

The Effectiveness of Head Lice Management Program in Primary Schools in Bahra

¹Hend Al-Najjar, ^{1,2}Wafaa Elarousy and ^{1,2}Houaida Helal

¹College of Nursing, King Saud bin Abdul Aziz University, Saudi Arabia

²Faculty of Nursing, Alexandria University, Alexandria, Egypt

Abstract: Head lice is one of the most common parasitic contamination in the world that causes serious health problems for many communities, especially for school children. The nurse can apply family-centered care to control head louse infestation and prevent recurrence of it by supporting, encouraging and enhancing the family's strength and competence to manage and prevent recurrence of head louse infestation. The aim of this work is to evaluate the effectiveness of head lice management program in primary schools in Bahra. The experimental design was used in the study. Two primary schools in Bahra were randomly selected and allocated either to an experimental or control group. A total of 1050 students in addition to mothers of the infested students of the experimental group were recruited to the study. The head lice screening was done for both schools and the educational program and the management were distributed to the mothers of the infested students of the experimental group. Pre- and post-tests were used to evaluate the effectiveness of the program, in addition, to follow up screening at 2nd and 4th week after the program. Results showed that the overall prevalence of head lice among participants was 22.6%. In addition, the prevalence among participants from the experimental group was higher in crowded classes. The comparison between pre and post according to mean score knowledge about head lice infestation was 7.70 ± 2.18 and 13.12 ± 1.34 and the difference was very highly significant ($p=0.001$). Also, the mean score of the beliefs about head lice infestation was 3.21 ± 2.26 and 4.09 ± 2.54 and the difference was also significant ($p=0.002$). Furthermore, the prevalence of head lice infestation among participants in the experimental group was improved from 31.5% in the first screening to 16.8% in the third screening. **Conclusion and Recommendations:** The mother's knowledge and beliefs about head lice infestation were significantly improved after the educational program and the prevalence of head lice among participants of the experimental group was decreased in the third screening. Periodic screenings of head lice and associated risk factors with early management to prevent further infestation are recommended.

Key words: Head Lice • Prevalence • Educational Program

INTRODUCTION

Head lice contamination is one of the most common parasitic contamination in the world that causes serious health problems for many communities, especially for school children [1]. it cause embaressment to the parents [2. Studies carried out in different parts of the world have reported different prevalence for head lice in children. For example, the prevalence was 12.2 % by AL-Megrin [4] in Riyadh KSA and 27.2% from low socioeconomic school compared with 3.96% in the school of medium socio-economic by Karakus *et al.* and AL-Megrin [3, 4]. The overall prevalence of head lice was 42.1% in Viana, Angola [5]. While Falagas *et al.* [6] retrieved 55 studies

about head lice, most studies were referred to school children and found that the prevalence of head lice varied from 0.7to 59%. The prevalence in Saudi Arabia differs according to the province, in a study conducted in Jazan it reached 18.9% of the female students, while in Jeddah it reached 11.2 % and in Al-Khobar city the head lice prevalence was 5.2% among female school children [7-9].

The majority of transmissions of head lice occur by direct head-to-head contact with an infected close friend or relative. Slumber parties, shared beds, sports activities are examples of direct head-to-head contact. Vector transmission (indirect contact) may occur through the sharing of bedding, or by using personal items such as combs, brushes, scarves, hair ornaments, or hats of an

infected person [10, 11]. The lice bites are relatively painless, the signs and symptoms are caused by the reaction of the host to the saliva or anticoagulants injected by the lice into the dermis. The adult louse lives only about 48 hours if not in contact with the human host and the lifespan of the female is roughly one month. Eggs are laid at night, at the junction of a hair shaft and close to the skin; these nits will hatch within 7 to 10 days [2].

Head lice contamination is common worldwide and has been proposed as a major health problem not only in poor countries but also in developed and industrial countries [1]. Anyone can get head lice, but some people are at greater risk than others. Those people include children between the ages of 3 and 11 years. Girls are more likely to get head lice than boys [11]. A high rate of infestation was among students, who had long hair, poor family and illiterate mother's and washed their hair less often [4, 12]. In addition, Karakus *et al.* [3] found that the prevalence of head lice from low socioeconomic school was higher than in the school of medium socio-economic level in Izmir, Turkey.

In developing countries, the persistent infestation has been associated with secondary infections and impetigo [5]. In addition, it can cause sleep disturbances and difficulties in concentration, potentially leading to poor performance in school, social distress, discomfort, embarrassment and unnecessary absence from school. Furthermore, it causes a high level of anxiety among parents of school-aged children [13].

