

Louse Comb Versus Direct Visual Examination for the Diagnosis of Head Louse Infestations

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Abstract: The techniques used for diagnosis of head louse (*Pediculus capitis*) infestation are a source of controversy. Most epidemiologic and diagnostic studies have been done using direct visual examination. The main objective of this study is to compare the efficacy of direct visual examination versus the louse comb method. The hair of each child was examined twice; one team used a screening stick and another team used a louse comb. Seventy-nine boys and 201 girls, 7–10 years old were examined. Examination with a louse comb found that 25.4% of the children were infested with both lice and nits, while another 31.3% had nits only. Boys were significantly less infested with lice and nits than girls (lice: 15.2 and 29.6%; nits: 21.5 and 35.4%, respectively). The infestation rate with lice and nits was significantly higher in children with long (68.9%) and medium-length (63.9%) hair than in children with short hair (44.0%) ($p < 0.01$). Direct visual examination found that 5.7% of the children were infested with both lice and nits, and another 49.0% with nits only. The average time until detection of the first louse was 57.0 seconds with the comb as compared to 116.4 seconds by direct visual examination. Diagnosis of louse infestation using a louse comb is four times more efficient than direct visual examination and twice as fast. The direct visual examination technique underestimates active infestation and detects past, non-active infestations.

The optimal way to diagnose head louse infestation is controversial. Most epidemiologic studies have used direct visual examination and most examinations in schools are done the same way. In addition, the diagnosis of louse infestation is generally based on the presence of nits. However, not everyone who has nits also has living

lice. Direct visual examination is not a reliable method for the diagnosis of living lice on hair. Over the last 12 years we examined more than 15,000 school children in Israel with the louse comb method and found it to be an efficient method for detecting living lice (1–3). However, comparison of the two methods has never been

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done under experimental conditions. The aim of this study was to compare the two techniques of diagnosis of *Pediculosis capitis*, direct visual examination versus examination with a louse comb, and to compare the minimum time for finding the first louse.

METHODS

Children living in Bet-Shemesh, an urban area with a socioeconomically heterogeneous population, 25 km from Jerusalem, were examined. The population in 1988 was 14,200, of whom 4300 were children between 5 and 17 years of age.

Seventy-nine boys and 201 girls, 7–10 years old, in grades 1–4, were examined during the period June 17–25, 1998. Most of the children had four to six siblings and were from families of a medium socioeconomic level. Of the 280 children, 279 were examined by hand and 268 were also examined by comb.

Each child was examined by two parasitologists, one of whom inspected the hair by hand using a screening stick and the other, working in a different room, who used a louse comb (Inomed). Four parasitologists participated in the study. Every hour the parasitologists switched rooms and examination method.

Hair length (short, medium, long), color (black, brown, red, blond), and structure (straight, wavy, curly, and frizzy) were noted. The duration of the examination varied with hair length: children with short hair (neck visible) were examined for 3 minutes; those with medium-length hair (reaching the shoulders) for 4 minutes; and those with longer hair for 5 minutes (1). The total time from the beginning of the examination until the finding of the first louse was recorded.

The examination procedures were as follows: First the hair was brushed or combed with an ordinary comb to remove tangles. With the louse comb, the hair was examined under a good light source by combing thoroughly; after each combing the teeth of the comb were examined for living lice. Starting from the middle of the anterior part of the scalp, the hair was combed from the scalp down to the end of the hair. In order not to lose any lice or eggs, the comb was raised toward the end of the hair. If necessary, a magnifying glass was used to distinguish young lice and eggs from debris (e.g., dandruff). During the combing, the hair was also inspected for the presence of eggs and nits. With the direct visual examination, the hair was parted with the fingers or with a screening stick every 2 cm and searched for lice moving near the scalp. Children were classified as positive for lice; negative for lice but positive for nits; positive for both lice and nits; or negative for both lice and nits.

The data were analyzed using SPSS software (SPSS Inc., Chicago, version 5.0, 1993). The chi-squared test was used to compare subgroups of boys and girls by categorical variables such as infestation rate and hair length. The McNemar test was used for comparing the efficacy of the two methods, and the paired Student's *t* test was used to compare the average time that elapsed until the first louse was detected by each of the two methods.

RESULTS

Of 268 children examined with a louse comb, 68 (25.4%) were found to be infested with lice and eggs, while another 84 (31.3%) had nits only (Table 1). Boys were significantly less often infested with lice than girls (15.2

TABLE 1. Infestation Rate of Children with Lice and Nits According to Method of Examination as well as Gender and Hair Length of the Child

	Examination by Comb (n = 268)			Direct Visual Examination (n = 279)		
	Lice and Nits	Nits Only	Overall Infested	Lice and Nits	Nits Only	Overall Infested
Gender						
Boys and Girls (n = 280)	68 (25.4%)	84 (31.3%)	152 (56.7%)	16 (5.7%)	139 (49.0%)	155 (55.5%)
Boys: 79 (28.2%)	12 (15.2%)	17 (21.5%)	29 (36.7%)	1 (1.3%)	15 (19.0%)	16 (20.3%)
Girls: 201 (71.8%)	56 (29.6%)	67 (35.4%)	123 (65.1%)	15 (7.5%)	124 (62.0%)	139 (69.5%)
Hair length (n = 278)						
Short: 110 (39.6%)	23 (21.1%)	25 (22.9%)	48 (44.0%)	5 (4.5%)	32 (29.1%)	37 (33.6%)
Medium: 85 (30.6%)	24 (28.9%)	29 (34.9%)	53 (63.8%)	6 (7.0%)	52 (61.2%)	58 (68.2%)
Long: 83 (29.8%)	21 (28.4%)	30 (40.5%)	51 (68.9%)	5 (6.1%)	55 (67.1%)	60 (73.2%)

