

Original Article

Evaluation of Efficiency of Ivermectin Lotion in Comparison with Permethrin Shampoo and Dimethicone Lotion for Treatment of Head Lice (*Pediculus humanus capitis*) in Areas Covered by Health Centers of Islamshahr City, Tehran, Iran in 2019

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Abstract

Background: Head lice infestation is known as a serious health problem in developing and developed countries. The prevalence of pediculosis in children and females is higher than others. The infestation may cause the absence of student from school and make their parents upset. The aim of current study was to evaluate the WHO recommended insecticides for control of head lice in Islamshahr health center.

Methods: In the current study infested individuals were older than 6 years old and have been diagnosed with at least 3 head lice adult and 10 live nits from less than 0.7 cm scalp. The pediculicides was applied randomly among groups. Permethrin shampoo as a golden standard was used. Dimethicone lotion 4% and Ivermectin lotion was compared with it. This study was conducted on 179 infested people. Results of infestation were evaluated after one month of intervention. Different indicators such as: present of head lice adult or live nit, redness and irritation in head skin were investigated.

Results: All the participants were female and 72.6% of them were in the age group of 6-11. The result revealed that aging not only decreases the infection rate but also raised the recovery percentage. The results showed that 79.5% permethrin receiver, 83% of people who treated with Dimethicone lotion and 90.6% of Ivermectin receiver had no head lice. There was no significant difference among these three pediculicides.

Conclusion: There was no significant difference among tested pediculicides. An appropriate pediculicide can be selected by training people.

Keywords: Head lice; Treatment; Permethrin; Pediculicide

Introduction

Head lice infestation is a global health problem that is not limited to one community or continent. The disease is present in varying proportions in most developed and developing countries (1-7).

Despite preventive activities in countries, head lice infestations still persist at different ages and exist in densely population areas. Economic, social and cultural status are also very important in lice infestation. Children

are infested more than adults. The highest infestation was reported in 5-11 year-old children. It is more common in girls than in boys and in whites than in blacks. However, the prevalence of infestation is higher among primary school students and their families, especially in poor areas receiving substandard health care (8-10). In addition to direct contact and head-to-head contact with an infestation person, lice infestation is also the most common method of transmission through personal stuff such as combs, hats, scarves, underwear and towels (11). Head lice have no role in transmitting any diseases, but it may cause discomfort and embarrassment to people in the family and school, especially in the sensitive ages of childhood and adolescence. So far, various methods have been used to treat head lice infestation, the most available pediculicides used to kill adults. There are numerous reports of increased cases of pediculosis and recurrences after treatment and in most cases, after treatment, between 20 and 80 nits remain on the head, which are the main cause of re-infestation. Treatment with 1% permethrin shampoo and 1% lindane shampoo has been available in Iran since previous years, and dimethicone lotion has been used in the treatment of pediculosis since 2014. While Ivermectine lotion has not yet officially entered the drug distribution network system despite receiving a license from the Food and Drug Administration.

In this study, the efficiency of Ivermectine lotion in comparison with permethrin shampoo as the standard pediculicide and dimethicone lotion has been evaluated so the results can be used in the implementation of pediculosis control policies.

Material and Methods

The study was a clinical trial based on direct observation of at least three live adult lice or more than 10 active nits at a special distance (less than 0.7 cm from the scalp) on patients six years and older referred to health centers. Also, the infested individuals that were identified by trained personnel

of Islamshahr city's school by Tehran performer.

