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Effect of Health Education on Knowledge Attitude Practice towards Malaria among Basic Schools Pupils in Taiz

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Abstract

Background: Malaria is one of the main health problems in Yemen. Health education is essential for the control of diseases such as malaria. School-age children represent 25% of Yemen's population. Schools children can convey the knowledge and skills that they acquire at school to the community, thus increasing general community awareness about malaria. Aim to determine the impact of school-based malaria education intervention on knowledge, attitude and practice of school children towards malaria prevention and control. **Methods:** We conducted a community-based trial, intervention and non-intervention comparison (exposed & non-exposed), in four randomly selected districts (rural and urban) of Taiz governorate. This study was conducted in four districts of Taiz governorate. The study population was 2130 pupils of grade 6, 7, and 8 in primary schools, chosen from four randomly selected districts; two of them were rural and the others urban. Four schools and their pupils (1065 pupils) were chosen for the study and assigned as an intervention group and four schools with their pupils (1065) were chosen for the study and assigned as a non-intervention (1065 pupils). Data were collected using questioner in intervention and non-intervention schools (three months apart). The major intervention activities included lectures about malaria, distribution of educational materials. χ^2 was used to analyze differences. **Results:** Health education activities in schools were associated with the increased knowledge of malaria symptoms and methods of prevention. The mean knowledge of malaria symptoms is higher in the intervention schools 4.4 ± 1.9, compared with 2.1 ± 1.4 in the non-intervention group. With statistically significant difference ($P < 0.001$), also the positive attitude and practice toward malaria was higher to be (48%) in the intervention group; compared

with (35%) in the non-intervention group the difference was statistically significant. The knowledge of mode of malaria transmission was higher in the intervention schools to be (86.2%) compared with (59.1%) in the non-intervention group, with statistically significant deference (P value <0.001). The knowledge of fever as a main malaria symptom was higher to be (90.4%) in the intervention schools compared with (63.6%) in the non-intervention schools with statistically significant deference. **Conclusions and Recommendation:** This study concludes that the health education intervention in primary schools in Taize governorate had a positive impact on the knowledge, attitude and practice of pupils. We recommend to conduct similar methods of the health education activities in schools with suitable modifications to reach all schools level.

Keywords

Community-Based Trial, Heath Education, School Children, Intervention and Non-Intervention, Impact of Health Education Campaign, Malaria, Taiz, Yemen

1. Introduction

Malaria is a preventable and treatable infectious disease that kills more than one million people each year [1]. It is a protozoal infection transmitted to human beings by mosquitoes biting mainly between sunset and sunrise. Human malaria is caused by four species of *Plasmodium protozoa*: *Plasmodium falciparum*, *P. vivax*, *P. ovale* and *P. malariae* [2]. According to the latest estimates, released in December 2014, there were about 198 million cases of malaria in 2013 (with an uncertainty range of 124 million to 283 million) and an estimated 584,000 deaths (with an uncertainty range of 367,000 to 755,000). Malaria mortality rates have fallen by (47%) globally since 2000, and by (54%) in the WHO (World Health Organization) African Region [3]. It is a deadly mosquito-born disease, which took 781,000 lives in 2009 and affects as many as half a billion people in 106 countries in Africa, Asia and Latin America [4]. Malaria is endemic in 109 countries and territories in tropical and sub-tropical zones, spanning all continents of the world except Antarctica and Australia, with intensities of transmission that vary from very low to extremely high [5]. Every 45 seconds, a child dies from malaria. Each of these deaths is avoidable [6]. By the mid-19th century, malaria had been eliminated from several countries in temperate zones in which it had been endemic [7]. The recent impact of malaria control interventions, showing in multiple countries over a few years over (75%) reduction in malaria cases with high coverage of effective treatment and vector control, has renewed global interest in malaria elimination and eradication [8]. *P. falciparum* is the dominant species of parasite in Djibouti, Saudi Arabia, Sudan and Yemen, but the majority of cases in Afghanistan and Pakistan and almost all cases in the Islamic Republic of Iran and Iraq are due to *P. vivax* [9]. The renewed effort to control malaria world-

