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Epidemiological Aspects of *Pediculosis capitis* and Treatment Evaluation in Primary-School Children in Iran

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Abstract: This study was undertaken to assess the prevalence of and epidemiological factors associated with head lice infections in Iranian primary schools in 2006 and evaluate data on the therapeutic efficacy of lindane shampoo. A total of 40586 children (19774 boys (48.72%) and 20812 girls (51.28%)] from 198 Government primary schools in Kerman, were screened for head lice between March and June 2006. The diagnosis of head lice infestation was confirmed by clinical inspection of scalp and hair for the presence of adult lice nymphal stage, or eggs (nit) by line-toothed head lice comb. All children infested with lice were treated with lindane shampoo (1% gamma benzene hexachloride). The overall prevalence of head lice infestation was 1.8%. The prevalence of infestation was significantly higher in girls (2.9%) than in boys (0.6%) ($p = 0.000$). The infestation rate was greater among pupils who were living in rural areas (4.6%) than in urban areas (1.5%). Of the 721 children with a positive examination result, 424 pupils (58.8%) were reported as having been infested with head lice in the previous 6 months. Mother's education level was a significant risk factor in this model ($p < 0.05$). At 2 weeks after the primary treatment, the success rates of treatment were 49%. Comprehensive survey in our work showed the better future of the disease and related factors. Education campaigns by health care officials, physicians and teachers are expected to be helpful for head lice control. It is essential that governments should be supported form cooperation between the school authorities and public health centers to successful control head lice infestation in primary school. Also there is an urgent need to identify safe, novel insecticides for proved efficacy.

Key words: Head louse infestation, *Pediculus humanus capitis*, treatment, Iran

INTRODUCTION

The human head louse, *Pediculus humanus capitis* De Geer (Anoplura: Pediculidae) is a worldwide public health concern. Head lice generally affect children, primary girls, aged 3-12 years, in both the developed and the developing countries. This ectoparasite feed by sucking blood and cause pruritus and subsequent skin excoriation may lead to secondary infection. In addition, chronic irritation and secondary infection may disrupt behavior and school performance (Bailey and Procriv, 2000) and cause psychological distress (Dodd, 2001; Mumcuoglu, 1999). Recently, two studies have suggested that head lice can transmit *Bartonella quintana* Brenner (Causative agent of Trench fever) (Sasaki *et al.*, 2006) and

Richkettisia prowazekii da Rocha-Lima (Robinson *et al.*, 2003). In certain epidemiologic school surveys conducted in different countries the prevalence of head lice has been found to be 6.8% in Turkey (Kokturk *et al.*, 2003), 8.9% in Belgium (Willems *et al.*, 2005), 13% in Australia (Counahan *et al.*, 2004), 35% in Brazil (Borges and Mendes, 2002), 5.8% in Korea (Sim *et al.*, 2003) and 52% in Ukraine (Kurhanova, 2006).

Prevalence of infestation was reported from 0.68% (Motovali Emami *et al.*, 2003) to 52% (Kurhanova, 2006) in different studies that may be affiliated with social situation, genetic and characteristics of a population. Resistance to pediculicides such as lindane and permethrin is common in populations where these pediculicides have been heavily used (Elson, 2005).

Drug resistance has also increased the risk of infestation among other schoolmates and family members and therefore, presents a public health problem that is difficult to solve. Since 2003 numerous earthquake in Kerman County (the biggest county in Iran) have been caused environmental and socioeconomic changes, so health authorities are persuaded to evaluate the impact of control strategies.

This study was undertaken to assess the prevalence of and epidemiological factors associated with, head lice infections in all the Kerman primary schools in 2006 and evaluate data on the therapeutic efficacy of lindane shampoo.

MATERIALS AND METHODS

A total of 40586 children (19774 boys (48.72%) and 20812 girls (51.28%)) from 198 Government primary schools in Kerman, were screened for head lice between March and June 2006.

Ethical approval was obtained from the Kerman University of Medical Science Ethics Committee (ethics approval number: K-85/34).

