curly. The collection of data regarding hair thickness followed the standards established by Marinho et al. (2018).

The questionnaire, answered by parents/guardians during scalp inspection, consisted of multiple choice questions to determine the level of awareness of these individuals regarding the epidemiology, ectoparasite biology, methods of pediculosis control, the child's personal data (age) and data regarding the parents/guardians such as profession, average salary and education.

After data collection, the occurrence of pediculosis was compared according to the different age groups, sex and hair characteristics (length, type, color and thickness). Aspects related to parent/guardian income and level of education as well as hair washing frequency were considered to verify a possible association with pediculosis.

Different parametric tests were applied to compare data. Student's t test was applied in the comparison between two groups while for comparisons between three or more groups the analysis of Variance (ANOVA) was utilized. When significant differences were found between more than two proportions, the data were ultimately subjected to the Tukey multiple comparison test (Zar, 2010). Significance level of 5% was adopted. In addition, the confidence intervals (95%) for occurrence rates and occurrence ratios were calculated.

The study was approved by the Research Ethics Council of the Federal University of Uberlândia, CAAE 64369316.0.0000.5152, number 1.990.239.

## RESULTS

An overall occurrence of 6.1% was noted in 230 children inspected. Children ( $F = 13.797$ ;  $P = 0.000$ ) with medium length and long hair ( $F = 10.957$ ;  $P = 0.000$ ) were the most infested. Regarding age group, children aged four to eight ( $F = 2.358$ ;  $P = 0.097$ ) presented the highest occurrence of pediculosis (Tables 2 and 3).

With regard to parent/guardian income and schooling, as well as frequency of child hair washing, children whose parents/guardians had incomes up to one minimum wage and low levels of education presented the most infestations (Table 3) in spite of no statistical difference. Although there was not a significant difference, the parents/guardians of the child group presenting the highest pediculosis occurrence stated that they washed their children's hair less frequently (Table 4).

Table 2. Occurrence of *Pediculus capitis* according to sex, age groups of children and income and education level of the parents/guardians in a public hospital in Uberlândia, Minas Gerais, Brazil.

	n inspected	n infestations (%)	F ratio/ p
<b>Sex</b>			
Male	119	01 (0.8) A <sup>a</sup>	13.797/0.000
Female	111	13 (11.7) B	
<b>Age groups</b>			
2 ≥ 4	74	01 (1.4) A <sup>a</sup>	2.358/0.097
4 ≥ 8	97	09 (9.3) B	
8 ≥ 12	59	04 (6.8) AB	
<b>Income</b>			
< 1	13	01 (7.7) A <sup>a</sup>	0.326/0.722
≥ 1 ≤ 3	184	13 (7.1) A	
> 3 ≤ 5	33	00 (0.0) A	
<b>Education level</b>			
Graduate	33	00 (0.0) A <sup>a</sup>	2.503/0.115
Under graduate	197	14 (42.4) A	

a: occurrence rates with different letters are statistically different at the 5% level of significance ( $p < 0.05$ ). F: indicates if there was any general difference between the means. n=number.

Although individuals with dark thick straight hair presented a higher incidence, there was no significant difference when these results were compared with the other characteristics (Table 4).

Two hundred and thirty questionnaires were answered by parents/guardians. The most natural control method was the fine comb (62.7%) followed by manual picking (33%) and chemical control using pediculicides (65.9%). Intense itching (59.9%) was the main symptom associated with the infestation. Regarding possible places of transmission of this ectoparasitosis, 79% of parents/guardians reported that the infestations occurred in school. According to them 44.4% of the children were never infested and 36.5% had at least one infestation during their lifetime, while 64.8% reported that they lived in Uberlândia, Minas Gerais (Table 5).

Table 3. Occurrence of *Pediculus capitis* according to the hair characteristics of children seen at a public hospital in Uberlândia, Minas Gerais, Brazil.

Characteristics	n inspected	n infestations (%)	F ratio/ p
Hair length			
Short	144	01 (0.7) A <sup>a</sup>	10.957/0.000
Medium	39	05 (12.8) B	
Long	47	08 (17.0) B	
Hair type			
Curly	27	00 (0.0) A <sup>a</sup>	1.067/0.346
Wavy	82	05 (6.1) A	
Straight	121	09 (7.4) A	
Hair color			
Fair	17	00 (0.0) A <sup>a</sup>	1.186/0.277
Dark	213	14 (6.6) A	
Hair thickness			
Thick	70	07 (10) A <sup>a</sup>	1.082/0.299
Fine	160	07 (4.4) A	

a: occurrence rates with different letters are statistically different at the 5% level of significance ( $p > 0.05$ ). F: indicates if there was any general difference between the means. n=number.

Table 4. Occurrence of *Pediculus capitis* in relation to the frequency of washing children's hair at a public hospital in Uberlândia, Minas Gerais, Brazil.

Hair washing	n answers	n infestations (%)	F ratio/ p
Frequent	198	12 (6.1) A <sup>a</sup>	0.020/0.887
Rare	32	02 (6.2) A	

a: occurrence rates with different letters are statistically different at the 5% level of significance ( $p < 0.05$ ). F: indicates if there was any general differences between the means. n=number.

*Table 5.* Parent/guardian awareness of head pediculosis in children seen in a public hospital in Uberlândia, Minas Gerais, Brazil.

