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Pediculus capitis infestation according to sex and social factors in Argentina

Infestação por *Pediculus capitis* segundo sexo e fatores sociais na Argentina

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Keywords

Lice infestations, prevention & control. Students. Risk factors. Argentina.

Abstract

Objective

To determine the intensity of *Pediculus capitis* infestation (abundance) among Argentinean schoolchildren. Children's sex and social stratum were analyzed as modifiers of the general prevalence and degree of parasitism.

Methods

The study included 1,370 schoolchildren (692 girls, 678 boys) from 26 schools of the province of La Rioja (21 public schools, five private schools). Classic prevalence was obtained as the percentage of children with nits and/or lice. Moreover, five degrees of parasitism were classified: 0) children with no signs of pediculosis; 0+) children with evidence of past infestation; 1) children with a recent infestation and low probability of active parasitism; 2) children with a recent infestation and high probability of active parasitism; 3) children with mobile lice (active pediculosis).

Results

The general prevalence was 61.4% (girls: 79%; boys: 44%, $p < 0.001$). Private schools showed lower prevalence than public schools ($p = 0.02$), especially due to the low prevalence in boys. Fifty percent of children were classified in classes 0 and 0+, 22% in class 1; and 28% in grades 2 and 3. The proportion of children in grade 3 was higher in public schools than in private schools. There were significant sexual differences in the intensity of parasitism for grades 2 and 3, where girls' rates exceeded twice those of boys'.

Conclusions

Sex and social stratum are important modifiers of *P. capitis* general prevalence and degree of infestation. The classification of children by intensity of infestation allowed a more precise delimitation of this condition, which is especially important for disease surveillance and application of control measures.

Resumo

Objetivo

Determinar a intensidade de infestação (abundância) de *Pediculus capitis* em crianças argentinas em idade escolar. Analisar se sexo e classe social das crianças são fatores influentes na prevalência e grau de parasitismo.

Métodos

Foram examinados 1.370 alunos (692 meninas e 678 meninos), de 26 escolas (21 públicas e cinco particulares) da província de La Rioja, Argentina. A prevalência foi

Descritores

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obtida pela percentagem de crianças com lêndeas e/ou piolhos. O parasitismo foi classificado em cinco graus: 0) crianças sem sinal de pediculose; 0+) com sinal de infestação curada; 1) infestação recente, mas baixa probabilidade de parasitismo ativo; 2) com infestação e alta probabilidade de parasitismo; 3) com piolhos móveis (pediculose ativa).

Resultados

A prevalência geral foi de 61,4% (79% em meninas e 44% em meninos, $p < 0,001$). Crianças de escolas particulares apresentaram menor prevalência que as de escolas públicas ($p = 0,02$), especialmente devido à baixa prevalência em meninos. Metade das crianças foram classificadas nas classes 0 e 0+; 22% na classe 1; e 28% nos graus 2 e 3. A proporção de crianças no grau 3 foi maior em escolas públicas que particulares. Observou-se diferença significativa na intensidade do parasitismo em relação ao sexo, onde para os graus 2 e 3 de parasitismo os valores para meninas excederam em duas vezes àqueles dos meninos.

Conclusões

Sexo e classe social são importantes fatores para a prevalência geral e grau de infestação por *P. capitis*. A classificação das crianças por intensidade de infestação permitiu delimitação mais precisa do problema, especialmente importante para vigilância e aplicação de medidas de controle.

INTRODUCTION

Lice infestation is a worldwide distributed disease, very common in childhood. It is produced by an ectoparasite, *Pediculus capitis* (*Pediculus humanus capitis*), which spends its complete life cycle in its human host. Transmission is mainly through contact, with the parasite migrating from head to head. Moreover, hugging or playing where heads are in contact favors infestation. Although head lice do not transmit any pathogenic agents, complications derived from parasitism, such as scalp lesions caused by scratching, secondary bacterial infection, posterior neck adenopathy, unspecific generalized dermatitis, local post-therapeutic dermatitis, chronic anemia by pillaging and even secondary myiasis, in extreme cases, can occur.^{1,4}