There was a large variation in School size across the county with total enrolments varying from 9 to 1511.

Thirty one Schools were in rural areas and the remainder in urban areas.

Before examining the students, a detailed structured questionnaire was submitted to the parents and written informed consent was obtained. In this proforma, the sex, age, family size, parent's education, bathing facilities in the house and hair washing (per week) were recorded for each child.

A team of health specialists and general practitioners skilled in the detection of head lice and trained in study procedures conducted the screening under the supervision of the co-investigator dermatologist.

The diagnosis of head lice infestation was confirmed by clinical inspection of scalp and hair for the presence of adult lice nymphal stage, or eggs (nit) by line-toothed head lice comb, a validated method of detection (Mottram, 2000).

The viability of nits was confirmed by stereomicroscopic inspection. A history of previous head lice infestation was obtained from medical records and parental anecdotes.

All children infested with lice were treated with lindane shampoo (1% gamma benzene hexachloride). Children were reexamined at 2 weeks after treatment for head lice infestation. A dermatologist or general physician

performed examinations of scalp and hair. We defined treatment failures as the presence of adult lice and nymphal stage, or viable eggs (nits).

All infested children and their parents were given information on how to prevent reinfestation. The washing of house hold clothes bed linens and pillowcases in hot water in an automatic washing machine, immersing fomites such as combs and brushed in hot water at a temperature of 70°C or greater and treating other infested individuals in close contact with the patient were recommended.

Statistical analysis: Statistical analysis of results was performed using SPSS version 11.0. Standard statistical method including chi-square test was used in order to analyses the data. Statistical significance was assumed at a $p < 0.05$.

RESULTS

Of the 40586 children (all primary children in Kerman county) examined, the mean age of the children was 8.1 ± 1.9 years (range, 6-11 years). Demographic data and prevalence of infestation are shown in Table 1.

The overall prevalence of head lice infestation was 1.8%. In 29 (4%) of the 721 positive children, only egg residues were found, whereas in the other 692 children, at least one of the lived (viable) instars of development was observed.

The prevalence of infestation was significantly higher in girls (2.9%) than in boys (0.6%) ($p = 0.000$).

As shown in Table 1 infested children aged 6-8 years exhibited a statistically significantly higher rate than children aged 9-11 years and above.

Only 4071 students (10%) were living in families with family size > 10 and this prevalence was greater (3.51%) than among others. In addition, the infestation rate was greater among pupils who were living in rural areas (4.6%) than those in urban areas (1.5%).

Of the 721 children with a positive examination result, 424 pupils (58.8%) were reported as having been infested with head lice in the previous 6 months.

Mother's education level was a significant risk factor in this model ($p < 0.05$).

The analysis of other variables, such as father's education level, bathing facilities in the house and the frequency of hair washing, in relation to infestation showed no significant differences between infested and noninfested subjects.

At 2 weeks after the primary treatment, the success rates of treatment were 49%.

Table 1: Prevalence of head louse infestation in primary school children in Iran 2006-2007

Characteristics	No. of examination	(%)	No. of infestations	Prevalence (%)	p-value
Sex					
Boys	19774	48.7	118	0.60	<0.0001
Girls	20812	51.3	603	2.90	
Age (years)					
6	7412	18.3	298	4.02	0.05
7	6051	14.9	194	3.20	
8	7965	19.6	103	1.30	
9	9904	24.4	80	0.80	
10	8972	22.1	45	0.50	
>10	282	0.7	1	0.40	
Family size					
<5	15913	39.2	109	0.68	0.05
5-10	20602	50.8	469	2.28	
>10	4071	10.0	143	3.51	
Father's education					
Literate or primary	10949	27.0	254	2.30	
High school or diploma	20915	51.5	275	1.30	
University education	7901	19.5	180	2.30	
Missing	821	2.0	12	1.50	
Mother's education					
Literate or primary	21159	52.1	493	2.30	0.05
High school or diploma	15041	37.1	218	1.40	
University education	4129	10.2	8	0.20	
Missing	257	0.6	2	0.70	
Bathing facilities in the house					
Yes	33417	82.3	620	1.80	
No	7169	17.7	101	1.40	
Area					
Urban	36671	90.0	539	1.50	0.05
Rural	3915	10.0	182	4.60	
Frequency of hair washing					
Once a week or less	24176	60.0	406	1.60	
Twice a week	16410	40.0	315	1.90	
History of infestation					
Yes	8513	21.0	424	5.0	0.05
No	32073	79.0	297	0.9	