wide and move towards elimination in some countries is founded on the latest generation of effective tools and methods for prevention and treatment, increasing use of long-lasting Insecticide Nets (LLINs), Artemisinin-based Combination Therapies (ACTs) and Indoor Residual Spraying (IRS) for scaling up global malaria control and elimination [10] [11]. Malaria is considered as one of the main health problems in the Republic of Yemen [12]. Regarding malaria epidemiologically Yemen is classified as an Afro-tropical, because of the predominance of the life-threatening species, and the plasmodium falciparum [13] [14]. Malaria in Yemen is unstable, seasonal malaria that is closely related to altitude, rainfall and topography [15]. In some settings, it is estimated that up to (40%) of severe pediatric admissions can be due to malaria during the malaria transmission season, with appreciable mortality [16]. Pregnant women and children under five are the mostly affected groups whereas all age groups are at great risk in the epidemic prone areas where epidemics may occur following unusual climatic changes, e.g. heavy rainfalls, unexpected warming and rise in humidity [17]. WHO estimated the malaria cases in Yemen in 2009 to be around 265,074 cases and 779 estimated related deaths [18]. In an effort to reduce the burden of malaria in the country, the national malaria control program has implemented an integrated malaria control strategy of case management, integrated vector control including long-lasting insecticide nets, indoor residual spraying (IRS) and larviciding and community health education (increasing the capability of the community to recognize, prevent and control malaria is the nine strategic directions of the NMCP (National Malaria Control Program) [19]. Skills-based health promotion and disease prevention should be integrated into school health curricula as schools have the responsibility to equip children of all ages with the skills and information that they need in order to make informed choices to lead healthy and productive lives [20].

In general, skills-based health education aims to help children develop attitudes, knowledge and skills necessary to allow them to maintain and enhance their own health [20].

In Yemen malaria cause a major cause of absenteeism [21]. School-age children represent 25% of Yemen's population, and an increased proportion of these children are going to school, who could benefit from a systematic approach to school-based malaria control [22]. The aim of the study is to determine the impact of school-based malaria education intervention on knowledge, attitude and practice of school children towards malaria prevention and control.

2. Methodology/Subjects and Methods

Community-based trial (intervention and non-intervention comparison (exposed &non-exposed)) was conducted in Taiz governorate, Yemen (**Figure 1**).

The study was conducted from Feb. 2013 to May 2013. After taking the baseline survey, we introduced a school-based malaria control activities to the target schools in Feb. 2013.

The sample size was calculated using Epi Info. version 3.5.1 (August 2008).