At the beginning of the study, a workshop was held by the organizers about the necessary training on how to examine, research ethics, how to diagnose infestation and refer infested people, as well as treatment methods for each pediculicide gave to school health's experts and health network diseases. Eligible individuals were divided into three groups, 6 to 11 years, 11 to 15 years and 15 years and elder, the pediculicide were randomly distributed among the groups where as 1% permethrin shampoo is used as a common pesticide in the treatment of head lice, it was considered as a standard and the two groups of 4% dimethicone lotion and 0.05% ivermectine lotion were studied in comparison with the permethrin shampoo. After the intervention for one month, based on the presence of symptoms such as the presence of adult lice or active nits on the head or the presence of itching and redness on the scalp of patients were evaluated. The results were recorded in the relevant forms and finally the results were compared. Exclusion criteria included pregnant and lactating women, people with chronic diseases of the scalp and body and using any type of treatment to get rid of lice in a recent month. In order to determine the sample size of the intervention statistical population by considering the 95% confidence interval and 80% test power and also considering the relative accuracy of 20% by using Ivermectine lotion compared to permethrin (6, 12, 13, and 14), the sample size was 179; it included 73 Permethrin, 53 Dimethicone and 53 Ivermectine receiver. In order to blinding, the pediculicides were poured at the rate of usage of one person in unlabeled containers with only codes A, B and C written on them, and Wilcoxon Signed-Rank test was used to evaluate the effectiveness of each pediculicide. In order to make the best use of 1% permethrin shampoo, infested people or their companions were instructed to wash their hair with regular shampoo at first, and if the hair was dehydrated eventually, then hair and the scalp of the

infested person should be thoroughly soaked in permethrin shampoo for 10 minutes, then the shampoo would soak the hair. In order to use Dimethicone 4% and ivermectine lotion 0.5% for infested people optimally, considering that the hair shouldn't be wet or damp, the participants or his/her companion should be instructed to apply dimethicone lotion from the scalp to the ends of dry hair at home. The whole scalp should be completely covered by the lotion. In the case of dimethicone lotion after 8 hours, for ivermectine lotion after 10 minutes, washing the hair with regular shampoo under the pressure of water with the help of a fine-toothed comb and separate the dead lice and nits from the hair. All subjects were accurately evaluated for adult lice or active nits for up to one month and the evaluation results were recorded in the relevant form. The primary outcome in all three groups was the percentage of patients who did not have any adult head lice or nits from less than 0.7 cm of scalp. The 14th and 30th day need to be checked out, and the secondary consequence was lack of local allergic reaction on the scalp, body skin or around the eyes. Also, no re-infestation was observed at the end of the month. Also, the level of satisfaction of the subjects with the quality of treatment was very important. Due to the interventional nature of this study, it was first obtained from the University Ethics Committee under the IR.TUMS.SPH.REC.1398.305 agreement.

Then, based on the informed consent of the patient or his guardian, while providing the telephone number of the project manager for any questions and counseling, all the necessary training was carefully given to the infested person or his companion. Since this study, like other studies, has limitations such as finding infested cases in a timely manner, follow-up after the intervention, proper training in pediculicide use, providing the required pediculicide, especially Ivermectine lotion, outbreak of corona virus at the end of the study, traffic problems were encountered and the necessary arrangements were made for each case.

Results

This study was performed based on the calculation of statistical volume on 179 infused individuals, all were female, and the age was 6 years old to the top. The age distribution of these individuals is shown in Table 1.

According to the results presented in Table 1, the most infested people (72.6%) belonged to the age group of 6-11 years and the lowest (10.6%) belonged to the age group of over 15 years.

The infested individuals were randomly intervened with three pediculicides, the most common use of permethrin was accorded in the age group of 11-15 years and to the top, and the highest use of dimethicone and ivermectine lotion occurred in the age group

Table 1. Frequency distribution of people participating in the treatment of head lice infestation by age groups in Islamshahr city in 2019

Age groups	Frequency	Frequency percentage	Cumulative percentage
6-11	130	72.6	72.6
11-15	30	16.8	89.4
Above 15	19	10.6	100
Total	179	100	

Table 2. Distribution of efficiency of three used pediculicide in treatment of head lice in some age groups in Islamshahr in 2019

Intervention (year) Age group	Permethrin		Total		Ivermectin		Total		Dimethicone		Total		Total		
	number	percentage	Number	percentage	Number	percentage	number	Percentage	number	percentage	number	percentage	number	percentage	
6-11	cured	18	58.1	31	23.8	42	91.3	46	35.4	44	83	53	40.8	104	80
	Not cured	13	49.1												
11-15	cured	24	92.3	26	86.6	0	0	4	13.3	0	0	0	0	3	6.6
	Not cured	3	7.7												
Above15	cured	16	100	16	84.3	2	66.7	3	15.8	0	0	0	0	18	94.7
	Not cured	0	0												
Total		73	41			53	29.5			53	29.5			179	100

of 6-11 years (Table 2).