There are three basic treatment options for head lice for which there is some scientific evidence of efficacy: topical insecticides, wet combing and oral therapy [10-14]. Choice of treatment is determined by age, louse resistance patterns particular to the local area and potential toxicity. Wet combing, otherwise known as "bug busting," is a commonly used method for eradication of head lice infestation. Topical pediculicides compared the effectiveness of the Bug Buster kit with pediculicides for eliminating head lice and concluded that Bug Buster kit was the most effective over the counter treatment for head louse infestation when compared with pediculicides [14, 15]. There is a list of the topical insecticides, pyrethrins and permethrin have favorable safety profiles with minimal percutaneous absorption evaluated the effectiveness of oral albendazole therapy in the treatment of pediculosis capitis [16, 17]. No statistically significant differences were found, oral albendazole/topical malathion combination was more effective than either one alone, while the least effective was the oral albendazole.

The results of a study by Kurt *et al.* [18] showed no significant differences between dry and wet combing strategies for the removal of head lice.

Nurses should emphasize that anyone can get pediculosis; it has no respect for age, socioeconomic level, or cleanliness. The louse does not jump or fly, but it can be transmitted from one person to another on personal items. Children are cautioned against sharing combs, hair ornaments, hats, caps, scarves, coats and other items used on or near the hair. Children who share lockers are more likely to contract an infestation and slumber parties place children at risk. Lice are not carried or transmitted by pets. Nurses or parents should carefully inspect a child who scratches the head more than usual for bite marks, redness and nits. The hair is systematically spread with two flat-sided sticks or tongue depressors and the scalp is observed for any movement that indicates a louse. Nurses should wear gloves when examining the hair and use tongue depressors or examining sticks for each child [19].

Conceptual Framework: Family centered-care approach (FCC) is a philosophy of care that focuses on the family unit during all health care intervention. This model of care recognizes the collaborative relationship between the family and the professional care provider [2]). The philosophy of FCC recognizes the family as the constant in a child's life. Service system and personnel must support, respect, encourage and enhance the family's strength and competence by developing a partnership with parent. It is important to facilitate family-professional collaboration at all levels of the hospital, home and community care. No matter where the pediatric nurse's practice, their primary concern is the welfare of the child and the family [19]

Action research for Lewin was demonstrated by the discussion of problems by those who have to carry out the work. After investigation of these problems the group makes decisions, monitoring and keeping note of the consequences. Regular reviews of progress follow. The group would decide on when a particular plan or strategy had been fulfilled, come to nothing and would bring to these discussions newly observed problems [20]. Screening was done in the current study to assess the prevalence of head lice among children in the selected schools. Then, an educational program for parents about management and control of head lice was conducted in addition to providing the management kits for children with head lice infestation. Finally, follow up was done immediately, after 2 and 4 weeks.

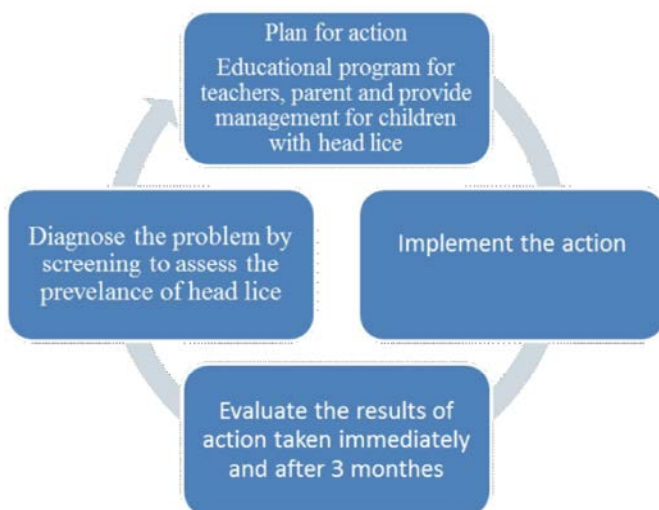


Fig. 1: Steps in the Action Research Cycle

The steps of the action research cycle have been identified as diagnosing, planning, taking action and evaluation. Fig. 1 provides an overview of the process involved

The diagnosing phase included a screening of all students for both schools for head lice. The planning action consists of two parts planning the mother education programme and the development of a planned schedule for the introduction of the education programme in the respective schools. The taking Action was concerned with the administration of the Questionnaire and implementation of parental education and administration of the intervention. Finally, the evaluating Action in which the post-test questionnaire was filled and the post-screening of head lice in both schools for clearance after 2 weeks and recurrence after 4 weeks

Significance of the Problem: Head lice infestation is a significant public health problem among primary schools. Increasing the knowledge about pediculosis and self-hygiene would be helpful in successfully reducing head louse infestation in the school setting. School authorities must encourage the parents to look for head lice routinely and a “school nurse” system is needed for effective head louse control in the schools [3]. The nurse has an important role in activating the role of teachers in controlling head louse infestation. Magalhães *et al.* [5] reported that teachers demonstrated knowledge of biology and clinical signs of head lice, but did not have adequate knowledge about its treatment, suggesting a need for increased competence on the part of teachers to be able to teach children about preventative measures.

