

Study on Efficacy of 1% Permethrin Shampoo and Some Traditional Physical Treatment for Head Lice Infestation

Abstract

Background: There is an increase in the prevalence of head lice among urban communities with high density in recent years. This study was aimed to determine the efficacy of 1% permethrin shampoo and some traditional physical treatment for head lice infestation in Qom Province, central Iran. **Methods:** This analytical cross-sectional study was carried out on all 11,223 cases in six categories that were referred to Qom health care system from 2016 to March of 2017. The infested people were treated with 1% permethrin shampoo, twice at a 1-week interval and other recommended therapeutic categories, such as the use of physical treatments such as wooden fine-toothed combs impregnated with a mixture of water and white vinegar on infested hair for 30 min and secondly, carrier oils such as olive oil, bitter almond on infested hair over a therapeutic period. After completing the course of treatment, treatment success was checked by questionnaires. **Results:** A total of 11,223 cases with head lice infestation were confirmed and were enrolled for study. Out of six categories, three therapeutic categories were utilized as follows: (a) 1% permethrin shampoo and the use of physical treatments; (b) 1% permethrin shampoo and the use of carrier oils; (c) the above-mentioned therapeutic categories combined had high treatment success. It was estimated to be 82.00%, 87.31%, and 94.33%, respectively. **Conclusions:** According to the findings, in addition to the application of 1% permethrin shampoo, the use of physical treatments and carrier oils such as olive oil, bitter almond can increase the treatment success of head lice infestation.

Keywords: Head lice, *Pediculus humanus capitis*, permethrin

Introduction

The head louse, *Pediculus humanus capitis* (Phthiraptera: Pediculidae), is obligate ectoparasite of humans and transmitted by the head-to-head contact.^[1] This health problem (pediculosis) is observed mostly in areas where population densities of humans are high with poor hygiene.^[2] Some health issues such as feeling of humiliation, psychological distress, depression, insomnia, educational decline, loss of social status, secondary bacterial infection from frequent itching, hair loss, and allergy because of head lice infestation occur in long term and chronic head louse infestations.^[3] Despite spending huge resources for the prevention and treatment of pediculosis by the Iranian government, head lice prevalence is still high in Iranian cities.^[4-6] The prevalence rate of head lice infestation varies from 0.9% to 20.5% in different areas of Iran.^[7] Many therapeutic approaches have been studied

and evaluated for head lice treatment in the world. These approaches are classified into four categories: (a) treatment by the use of chemical insecticides with shampoo formulation as a standard method. The 1% permethrin shampoo was able to cure 29.2, 68.9, and 90.3% of infested students in the southeast of Iran after the first, second, and third week of treatment, respectively.^[8] In a similar study on head lice-infested students in Yasouj city, southwest of Iran, Shahraki *et al.* demonstrated that using permethrin shampoo twice at a 1-week interval can cause a recovery in 56.1% of cases.^[7] (b) Treatment with non-neurotoxic chemical products such as dimethicone lotion: it is one of the first-line treatment options for head lice infestation. In a randomized observer blinded comparative trial, efficacy of 1% permethrin shampoo with the silicone oil dimeticone was compared. The results showed that cure rates were as follow: day 2 – dimeticone 94.5%, permethrin 67.6%; after day 7 – dimeticone 64.4%, permethrin 59.7%;

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day 9 – dimeticone 97.2% and permethrin 67.6%. Because of the physical effects of dimeticones, development of resistance is unlikely.^[9] (c) Oral treatments: in recent years, the oral antihelmintic agents, for instance, albendazole, diethylcarbamazine,^[10] and oral ivermectin,^[11] have been studied for controlling head lice infestation. Mostly, the pediculicidal effects of them have been <70%. (d) Physical treatments: such as regular combing of hair with a wooden fine-toothed comb and use of heated air.^[12,13] Many factors such as warm and dry weather, high population density in Qom province (approximately 1,200,000 people),^[14] probably have provided an appropriate breeding place in the environment for head lice spread. Recently, the annual reports of the Qom health center indicate that the prevalence of head lice infestation is high in this area (29.35%) and needs to be addressed appropriately.^[4] This study was aimed to determine the efficacy of 1% permethrin shampoo and some traditional physical treatment for head lice infestation.

Methods

Qom is one of the 31 provinces of Iran, with an area of 11,237 km². It is located in the central part of the country, with provincial capital in the city of Qom, 125 km southeast of Tehran [Figure 1].^[14] At the last census in 2016, this province had a population of approximately 1,200,000 of which 91.2% reside in urban areas. The province contains 1 city, 5 counties, 9 rural districts, and 256 villages. This study was conducted in the Qom city.

