

Head Lice Infestation in School Children at Dera Ismail Khan

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Abstract.- Prevalence of head lice infestation was studied among school children at Dera Ismail Khan from November 2002 to January 2003. A standard questionnaire was designed for recording a variety of information at the time of survey. Visual inspection of student's head, and combing of their hair for 2-4 minutes were made to check the presence of lice, nymphs and eggs. The overall infestation rate was 26%. Girls showed higher prevalence (29%) than the boys (15%). Prevalence decreased with age in girls and was found to be inversely related to hair length. Direct association was also found with hair lubrication and crowding, while negative association was found with dandruff, and economic conditions. No association was recorded with hair texture and bathing frequency. The degree of infestation, like prevalence, was higher in girls than in boys and decreased linearly with age in both sexes.

Key words: Head lice infestation, school children.

INTRODUCTION

All types of human louse cause the usual irritation resulting from the bites of blood sucking insects. Two important species of lice belong to the genus *Pediculus*. According to Kettle (1995) the medical importance of *Pediculus* does not reside in its direct effects on the human host, but in its role as the vector of epidemic typhus and relapsing fever caused by *Rickettsia prowazekii* and *Borrelia recurrentis* respectively. He further stated that pathogens associated with *Pediculus* are transmitted less often through the direct bite of the lice than by their excreta or dead bodies being rubbed into the bites. Since each louse can infect only one man, the disease cannot assume epidemic proportions unless people are crowded together in insalubrious conditions. Apart from these unpleasant results of louse infestation, the insect itself is a considerable disgust and shame, which, unfortunately sometimes lead to infestations being hidden or denied (Busvine, 1980).

Pediculus humanus capitis, one of the important lice species, the head louse, is a small wingless insect of the order Anoplura. It is a host specific ectoparasite that live on the human scalp and hair. Head lice infestation is found everywhere,

sometimes infesting large proportions of children in schools. Head lice are acquired from other infested people by direct head to head contact or by sharing items such as combs, brushes, scarves, caps, head phones or sports helmets. They can also be transferred from person to person via coats, theater, car or bus seats and bedding etc.

Prevalence of head lice infestation in schoolchildren has been studied by several workers in different parts of the world. The estimates of infestation rate in some reports are 2.4% in England (Donaldson, 1976); 49% in Accra, Ghana (Kwaku-Kpikpi, 1982); 75% in Dhaka, Bangladesh (Burgess *et al.*, 1994); 59.7% in Shillong, India (Roy and Tandon, 1992); 12.9% in Malaysia (Sinniah *et al.*, 1983); 5.7% in Nigeria (Ogunrinade and Oyejide, 1984); 46% at Peshawar, Pakistan (Suleman and Fatima, 1988) and 25.5% in Lahore, Pakistan (Kazmi *et al.*, 1993). Different views have been expressed by some of these workers about the role of factors like age, sex and hair length in the distribution of head lice among school children (Sinniah *et al.*, 1981, 1983; Suleman and Fatima, 1988; Kazmi *et al.*, 1993).

This paper is about a study made on school children at Dera Ismail Khan to find out the prevalence of head lice infestation and the effects of different factors contributing to their transmission and prevalence.

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SUBJECTS AND METHODS

The prevalence of head lice infestation among 1516 school children including 1151 girls and 365 boys was studied in Dera Ismail Khan. The study was carried out during the period November 2002 to January 2003. The survey was conducted in eight schools (Table I).

Table I.- List of schools surveyed at D. I. Khan showing total strength and size of the sample studied.

School	Total strength	Sample studied	
		Male	Female
1. Telecom Foundation Public School	464	146	106
2. O.P.F. Public School	364	98	129
3. University Wensam College	400	121	44
4. Govt. Girls High School Dinpoor	377	-	152
5. G.G.H. S. No. 3 Samundar Khan	350	-	211
6. G.G.H.S. No. 5 Qasaban	542	-	252
7. G. Girls Primary School City	232	-	112
8. G.G.P. School Mujahid Nagar	354	-	145

Sampling methods

The sample included the school children from class 2nd to 10th. These children were able to respond to the questionnaire used in the survey. The maximum number of students examined in each sample was 30 who were selected randomly. If the number of students in any class was less than 30, then all the students were examined.