Furthermore, the nurse can apply family-centered care to control head louse infestation and prevent recurrence of it by supporting, encouraging and enhancing the family’s strength and competence to manage and prevent recurrence of head louse infestation. Bahra governorate is affiliated to Makkah province, the population is estimated to be 70.000 residents. The results of several screening projects conducted by nursing students during their clinical training in governmental schools in Bahra revealed high prevalence rate of head lice infestation ranging between 60 to 75 %. So, the aim of the current study is to evaluate the effectiveness of head lice management program in primary schools in Bahra.

The aim of the Study: To evaluate the effectiveness of head lice management program in primary schools in Bahra

Specific Objectives:

- To determine the prevalence of head lice infestation among primary school students in Bahra.
- To develop the head lice management program in the primary schools in Bahra.
- To assess the knowledge and believes of mothers about the head lice management and prevention before and after the head lice management program.
- To determine the prevalence of head lice re-infestation among primary school students in Bahra.

Hypothesis: The implementation of head lice management program will affect the prevalence rate of the experimental group.

Nonhypothesis: No association between the community intervention programme and the prevalence of head lice infestation.

MATERIALS AND METHODS

Study Area/Setting: Bahra governorate is one of the Makka province governorate in the western region in Saudi Arabia. The total population is 70.000 residents. Six primary schools governmental for girls are available in the governorate with total number of 5345 students in the current scholastic year 2016-2017. As female group researchers are limited to female school due to culture constrain and unacceptability from the community to access male schools. No school nurses or physicians are assigned to the governmental schools in Saudi Arabia, A teacher usually takes the responsibility of any health issues that can happen during the school day and is called: “health counselor”, the majority of them were trained on first aid and can manage only student emergencies with the help of school administration.

Study Subjects: Students of the two school randomly selected were included in the study in addition to mothers of the infested students of the experimental group All students attending the two schools and their parents agreed to participate in the study. Mothers of students infested by head lice who were willing to participate in the study and accepted to attend an educational program.

Sampling Technique: Simple random sample method was utilized in the selection of the two schools that were included in the study and the same technique was used in the assignment of school to either the experimental or control group. The convenience sample was used to collect data from all students of both schools. A total number of students in these schools were 5345 students in the current scholastic year. Sample size calculation showed that the minimum sample size was 236 considering the margin of error 5, level of confidence 95% and response distribution 20%

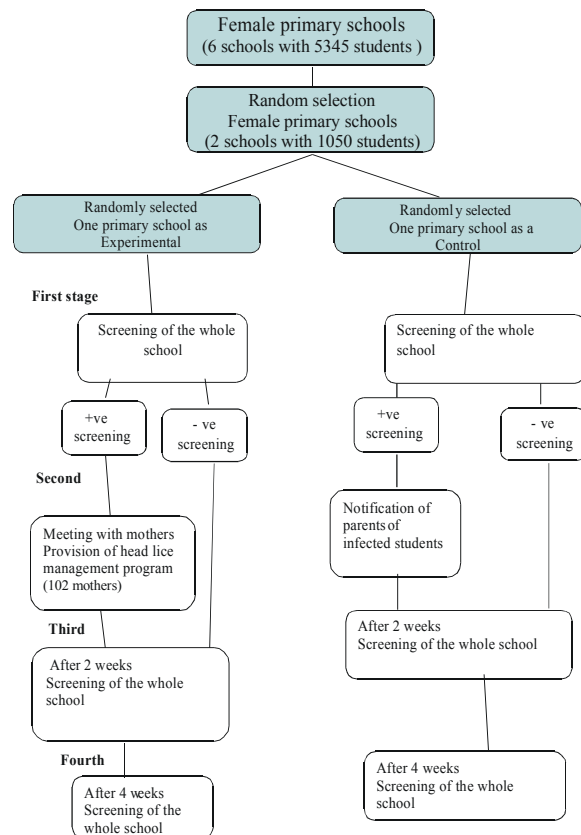
Study Design: An experimental design was used in the study. The three identifying properties of true experimental design were achieved: randomization, control and manipulation.

Randomization was achieved by simple random selection of two primary schools from six primary schools available in Bahra. Schools were then randomly assigned as experimental or control group.

Table 1: Distribution of the two studied groups according to their grade

Grade	Experimental (n = 333)		Control (n = 717)	
	No.	%	No.	%
1	73	21.9	116	16.2
2	55	16.5	124	17.3
3	58	17.4	133	18.5
4	54	16.2	123	17.2
5	48	14.4	118	16.5
6	45	13.5	103	14.4

Manipulation (head lice management program) was being implemented in the experimental group only.



Data Collection Methods, Instruments Used, Measurements:

Data collection instruments: First: The questionnaire tool was derived from ALBashtawy [21] (pretest and post-test) included three parts:

The first part includes sociodemographic data: age, a number of siblings, crowding index, mother education, the occurrence of infestations during the previous years.