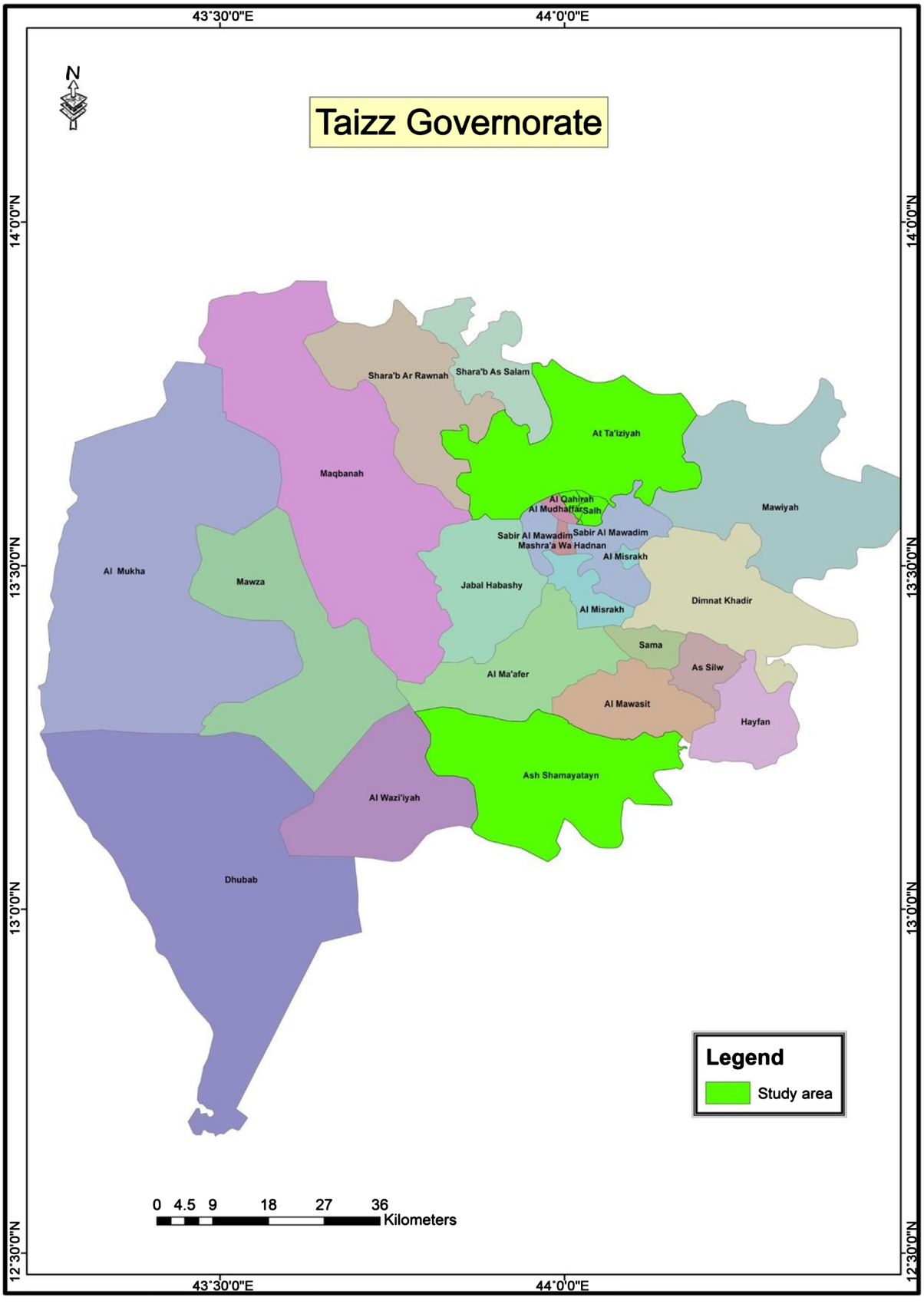

Figure 1. Map: Taiz Governorate. Republic of Yemen-Study area.

The sampling was according to the following criteria;

- The population size of Taiz basic school children = 593,246 pupils [23].
- The expected prevalence = 50% (since we don't have previous study that showed behavior change, so we select 50% to give us maximum sample size.
- The worst acceptable results = 3% (percent that we can accept the division of the study result (sample statistics) from population parameters (corresponds to the level of significance 95%).

Based on that, calculated sample size was found to be 1065 pupils. A larger sample size is needed, because of the design effect. Since we will use (Urban-Rural), the design effect (DEFF) was estimated as 2. So, the actual sample size was double of the calculated sample size.

$$N = 1065 \times 2 = 2130 \text{ pupils.}$$

Half of the sample size (1065) is as an intervention group, and another half (1065) as a non-intervention group.

Multistage sampling technique was used.

1) A list of all districts in Taiz governorate (sampling frame) was made, including rural and urban district. Random selection of two districts one rural and other urban for the study as a study group, according to that Alqahera (urban district) & Ataizea (rural district) have been selected, and two districts one rural and other urban as a control group, according to that Salah (urban district) & Alshameaten (rural district) have been selected.

2) A list of schools (sampling frame) was made, including schools in Alqahera district (urban) and Ataizea (rural district), random selection of one school for boys & one school for girls from each district (4 schools: 2 from urban (one for boys & one school for girls) and 2 from rural (one for boys &one school for girls) as a study schools).

3) A list of schools (sampling frame) was made, including schools in Salah (urban district) & Alshameaten (rural district), random selection of one school for boys & one school for girls from each district (4 schools: 2 from urban (one for boys & one school for girls) and 2 from rural (one for boys &one school for girls) as a control schools).

4) Systematic random sample was used to select pupils from 8 basic schools (4 as the intervention schools and 4 schools as the control schools) using the list of students in each school. The including criteria are: 1—Pupils of 6, 7, and 8 grades, 2—Participant voluntary agreed to participate in the study. The excluding criteria are: 1—Pupils from other grades of the same schools, 2—Students from other than selected schools, 3—Pupils from intervention schools who did not attend the health education program.

Specially designed Arabic questionnaire was prepared by principle investigator; the questions related to bed net was taken from previous study, that conducted in Yemen about BN [24]. The questionnaire was validated by experts from Sana'a University and from the Ministry of Public Health & Population. The questionnaire includes demographic, knowledge, attitudes and practice da-

ta, the same questionnaire was used in pre and post intervention by the same training team at the same time for the intervention group (schools receive health education) and the control group (schools not receive health education activities), the control group (1065). One pilot study was conducted before implementation of the study in two schools urban and rural. At the end of each day of data collection, the completed questionnaires were checked for errors, and completeness, the data were coded to be suited for computer feeding.

Data collectors were trained to ensure the standardization of data collection. The variables are demographic (age, sex, ..., and schooling level of the students).

Knowledge about mode of malaria transmission, cause of disease, symptoms, complication of disease, prevention, information about bed net and sources of information. Attitude and practice (what is group you think are at high risk in malaria, is bed net prevent from malaria, do you think health education about malaria is important, sleeping under bed net, and washing of bed net).

Researcher supervised all steps of data collection that was performed by trained data collectors. Educated teachers from the same localities were trained by researcher to perform the data collection.

The same questionnaire was used in intervention and non-intervention by the same trained data collection team.

The completed questionnaires were checked for completeness; the data were coded and entered to the computer. Quality control of the data was ensured by rechecking 25% of entered data.

The statistical analysis was performed using the Statistical Package for Social sciences (SPSS) program V.17.0, Chi-square test was used to analyze categorical variables, P value < 0.05 was considered as statistically significant difference.