By the end of the sixties and beginning of the seventies an important increase of *Pediculosis capitis* prevalence was observed in many countries and lice infestation throughout the world was estimated to run into hundreds of millions. Decline of personal hygiene, increased promiscuity and long hairstyle, particularly in adolescents and young people, seemed to mark the beginning of this new context.¹¹

In Argentina, lice infestation seems to have reached alarming levels. Most of the population does not have resources to buy specific thin combs and other products used against lice and, in many cases, general hygiene conditions of children are deficient. Moreover, there is a high degree of resistance to pyrethroid insecticides in *P. capitis* extracted from Argentinean children.⁹

wide in Argentina, there are no official regulations on actions to carry out when cases of lice infestation are detected at schools. Some teachers send children back home to be deloused; others ignore the presence of the parasite. Children with myiasis and/or secondary pyodermitis derived from an intense infestation with *P. capitis* have often been detected. It is necessary to look for control and preventive measures for lice infestation and it is urgent to know the epidemiological characteristics of this disease in Argentina.

Current knowledge on pediculosis shows that there are human groups which are more affected than others, as well as individuals which are totally resistant to infestations, even in identical conditions of hygiene and socioeconomic level. Most people affected by pediculosis have very few lice.² A recent study⁸ in 300 children of Villa María (Córdoba, Argentina) showed that half of infested children only had nits and, although they were considered as positive, they showed a "non-infectious parasitism". This important reference agrees with results obtained by Williams et al,¹⁴ who also verified that only 19% of children who had nits reached an "active" parasitism, i.e., with mobile lice. This last study raised important controversies in the US. Based on the observation that many children with nits never reach an active infestation, the Centers for Disease Control and Prevention (CDC) recommended that only cases in which nits were located within 0.6 cm of the scalp, which means they were likely viable, should be treated as an infestation.¹³ This avoids the excessive use of pediculicides and the unnecessary exclusion of children at school.

In the province of La Rioja, and, in general, nation-

Findings by Ormeño⁸ and Williams et al¹⁴ indicate

a need to obtain a more precise approach to pediculosis intensity so that children with different degrees of infestation should receive adequate care and vigilance. In the present study, the general prevalence of pediculosis was determined as well as the characterization of children according to the different degrees (or mean abundance) of parasitism. Moreover, sex and social stratum, proposed as risk factors, were analyzed.

METHODS

The study was carried out from May to October 2003 in 26 schools of the province of La Rioja (Argentina), two of them in the rural zone and 24 of them from the capital city of the province. The study included a total of 1,370 children from six to eight years old (692 girls and 678 boys) from first grade classes of primary school. Five schools were private, thus including children from well-off families. The 21 public schools had a population of low-to-middle income children. On the other hand, one of the private schools was exclusively for boys (one class) and another one only for girls (two classes). Each class was visited only once, and children's names, sex and age were recorded.

Classic pediculosis prevalence was obtained as the proportion of children with nits and/or mobile lice (nymphs and adults) expressed in percentage. To determine prevalence in relation to social stratum, the five private schools were grouped and contrasted with the 21 public schools.

In order to determine the mean abundance of *P. capitis*, the head of each child was examined for three minutes. This time was set based on Mumcuoglu et al,⁶ who showed that the average time until detection of the first (mobile) louse by direct visual examination was 116 seconds. Based on the results obtained by Williams et al¹⁴ special attention was put on the number and position of nits in relation to the scalp as indicators of parasitism intensity.

Five degrees of parasitism were considered:

- 0) Children free of *P. capitis* (any development stage)
- 0+) Children with signs of past infestation: they only showed nits more than 1 cm of the scalp (old nits, more than 30 days). No mobile lice or nits were found.
- 1) Children with recent infestation and low probability of an active parasitism: they showed up to 10 nits less than 1 cm from the scalp. No mobile lice were observed. As nits that are at less than 1 cm from the scalp are less than 30 days old, these children were considered as "recently infested children," with low probability of having a future active parasitism.¹⁴
- 2) Children with recent infestation and high

probability of an active parasitism (SAP: suspected active pediculosis): they showed more than 10 nits less than 1 cm from the scalp, with no mobile lice observed.