Second Part: 20 statements for assessing the knowledge of the mothers about head lice.

Third Part: Beliefs and attitude about the head lice.

Second: Screening Tool: Insufficient daylight, wearing coat and gloves, by combing the hair with fine-toothed comb on a piece of white paper for about 1-3minutes. The hair and scalp were examined by separation of the hair every 1 to 2 cm and eggs, nymph and adult lice were identified using a magnifying glass; cleanliness and length of hair were assessed. The student was considered as positive of head lice infection if there is no evidence of head lice, such as detected head lice or nymphs and live or dead eggs. The procedure was accomplished by the researchers with the assistance of data collectors.

Intervention Program

First Stage:

- The initial visit for both schools will be conducted by the researchers to gain their cooperation.
- The head lice management program was developed by the researches and including:
- Data collectors were trained by the researchers on the screening of head lice. It includes the dry method of head lice screening: description, procedure and outcome.

Data collectors were responsible for the following: after ensuring adequate lighting, they randomly check areas of the scalp; check the full length of the hair and behind the ears to discover the louse eggs (2 hours training including the morphology and life cycle of head lice and practice of the screening).

- Headlice management program for the mothers was prepared. Methods of teaching for implementing the educational program were:
- Videos about the proper use of treatment,
- Powerpoint presentation
- Health education materials.
- The educational training program was conducted on one day for 2 hours through 2 consecutive sessions.
- The first session was 45 minutes followed by 15 minutes break.
- The second session for another 45 minutes.
- Discussion and answer all mothers questions and concerns for 15 minutes.
- Setting: Arrangements were done with the school to use the school theatre.
- The educational program outlines:

- Definition of the head lice infestation.
- Causes and risk factors.
- Mode of transmission.
- Signs and symptoms.
- Complications.
- Management of head lice.
- Prevention of head lice.
- Screening of each student in both schools was done by visual examination of the head

And took about 1 minute and the student privacy was insured

- The sociodemographic characteristics tool was completed by all students in the experimental group.

Second Stage: Based on the results of the screening in both schools the students were divided into two groups, the positive infected students were included in the study i.e. the presence of live (moving) lice,

The exclusion criteria were as follows:

- Children with active symptomatic asthma;
- Persistent skin disorder of the scalp; treatment with other head lice products within the previous 4-week period;
- Hair that had been bleached, colored within the previous 4-week period; and known sensitivity to parathyroid, organophosphate and/or carbonate insecticides and/or sensitivity to chrysanthemums.

The Control Group: Notification letter was issued for the parents of infected students with advice to manage child through primary health care center.

The Experimental Group: An invitation letter was sent to the mothers of the infected students to attend the first meeting. Data was collected using structured questionnaires (pre-test)

Following the completion of the first questionnaire, a focused teaching session on the management program of headlice was provided by the researchers to the mothers. The researchers offered the same treatment modalities approved by the primary health care centers in addition to the educational program to ensure management compliance. Head lice treatment package was distributed to each mother with clear instructions on the method, duration of use.

Third Stage: after Two Weeks (Clearance)

The Control Group: Notification of treatment letter was sent to the parents of the infected students.

The Experimental Group: An invitation letter was sent to the mothers of the infected students to attend the second meeting.

During the Meeting: Data were collected using structured questionnaires (posttest) based on the literature dealing with the problem of head lice in children to assess their knowledge and beliefs of head lice. Feedback about the treatment was obtained from the mothers. The second screening was conducted for all the students.

Fourth Stage: After 4 Weeks (Recurrence): Third screening for all the students were done held in both schools.

Data Management and Analysis Plan: The statistical analysis of numerical data was conducted using SPSS, version 20 software. Descriptive statistics (i.e., frequency and percentages or mean scores and standard deviation) and inferential statistical methods (Paired t-test and t-test independent samples) were applied. A significant level of $P = .05$ was used. Categorical data and McNemar test were applied. A significant level of $P = .05$ was used.

RESULTS

The results of the study are illustrated in four parts:

Part One: The prevalence of the head lice among the students in both schools.

Table 2 shows the distribution of the prevalence rate in the examined students according to their grades and crowdedness of their classes. The highest prevalence was among children studying in Grade 4 (29.3%) followed by students enrolled in Grade 3 (25.5%). In order of seniority in class levels, a large chunk of the head lice positive participants with considerable head lice infestation were studying in Grade 6 (24.5%) followed by 17.9% of them included in Grade 5.

Table 2 offers a comparative assessment of the effects of crowding of the class on head lice infestation in children. Data attained after the first screening stage reveals that 23.7% of the head lice positive subjects were in 'not crowded' class settings. Class crowding is positive with head lice distribution in 16.9% of the head lice positive participants. 71.4 and 80.3% of head lice negative children were in 'not crowded' and 'crowded' class settings respectively.

