Research Article

Knowledge, attitudes, and practices relating to dengue fever among high school students in Makkah, Saudi Arabia

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Abstract

Background: The incidence of dengue fever (DF) is rapidly increasing globally, and now 128 countries are endemic by it. Today, DF is considered as one of the most important vector-borne diseases in terms of mortality and morbidity. The prevention and control of DF is one of the most important priorities because of the continuous increases in the number of cases globally.

Objective: To evaluate the baseline level of knowledge, attitude, and practice (KAP) about DF and their predictors among high school students in Makkah City, Saudi Arabia

Materials and Methods: A cross-sectional study was designed and was conducted at Makkah high schools during the educational year 2014/2015. A multistage stratified random sample method with a proportional allocation technique was used in the study. The stratifications took into consideration the gender, school type, geographic educational district, specialty of the student, and educational year. Ten schools were randomly selected in Makkah to evaluate KAPs of students about DF. A total of 362 questionnaires were completed.

Result: This study showed that knowledge about DF was deficient; 59%, 32.7%, and 8.3% of the students obtained poor, fair, and satisfactory knowledge scores, respectively. Having heard about DF was the strongest predictor for having high knowledge score (t test = 4.47, $p < 0.001$). This was followed by female gender (t test = 5.81, $p < 0.001$) and positive family history of DF (t test = 3.18, $p < 0.01$). The only factor that significantly affected the self-reported practices scores was their level of knowledge about the disease (t test = 3.16, $p < 0.01$).

Conclusion: KAP toward DF was deficient among target populations. School-based educational campaigns and social mobilizations are needed to raise the awareness and to translate knowledge into sound practice within all schools in Makkah City.

KEY WORDS: Dengue fever, knowledge, attitude, practices, high school, students

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Introduction

The incidence of dengue fever (DF) in the past five decades has increased up to 30-fold, which makes it a global public health problem.[1–4] It has been reported that 128 countries all over the world are endemic by DF.[5] In addition, a recent study estimated that there are 390 million cases of dengue virus (DENV) infection every year, and this represents greater

than a threefold increase in the cases compared with a previous World Health Organization (WHO) estimate.[1] Despite clinical progress toward the development of a vaccine against the DENV, there are no vaccines available yet.[6] Furthermore, given that no treatment is available for DF, efforts to control the numbers of DF cases must focus on limiting populations of the vector and preventing their expansion to other regions.[7,8] Today, DF is considered as one of the most important vector-borne diseases in terms of its mortality and morbidity.[9]

The mosquito, *Aedes aegypti*, is the primary vector of DF, and it is a "hydrophilic species." Therefore, the presence of stagnant water creates perfect breeding sites for the mosquito. The factors that contribute to expanding mosquito populations are the rainy season, high humidity, and low temperatures, and these factors play important roles in DF transmission.[10]

The overriding issues include the absence of treatment and a vaccine against DENV, rapidly evolving vector resistance and mutations, the public's perception that mosquito control is not their responsibility, and ineffectiveness of resources in some areas and very limited resources in most areas.[6–8]

Regarding the mortality, around 20,000 deaths were estimated to occur yearly because of DF-related causes.[11,12] Children in particular are at a high risk of mortality because of complications and lack of access.

Concerning DF burden, the DENV and its vector, *A. aegypti*, have extended significantly into regions previously unaffected by DF, and this is associated with a subsequent substantial cost burden in relation to the impact of DF.[11,12] It was estimated that the global disability-adjusted life year as a consequence of DF was 700,000 per year.[13,14]

The incidence rates of DF and dengue haemorrhagic fever (DHF) have increased over the past few years, and they continue to pose public health problems in the western region of Saudi Arabia. A sharp vigilance is required from the relevant authorities to prevent and contain any future outbreaks. It is extremely important to implement and maintain effective, sustainable, and community-based disease prevention programs.[15]

In the Kingdom of Saudi Arabia (KSA), the DF incidence was 21.71 per 100,000 people in 2013. There was an increase in the number of cases from April to July. Furthermore, DF exhibits geographic variations, and Jeddah has the highest number of DF cases (67.73% of the total cases) followed by Makkah. Most of the DF cases (70.98%) occur among people aged in the range of 15–44 years.[16]

To the best of our knowledge, no cross-sectional study has been conducted in Makkah to assess the knowledge, attitude, and practice (KAP) of high school students about DF. So, such study is warranted.

Materials and Methods

Cross-sectional study was conducted at high schools in Makkah City during the 2014–2015 educational year. The study populations were the high school students who attended the day of the study and accepted to participate in it. The Ministry of Education had divided the Makkah City into five districts (North, South, East, West, and Central).