Questions	Number of replies (%)
Frequency of infestations ( n* = 230)	
One or two infestations	84 (36.5)
Several infestations	44 (19.1)
No infestation	102 (44.4)
Natural control (n* = 161)	
Manual picking	53 (33)
Hair shaving	07 (4.3)
Fine comb	101 (62.7)
Chemical control (n* = 123)	
Pediculicides	81 (65.9)
Creams and oils	23 (18.7)
Others	19 (15.4)
Children's symptoms (n* = 157)	
Insomnia	10 (6.4)
Itchy scalp	94 (59.9)
Restlessness	53 (33.7)
Place of residence of respondents (n* = 230)	
Uberlândia	149 (64.8)
Another county	81 (35.2)
Possible places of transmission (n* = 129)	
School	102 (79)
Home	17 (13.2)
Leisure areas, playgrounds.	10 (7.8)

\* n = number of respondents.

## DISCUSSION

The general incidence of pediculosis in children noted in the present study was relatively low and confirmed results obtained in recent studies in this same city (Marinho et al., 2018; Santos et al., 2020). These studies and others carried out previously (Borges & Mendes, 2002; Borges-Moroni et al., 2011) demonstrate that there has been a drop in the occurrence of head pediculosis in the child population of Uberlândia over the years. Costa et al. (2017) obtained results close to these in Divinópolis, also in Minas Gerais.

It is noteworthy that pediculosis continues to show high occurrence rates in other locations in Minas Gerais, in other states in Brazil and in other countries. Studies carried out on children and adolescents in Manaus found occurrence rates of 18.5% (Borges-Moroni et al., 2011) and 44.8% (Amazonas et al., 2015). Liao et al. (2019) in Cambodia found an occurrence of 44.3%. Dagne et al. (2019) found an occurrence of 65.7% in schoolchildren in Ethiopia. Large variations in the occurrence of pediculosis in populations from different locations in Brazil and other countries are related to regional, socioeconomic, cultural and genetic factors (Borges & Mendes, 2002; Gabani et al., 2010; Nunes et al., 2014; Nunes et al., 2015; Borges-Moroni et al., 2015).

The results found in this study seem to be due to parent/guardian care for the children's personal hygiene and the control of pediculosis. Responses during the interviews and in the questionnaires showed that the parents/guardians followed a personal hygiene routine for the children and used control methods considered effective against this ectoparasitosis (Linardi et al., 1995; Heukelbach et al., 2005).

Although the present study indicated a decrease in the occurrence of pediculosis, 34.7% of the participating children had at least one infestation by this parasite during their life time according to responses by their parents/guardians. The socioeconomic disparities that exist between the various population groups in a given location in this country must also be considered, including Uberlândia. Socioeconomic level can be a contributing factor in the occurrence of this and other parasitic diseases. Further studies are necessary in population groups of low socioeconomic status, with little or no State health care.

Despite the data on income and education of parents/guardians, these were not statistically significant in this work. There are indications in the literature that the socioeconomic situation of individuals may be associated with the occurrence of pediculosis. Aciöz & Öztürk (2018) in a study conducted in Turkey reported that the highest rates of infestation occurred in low-income families, who lived in overcrowded homes, in addition to sharing fomites, such as combs. Manrique-Saide et al., 2011, in a study conducted in Mexico, found that the chances of lice infestation in children belonging to low-income families were ten times greater than in children from families with greater



purchasing power. According to the authors, limited access to education and health services is considered a crucial factor for maintaining the transmission of this ectoparasitosis.

Female children had a higher incidence of pediculosis, corroborating results found in studies carried out in Brazil (Amazonas et al., 2015, Santos et al., 2020) and in other countries (Jamani et al., 2018; Molina-Garza & Galaviz-Silva, 2017; Maramazi et al., 2019). The higher incidence in girls would be due to most of them having medium to long hair, which would provide a greater contact surface, facilitating transmission. Longer hair would also hinder the early diagnosis of ectoparasitosis (Borges et al., 2007; Santos et al., 2020). In addition, cultural customs, such as hugging and playing more closely together, which is usual among female children, would also facilitate transmission (Shayeghi et al., 2010).

In this study, children in the four to eight age group presented a higher occurrence, corroborating Marinho et al., 2018 studies. Although, in general children are more frequently affected by pediculosis, there are several studies showing that ectoparasitosis also occurs in young people, adults and the elderly when they live in collective environments and have characteristics / factors known to be important in pediculosis (Mimouni et al., 2001; Ismail et al., 2018; Figueira et al., 2019).

Studies have found divergent results regarding head pediculosis and hair characteristics such as length, color, thickness and shape (Borges-Moroni et al., 2015; Molina-Garza & Galaviz-Silva, 2017). The results of these studies seem to indicate that, although these factors may influence the occurrence of pediculosis, they are not determinant and there are other factors as or more important that would also influence the occurrence of ectoparasitosis in a given population group.

References to the occurrence of lice in children attending health facilities similar to this one are scarce. Another study performed at the same institution where the present study was conducted (Marinho et al., 2018) found a slightly lower incidence rate. Nonetheless, generally confirming the results obtained here.

In this study, most parents/guardians stated that the main symptom associated with the infestation was intense itching on the scalp and that transmission occurred at school. This information is consistent with other studies conducted with children. School-age children spend much of the day at school, a collective environment considered conducive to pediculosis transmission (López-Valencia et al., 2017; Mendes et al., 2017; Marinho et al., 2018; Borges-Moroni et al., 2020).

We conclude that the occurrence of head pediculosis, although declining, is still a prevalent public health problem in the child population of Uberlândia-MG. Pediculosis may be associated with gender, age and characteristics of the hair (length). Moreover, variations in the degree of influence of these factors depend on the profile of the population studied. Additional studies are required in this population group over time and in population groups that lack or receive inadequate State educational and health assistance.

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#### CONFLICT OF INTEREST

The authors declare there is no conflict of interest regarding this article.

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