DISCUSSION

Pediculus humanus capitis is an obligate ectoparasite that lives only on human hair and feeds on the blood from the skin. The prevalence is generally 1 to 3% in industrialized countries; however, it may on occasion exceed 25% in elementary schools (Roberts, 2002).

In Iran, as in other countries, there is often a more serious consequence than physical problems for those affected, because social stigma is associated with having head lice.

The present study shows that the overall prevalence (1.8%) of head lice infestation in Iran has decreased. In Iran, it was previously reported that the prevalence of pediculosis was 0.68% (Motovali Emami *et al.*, 2003) to 27% (Alempour Salemi *et al.*, 2003). The prevalence of active pediculosis detected among all primary school students in present study (1.8%) was lower than previous reported in Kerman city by kamiabi and Nakhaei in randomized study (3.8%) (Kamiabi and Nakhaei, 2005). There may be a number of likely explanations for this difference including, a bias due to the detection method

or the sampling strategy used, deficient population groups, variation in the study design, earthquake in Kerman county three years before our survey and consequently increase of Government attention to health of schools.

Because the adult louse moves quickly through dry hair it is useful to look for lice when the hair is wet (Koch *et al.*, 2001). This has the effect of slowing them down, which gives the examiner extended time to find them. Active infestation by head lice is evidenced by the presence of adult lice, nymphs or live eggs, whereas hatched or dead eggs point to inactive infestation. An additional complication in diagnosis is the presence of pseudo nits. These are objects detected in the hair that might be confused with nits, such as dandruff. Lice typically lay nits within 1-2 mm of the scalp and for practical purposes; nits within 1 cm of the scalp should be counted as a sign of active infestation (Frankowski, 2004). Also we are of the opinion that comprehensive survey in our work showed the better future of the disease and related factors.

In the present survey, girls are found to show a significantly higher infestation rate than boys. Most

previous studies have shown the prevalence to be higher in girls (Motovali Emami *et al.*, 2003; Kokturk *et al.*, 2003; Counahan *et al.*, 2004; Sim *et al.*, 2001). Difference in behavior patterns between boys and girls might have affected transmission rates and susceptibility to head lice infestation. Transmission of head lice most commonly occurs through close physical contact, especially head-to-head contact, but fomites, such as hats also play a role. Girls in Iran use kerchief in the classroom situation and outside during daily activities. They occasionally replace their kerchief to each other that would in theory be an ideal situation for the transfer of head lice. In addition we observed that most of the boys have very short hairs, however a number of studies have failed to show a relationship between hair length and head lice infestation (Chouela *et al.*, 1997; Slonka *et al.*, 1977). Differences in the head louse distribution rates between age groups are not supported by many studies (Kokturk *et al.*, 2003; Borges *et al.*, 2002; Kamiabi and Nakhaei, 2005), but in some reports, it has indicated that there is a increase in the infestation rate with age (Amr and Nusier, 2000; Shakkoury and Abu Wandy, 1999) or no statistical significance relationship (Motovali Emami *et al.*, 2003; Zabihi *et al.*, 2006).

Although some children with infestation are asymptomatic, the most common symptom is pruritus, which occurs due to sensitization to either louse salivary or fecal antigens. Children bellow 5 years may not immediately feel the physical effect of having head lice but older children especially over 10 years old become aware sooner.

In present study, urban areas had lower prevalence of head lice infestation than rural areas, which is attributed to better hygiene, because more often urban school have health teacher or supervisor. Some researchers have claimed that head louse is found in all socio-economic classed (Kokturk *et al.*, 2003; Counahan *et al.*, 2004; Borges *et al.*, 2002), whereas others have reported that head louse is more frequent in rural area with socio-economic classes (Sim *et al.*, 2003; Kamiabi and Nakhaei, 2005). It has been proposed that in areas of high social disadvantage, larger families may pay less attention to hair care due to lake of support and financial limitations.