T-test was used to analyze variables that have mean scores. The 23 items of knowledge (one item was a mode of malaria transmission, 8 items were symptoms of malaria, 7 were complication and 7 items were for malaria prevention) were aggregated to create a single knowledge outcome for each student with possible scores ranging from 0 (23 were incorrect) to 23 (23 were correct). The knowledge composite measure was converted to a metric from 0 to 100, where higher values indicate more correct responses; the purpose of this conversion was to allow for more intuitive results with scores conceptualized in concert with traditional classroom grading [25]. The 7 attitudinal items measuring opinions which were scored on a scale of 5 (the most favorable) to 1 (the least favorable), were summed to create a single attitudinal outcome. The resulting attitudinal scale ranged from 35 (positive on all 7 questions) to 7 (negative on all seven questions). The attitudinal composite measure was then converted to a metric, where 100 indicates positive attitude to allow for more intuitive interpretation of the results. Paired t-tests were completed to compare the mean values pre-intervention and post-intervention on knowledge, attitude and practice outcomes. The critical value for determining statistical significance was $P < 0.05$.

Interpretation:

Very good knowledge = correct answer for (75%) and above of questions.

Good knowledge = correct answer for questions (50% to 74%).

Poor knowledge = correct answer for questions (less than 50%).

We used 5 points Likert scales to measure the attitude (strongly agree, agree, uncertain, disagree and strongly disagree).

Informed consent was obtained from parents/caretakers along with the children's assets. Institutional approval was obtained from the Ministry of Education Office in Taiz Governorate, district education offices, and headmasters of targeted schools before the start of data collection.

3. Result

In our study 2130, pupils were included; half of them 1065 from urban (Al-Qaherah, Salah districts) and another half from rural (Attaezzeiah, Alshameatan districts). Females constituted 50%, and males constituted 50%. The mean age of participants was 12.9 ± 1.4 years, with slight difference according to sex; it was 12.8 ± 1.4 for females and 13.1 ± 1.4 for males. After the intervention (health education activities), the number of pupils who recognized mosquito bite as a route of malaria transmission in the intervention schools was higher 918 (86.2%), compared with 600 (56.3%) in the non-intervention group with statistically significant difference.

From Table 1, it is clear that the statistically significant difference was observed in all symptoms, the highest difference occurred in mentioning the cardinal symptoms of malaria like fever, headache, loss of appetite, and vomiting.

After introducing the malaria education campaign, the mean knowledge of malaria complications increased to 3.9 ± 1.8, compared with 1.6 ± 1.1 in the non-intervention group. A statistically significant difference was detected between the intervention and the non-intervention groups. Details are presented in Table 2.

Table 1. Knowledge of pupils about the signs and symptoms of malaria.

Symptoms	Intervention (n = 1065)		Non-intervention (n = 1065)		P value
	No.	(%)	No.	(%)	
Fever	963	(90.4)	640	(60.1)	<0.001
Headache	709	(66.6)	276	(25.9)	<0.001
Vomiting	700	(65.7)	193	(18.1)	<0.001
Sweating	466	(48.3)	167	(15.7)	<0.001
Shivering	396	(37.2)	183	(17.2)	<0.001
Loss appetite	671	(63)	283	(26.6)	<0.001
Bone pain	377	(35.4)	106	(9.9)	<0.001
Don't know	38	(3.6)	211	(19.8)	<0.001

Percent cannot be accumulated due to the possibility of mentioning more than one signs from the same pupil.

After introducing the malaria education campaign, the mean score of knowledge of malaria protection increased to be 4.8 ± 1.8, compared with 2.8 ± 1.8 in the non-intervention group. The difference was statistically significant between the intervention and the non-intervention. Details are illustrated in Table 3.

After the intervention the knowledge of pupils about the BN among intervention was 952 (89.4%) in the intervention group, while only 219 out of 1065 pupils (20.5%) in the non-intervention group. The difference was statistically significant (P value < 0.001). In the intervention group out of 179 (16.8%) who have BN, 129 (72%) of them slept under it, compared with 129 (12.1%) who have BN in the non-intervention group, 81(62%) of them slept under BN. The difference between the intervention and non-intervention group was statistically significant, also the sleeping of pregnant women and children under BN higher

Table 2. The knowledge of the malaria complications among intervention and non-intervention groups.

Complications	Intervention (n = 1065)		Non-intervention (n = 1065)		P value
	No.	(%)	No.	(%)	
High fever	952	(89.4)	585	(54.9)	<0.001
Convulsion	691	(64.9)	210	(19.7)	<0.001
Coma	368	(34.6)	163	(15.3)	<0.001
Renal failure	313	(29.4)	108	(10.1)	<0.001
Cerebral malaria	544	(51.1)	281	(26.4)	<0.001
Low weight	618	(58)	139	(13.1)	<0.001
Abortion	563	(32.9)	98	(9.2)	<0.001
Don't know	27	(2.5)	267	(25.1)	<0.001

Percent cannot be accumulated due to the possibility of mentioning more than one signs from the same pupil.

Table 3. The knowledge of the malaria protection among intervention and non-intervention groups.