TABLE 2. Infestation Rate of Children with Lice and Nits According to Their Age

Age	N (268)	Comb Examination			Direct Visual Examination		
		Lice and Nits	Nits Only	Total	Lice and Nits	Nits Only	Total
7	112	24 (21.4%)	36 (32.1%)	60 (53.5%)	2 (1.8%)	49 (43.8%)	51 (45.6%)
8	72	20 (27.8%)	19 (26.4%)	39 (54.2%)	5 (6.9%)	30 (41.7%)	35 (48.6%)
9	54	17 (31.5%)	18 (33.3%)	35 (64.8%)	7 (13.0%)	35 (64.8%)	42 (77.8%)
10	30	7 (23.3%)	11 (36.7%)	18 (60.0%)	1 (3.3%)	19 (63.3%)	20 (66.6%)
Average		26.0%	32.1%	58.1%	6.3%	53.4%	59.7%

versus 29.6%, respectively; $\chi^2=6.14$, $p=0.013$). The rate of infestation with nits in boys was also significantly lower than in girls (21.5 versus 35.4%, respectively; $\chi^2=5.02$, $p=0.025$). The overall infestation rate in children with medium (63.8%) and long hair (68.9%) was significantly higher than in children with short hair (44.0%; $\chi^2=6.95$, $p=0.031$). No significant differences were found between examiners, as well as between infestation rate and hair structure and hair color.

The direct visual examination method, using a screening stick, found 16 children (5.7%) infested with lice and nits and another 139 children (49.0%) infested with nits only (Table 1). Boys were also significantly less infested with lice (1.3 versus 7.5%, respectively; $\chi^2=4.07$, $p=0.043$) and with nits (19.0% versus 62.0%, respectively; $\chi^2=41.9$, $p < 0.001$) than girls. No differences were found in the infestation rate and hair length, hair color, and hair structure.

Comparing age groups of the children (9 and 10 years versus 7–8 years), both comb examination and direct visual examination showed the highest infestation rate with lice and nits to be in 9-year-old children ($\chi^2=5.01$, $p=0.021$ comb examination; $\chi^2=4.31$, $p=0.038$, direct visual examination). Comb examination showed no significant differences in age in children who were infested with nits only (Table 2), while direct visual examination indicated that 9- and 10-year-old children were significantly more infested with nits as compared to 7–8 year olds ($\chi^2=15.7$, $p < 0.0001$).

Comparison of the two methods by the McNemar test shows that direct visual examination detected significantly fewer lice than examination with a comb (5.7 versus 25.4%, respectively) ($\chi^2=41.6$, $p < 0.001$). However, direct visual examination revealed a higher percentage of children with nits only than the examination with a comb (49.0 versus 31.3%, respectively) ($\chi^2=20.7$, $p < 0.001$). The average time until the first louse was detected was 57.0 seconds with the comb and 116.4 seconds by direct visual examination ($p < 0.002$).

DISCUSSION

The average infestation rate in the children examined by the comb method with lice and their eggs (25.4%) and

with nits only (31.3%) was higher than in other studies conducted in Israel. Earlier studies using the louse comb showed the rate to be 11.6–12.1% infested with lice and 22–23.4% with nits only (1–3). This could be related to the fact that most of the children in our study had a large number of siblings (four to six). A positive correlation between infestation rate with lice and crowding at home has been found (4).

In the present study, girls were more often infested than boys. This is in accordance with results obtained in some studies (3–7). However, in other studies boys and girls were equally infested (1,8). The gender differences are even more pronounced when infestation with nits only is also considered a sign of louse infestation, as the nits remain longer on the infested girls with their longer hair than in boys, where the nits are often removed by a short haircut. Children with long and medium-length hair (in this study, all girls) were found to be more infested than children with short hair.

Nine-year-old children were the most-often infested age group. This is in accordance with a previous study where 4- to 17-year-old children were examined and those 4–11 years old (with a peak at 9 years) were the most often infested (1).

Combing with a louse comb was four times more effective and twice as fast for the diagnosis of louse infestation as direct visual examination in this study. Although the number of children with lice and nits and with nits only was similar in the two groups, the distinction between living lice and nits only is important. Living lice indicate an active infestation, while nits only indicate a past, nonactive infestation. When the diagnosis of head louse infestation is based on the presence of nits only, children are treated unnecessarily, may miss school, and their parents miss work.

Direct visual examination underestimates active infestation. Detecting lice by direct visual examination is practically feasible only for heavily infested children. In a previous study using combs, approximately 78% of the infested children had only 1–10 lice on their scalp, 18.7% had 11–20 lice, while 3.2% had more than 20 lice (1). Most of the lice are nymphs (9), 1–2 mm in length,

and difficult to see without a magnifying glass. Moreover, even if the visible nits are removed from the scalp, it does not necessarily mean that the person is no longer infested with lice. In addition, direct visual examination reveals a higher percentage of children with nits only than examination with a comb, as the examining person spends more time looking at the hair rather than at the comb. Therefore the chances of diagnosing a false-positive infestation are greater when examining by hand, and even more so if the examiner is experienced in finding nits. In this particular study, had the diagnosis been based on examination by hand and the presence of nits considered as an indication of infestation, 139 of 280 children would have been treated for pediculosis unnecessarily. It is important to stress that in order not to miss any living eggs on the hair of children who are infested with nits only, they should be examined, first for a few consecutive days and then 1 week later for living lice. If no living lice are detected, the child should be considered negative for head louse infestation.

We recommend that a louse comb be used to screen children for lice infestation and for confirmation that treatment with a pediculicide is effective. Since louse combs can also be used for prevention and treatment of louse infestations and for the removal of nits, they should be an integral part of any louse control strategy.

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