The results of the relationship between treatment success and age groups in the study population showed a significant relationship in the Permethrin group ($r = -0.455, p < 0.001$) and with increasing age, the incidence decreased (increased recovery) so that the chance of infection in the group of 6-11 years, that was 8.8 times higher than the group of 11 years and above, while this relationship was not significant in the group of Ivermectine and dimethicone. The results showed that out of 130 infested people in the age group of 6-11 years (80%), out of 30 infested people in the age group of 11-15 years (93.3%) and out of 19 infested people in the age group of 15 years and above (94.7%) had been recovered. The results showed that the best efficiency of permethrin shampoo was in the age group 15 years and above, which was 100% of the infested people who had been recovered, and the lowest efficiency was in the age group of 6-11 years, in which only 58.1% of the infested people had been treated. The results also showed that dimethicone lotion was used only in the age group of 6-11 years and 83% of the intervened people were treated with this lotion. Ivermectine lotion efficiency in the age group of 11-15 years was 100% and in the age group of 6-11 years was 91.3%. This lotion was not used in the age group over 15 years. In general, the efficiency of the three pediculicides used in the treatment

of head lice in Islamshahr in 2019 showed that 83.5% of the people recovered and only 16.5% of them did not respond to treatment methods.

In order to compare the success ratio of treatment of these three pediculicides with each other in the study population, Chi-square test (test statistic value = 2.83, degree of freedom = 2 and probability value = 0.243) was used and the results showed that the success ratio independent on type of treatment. Also, the separate results of the three intervened pediculicides showed that the highest efficiency was related to ivermectine and the lowest was related to permethrin (Table 4).

As Table 4 shows, 79.5% of the subjects who received permethrin, 83% of those who received dimethicone, and 90.6% of those who received Ivermectine were recovered. Wilcoxon Signed-rank test was also used for the efficiency of each pediculicide (Table 5).

Wilcoxon signed rank test showed that the treatment used in each group was effective ($p < 0.001$).

In order to compare the success ratio of treatment in the treatment groups, the ratio test was used (Table 6).

According to the probability value, it is concluded that the success ratio of treatment in all three treatment groups is similar, and there is no significant difference between the three pediculicides.

Table 3. General distribution of efficiency of the three pediculicide used in treatment of the head lice infestation in Islamshahr in 2019

Result after intervention	Frequency	Percentage
Recovered	150	83.5
Not recovered	29	16.5
Total	179	100

Table 4. Intervention results of the pediculicides used

	Intervention results			
	Treated		Not treated	
	Number	Percent	Number	Percent
Permethrin	58	79.5	15	20.5
Dimethicone	44	83	9	17
Ivermectin	48	90.6	5	9.4

Table 5. Wilcoxon Signed- rank test to evaluate the efficiency of each pediculicide

Type of treatment	Z test criterion	Probability value
Permethrin	-7.616	<0.001
Dimethicone	-6.663	<0.001
Ivermectin	-6.928	<0.001

Table 6. Comparison test of success rates in treatment groups

Type of treatment	Treatment success ratio	Degree of freedom	Test criteria	Probability value
Permethrin	0.794			
Dimethicone	0.830	2	2.828	0.243
Ivermectin	0.906			

Therefore, in case of using any of the treatments methods with good results (though Ivermectine was more appropriate), due to almost similar and no significant difference between them will be obtained desirable results.