- 3) Children with an active parasitism (DAP: demonstrated active pediculosis): mobile lice and nits close to the scalp were observed.

Percentages were compared through the Chi-square test. The analysis was carried out using Statistica version 5.

RESULTS

From 1,370 children examined, 842 of them showed at least one sign of pediculosis (nits, mobile lice). This indicates a general prevalence of 61.4%.

Prevalence was significantly higher in girls (79%) than in boys (44%) ($p < 0.0001$), 298 boys (out of 678) and 544 girls (out of 692) showed the presence of *P. capitis*.

Prevalence in private schools was lower than in public schools ($p = 0.02$). However, that difference was explained by a lower prevalence in boys from private schools found compared to the prevalence by sex ($p = 0.005$). In girls, parasitism reached similar levels in both public and private schools ($p > 0.05$), showing equally high values (80% in public schools and 72% in private schools).

At the girls' private school prevalence was 83% while at the boys' private school it was 24%. These values were not significantly different from values obtained for boys and girls in mixed classes of other private schools.

When examining total prevalence of pediculosis differentiated by degrees of parasitism (Figure 1), it was observed that half of the children were in grades 0 (with no signs of *P. capitis*) and 0+ (with old nits). The rest of the children (50%) were distributed within the three grades of current parasitism, predominating grade 1 (22%), identified as a low probability of having active pediculosis. Finally, 28% of children categorized in grades 2 and 3 (SAP and DAP) would be the most affected cases because of the high density of nits close to the scalp and the presence of mobile lice.

Samplings showed that heads with mobile forms (nymphs and/or adults) of *P. capitis* were mainly those with more than 10 nits at less than 1 cm from the scalp. Therefore, this last variable is an excellent indicator of active parasitism. The presence of mobile *P. capitis* with no nits was rare, 1/1,370.

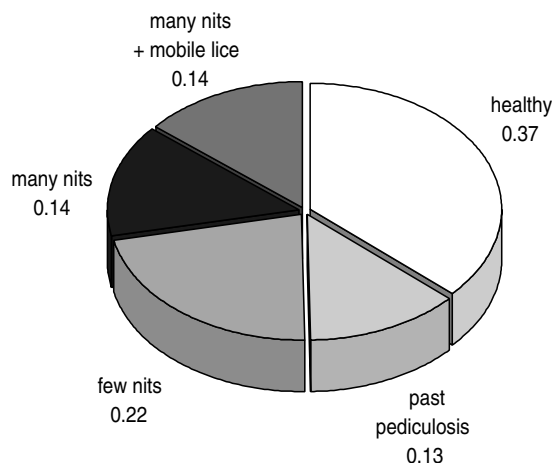


Figure 1 - Proportion of children on each *P. capitis* infestation category. N=137

When social stratum differences were analyzed, public schools showed higher prevalences (public 64%, private 50%, $p < 0.05$), no differences were found among girls (public 80%, private 72%), but were found in boys (public 48%, private 25%, $p < 0.01$).

Significantly higher percentages of children in grade 3 (maximum intensity) were found in public schools. However, it was observed great prevalence variability in these institutions, as opposed to private schools (Figure 2).

The Table lists schools in an increasing order of (grouped) SAP and DAP children. Some public schools located in the central area of the city (schools 3 to 6 and 8) showed low infestation.

Figure 3 shows sexual differences in intensity of parasitism. Except for the proportion of children in grade 0+, all other differences were significant, indicating that girls' heads constitute a more viable habitat for lice populations. It is interesting that for grades 2 and 3, which indicated maximum intensity of pediculosis, the proportion of girls was twice that of boys.

DISCUSSION

Many authors have determined the prevalence of pediculosis in children from different countries. Values ranged from 5-8% to more than 50%.^{7,10} General prevalence for schoolchildren of the province of La Rioja was high (62%) and there was great variation among schools. Similar prevalences have been described for other provinces in Argentina⁸ indicating the great impact of this disease in Argentinean children. Sex and social

stratum were confirmed as important modifiers of prevalence.