This descriptive, analytical study was carried out on 11,223 confirmed head lice-infested human cases that referred to governmental health centers and private clinics in the Qom city from 2016 to March of 2017. The demographic profile of the patients is presented in Table 1.

The patients were grouped into six categories using random allocation [Table 2]. According to the Ministry of Health guideline of Iran,^[15] the basis of diagnosis of head lice infestation was a physical examination of the hairs by visual inspections of scalp and hair for detecting of adult lice, nymphs, and nits in studied suspected cases. Hairs behind the neck and ears were investigated for 5 min by the direct observation method. Diagnosis of head lice was made by

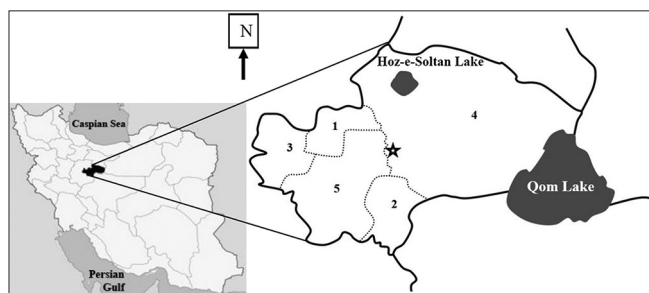


Figure 1: Map of Iran, highlighting the position of Qom Province and its five counties: 1. Jafarabad, 2. Kahak, 3. Khalajestan, 4. Markazi, and 5. Salafchegan (★ Qom city as the present study area)

expert medical entomologists. The inclusion criteria were considered of being Iranian suspected to human head lice infestation who were resident in urban districts of Qom Province and being satisfied to participate in this study. The exclusion criteria were included: being non-Iranian, not living permanently in this study region, just partial completing of the questionnaire and unwillingness for participation in this study. People confirmed with head lice infestation were recommended to use of 1% permethrin shampoo (Gilaranco, Iran) twice at a 1-week interval as a main and first-line and routine treatment. The method used for treating this health problem was each infested person was given a permethrin shampoo and was asked to use it on the head twice at a 1-week interval. Half of the permethrin shampoo was to be massaged on the scalp for 10 min and then rinsed. It was recommended that in addition to using just permethrin shampoo over a therapeutic period, twice

Table 1: Demographic profile of the patients with pediculosis capitis infestation in Qom, from 2016 to March of 2017

Variables	Level	Cases (%)
Gender	Male	4041 (36.00)
	Female	7182 (64.00)
Age group (years)	<5	1793 (15.98)
	5-15	6512 (58.02)
	>15	2918 (26.00)
Educational grade	Illiterate	2124 (18.93)
	Initial education	8002 (71.30)
	University education	1097 (9.77)
Family size	3 persons	1201 (10.70)
	4 persons	3172 (28.26)
	5 persons	2481 (22.11)
	≥6 persons	4369 (38.93)
Living area	Urban	11103 (98.93)
	Rural	120 (1.07)
Water source	Public tube	212 (1.89)
	Own	11011 (98.11)
Family income (per month for each family, in US dollars)	Poor (<\$300)	7968 (71.00)
	Good (\$300-600)	2470 (22.00)
	Fine (>\$600)	785 (7.00)
Mother's occupation	Housewife	9802 (87.34)
	Employed	1421 (12.66)
Mother's education	Illiterate or died	694 (6.18)
	Initial education	4617 (41.14)
	University education	5912 (52.68)
History of infestation	Yes	1970 (17.55)
	No	9253 (82.45)
Access to primary health care services	Yes	10709 (95.42)
	No	514 (4.58)
Number of combing per day	None	6341 (56.50)
	Once	2226 (19.83)
	Twice	1799 (16.03)
	Thrice and more	857 (7.64)

Table 2: The therapeutic categories and their effects on head lice infestation treatment success