Protection	Intervention		Non-intervention		P value
	No.	(%)	No.	(%)	
Cover tank	924	(86.8)	588	(55.2)	<0.001
Fill up pond	702	(65.9)	174	(28.3)	<0.001
Dealing water	590	(55.4)	355	(33.3)	<0.001
Using bed nets	957	(89.9)	330	(53.6)	<0.001
Using nets on window	900	(84.5)	442	(41.5)	<0.001
Indoor residual spray	512	(48.1)	150	(14.1)	<0.001
Repellent	515	(48.4)	207	(19.4)	<0.001
Don't know	23	(2.2)	161	(15.1)	<0.001

Percent cannot be accumulated due to the possibility of mentioning more than one signs from the same pupil.

in the intervention group, but without statistically difference. The schools as a source of information was the main source 533 (50%) in the intervention group, while it was only 9 out of 1065 pupils (0.8%) in the non-intervention group.

To assess the attitude of pupils, researchers put some statements and compared numbers and percent of those pupils who mentioned strongly agree of some attitudes towards malaria intervention and non-intervention groups. Almost all items were higher in intervention group compared with non-intervention group. Details are illustrated in Table 4.

Level of knowledge:

The mean of the knowledge was higher in the intervention group 60.2% ± 17%, compared with 31.7% ± 13.5% in the non-intervention group (P value < 0.001).

The number of pupils who scored seventy-five percent 75% or more (high level that answered correctly more than 16 of 23 questions) after the activities of health education was 213 (20%) in the intervention group, compared with 2 (0.2%) in the non-intervention group. The difference between score of pupil's knowledges in the intervention and the non-intervention schools is illustrated in Figure 2.

Level of attitude:

The mean level of attitude increased in the intervention group to 48% ± 14% compared with 34.7% ± 13.5% in the non-intervention group.

The number of pupils who scored seventy five percent 75% or more (high level who answered correctly 6 or more question of 8 question) after the activities of health education was increased to 301 (28.3%) in the intervention group, compared with 124 (11.5%) in the non-intervention schools. The difference between score of pupil's attitudes in the intervention and the non-intervention schools is illustrated in Figure 3.

The relationship between an age group of the intervention group and the grade of knowledge and the grade of attitude illustrates that, the grade of knowledge is associated with increase in the age, the difference is statistically significant, P value was <0.001, while the grade of attitude was increased with increase

Table 4. The attitudes of pupils towards malaria among intervention and non-intervention groups.

Strongly believe that	Intervention		Non-intervention		P value
	Freq.	%	Freq.	%	
Exposure to malaria is dangerous	205	19.2	120	11.5	<0.001
Fever is the important symptoms	592	55.6	409	38.4	<0.001
Health education is important	771	72.4	564	53.0	<0.001
Usefulness of BNs	585	54.9	225	21.1	<0.001
Usefulness of IRS	311	29.2	266	24.9	0.0001
Fulness of appropriate use of anti-malaria drugs	38.6	411	47.1	502	0.001

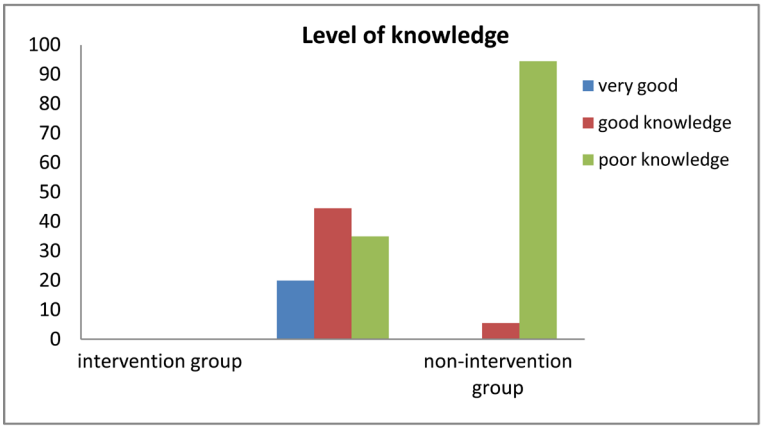

Figure 2. The level of pupil's knowledge in the intervention and the non-intervention schools.

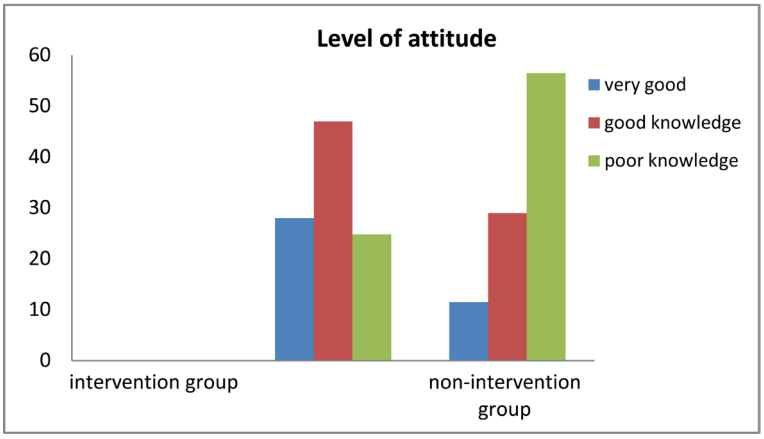

Figure 3. The level of pupil's attitude in the intervention and the non-intervention schools.

in the age, but the difference is not statistically significant, P value was 0.401.