The study proposes a new way to determine prevalence of pediculosis through visual exam, with differentiation of parasitic forms. This method allows the rapid identification of the intensity of parasitism and then to define the management or treatment to adopt.

The obtained results when classifying pediculosis according to intensity degrees showed that prevalence obtained in the classic way is not totally adjusted to reality, in agreement with observations by Williams et al.¹⁴ and Pollack et al.¹⁰ The latter pointed out that "microscopic examination of specimens identified as lice or nits by health care professionals and lay personnel revealed that both groups tend to overdiagnose and mismanage infestations by failing to distinguish extinct from active infestations". However, the position of nits on hair allows making this distinction. In the present study, 7% to 29% of children were classified as 0+ (false positives) because they only had nits at more than 1 cm of the scalp and no mobile lice were found within the given time. The hypothesis that these children are false positives is reinforced because no nits were found close to the scalp, evidence of a recent colonization. Mumcuoglu⁵ showed that nits may remain stuck to the hair for at least six months, even after a successful treatment, and may lead to a false positive diagnosis of louse infestation. If it is accepted that grade 0+ children are false positives, general prevalence in the study school-children decreases to 50% and including only those children with mobile lice.

Children of grade 1 of parasitism are cases where the probability of developing an active parasitism is low and would only need vigilance without any type of intervention or treatment. It is believed that many of

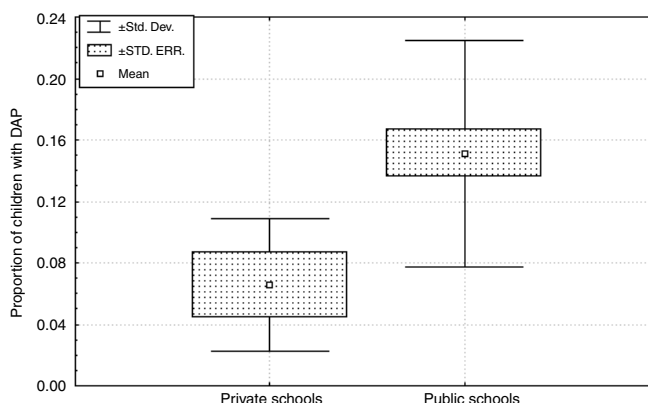


Figure 2 - Proportion (mean) of children with demonstrated active pediculosis (DAP) at public and private schools.

Table - Pediculosis intensity (= mean abundance of parasites).

School	Pediculosis intensity % (= mean abundance of parasites)					
	0 Healthy children	0+ Past pediculosis	1 Few nits	2 Many nits	3 Mobile lice Many nits + mobile lice	2+3 Mobile lice
1*	77	9	11	0	3	3
2	64	18	9	4	3	7
3	42	21	26	4	7	11
4	25	11	52	3	9	12
5	42	20	20	14	5	19
6	52	14	15	12	7	19
7	42	11	26	11	10	21
8	42	14	23	7	14	21
9	45	14	18	09	14	23
10	52	7	17	16	8	24
11	46	13	14	14	14	28
12	24	17	30	12	17	29
13	30	10	31	8	21	29
14	21	29	17	21	12	33
15	33	12	22	12	21	33
16	41	8	18	12	22	34
17	28	15	23	14	19	33
18**	22	19	25	27	08	35
19	31	17	16	10	25	35
20	40	07	17	26	10	36
21	24	13	25	06	32	38
22	39	10	12	22	17	39
23	35	14	12	19	20	39
24	25	4	32	16	23	39
25	37	11	11	37	5	42
26	29	7	20	34	10	44

0: Healthy children, 0+: past pediculosis, 1: few nits, 2: many nits, 3: many nits + mobile lice