A standard questionnaire was designed to record information on the students age, sex, hair length, hair texture, presence of dandruff, number of living rooms in the house, number of persons in the family, parental occupation, frequency of hair lubrication, bathing frequency, bedding, and number and stages of lice recovered was recorded at the time of the survey.

Each student was examined by visual inspection of the head in sufficient light and if suspected, the presence of dead or live nits was used as the criterion of selection for further examination to check the presence or absence of lice. Such

students were subjected to combing of the hair with fine-toothed comb on white paper for about 2-4 minutes (depending on condition of hair, like hair texture and density of hair). Any lice that were found were counted and preserved in 70% ethyl alcohol.

Statistical analysis

Chi-square test was used for determining association between two variables and also for comparison of prevalence rates among different groups. Other tests like regression and correlation were also used.

RESULTS

The overall crude prevalence of head lice infestation among school children at D. I. Khan was 26%. Variation among the schools ranged from 6% – 57%, with highest infestation rate in Govt. Girls Primary School City and lowest in OPF Public School (Table II). The difference in infestation rates was highly significant ($X^2=124.06$, d.f. =7, $P < 0.001$).

Age and sex

Data from all the eight schools were pooled to find out the effect of age and sex on prevalence of head lice infestation among school children. Age specific prevalence in boys and girls based on pooled data is shown in Table III and graphically represented in Figure 1. Age-specific prevalence rates were higher for girls than boys and the difference was significant for four age groups (8, 9, 10 and 13), while for the other five age groups the difference was non significant. The prevalence rates in girls varied from 0.14 to 0.43 with maximum head lice infestation in 4th class i.e. 10 years age group. The prevalence rates in boys varied from 0.05 to 0.27 with no clear trend in infestation because of the small sample size.

Regression slope for girls is significantly larger than zero, while it is almost equal to zero in case of boys indicating decrease in prevalence rate with age in girls but not in boys (Fig. 1).

Hair length

Relationship between hair length and prevalence

Table II.- Crude prevalence of head lice infestation in children of different schools at D.I. Khan.

No.	Schools	+ve/ examined	+ve (%)	Status
1.	T.F. Public School	52/252	22	Semi Govt. Schools
2.	U.Wensam College (N.S)	39/165	23	
3.	O.P.F. Public School	15/227	6	Govt. Girls High schools
4.	G.G.H. School Dinpoor	46/152	30	
5.	G.G.H.School No.3 Samundar Khan	51/211	21	
6.	G. G.H. School No.5 Qasaban.	69/252	27	
7.	Govt. Girls Primary School Mujahid Nagar	64/112	57	Govt. Girls Primary Schools
8.	Govt. Girls Primary School City	60/145	41	
	Total	396/1516	26	

Table III.- Comparison of age specific prevalence of head lice infestation in school girls and boys at D.I.Khan based on pooled data.

Age (Years)	Girls			Boys			Comparison X ²
	Sample	+ ve	Prevalence	Sample	+ ve	Prevalence	
8	98	40	0.41	78	14	0.18	10.68 *
9	97	37	0.38	62	10	0.16	8.77 *
10	100	43	0.43	62	6	0.10	20.55 *
11	101	34	0.34	47	12	0.26	0.98 ns
12	167	56	0.33	35	6	0.17	3.62 ns
13	146	42	0.29	34	4	0.12	4.17 *
14	176	47	0.26	18	2	0.11	2.06 ns
15	146	22	0.15	18	1	0.05	0.15 ns
16	120	17	0.14	11	3	0.27	1.33 ns
Total	1151	338	0.29	365	58	0.15	26.07 *

ns= Difference is not significant P>0.05

* = Difference is significant.P<0.05

$X^2_{tab} = X^2_{(0.05)(1)} = 3.84$

Table IV.- Prevalence of head lice infestation in relation to hair length in girl students based on pooled data from eight schools students at D.I. Khan.