Discussion

The results of this study, like the results of other researchers, showed that the highest ratio of infestation is in females and in the age group of 6-11 years, therefore sex and age are the two main epidemiological factors in the studies and interventions related to pediculosis (8, 14-25). Numerous studies have been performed on the efficiency of pediculicides used to control head lice infestation and comparing pediculicides with each other. The results of this study showed that the success ratio of treatment with the three pediculicides, despite a slight difference, had a relatively similar effect. Also, the results of the efficiency of each pediculicide showed that aging had a positive role on efficiency, which may due to increasing awareness and mastery of how to use at this ages, while the lotions studied had more effective results at young ages, this study also had a good result because lotions have much less side effects than permethrin shampoo and this can be used even in children under two years. The results of this study is similar to Bashiri study (26) that the efficiency of permethrin shampoo was 97.3% and Rafinejad et al. (15) that the efficiency

of permethrin in girls was 75%, also Dinapli et al. (27) showed that permethrin 1% was the most effective substance with high safety to treat head lice infestation, it has been announced that this pediculicide can be made available to the public without a doctor’s prescription. Zahirnia et al. (28) declared the efficiency of permethrin shampoo was 88% was consistent. Burgess et al. (29,30) reported the efficiency of 4% dimethicone lotion compared with 5% phenothrin in a randomized clinical trial and obtained almost similar results between 70% and 75%, which was consistent with the present study. Feldmeier (2012) study showed that dimethicone lotion and silicone oils worked perfectly physically with low surface tension and complete surface coverage, so this group of compounds is very effective and safe, and there is no risk to use head lice resistant (31). Ferrara et al (2013) study in Rom, Italy, determined the efficiency and safety of dimethicone 4% in the treatment of head lice infestation and they received prevention for all participants, with a cure rate of 82.4% (32). Monisha et al. (2018) showed in a cohort study on the efficiency of 0.1% permethrin shampoo in comparison with 0.5% Ivermectine lotion in head lice infestation after treatment with topical permethrin and 0.1% Ivermectine lotion 0.5%, the presence of active nits were significantly reduced in the Ivermectine group (33). Saghafipour et al. (2017) (9) studied the effect of 1% permethrin shampoo on head lice in Qom province. In this trial,

378 people infested with head lice were treated with 1% permethrin shampoo and one week after the end of the treatment period, they were examined and the infested people received another course of treatment and this process continued for up to 4 treatment periods. The results showed that 58.2% recovered after one course of treatment, 35.4% in two courses, 2.4% in three courses and 1.6% after four courses of treatment. In 2.4% of cases, the infestation was not eliminated. In total, 93.6% of infested people were free of infestation during one to two treatment periods. There was a relationship between the density of infestation in the family and the level of literacy of the mother in the family with increasing the length of treatment. People over the age of 20 (compared to those under the age of 10) had a better chance of increasing their treatment (9).

Conclusion

The results of this study showed that taking one pediculicide is not particularly preferable to other pediculicides except due to some factors such as economic status, pesticide price, availability, underlying diseases, pesticide sensitivity, how to use and age of people. Correctly, the necessary effectiveness and the recurrence of infestation and the problems and challenges are related to wrong training and incorrect practice that can be compensated with proper training and proper use of compounds. Also, screening before the beginning of the school year to identify and treat infested cases, use the capacity of medical entomology and vector control graduates in screening and treatment of infested people at the beginning of the school year. Holding workshops and training classes for school health educators and experts or employing trained entomologists as school health educators, uploading reliable and simple scientific information for public use on the Ministry of Health's system, universities and health centers, using the capacity of cyberspace to teach the correct way to diagnose and treat

infestation, introduce common and approved pediculicide of the Ministry of Health along with the standard treatment guidelines, review, modify and create a national standard guidelines for diagnosis and proper treatment of pediculosis is one of the issues that health policy makers in countries should be considered. Monitoring of resistance of head lice to these insecticides is an important factor for decision makers.

Conflict of Interest

All authors declare that there is no conflict of Interest.

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