Multistage stratified random sampling method was applied. All of the Makkah districts were equally represented using a proportional allocation technique. Stratifications considered the students' sex, the type of school (private or government), the location of the school, the students' specialties (literature or science), and the students' school years (first, second, or third).

Ten schools were selected. Two schools were selected; one boys' and one girls' school from every sector were taken. As the ratio of government to private schools is the same for boys' and girls' schools (4:1), we randomly selected one private boys' school and one private girls' school.

The sample size was calculated using Epi Info program formula. Hence, the sample size to achieve a precision of ±4 with a 95% confidence interval (CI) was 172, with this sample size there was a 90% likelihood that the study will yield a statistically significant result. During the fieldwork, the sample was increased to reach 362 students.

A standardized, confidential, anonymous, self-administered questionnaire was used in this study. It had been constructed and used previously.[3] Some modifications were made, and two expert epidemiologists were appointed for assessing its face and content validity. Internal consistency reliability of the current questionnaire was assessed for the whole sample and it was 0.82. Questionnaire comprising 70 questions was used. It inquired about personal, sociodemographic information, and family history of DF. Furthermore, it contained three sections to assess participants' knowledge, attitude, and self-reported practice toward DF. Pilot study was conducted to assess the clarity of the questions and the time required to complete the questionnaire.

The study was conformed to the ethical standards of Helsinki Declaration. Approval for the study was taken from the Institutional Review Board of King Abdulaziz University Hospital (Reference number: 267/14). A written informed consent was taken from every student willing to participate in the study. Administrative approvals for conduction of the study were taken from the Minister of Education, the head of Makkah Directorate of Educational Affairs and from the administration of each selected school.

The data from the questionnaires were coded and entered into a computer using IBM® SPSS® software version 22 (SPSS Inc., Chicago, IL). The responses to the knowledge questions were coded with one (1) for correct answers and zero (0) for incorrect and "don't know" answers, with a maximum of 24 points. The students' knowledge was classified into the following categories: poor knowledge: a score of <12; fair knowledge: a score of 12–15; and satisfactory knowledge: a score of >15. The responses to the attitude questions were based on a 3-point Likert Scale with disagree, neutral, and agree as the possible responses for each statement. The mean scores from the Likert Scale were calculated. The responses to DF practice questions were coded as one (1) if correct

practice and zero (0) if incorrect practice. The maximum score achievable for all of the practices was 23. A total practice score was calculated. All *p*-values were two tailed and were considered statistically significant at $p < 0.05$.

Result

This study was conducted within ten high schools in Makkah City, comprising five boys' and five girls' schools. Both government and private schools were included in the study at a ratio of 4:1. One boys' and one girls' school were selected from each district. The study involved 362 participants. Table 1 shows their distribution according to the sociodemographic characteristics. The students were almost equally distributed across the five districts, with 19.9% from the northern district, 19.6% from the southern, 20.4% from the eastern, 20.2% from the western, and 19.9% from the central districts. Their ages ranged from 14 to 19 years, and their mean age was 16.94 ± 1.02 years. The girl to boy ratios were almost the same across the districts (1.09:1). Most of the students (80.4%) attended government schools, and 47.8% of the students had specialized in science, 16.3% of the students had specialized in literature, and 35.9% of the students were in their first year and had not specialized in any of the subjects. Regarding the parents' education, 46.4% and 43.6% of the students' fathers and mothers, respectively, had university degrees and above.

Table 1: Personal and sociodemographic characteristics of the high school students who attended the dengue fever educational program

Variable		Number	%
Type of school			
Governmental		291	80.4
Private		71	19.6
Sex			
Male		173	47.8
Female		189	52.2
Educational year			
First year		130	35.9
Second year science		98	27.1
Second year literature		33	9.1
Third year science		75	20.7
Third year literature		26	7.2
Fathers' educational level			
Less than university level		194	53.6
University level or higher		168	46.4
Mothers' educational level			
Less than university level		204	56.4
University level or higher		158	43.6
Total		362	100
Mean age	SD	Minimum	Maximum
16.94	±1.02	14	19

SD, standard deviation.

Table 2: Knowledge and previous family histories of dengue fever within the high school student sample

Variable	Number	%
Did you hear about dengue fever		
Yes	353	97.5
No	9	2.5
The health educator visited home and provided education about dengue fever		
Yes	105	29
No	257	71
Family history of dengue fever[a]		
Yes	95	26.2
No	256	70.7
Total	362	100

[a]A total of 11 students responded by "don't know."