School may have to recognize that they need to play a more active role in the control of *Pediculus capitis*.

We found that there was a relationship between the rate of infestation and mother's education. This is agreement with results of a number of previous studies (Kamiabi and Nakhaei, 2005; Motovali Emami *et al.*, 2003).

Mothers with low education may be unaware of how to detect infestation with head lice and may use techniques of how sensitivity.

Among the infested subjects, 58.8% reported in the questionnaire that they had previous infestation and received prior treatment. We believe that in order to lower significantly the infestation prevalence is a community; a systemic strategy is required for a global and simultaneous thrust in a semiclosed community, such as school, together with joint action on the part of health staff, teachers and parents to maintain epidemiologic surveillance.

Other factors such as fathers education, bathing facilities in the house and frequency of hair washing had no statistically significant influence on the prevalence of head lice infestation ($p>0.01$) in this study.

The success rate of treatment at the 2 weeks follow-up was 49%. Lindane shampoo is widely used as pediculicides in Iran health centers. Lindane (Gamma benzene hexa chloride 1% shampoo) is pediculicidal but it has limited ovicidal activity. Given lindane's increased side-effect potential including neurotoxicity and bone marrow suppression. Unfortunately resistance to lindane is common in populations where these pediculicide have been heavily used (Elson, 2005). Meinking *et al.* (2002) in a recent study, showed 1% lindane was the slowest and least effective pediculicide with no lice eradicated after 10 min and killing only 17% of lice after 3 h. Ingestion or frequently repeated applications of lindane increase the risk of toxicity. A nymph that has been exposed to a pediculicide can shed its exoskeleton and receive only a sublethal dose, which contributes to resistance (Meinking, 2004).

To slow the emergence of resistance, therapeutic agents can be rotated (Meinking *et al.*, 2002). Patterns of resistance often appear to follow patterns of drug use in different areas of the world (Berker and Sinclair, 2000; Downs *et al.*, 2002). We believe that education campaigns by health care officials, physicians and teachers are expected to be helpful for head lice control. It is essential that governments should be supported form cooperation between the school authorities and public health centers to successful control head lice infestation in primary school. Also there is an urgent need to identify safe, novel insecticides for proved efficacy.

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REFERENCES

- Alempour Salemi, J., N. Shayeghi and H. Zeraati, 2003. Some aspects of head lice infestation. In: Iranshahr area (Southeast of Iran). Iran. J. Public Health, 3: 60-63.