The relationship between sex of study population and the grade of knowledge and the grade of attitude illustrates that, the grade of knowledge is higher in the male, the difference is statistically significant, P value is <0.001. While the grade of attitude has some difference but the difference is not statistically significant (P value was 0.430). The relationship between the schooling level of the study population and the grade of knowledge and the grade of attitude illustrates that, the very good grade of knowledge was increased by increasing the schooling level of pupils, the difference was statistically significant (P value is <0.001).

The very good grade of attitude was higher among pupils of seventh class the difference was statistically significant (P value is <0.001).

Analysis of the relationship between a residence of the pupils and grade of knowledge and grade of attitude illustrates that, although the grade of knowledge was difference, but there was no statistically significant, P value is 0.581.

4. Discussion

The knowledge of mode of malaria transmission is very important because a lack

of understanding of the linkage between malaria and mosquito bites is associated with poor adherence to vector control interventions [26].

The knowledge of correct mode of transmission was higher in among intervention group, 918 (86.2%), compared with 600 (56.3%) in the non-intervention group with statistically significant difference P value < 0.001. This agrees with studies conducted in Thailand the improvement was 62.1% [26], and in Ghana where the positive change was 99% in the intervention group [27], while in rural areas in China the improvement was 76.31% [28]. Good knowledge of the symptoms of malaria is crucial to recognizing the disease and to seeking appropriate health care [26]. The initial knowledge of symptoms in our study population was less than the findings of a study conducted in southeastern Iran which obtained that (80% - 90%) of the respondents were aware about signs and symptoms of malaria [29]. In our study the knowledge of fever as a cardinal symptom of malaria increased to 952 (89.4%) in intervention group compared with 585 (54.9) in non-intervention group, the difference was statistically significant (P value < 0.001), this is in agreement with the study conducted in Thailand, where the knowledge of fever as a symptom of malaria was increased with statistical significant difference to be (56%) [26] in intervention group, it was denoted a substantial increase of the awareness of malaria, (67.6%) of pupils knew how to prevent malaria, while a study conducted in south-western Tanzania obtained that more than (85%) of the respondents were knowledgeable of malaria preventive measures [30]. Our findings revealed that mosquito-proof nets on windows increased to (84.5%) in the intervention group, compared with (41.5%) in the non-intervention group, and water storages were increased to (86.8%) compared with (55.2%) in the non-intervention group. This is in agreement with the study conducted in Ghana where the mosquito-proof nets on windows was higher (69.4%) in the intervention group compared with (41.3%) in the non-intervention group. And water storages were more likely to be covered in the intervention group (77.9%) than in the non-intervention group (67.3%), P value = 0.028 [31]. Personal protection is widely used and accepted to prevent mosquito bites [31].

In our study the positive change toward malaria prevention in the intervention group obtained that the percent of pupils who own BN increased with statistical significant difference to (16.8%), compared with (12.1%) in the non-intervention group, Regarding to using of BN the sleeping under BN was higher (72.1%) in the intervention group compared to (62%) in the non-intervention group with statistical significant difference. This is in agreement with the study conducted in Uganda [32]. Where the sleeping under bed net increased to (99%) in the intervention group compared to (93.6%) in the non-intervention group, and it showed a significantly higher proportion of respondents in the intervention group reported use of effective malaria prevention methods (BN, insecticide spray and coils) in their house hold (73.8%) compared with respondents in the non-intervention group (59.6%) (P = 0.037) [32].

Factors such as vulnerability, economic constraints, inadequacy or unavailability of appropriate health services, and other related factors play an important role in explaining health seeking behavior of the people [28]. In our study seeking medical care increased to be (87%) in the intervention group. Our findings in this regard are inagreement with the study conducted in rural areas of China where the positive change toward correct treatment was significantly increased from (10.7%) to be (39.4%), and the seeking medical care increased from (78 %) to be (91%) [28]. After the intervention, the mean knowledge increased to (4.4) ± 1.9 ($P < 0.001$), it was less than studies conducted in Kenya where the study pupils had a significant increase in the mean knowledge, the difference was (6 ± 4.0) (P value < 0.0001) [33], and in India where an average overall pretest score was 11.8 ± 5.03 which increased significantly to 19.3 ± 4.69 after intervention [34].