Groups	Variables (risk factors)	Effect of pediculicide categories			Success (%)	Odds ratio**	P
		No.(%) contaminated cases exposed	No. (%) failure in treatment	No. (%) recovered cases			
A	*Receiving just permethrin shampoo over a therapeutic period regardless of the prescribing information	2021	1793 (88.72)	228 (11.28)	11.3	–	<i>P</i> <0.001
B	Applying permethrin shampoo twice at a 1-week interval + cleaning and washing the sources of head lice infestation, such as clothes and beddings	2019	925 (45.82)	1094 (54.18)	54.2	9.3	<i>P</i> <0.1
C	Applying permethrin shampoo twice at a 1-week interval + the proper training about head lice infestation treatment and follow-up their treatment by health staff	2008	589 (29.33)	1419 (70.67)	70.7	18.9	<i>P</i> <0.002
D	Permethrin shampoo twice at a 1-week interval +use of physical treatments such as the use of wooden fine-toothed comb impregnated with a mixture of water and white vinegar on infested hair for 30 min	2028	365 (18.00)	1663 (82.00)	82	35.8	<i>P</i> <0.001
E	Applying permethrin shampoo twice at a 1-week interval + a carrier oil such as olive oil, bitter almond on infested hair over a therapeutic period	2001	254 (12.69)	1747 (87.31)	87.3	54	<i>P</i> <0.004
F	All of above-mentioned therapeutic categories	1146	65 (5.67)	1081 (94.33)	94.3	130	<i>P</i> <0.001
Total		11,223 (100)	–	–			–

* Reference group. **Logistic regression

at a 1-week interval, other categories should be applied as complementary therapies. All infested people were recommended to use complementary therapies such as cleaning and washing the sources of head lice infestation, such as clothes and beddings, at the same time with permethrin shampoo therapy, the proper training about head lice infestation treatment and follow-up of their treatment by health staff (educational context such as treatment using permethrin shampoo according to its guidelines and catalog of the manufacturing company, household members must receive a head lice treatment and all family members should be treated at the same time), use of physical treatments such as use of wooden fine-toothed comb impregnated with a mixture of water and white vinegar on infested hair for 30 min, a carrier oil such as olive oil, bitter almond on infested hair over a therapeutic period, and applying of above-mentioned therapeutic categories. Furthermore, the people who were found with head lice infestation and received just permethrin shampoo regardless of the prescribing information were studied. Data on the recovery rate were collected via questionnaire, checklist and head examination were done clinically. A validated questionnaire of 42 questions, broken down into sections on demography, epidemiology, and treatment success, was completed at the final examination after treatment. The indicators of head lice infestation treatment success were the absence of all life stages of head lice from nymph to adult and their

eggs, after using the therapeutic categories.^[15] Following completion of the treatment, the patients were examined clinically and the questionnaire on head lice infestation treatment success was completed for them. The infested people were involved with the head louse in one of its life cycle stages (such as eggs, nymph, or mature insects) or with viable eggs laid in the top 1 cm of hair from the scalp.^[16]

Frequency tables were used for descriptive data and χ^2 test was used for analyzing them using SPSS software, V.11. The reliability of the questionnaire was assessed by Kuder and Richardson (1937) formula 20 (KR-20) for dichotomous items.

Results

Totally, 87.5% of 11223 cases were reported from governmental health centers (Comprehensive Health Centers) and 12.5% of them from non-governmental clinics. The treatment success of six categories (A–F) are including:

(A) A total of 228 (11.28%) head lice-infested people were treated using just 1% permethrin shampoo over a therapeutic period regardless of the prescribing information.

(B) 54.18% treatment success was evaluated among 2019 cases who in addition to using of 1% permethrin shampoo over a therapeutic period, twice at a 1-week

interval, cleaned and washed the source of possible head lice infestation, such as clothes and beddings at the same time with permethrin shampoo therapy.

(C) The recovery among the participants who received proper training about head lice infestation treatment and follow-up their treatment by health staff in addition to applying permethrin shampoo twice with a 1-week interval was 70.67%. This participants' group was educated properly on the proper treatment.

(D). There was 82.00% success in users of permethrin shampoo twice at a 1-week interval + use of physical treatments such as the use of wooden fine-toothed comb impregnated with a mixture of water and white vinegar on infested hair for 30 min.

(E) In 2001 infested cases who were applying permethrin shampoo twice at a 1-week interval + a carrier oil such as olive oil, bitter almond on infested hair over a therapeutic period, 87.31% success was observed.

(F) Ultimately, 94.33% of cases who received all of the above-mentioned therapeutic categories were earned recovery [Table 2].

Head lice treatment success in six categories (A–F) was 11.3%, 54.2%, 70.7%, 82%, 87.3%, and 94.3% respectively. By considering category A as a reference, odds ratios (OR) were 9.3, 18.9, 35.8, 54, and 130, respectively [Table 2].