Age (Years)	Sample	Short		Medium		Long		Comparison X ²		
		+ve	Prevalence	Sample	+ve	Prevalence	Sample		+ve	Prevalence
8	70	30	0.43	18	4	0.22	10	6	0.60	4.21ns
9	64	20	0.31	18	8	0.44	15	9	0.60	4.62 ns
10	36	16	0.44	33	12	0.36	31	15	0.48	1.16 ns
11	25	10	0.40	38	8	0.21	38	16	0.42	3.72 ns
12	18	6	0.33	30	14	0.47	119	40	0.34	1.83 ns
13	10	3	0.30	27	9	0.33	109	36	0.33	0.40 ns
14	11	2	0.18	22	6	0.27	143	39	0.27	0.96 ns
15	4	0	0.00	15	3	0.20	129	19	0.15	1.01 ns
16	4	1	0.25	14	1	0.07	102	15	0.15	0.91 ns
Total	242	88	0.36	228	65	0.28	681	185	0.27	7.38*

Ns = Difference not significant P>0.05; * = Difference significant P<0.05.

of lice was analyzed in female children only because of negligible variation in hair length among male

students. Hair length was divided into three categories, following the scheme of Sinnah *et. al.*

(1983) and Suleman and Fatima (1988) as short (above collar and ear), medium, (above shoulder) and long (extending below shoulder).

Head lice infestation was analyzed in relation to hair length for each age group as well as for the whole sample collectively (Table IV). The sample included 1151 girls, of which 242 had short hair, 228 had medium and 681 had long hair. The age specific rate did not vary significantly in the three categories of hair length. However, overall rate differ significantly ($X^2=7.38$, d.f.=2, $P<0.05$) but opposite to expected direction i.e. infestation rate was higher in short hair category than in the medium and long-hair categories.

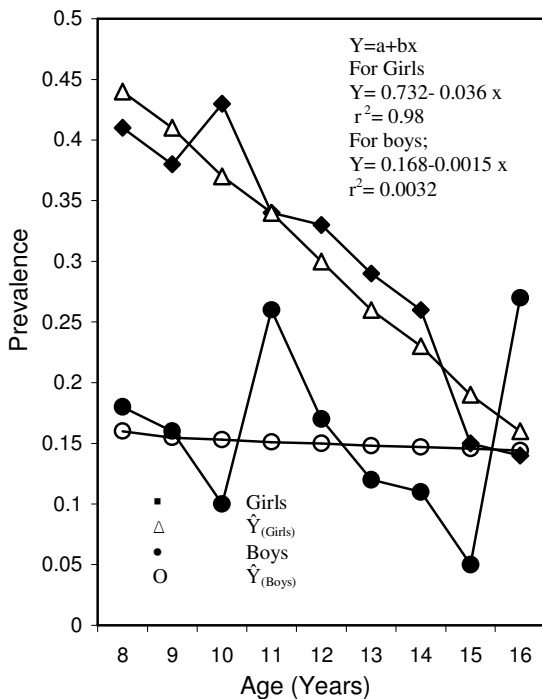


Fig. 1. Prevalence of head lice infestation in school girls and boys at D.I.Khan in relation to age. Fitted regression lines, regression equation, tests for slopes and comparison of slopes are included. r^2 =Coefficient of determination.

Hair texture (curly and straight)

Of the total sample of 1516 children, 159 had curly hair and 1357 straight hair. The infestation was found in 47 and 349 children with these two

types of hair. A Chi square test for association between lice and hair texture indicated no association ($X^2=1.08$, d.f.=1, $P>0.05$).

Dandruff

The presence of white scale on the head is called dandruff. In the present study presence or absence of dandruff was recorded at the time of the survey without considering its intensity. As head lice are restricted to the head, it seems that prevalence of head lice might have some relation with presence or absence of dandruff. Data were organized and analyzed in order to find the relation between dandruff and prevalence of lice.

Data sets from all the eight schools subjected to X^2 test gave mixed results; four schools showed negative association between head lice and dandruff while the remaining four schools showed no significant association between the two variables. However, data pooled over all the schools indicated a highly significant negative association between dandruff and head lice infestation (Table V, $X^2=26.03$, d.f.=1, $P<0.05$). In other words children without dandruff were more likely to have head lice infestation than those with dandruff.