Part Two: Demographic characteristics of the positive students in the experimental group

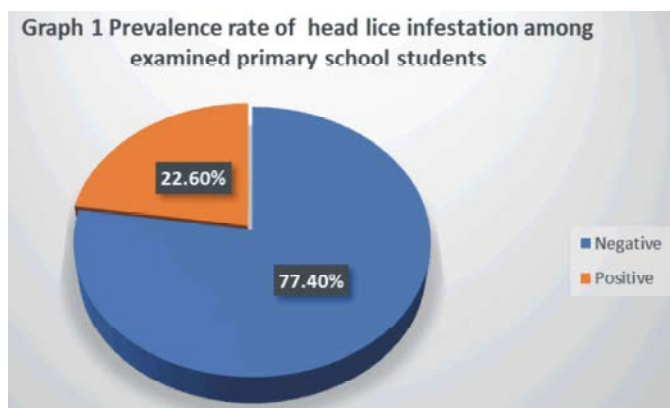
Table 3 reveals the distribution of the studied sample according to demographic data in positive cases of the experimental group in the first screening. The total number of students present during the implementation of the program was 102 students. It shows that the highest number of head lice positive children were enrolled in grade 4 (27.5%) whereas 21.6% of these students belonged to Grade 6. Within the positive cases, the largest number of subjects (46.1%) was notified with father education up to secondary level. 33.3% had less than a secondary level of father education. Only 13.7% of the head lice positive participants had fathers with university-level education. 6.9% of the participants had illiterate fathers.

Also within the positive cases, the largest number of participants (41.2%) was notified with mother education up to secondary level. 37.3% of the mothers in the head lice positive children had less than a secondary level of education. Only 13.7% of the head lice positive participants had mothers with a university level of education whereas, 6.9% of the participants had mothers with post-graduate degree education and only 1% of the mothers in the head lice positive group had no education.

Table 3 indicates an important finding that the highest number of head lice positive participants had more than 5 siblings (32.4%). 19% of these head lice positive children had 4-5 siblings. The data show further than 48% of the head lice positive children had 1-3 siblings.

Part Three: The knowledge and beliefs of the education program for the mother's in the experimental group.

Table 3 offers comparative data on how the head lice education program has affected the beliefs of the mothers pertaining to her knowledge about head lice. The knowledge to identify head lice and nits has significantly enhanced. Table 3 demonstrates that the comparative difference in the beliefs of the mothers in pre and post groups of the intervention (head lice education) is highly significantly different in areas of detecting head lice and nits ($p=0.001$). The knowledge required to differentiate between nits and dandruff in the pre and post group is also highly significantly ($p=0.001$). The difference in knowledge to differentiate between head lice and other insects in the pre and post education group is also highly significantly ($p=0.002$). The belief regarding the ability to check family for head lice in the pre and post group is also highly significantly ($p=0.001$). The belief regarding the ability to treat family for head lice in the pre and post



Graph 1: Shows that the prevalence of head lice infestation among examined primary school students in both experimental and study group in Bahra. 22.60% of students were positive to the head lice and 77.40 students were negative to the head lice

Table 2: Distribution of the prevalence rate in the examined students (experimental and control group) according to their grades and crowdedness of their class

		First Screening						
		Negative		Positive		Total		
		Count	Row N %	Count	Row N %	Count	Row N %	P
Grade	1	138	78.4%	38	21.6%	176	100.0%	.047*
	2	141	83.4%	28	16.6%	169	100.0%	
	3	137	74.5%	47	25.5%	184	100.0%	
	4	118	70.7%	49	29.3%	167	100.0%	
	5	133	82.1%	29	17.9%	162	100.0%	
	6	111	75.5%	36	24.5%	147	100.0%	
Total		778	77.4%	227	22.6%	1005	100.0%	
Class Crowdedness	Not crowded	522	71.4%	173	23.7%	695	100	0.001*
	Crowded	256	80.3%	54	16.9%	310		

Table 3: Distribution of the studied sample according to demographic data in positive cases of the experimental group in the first screening (program)

		Total No. of +ve cases in the experimental group No. (102)	%
Grade			
	1	12	11.8
	2	12	11.8
	3	16	15.7
	4	28	27.5
	5	12	11.8
	6	22	21.6
Class Crowdedness			
	Crowded	64	62.7
	Not crowded	38	37.3
Father education			
	Illiterate	7	6.9
	Less than secondary	34	33.3
	Secondary	47	46.1
	University	14	13.7
Mother education			
	Illiterate	1	1.0
	Secondary	42	41.2
	University	14	13.7
	Postgraduate	7	6.9
Siblings			
	1-3	49	48.0
	4-5	20	19.6
	More than 5	33	32.4

Table 3: Comparison between pre and post education program according to mothers beliefs about head lice infestation