Discussion

In this study, about 11% of head lice-infested people were treated over a therapeutic period using permethrin shampoo regardless of the prescribing information. In a clinical trial study, the results showed that overall cure rates of permethrin after 1, 7, and 9 days were 67.6%, 59.7%, and 67.6%, respectively.^[9] Furthermore, Stough *et al.* in the USA showed that 42.9% of permethrin-treated participants were head lice-free.^[17] In a similar study, Moemenbellah-Fard *et al.* observed that the head lice infestation treatment success using permethrin shampoo on days 2, 6, 9, and 14 were 71.8%, 64.1%, 89.7%, and 89.7%, respectively.^[18] It seems that various factors including the frequency of head lice infestation, family size, socioeconomic status, family income, drug resistance, differences in educational techniques to educate suspected head lice infested individuals, and quality of people's awareness on head lice treatment can explain the differences of head lice infestation treatment success in previous studies.^[4] It was previously approved that head lice can be spread by direct contact through the head-to-head contact and by indirect contact such as sharing and using personal items such as clothing, combs, brushes, towels, scarves, hats, blankets, bed linens, etc. Although many scientists believe that lice which are found on clothing, bedding, etc., have fallen off the head as they are sick, ill, dead, or dying.^[19] Another finding of this research indicates that 54% of 2019 head

lice-infested people were successfully treated using 1% permethrin shampoo twice at a 1-week interval and cleaned and washed the sources of head lice infestation, such as clothes and beddings. Sometimes the head lice treatment is completely done with a common method, but because of the remains of its local sources, this health problem is not removed completely. Maybe the source of infestation with head lice can be clothing and beddings, or head lice-infested people who live near them.^[20] In addition, in this study, >70% of the cases were treated using 1% permethrin shampoo twice at a 1-week interval and received proper training about head lice infestation treatment and follow-up of their treatment by health staff. Because of the elimination of all adults and nymphs of head lice among all household members with the active infestation, who were all treated at the same time, control of these insects were achieved completely. In addition to the use of head lice killing shampoo already mentioned, longevity, fertility, and reproduction of head lice must also be considered; they lay 4–6 eggs per day on human hair during their life cycles. Eggs were attached to the hair near the scalp. The eggs take 7–10 days to hatch and then nymphs mature after three molts, become adults, and are able to grow and reproduce new generation.^[15] Consequently, using this method (use of 1% permethrin shampoo twice a week) can kill all of them. In addition to control of adult lice, we can remove their eggs as an effective control method to combat against the infestation. The removal of eggs on human's hair can cause them to die because they are ectoparasite of warm-blooded vertebrate hosts. As soon as they are away from the body of warm-blooded hosts, they die or lose the ability to be transferred to another person. Therefore, besides using permethrin shampoo, physical treatments such as the use of wooden fine-toothed comb impregnated with white vinegar and water on infested head hair for 30 minutes can be effective in the removal of head lice. According to the results, 82% of cases who used 1% permethrin shampoo twice at a 1-week interval and used physical treatments, such as wooden fine-toothed comb impregnated with a mixture of water and white vinegar on infested hair for 30 minutes, recovered. This therapeutic method, such as regular combing of hair with a wooden fine-toothed comb,^[12,13] and other physical treatments, such as the use of hot air, such as hair dryers and electric heating coils, can be helpful in clearing infestation.^[21,22] Also, Rafinejad *et al.* have observed that combing daily (one of the physical therapeutic categories) is effective in the removal of head lice infestation and there was a significant relationship between prevention of head louse infestation and the number of combing per day statistically.^[23] Also, in this study, the results showed that >87% improvement was observed in the applicators of 1% permethrin shampoo twice at a 1-week interval and a carrier oil such as olive oil, bitter almond on infested hair over a therapeutic period. The essence of this mode of action of carrier oil is that it blocks the respiratory spiracles of head lice and

eggs, thereby suffocating and killing them. It can be fatal in adult and nymphs of head lice and destruction of the embryo inside their eggs, and therefore, lice eggs cannot hatch. In this study, >94% of 1146 infested cases with head lice were treated by all of the above-mentioned therapeutic categories. However, despite this success, 100% of cases did not recover. Possible reasons for this maybe the probability of antilice products resistance or the remain of its local sources.^[24]

Conclusions

Head lice treatment success depends on several principles and factors that only if they are observed can lead to the total treatment of head lice. According to the findings, in addition to the application of 1% permethrin shampoo, twice at a 1-week interval, the use of physical treatments and carrier oils such as olive oil, bitter almond can increase the treatment success of head lice infestation.

Suggestions

Besides that, regarding other auxiliary methods according to the Iranian Ministry of Health guidelines and its catalog of the manufacturing company, it is necessary to control this health problem. In terms of correct treatment of head lice infestation, people should be educated sufficiently. Education of principles of prevention and treatment of head lice infestation should be an emphasis by CDC, Ministry of Health and health care workers.

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Conflicts of interest

There are no conflicts of interest.

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