- Amr, Z.S. and M.N. Nusier, 2000. *Pediculus capitis* in northern Jordan. Int. J. Dermatol., 39: 919-921.
- Bailey, A.M. and P. Prociv, 2000. Persistent head lice following multiple treatments: Evidence for insecticide resistance in *Pediculus humanus capitis*. Aust. J. Dermatol., 41: 250-254.
- Berker, D. and R. Sinclair, 2000. Getting ahead of head lice. Aust. J. Dermatol., 41: 209-212.
- Borges, R. and J. Mendes, 2002. Epidemiological aspects of head lice in children attending day care centers, urban and rural schools in Uberlândia, Central Brazil. Mem. Inst. Oswaldo. Cruz., Rio de Janeiro, 97: 189-192.
- Chouela, E., A. Abeldao and C. Marcela, 1997. Head louse infestations: Epidemiologic survey and treatment evaluation in Argentinian schoolchildren. Int. J. Dermatol., 36: 819-825.
- Counahan, M., R. Andrews, P. Büttner, G. Byrnes and R. Speare, 2004. Head lice prevalence in primary schools in Victoria. Aust. J. Paediatr. Child Health, 40: 616-619.
- Dodd, C., 2001. Treatment of head lice. Br. Med. J., 10: 323, 1084.
- Downs, A.M., K.A. Stafford, L.P. Hunt, J.C. Ravenscroft and G.C. Coles, 2002. Widespread insecticide resistance in head lice to the over-the counter pediculocides in England and the emergence of carbaryl resistance. Br. J. Dermatol., 146: 88-93.
- Elson, D.M., 2005. Drugs used in the treatment of pediculosis. J. Drug Dermatol., 4: 207-211.
- Frankowski, B.L., 2004. American Academy of Pediatrics guidelines for the prevention and treatment of head lice infestation. Am. J. Manage. Care, 10: S269-272.
- Kamiabi, F. and H.H. Nakhaei, 2005. Prevalence of pediculosis capitis and determination of risk factors in primary-school children in Kerman. East Med. Health J., 11: 988-992.
- Koch, T., M. Brown and C. Isam, 2001. Towards the eradication of head lice: Literature review and research agenda. J. Clin. Nurs., 10: 364-371.
- Kokturk, A., K. Baz, R. Bugdayci, T. Sasmaz and U. Tursen, 2003. The prevalence of pediculosis capitis in schoolchildren in Mersin. Turkey Int. J. Dermatol., 42: 694-698.
- Kurhanova, I., 2006. Lice infestation and lice control remedies in the Ukraine. Ann. N.Y. Acad. Sci., 1078: 357-360.
- Meinking, T. and C.N. Burkhart, 2002. Head lice (letter). N. Eng. J. Med., 347: 1381-1382.
- Meinking, T.L., L. Serrano and B. Hard, 2002. Comparative *in vitro* pediculicidal efficacy of treatments in a resistant head lice population in the United States. Arch. Dermatol., 138: 220-224.
- Meinking, T.L., 2004. Clinical update on resistance and treatment of *Pediculosis capitis*. Am. J. Manage. Care, 10: 264-268.
- Motovali-Emami, M., M. Shams, G.H. Sadri, M. Zandiyeh and M. Yazdi, 2003. The study of prevalence of head pediculosis in students of Khomeinishahr district. Res. Med. Sci. J. (In Persian), 8: 102-108.
- Mottram, P., 2000. Research Report on the effectiveness of hair conditioner as a non-chemical agent to control head lice. Brisbane: Queensland Health.
- Mumcuoglu, K.Y., 1999. Prevention and treatment of head lice in children. Paediatr. Drugs, 1: 211-218.
- Roberts, R.J., 2002. Head Lice. N. Eng. J. Med., 346: 1645-1650.
- Robinson, D., N. Leo, P. Prociv and S.C. Barker, 2003. Potential role of *Pediculus humanus capitis*, as vectors of *Rickettsia prowazekii*. Parasitol. Res., 90: 209-211.
- Sasaki, T., S. Kanta, S. Poudel, H. Isawa and T. Hayashi, 2006. First molecular evidence of *Bartonella quintana* in *Pediculus humanus capitis* (Phthiraptera: Pediculidae), collected from Nepalese children. J. Med. Entomol., 3: 110-112.
- Shakkoury, W.A. and E. Abu Wandy, 1999. Prevalence of skin disorders among male schoolchildren in Amman Jordan. East Mediterr. Health J., 5: 9555-9559.
- Sim, S., I.Y. Lee, K.J. Lee and J.H. Seo, 2003. A survey on head lice infestation in Korea (2001) and the therapeutic efficacy of oral trimethoprim/sulfamethoxazole adding to lindane shampoo. Korean J. Parasitol., 41: 57-61.
- Slonka, G.F., M.L. Fleissner and J. Berlin, 1977. An epidemic of pediculosis capitis. J. Parasitol., 63: 377-383.
- Willems, S., H. Lapeere, N. Haedens and I. Pasteels, 2005. The importance of socio-economic status and individual characteristics on the prevalence of head lice in schoolchildren. Eur. J. Dermatol., 15: 387-392.
- Zabihi, A., R.J. Amiri, M. Rezvani and A. Bijami, 2006. Head louse infestations in primary-school children in Babol city. Iran. J. Babol Med. Univ. (In Persian), 4: 88-93.