Beliefs	Pre		Post		P
	No.	%	No.	%	
Do you believe that you can identify head lice?	62	60.8	86	84.3	<0.001*
Do you believe that you can identify head lice eggs (nits)?	54	52.9	86	84.3	<0.001*
Do you believe that you are adequately able to differentiate between head lice and other insects?	71	69.6	89	87.3	0.002*
Do you believe that you are adequately able to differentiate between head lice eggs and dandruff?	51	50.0	83	81.4	<0.001*
Do you believe that you are adequately able to check your family for head lice?	53	52.0	81	79.4	<0.001*
Do you feel that you are adequately able to treat your family for head lice?	65	63.7	79	77.5	0.022*
Do you believe yourself to be responsible for the detection of head lice in your family?	50	49.0	79	77.5	<0.001*
Do you believe yourself to be responsible for the treatment of head lice in your family?	70	68.6	79	77.5	0.188
Do you feel shame when your child is infested with pediculosis?	49	48.0	75	73.5	<0.001*
Do you feel ashamed to ask for help from a healthcare provider when your child is infested with head lice?	29	28.4	99	97.1	<0.001*

McNemar test

p: p-value for comparing between pre and post

*: Statistically significant at $p \leq 0.05$

Table 4: Comparison between pre and post education program according to mothers knowledge about head lice infestation

Knowledge	Pre		Post		P
	No.	%	No.	%	
Head lice are parasitic insects (true)	8	7.8	81	79.4	<0.001*
Head lice live and feed only on human scalps (true)	16	15.7	93	91.2	<0.001*
Head lice can live up to 1 year on a person's head (false)	40	39.2	83	81.4	<0.001*
If a louse falls off a person, it dies within 2–3 days (true)	89	87.3	92	90.2	0.629
Eggs (nits) hatch in 10–14 days and can reach reproductive maturity within 8–10 days (true)	40	39.2	91	89.2	<0.001*
Head lice are most often found toward the nape of the neck (true)	27	26.5	98	96.1	<0.001*
Head lice can fly from person to person (false)	75	73.5	10	9.8	<0.001*
Dandruff is usually difficult to move, whereas head lice eggs (nits) slide off easily (false)	56	54.9	6	5.9	<0.001*
Head lice infestations occur only in developing countries (false)	19	18.6	12	11.8	0.248
Boys get head lice more frequently than girls (false)	75	73.5	92	90.1	0.004*
Most children with head lice frequently scratch their heads, which may lead to skin sores and skin infections (true)	17	16.7	10	9.8	0.248
Head lice can be contracted from animals such as cats and birds (false)	26	25.5	92	90.2	<0.001*
Prolonged direct contact with a person who is already infested is one of the main modes of head lice transmission (true)	20	19.6	94	92.2	<0.001*
Sharing infested combs, brushes, or hair ribbons does not result in transmission (false)	45	44.1	16	15.7	<0.001*
During infestation, you should delouse your house by using hot water to wash all clothing and bedding your child has worn or slept in (true)	33	32.4	94	92.2	<0.001*
Contracting head lice is always a sign of poor hygiene (false)	57	55.9	10	9.8	<0.001*
Head lice are usually treatable with lice-killing products and rinses (true)	15	14.7	92	90.2	<0.001*
All available products kill all the lice and their eggs (false)	59	57.8	98	96.1	<0.001*
Parents should ask a healthcare provider before using lice-killing products on a child who has allergies, asthma, or other medical conditions (true)	12	11.8	100	98.0	<0.001*
You should use extra amounts of lice-killing medication to get the best result (false)	56	54.9	74	72.5	<0.001*

McNemar test

p: p-value for comparing between pre and post

*: Statistically significant at $p \leq 0.05$

education group in mothers was also statistically significant ($p=0.02$), on the other hand, the belief regarding their own responsibility to treat family for head lice in the pre and post education group in mothers was not statistically significant ($p=0.188$). Table 3 further shows that difference in feelings linked to shame and stigma regarding pediculosis (head lice) and seeking help regarding it, in the pre and post education group is highly significantly ($p=0.001$).

Table 4 shows the effects of the head lice management program and how the knowledge level of the post-education group is statistically different from the pre-education group. The difference in the mother's knowledge in the pre and post education groups was highly significant ($p=0.001<0.05$) in subject matters like parasitic nature of head lice, feeding on human scalps, lifespan of head lice, reproductive cycle, distribution in head area, transmissibility, convenience to remove nits,

Table 5: Comparison between pre and post according to mean score knowledge and beliefs about head lice infestation