Table V.- Negative association between head lice infestation and dandruff based on the total sample of school children from D. I. Khan

Lice	Dandruff		Total
	Present	Absent	
Present	100	296	396
Absent	443	677	1120
Total	543	973	1516
Rate	0.184	0.304	

$X^2_{tab(0.05)(1)} = 3.841, X^2_{Cal} = 26.0$

Crowding

The degree of crowding was assessed from the number of persons per room calculated from the family size and number of rooms in the house. Prevalence rates of head lice infestation in relation to crowding in females and males are depicted in Table VI and Figure 2. The infestation rate increased in both sexes with increase in number of persons/room as the correlations between prevalence rates and degree of crowding were

Table VI.- Prevalence of head lice infestation in school children by number of persons per room.

No. of persons/room	Female				Male			
	Mid points	Sample	Positive	Prevalence	Mid points	Sample	Positive	Prevalence
0-1.5	0.75	220	40	0.18	0.75	146	18	0.12
1.6-2.5	2.00	359	97	0.27	2.00	146	20	0.14
2.6-3.5	3.00	251	78	0.31	3.00	46	11	0.24
3.6-4.5	4.00	150	52	0.35	4.00	19	6	0.31
4.6-11.5	7.32*	171	71	0.42	5.68*	8	3	0.37
Total		1151	338	0.29		365	58	0.16

$r = 0.96, r^2 = 0.92$

$(r = 0.98, r^2 = 0.95)$

*Values represent weighted averages.

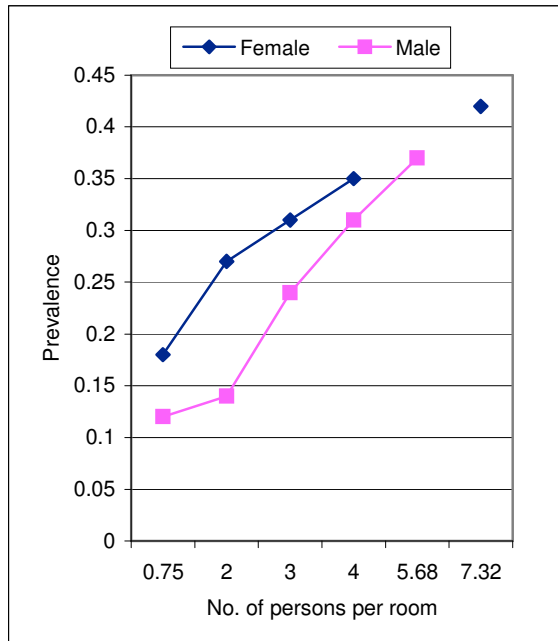


Fig. 2. Prevalence of head lice infestation in female and male children in relation to crowding of all family members (No. of persons/room).

significant in both sexes (females: $r = 0.96, r^2 = 0.92$; males: $r = 0.98, r^2 = 0.95$). The prevalence rate was higher in persons sharing rooms with a larger number of persons than those who had independent rooms or were sharing with a few other persons.

Economic conditions

The prevalence of head lice infestation in relation to economic conditions was studied by

classifying the subjects into three groups: high income group (Rs. $\geq 10,000$ p.m.); middle income group (Rs. 5000-10,000 p.m.); low income group (<Rs. 5000 p.m.).

It was supposed that economic conditions might have some association with head lice infestation because poor economic conditions are likely to result in overcrowding at home. Chi-square test applied to the data pooled over all the schools, showed that the infestation rates varied significantly among the three economic groups ($X^2 = 32.87, d.f. = 2, P < 0.05$, Table VII).

Bathing frequency

Table VII.- Association of head lice infestation with economic conditions based on the data pooled for all the schools.

Lice	High Income group	Middle Income group	Low Income group	Total
Present	92	137	167	396
Absent	381	433	306	1120
Total	473	570	473	1516
Rate	0.19	0.24	0.35	

$X^2_{tab} = 3.841, X^2_{Cal} = 32.87$

Prevalence of head lice infestation in relation to bathing frequency of the host was analyzed, because it was thought that lice might not infest a person practicing frequent bathes because of good hygienic conditions. To check the results, the data were classified into four categories viz. daily; thrice a week; twice a week; and weekly. The Chi square test indicates no association between head lice infestation and bathing frequency, as the calculated

value $X^2_{cal}=7.82$ is very close to the tabulated value $X^2_{tab}=7.81$ (Table VIII).