The schoolchildren who answered correctly more than 12 of the 23 knowledge questions increased significantly in the intervention schools to be (64.5%). This also agreed with the study conducted in Oudomxay province, Lao PDR that revealed the scores of the mean knowledge, attitudes and practices were significantly increased one month after the intervention [35]. As a result of HE, the schoolchildren changed their behavior positively towards malaria prevention. The schoolchildren in our study who answered correctly four or more out of eight attitude questions were increased to (58.2%). This was similar to the studies conducted in Thailand where schoolchildren changed their behavior positively towards malaria prevention with significant difference in 6 of 7 questions [26], and in India when schoolchildren exposed to different health education activities a high average of correct score (47.9%) in the intervention group comparing to that of the control group (26.6%) was noticed [34]. The relationship between the schooling level of the study population and the grade of knowledge and the grade of attitude illustrates that, the very good grade of knowledge was increased by increasing the schooling level of pupils, the difference was statistically significant (P value is <0.001), This was similar to the studies conducted in rural areas of China where was the grade of knowledge was increased by increasing the schooling level of pupils (P value is <0.001) [28]. Our study revealed that our school-based malaria HE activities had a positive impact in changing schoolchildren's behavior with regards to malaria prevention in Yemen. Such positive results were seen as we encouraged the teachers to use various participatory learning methods, including child-to-child approaches. The importance of these types of approaches, has been recognized. Some studies reported effectiveness of health education using child-to-child approaches for malaria control, it was reported that participatory learning methods were effective in changing behaviors [26]. Nonetheless, our positive findings with respect to knowledge and attitudes are encouraging in light of the tenets of health behavior theory which indicate that the knowledge and attitude change are important precursors to behavioral change [36].

Limitation of Study

1) There was a short time between exposure and follow-up that required us to focus on proximal learning outcomes and not on behavioral change.

2) Activities that are not based on the curricula increased teachers work load.

3) There is a need to study the effect of HE activities on the prevalence of malaria cases among schools' children by comparing cases of malaria among schools' children before and after HE activities.

5. Conclusions and Recommendation

In order to determine the impact of school-based malaria education intervention on knowledge, attitude and practice of school children toward malaria we conducted a community trial (intervention and non-intervention study) targeted 2130 school pupils in 8 schools in 4 randomly selected districts of Taiz-Governorate-Yemen. Our intervention was in form of health education activities. In general term, the present study concludes that; the intervention in schools had a positive change on the knowledge, attitude and practice of pupils. HE activities in schools was associated with increased in the knowledge to be (60.2%) in the intervention group, compared with (31.7%) in the nonintervention group with statistical significant deference (P value < 0.001), and also increased significantly in the positive attitude and practice toward malaria to be (48%) in the intervention group, compared with (35%) in the control group with statistical significant deference (P value < 0.001).

The knowledge of mode of malaria transmission was increased in the intervention schools to be (86.2%) compared with (59.1%) in the control group with statistical significant deference (P value < 0.001).

The knowledge of fever as a malaria symptom was increased with statistical significant deference to be (90.4%) in the intervention schools compared to (63.6%), in the control schools with statistical significant deference (P value < 0.001).

The positive change in knowledge of mode of transmission was not significantly associated with age, sex, schooling level, and education status of father or mother of pupils.

6. Recommendation

Since our study shows a positive impact, conduct health education campaigns to improve health education regarding malaria infection in schools is highly recommended. Since activities that are not based on the curricula could increase teachers work load. It may be recommended to integrate the activities of health education in to the curricula.

Our school-based malaria control study was effective in schools' children behavior, and could be effective and recommended in the wider community groups to comprehend malaria control activities.

Although short-term malaria health education campaigns may have a positive

impact on the control of malaria, a multi-channel approach is required.

Further studies on the impact of health education activities on knowledge, attitude and practice toward malaria control among schools' pupils, and the impact of these activities on the prevention and control of malaria in the community.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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A Questionnaire on the Impact of Health Education of Malaria Disease on the Knowledge and Behavior of School Students in Taiz Governorate

Dear student, put a mark (√) or (×) on the phrase you deem appropriate.

Date:

Serial number: District:

Al-Qahera ☐ **Sala** ☐ **Ataazya** ☐ **Ashamayatean** ☐

First: the demographic characteristics

1. Age in years:

2. Sex: Male ☐ Female ☐

3. The educational level of the student (class): 6 ☐ 7 ☐ 8 ☐

4. The educational level of father:

Illiterate ☐ Basic ☐ High school ☐ University ☐

5. The educational level of mother:

Illiterate ☐ Basic ☐ High school ☐ University ☐

6. Average household income per month:

10,000 - 19,000 ☐ 20,000 - 29,000 ☐ 30,000 - 39,000 ☐ 40,000 and more ☐

The profession of the head of the family:

Farmer ☐ Employee ☐ Retired ☐ Other: mention ☐

Second: Knowledge

1. Malaria is transmitted to humans by:

Flies ☐ Eating contaminated food ☐ Mosquitoes bite ☐

Other: mention ☐ Don't know ☐

2. What are the symptoms of malaria? (More than one answer can be chosen)?

Fever ☐ Vomiting ☐ Sweating ☐ Headache ☐

Anemia ☐ Joint pain ☐ Loss of appetite ☐ Shivering ☐

Other: mention ☐ Don't know ☐

3. Malaria complications are (more than one answer can be chosen):

High fever ☐ Spasm ☐ Coma ☐ Cerebral malaria ☐

Abortion ☐ Kidney failure ☐ The birth of low-weight baby ☐

Other: mention ☐ All of above ☐ Don't know ☐

4. How can we protect ourselves from malaria (more than one answer can be chosen)?

Covering tanks ☐ Backfilling ponds ☐ Draining stagnant water ☐

Making nets on windows ☐ Using impregnated nets with insecticide ☐

Spraying with residual pesticide ☐ using repellent ☐ Don't know ☐ Other (mention) ☐

5. Do you have information about the impregnated bed nets?

Yes ☐ No ☐

If no, go to Question 7

6. If the answer is yes to the previous question, then what is the source of this information (more than one answer can be chosen)?

Mosquito nets distribution team ☐ Television ☐ Imam of the mosques ☐
Radio ☐ The health office/health facilities ☐
Posters, leaflets ☐ Schools ☐ Newspapers ☐

7. Do you know anything about the treatment of malaria?

Yes ☐ No ☐

8. If yes, mention some of the treatments used

----------1----------2

Third: Attitudes, beliefs and behavior:

1. Who are the most vulnerable groups to severe malaria (more than one answer can be chosen)?

Adult ☐ Children ☐ Elderly ☐ Pregnant women ☐
Other: mention ☐ Don't know ☐

2. Do you think you are at risk of malaria this year?

Agree ☐ Strongly agree ☐ Disagree ☐
Strongly disagree ☐ Don't know ☐

3. Do you think the most important symptom of malaria is fever?

Agree ☐ Strongly agree ☐ Disagree ☐
Strongly disagree ☐ Don't know ☐

4. From your point of view, is awareness of malaria useful?

Agree ☐ Strongly agree ☐ Disagree ☐
Strongly disagree ☐ Don't know ☐

5. Do you belief that the insecticide-impregnated bed nets protect from malaria?

Agree ☐ Strongly agree ☐ Disagree ☐
Strongly disagree ☐ Don't know ☐

6. Do you belief that the spraying with residual pesticide protects from malaria infection?

Agree ☐ Strongly agree ☐ Disagree ☐
Strongly disagree ☐ Don't know ☐

7. Do you belief that taking malaria treatment immediately after diagnosis and in a correct way can protects from malaria complications?

Agree ☐ Strongly agree ☐ Disagree ☐
Strongly disagree ☐ Don't know ☐

8. If you get infected with malaria, where do you take the treatment of malaria?

From the pharmacy ☐ From doctor or near health center ☐
From home without a prescription ☐ Traditional healer ☐ Others ☐

9. Do you have a mosquito net at home (in the absence of a net, do not complete the questionnaire)?

Yes ☐ No ☐

10. Does anyone sleep under the net?

Yes ☐ No ☐

11. How many people usually sleep under a net?

2 ☐ 3 ☐ 4 ☐ 5 ☐

12. What is the time to use the mosquito nets?

After sunset ☐ After Isha'a prayer ☐ After 10 O'clock ☐ Other: mention ☐

13. Who usually sleeps under a mosquito net?

Head of family ☐ Mothers ☐ Pregnant women ☐

Children less than 5 year ☐ Any one ☐

14. Did the pregnant woman sleep under the bed net last night?

Yes ☐ No ☐ Not applicable (no pregnant woman) ☐

15. Did children under five years of age sleep under the bed net last night?

Yes ☐ No ☐ Not applicable (no children under 5 years) ☐

16. Is it a habit in this home for people to sleep under an impregnated net?

Yes ☐ No ☐

17. If the answer is "yes" to Question 16, why?

Protect from mosquitoes ☐ Protect from the harm of flies and other insects ☐

Other: mention ☐ Don't know ☐

18. If the answer is "No" to Question 16, why?

No mosquitoes and other insects ☐ Need fixation ☐

Chemicals cause allergies and diseases for pregnant women and children ☐

Other: mention ☐ Don't know ☐

19. What is the season for using mosquito nets in a year?

Summer ☐ Winter ☐ Other: mention ☐

20. Where the nets are placed after use? (Can choose more than one answer)?

The cupboard ☐ Hangs over the crib ☐ Other: mention ☐ Don't know ☐

21. How to protect impregnated net from damage (more than one answer can be chosen).

Keep away from children ☐ Keep away from fire ☐

Keep out of the sun ☐ Other: mention ☐

22. What do you do if the mosquito nets are torn?

Leave it as it ☐ Sew it ☐ Don't know ☐

23. How many times have you washed the impregnated nets?

Never ☐ One to two times ☐ Three to five times ☐

When becoming dirty ☐ Don't know ☐

Other notes:

Data Collector: **Supervisor:**