Knowledge/beliefs	Pre	Post	t	p
Total knowledge score				
Min. – Max.	3.0 - 13.0	10.0 - 17.0	21.636*	<0.001*
Mean ± SD.	7.70 ± 2.18	13.12 ± 1.34		
Total belief score				
Min. – Max.	0.00 - 9.00	1.00 - 10.00	3.115	0.002
Mean ± SD.	3.21±2.26	4.09±2.54		

t: Student t-test

p: p-value for comparing between pre and post

*: Statistically significant at $p \leq 0.05$

Table 6: Comparison between the two studied groups according to the prevalence of head lice infestation among primary school students in each screening

	First screening Prevalence rate		Second screening clearance rate		Third screening recurrence rate	
	No.	%	No.	%	No.	%
Experimental (n = 333)						
Negative	203	61.0	258	77.5	277	83.2
Positive	105	31.5	74	22.2	56	16.8
Not examined (Absent)	25	7.5	1	0.3	0	0.0
Sig. bet .periods	^{Mh} p ₁ <0.001*		^{McN} p ₂ <0.001*		^{MH} p ₃ =0.008*	
Control (n = 717)						
Negative	575	80.2	574	80.1	596	83.1
Positive	122	17.0	134	18.7	121	16.9
Not examined (Absent)	20	2.8	9	1.3	0	0.0
Sig. bet .periods	^{Mh} p ₁ =0.077,		^{McN} p ₂ =0.001*		^{MH} p ₃ =0.001*	
$\chi^2(p)$	45.328*(<0.001*)		3.801(0.149)		0.001(0.981)	

McNemar test χ^2 : Chi-square test

MH: Marginal Homogeneity Test

p: p-value for comparing between the two groups

p₁: p-value for comparing between first and second

p₂: p-value for comparing between first and third

p₃: p-value for comparing between second and third

*: Statistically significant at $p \leq 0.05$

modes of head lice transmission, contraction from animals, sharing infested combs, management strategies and treatability and usage of head lice-killing medications. The knowledge regarding the lifespan of head lice after falling off a person ($p=0.629$), infestations occurrence specifically in developing countries ($p=0.248$) and headlice infestation leading to skin sores and skin infections ($p=0.248$) was not found to be significantly different in mothers in the pre and post education groups. The knowledge area regarding gender-specific head lice frequency is significantly different ($p=0.004<0.05$) across the two pre and post education groups.

Part Four: The effectiveness of headlice program

As per Table 5, which shows the comparison between pre and post according to mean score knowledge about head lice infestation was 7.70 ± 2.18 and 13.12 ± 1.34 , the difference in the mother’s knowledge in the pre and post education groups was very highly significant ($p=0.001$). while the mean score of the beliefs about head

lice infestation were 3.21 ± 2.26 and 13.12 ± 1.34 , the difference in the mothers' beliefs in pre and post education groups was also significant ($p=0.002$).

Based on the results in the first the screening in both schools the students will be divided into two groups, the positive infected students were included in the study. Table 6 shows the comparison between the control and experimental groups according to the prevalence of head lice infestation among primary school students in each screening. In the experimental group, the positive head lice results have significantly decreased following the first screening ($P=0.001$), where this decline after 2 weeks is consistent with the second screening ($P=0.001$) and also after one month in the third screening, it is significantly reduced further ($P=0.008$). In the control group, the positive head lice outcome was persistent and not significantly different following the first ($p=0.07$) screening but statistically significantly different following the second ($p=0.001$) and third screening ($p=0.001$).

DISCUSSION

Head lice is considered a global major problem, with high rates of infestation in both developed and developing countries. Lice has plagued human beings for thousands of years. References to lice appear in the Bible and Egyptian manuscripts dating to the 16th century BC. Desiccated head lice and eggs have been found on Egyptian and prehistoric North American Indian mummies [22].

The current study aims to assess the prevalence of head lice in Bahra governorate, Makkah province, in the western region in Saudi Arabia. It was found that the prevalence rate of head lice in the two female primary schools reached 22.6%. This rate was less than the rate found in other Arab countries as the prevalence rate of pediculosis capitis was 44.2% in Meet Mazzah primary school children for girls in Egypt [23] while in Jordan, the prevalence of infestation was significantly higher among girls (34.7%) than boys (19.6%) [21] and it was 27.6% among girls in South Jordan [24].

Furthermore, in a study conducted in Mexico, The overall prevalence of head lice in schoolchildren was 28%, the highest prevalence was among girls (33.6%, 140/417) and children from the fifth grade (10-11 years old) were the most affected (6.2%; 52/840). Female gender, long hair and the father's education level were significantly associated with the infestation [25] However, in Greece, Tagka 2016 study showed that the rate was lower reaching The overall pediculosis rate was 5.30%. Head louse infestations were significantly higher in female children [26].