Table VIII.- Association of head lice infestation with to bathing frequency based on data pooled over all the schools.

Lice	Daily	Thrice a week	Twice a week	Weekly	Total
Present	11	131	51	203	396
Absent	42	452	136	490	1120
Total	53	583	187	693	1516
Rate	0.20	0.22	0.27	0.29	

$X^2_{cal}=7.82$, $X^2_{tab}=7.81$, d.f.=3, $P<0.05$

Bedding (separate/shared)

Prevalence of head lice infestation was analyzed in relation whether the child uses separate bedding or not. The data was arranged into two categories of children - children having separate bedding and those sharing bedding with any other person in the family. The X^2 value indicated that there exist a close positive association between head lice infestation and shared bedding ($X^2=15.57$, d.f.=1, $P<0.05$, Table IX).

Frequent use of oil (lubrication of hair)

Many people lubricate their hair. As head lice are restricted to the head region it was supposed that lubrication may affect the lice infestation.

Table IX.- Head lice infestation in relation to bedding (separate/shared) of the host, based on data pooled for all the school children surveyed.

Lice	Separate bedding		Total
	Yes	No	
Present	142	254	396
Absent	530	590	1120
Total	672	844	1516
Rate	0.21	0.30	

$X^2_{cal}=15.57$, $X^2_{tab}=3.84$, d.f.=1, $P<0.05$

To know the results data was separated into two categories and X^2 statistic was applied. The X^2 value indicated a positive association of head lice infestation and frequent use of oil ($X^2=9.81$, d.f.=1, $P<0.05$, Table X).

Table X.- Association of head lice infestation with frequent use of oil

Lice	Frequent use of oil		Total
	Yes	No	
Present	273	123	396
Absent	673	447	1120
Total	946	570	1516
Rate	0.29	0.22	

$X^2_{tab}=3.841$, $X^2_{cal}=15.57$, d.f.=1, $P<0.05$

Intensity of infestation

Persons positive for lice were divided in two categories, those from whom only nits were recovered, and those from whom other stages (nymphs and adults) were also recovered. Individuals of the former category were included in estimates for prevalence but were excluded from intensity data since nits were not counted. X^2 analysis of the data showed that proportion of individuals with nits only, were comparable in boys and girls ($X^2=0.47$, d.f.=1, $P>0.05$, Table XI).

Here intensity of infestation is defined as population density of lice per head represented by number of lice recovered in about 2-4 minutes combing (Suleman and Fatima, 1988). The intensity of infestation among 279 children (253 girls, 26 boys) showed that most of the children (48.22% girls, 50.00% boys) had found a density of 6-10 lice per head.

A comparison of frequency distribution of girls and boys by intensity of infestation demonstrated that relatively higher proportion of boys were concentrated towards low-density groups (Table XII, Fig. 3).

DISCUSSION

Head lice infestation is rampant among school children in both developed and developing countries. There are many surveys on the extent of head lice infestation, particularly among school children. Rate of infestation vary greatly from place to place. In the present study average infestation rate was 26%. The previous studies in Pakistan by Suleman and Fatima (1988) in Peshawar and Kazmi *et al.* (1993) in Lahore, recorded 45% and 25.5% pediculosis in the school children.

Table XI.- Comparison of girls and boys with respect to proportion of individuals with nits only, among those positive for lice in different schools at D. I. Khan.

	Total positive	No. of children having nits only	No. of children having other stages also
Girls	338	59	279
Boys	58	8	50
Total	396	67	329

$X^2_{cal} = 0.47, X^2_{tab} = 3.84, d.f. = 1, p > 0.05$

Table XII.- *Pediculus humanus* frequency distributions of the intensity of infestation in girls and boys.