Bolding: children in private schools

*Boys school

**Girls school

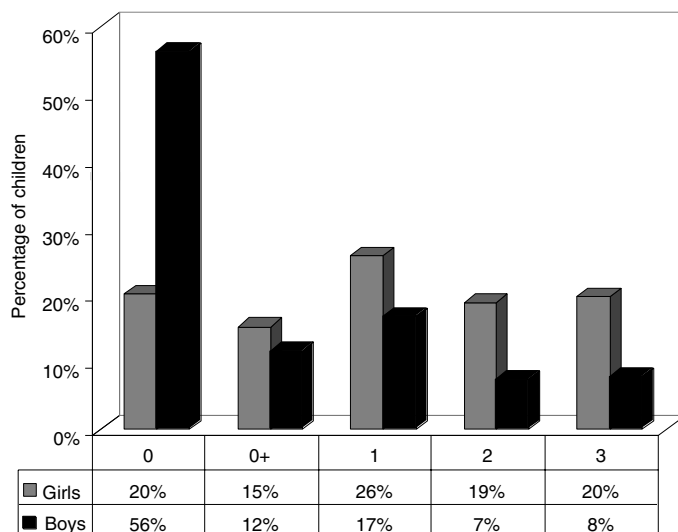
these cases are incipient colonization or a colonization where the female laid some eggs and then left the host. Adults could be picked off or deloused by the host, or may be the host is not susceptible to pediculosis. These observations agree with those by Ormeño,⁸ who used a thin comb in 300 children and showed that 30% of them only had nits. Moreover, Mumcuoglu et al.⁷ examined 940 children in Jerusalem, finding that 199 of them (21.2%) were infested with lice and eggs, while 164 (17.4%) were infested only with nits.

It is evident that control should focus particularly those children whose heads have more than 10 nits close to the scalp, i.e., SAP and DAP children (28% of first grade children).

Sex and social condition are important modifiers of pediculosis prevalence. Significant differences observed in the intensity of infestation in boys and girls confirm Ormeño⁸ findings. Undoubtedly, hair length in girls interferes with the cleanliness, the re-examination and the daily hairdo; however, there could be a hormonal and/or skin factor which could also produce a greater susceptibility to *P. capitis* in girls. Results obtained in a previous study³ indicated that, in boys, prevalence declines with age, while, in girls, it remains high during the whole primary school period. Since boys' hair was short during all

school period there must be another explanation for this decrease in prevalence.

Comparing both sexes using prevalence differentiated by degrees of parasitism provided a better understanding of the epidemiological behavior of *P. capitis*. Considering children of grade 0+ as false positives, the percent of children with pediculosis was reduced to 32% in boys and 65% in girls. And comparing the three degrees of current parasitism (grades 1, 2 and 3) it was evidenced that half of infested boys corre-

**Figure 3** - Distribution of children, according to sex, on each *P. capitis* infestation category.

sponded to the first grade, with less than 10 nits close to the scalp and without any evidence of mobile lice. Most girls were found in the SAP and DAP degrees of maximum intensity or abundance of parasitism, with more than 10 nits close to the scalp and mobile lice observed or with a high probability of finding them.

Although it was corroborated that children from all social strata suffer this parasitism, the study results revealed that characteristics of pediculosis change in relation to social position of families involved at each school. The lowest general prevalence was found in public schools located in the central area of the city of La Rioja (a well-off area) and in four out of the five private schools. The girls' private school was an exception, where the susceptibility by sex surpassed the social barrier. The surrounding schools, close to very poor neighborhoods, showed very high prevalences. The analysis according to degrees of parasitism indicated significant differences in the intensity of the disease; with a higher proportion of children in grade 3 (DAP) in public schools. Recently, Ormeño⁸ (2004) established that the highest difference between two schools of different social stratum was the total number of lice collected by using a thin comb. The school at which the

low social stratum children attended showed three times more mobile lice than the high-middle class school.

An association was found between presence of lice infestation and mother's education and frequency of shampooing, combing, and examining for lice.¹² Here, the key factors which allow a higher control of pediculosis at well-off homes may be a better hygiene, the availability of a thin comb and different preparations to fight these parasites, as well as a more efficient control by parents. However, there are still taboo barriers on pediculosis that, for example, lead some parents of private schools to oppose to the re-examination of their children. Well-prepared educational campaigns and the organization of community activities at school would significantly contribute to eliminate taboos and feelings of shame and to decrease the prevalence of this parasitism.

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