In comparison with other Saudi studies conducted in different Saudi governorates, results of the study in Riyadh done by Nehal *et al.* [27] revealed that the prevalence was common among girls students in 3rd and 4th Grade Level and their aged ranged from 8 to 10 years, more than half (55.0%) of girls were infected [27] Moreover, about (43.25%) of families have more than 5 children. In Abha, the prevalence rate of infestation among 672 primary school girls was found to be 45.45%. This rate is considerably higher than rates recorded in earlier studies conducted in Saudi Arabia [28], In Jeddah, the nearby governorate to Bahra, the prevalence was lower than our study was 11.26% in Al-Zanbagi [8] study as Bahra governorate is more crowded, has less health services facilities and their residents are less in their socioeconomic level compared with Jeddah the second important city in Saudi Arabia. According to the socio-economic status, girl students were mainly attended to the public schools in the 5 grade and in the age of

10->12 years [8] In the current study, the highest rate of infestation was among students enrolled in fourth grade aged between 10-11 years, as the majority of studies either Saudi or non-Saudi female students.

The head lice affect these group of students physically, psychologically and socially. It can cause irritation, insomnia and secondary bacterial skin infections. These students also feel shamed and embarrassed in front of their colleagues in school and also within their family member. It is considered a social stigma, not only for the affected child but to all the family [29]. Lack of knowledge and negative attitude toward the problem of head lice aggravated these associated problems which were proved in several studies [21, 30].

The current study investigated the knowledge and beliefs of mothers of the infected students, the results revealed that the mothers lacked information regarding the parasite and the mode of transmission as well as the preventive and the control measures. These results are in accordance with other studies conducted in Saudi Arabia and Nigeria [31, 32].

Similar findings were concluded in studies conducted in countries like Australia and Italy the knowledge of the parents about head lice was not satisfactory in spite of the high level of community awareness about the disease and that social stigma was not related to the infestation of head lice in these countries [33-35].

The results of the study also revealed that the majority of the mothers feel shame that her daughter is infested with pediculosis but less shame to seek help and ask for treatment from the health care provider. In Nigerian study where the prevalence of the head lice is higher, the students but their parents felt less ashamed from the disease. This contradiction is directly related to the cultural difference between the two population [33].

The management strategies of this public health problem varied including the use of pharmaceutical or traditional methods. The Council On School Health And Committee On Infectious Diseases stated in their reports published in 2015 the effectiveness of a variety of treatment lines for head lice and that the parent involvement is crucial either in the screening or in the management of the disease [36]. Several studies investigate the effectiveness of these strategies, while others rely on educational programs to increase the affected population awareness about head lice and the methods of prevention and control [37]. These programs were directed either to the affected students, teachers or parents, or a combination of these population. Following the Family centered-care approach, this study combines medical treatment with the health education program to

the student's family and their participation in the treatment and followup. The results show improvement in their knowledge and attitude after the program. This result is in agreement with several studies that implement and evaluate health education for head lice.

The prevalence of head lice reduced in the experimental group to 22.2% as compared to 31.5 % in the first screening . The improvement continue in the follow up screening reaching only 16.8%. However in the control group in which the parents used the on- counter medications to treat their daughters, the prevalence was nearly the same in the three screening This result is in accordance with several studies that implement and evaluate health education and found great effectiveness of these programs on the prevalence of head lice, in Iran The infestation rate was 69.3% in the case group before the intervention and decrease to 26.7% after the education .In Thailand also the same improvement was achieved [38-41] So, efforts to control this public health problem need the cooperation of health team, school personnel including teachers and the parents especially the mothers. These efforts should include health education programs as well as highly effective medical treatment.

CONCLUSIONS

The mother's knowledge and beliefs about head lice infestation were significantly improved after the educational program and the prevalence of head lice among participants of the experimental group was decreased in the third screening.

Recommendations: Periodic screenings of head lice and associated risk factors with early management to prevent further infestation are recommended.

Activate the role of school health nurses to organize awareness activities to students' mothers about prevention, identification and early management of head lice.

Include the parents in the headlice primary level prevention program as well as in the secondary level of head lice management.

The public awareness campaign is recommended and target the parents and the children themselves on the identification of the head lice and the available community resources.

Declarations: Ethics approval and consent to participate.

- The research proposal was submitted to King Abdullah International Medical Research Center

(KAIMRC) to obtain IRB approval. Informed consent for all parent was distributed. Student privacy during screening was insured

- An information sheet explaining the purpose complied for circulation to all concerned. Maintaining the anonymity of the participants of the school was agreed and the information provided from individual parents was kept confidential.
- A letter was given to parents of infected children of the experimental group. This letter explained the purpose of the research and asked the respondent (parent) to participate in the study by completing the attached questionnaire. It emphasized that participation in the research was voluntary and the confidentiality of individual responses was achieved.
- Consent for publication

Not applicable

- Availability of data and material

All the data and materials are kept in a secure place with the authors.

- Competing interests

The authors declared that they have no competing interests

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Author Details:

- College of Nursing, King Saud bin Abdul Aziz University, Saudi Arabia
- Faculty of Nursing, Alexandria University, Egypt

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