No. of lice recovered in 2 min. search	Mid points	Girls		Boys	
		Frequency	%age	Frequency	%age
1-5	2.5	84	33.20	10	38.46
6-10	7.5	122	48.22	13	50.00
11-15	12.5	35	13.83	2	7.69
16-20	17.5	7	2.77	1	3.85
21-25	22.5	5	1.97	-	-
Total		253	100.00	26	100.00

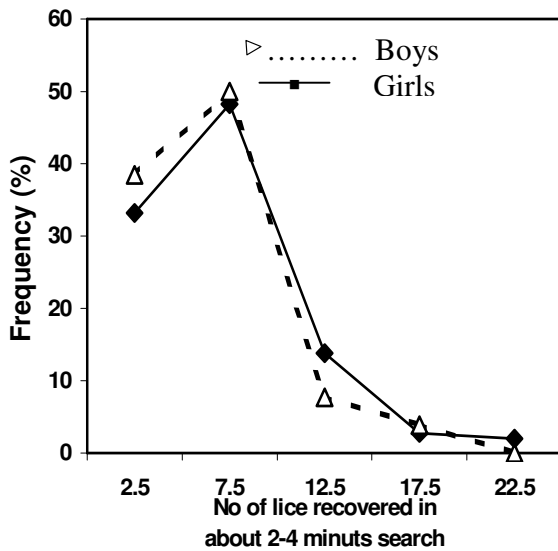


Fig. 3. *Pediculus humanus*: frequency distributions of the intensity of infestation in girls and boys.

Age and sex affect head lice infestation. In the present study the infestation rate in girls was significantly higher than boys almost in all age groups. In girls the infestation rate varied from 14%

to 43% with maximum infestation in the 4th class. Similar situation was reported in many other studies like Iwuala and Onyeka (1977) in Nsuka (East Nigeria), Suleman and Fatima (1988) in Peshawar (Pakistan), Kazmi *et al.* (1993) in Lahore, (Pakistan) and Roy and Tendon (1992) in Shillong (India).

The present study suggests that the prevalence of lice decreases with hair length. The present finding is contrary to that of the previous studies (Busvine and Reid, 1949; Sinniah *et al.*, 1983; Suleman and Fatima, 1988). The reasons for the opposite trends of lice prevalence in association with the hair length are not known.

This study indicated a negative association between head lice infestation and dandruff. Suleman and Fatima (1988) also reported similar situation in their study, and they suggested that probably head lice do not like the dry and scaly habitat, which is a common characteristic of the head with dandruff. The other possible causes may be as follow: head lice prefer a temperature 30°C-32°C (Kettle, 1995), while dandruff provide an insulation so alternately head lice can not avail favourable temperature or alternately they have difficulty in sucking blood; more frequent washing of hair in case of presence of dandruff on scalp, probably preventing pediculosis.

Overcrowding also affects the prevalence of

head lice infestation because they are mainly acquired by contact. Busvine (1980) found that the percentage of head lice infestation increased with the number persons in families, when he was comparing the proportions of children infested in families of different size. In the present study general overcrowding *i.e.*, number of person per room had direct relation with infestation rates both in girls and boys.

Although Pollack (1997) is of the opinion that lice do not respect socio-economic class distinctions, direct relation of socio economic conditions with pediculosis was found in this study. Gulati *et al.* (1981) working in Goa (India) and Kazmi *et al.* (1993) working in Lahore (Pakistan) considered poor socioeconomic conditions as the major contributing source of pediculosis.

Cleanliness and habit of frequent bath decreasesd the prevalence of head lice infestation. Borrer and Delong (1971) are of the opinion that people who bath and change clothes regularly seldom become infested with lice, but when they go for long periods without bathing or changing clothes and live in crowded conditions, lice infestation is likely to be prevalent. The latter conditions are often common during war time, when living quarters are crowded, sanitation facilities are at minimum, and people go for long periods without the change of clothes.

Intensity of infestation with *Pediculus humanus capitis* in this study was 6 – 10 lice per head. which seems to be within the range found in previous studies, *e.g.*, 1-10 lice per head in Africa (Buxton, 1947), 1-25 lice in Ethopia (Scholdt *et al.*, 1976) and 1-5 lice per head in most school children in Nigeria (Ogunrinade and Oyejide, 1984). The intensity of lice infestation was low in boys than in girls so girls not only had higher prevalence of lice but also had higher intensity of infestation compared to boys.

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