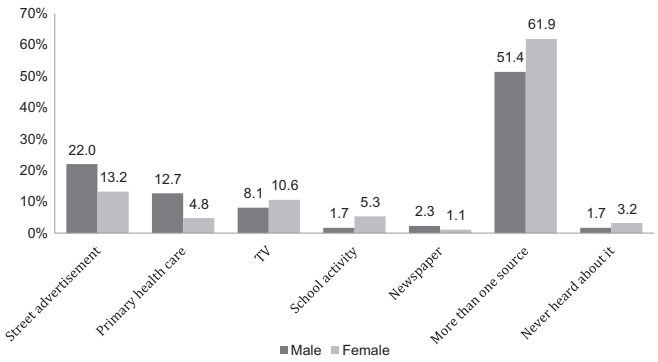

Figure 1: Sources of dengue fever information among high school students in Makkah City according to gender.

Table 2 shows that most of the students (97.5%) had heard about DF. Furthermore, 29% of the students reported that a health educator visited them at their homes to provide DF education. About one-quarter of the students (26.2%) had positive family histories of DF. Figure 1 illustrates the sources of DF information according to sex. Street advertisements as a source provided the DF information for 22% of the boys and 13.2% of the girls. About half (51%) of the boys and 61% of the girls had heard about DF from more than one source. In contrast, 1.7% of the boys and 3.2% of the girls had never heard of DF.

Table 3 shows the results of the multiple linear regression analysis of the predictors of students' knowledge about DF. The model was found to be statistically significant ($F = 21.51$, $p < 0.001$), and it accounted for 19.9% of the variance in the test scores ($R^2 = 0.199$). Having heard about DF was the strongest predictor for having more knowledge about it (t test = 4.47, $p < 0.001$, $B = 4.74$). This was followed by female gender (t test = 5.81, $p < 0.001$, $B = 1.95$). Positive family history of

Table 3: Multiple linear regression analyses of the predictors of dengue fever knowledge among high school students in Makkah City before the educational program

	B	Stand. beta	*t* Test	*p*-Value	95% CI	*R*	R^2	*F*	*p*-Value
Constant	2.26								
Hearing about DF (Yes)	4.74	0.21	4.47	<0.001	2.65–6.82				
Gender (Female)	1.95	0.28	5.81	<0.001	1.29–2.61	0.44	0.199	21.51	< 0.001
Family history of DF (Yes)	1.21	0.15	3.18	<0.01	0.46–1.97				
Strengthening their knowledge about DF (Yes)	1.05	0.15	3.11	<0.01	0.38–1.71				

CI, confidence interval; DF, dengue fever; B, regression coefficient; Stand beta, standardized regression coefficient.

Table 4: The attitudes of high school students toward dengue fever ($n = 362$)

Statement	Response	Frequency	Percentage
Agree that DF represents a public health problem in Makkah	Agree	223	61.6
	Neutral and disagree	139	38.4
Agreement about taking samples from patients as a preventive measure	Agree	265	73.2
	Neutral and disagree	97	26.8
Agreement about the importance of families' health education as a preventive measure	Agree	313	86.5
	Neutral and disagree	49	13.5
Agreement about importance of searching for breeding sites as a preventive measure	Agree	259	71.5
	Neutral and disagree	103	28.5
Agreement about the importance of home insecticides spraying as a preventive measure	Agree	286	79.0
	Neutral and disagree	76	21.0
Agreement about importance of family use of home mosquito trap for prevention	Agree	238	65.7
	Neutral and disagree	124	34.3
Agreement about importance of family use of mosquito-repellent creams	Agree	233	64.4
	Neutral and disagree	129	35.6
Agreement about importance of removing/covering the stagnant water collections	Agree	313	86.5
	Neutral and disagree	49	13.5
Agreement about the importance of conducting an educational campaign	Agree	319	88.1
	Neutral and disagree	43	11.9
Agreement about the importance of vector control campaign	Agree	308	85.1
	Neutral and disagree	54	14.9
Agreement about the importance of swamp elimination	Agree	288	79.6
	Neutral and disagree	74	20.4
Agreement about the importance of community participation	Agree	305	84.3
	Neutral and disagree	57	15.7
Agreement about the importance of elimination of breeding sites at home	Agree	279	77.1
	Neutral and disagree	83	22.9

DF, dengue fever.

DF (t test = 3.18, $p < 0.01$, $B = 1.21$) and students who tried to increase their knowledge about DF (t test = –3.11, $p < 0.01$, $B = 1.05$) were also the predictors of having good knowledge about DF.

The most common attitude statements among participants that were agreed on were the importance of conduction of an educational campaign (88.1%), the importance of removing/covering the stagnant water collections (86.5%), and the importance of families' health education as a preventive measure (86.5%) [Table 4].

Table 5 shows data relating to the participants' self-reported practices associated with DF prevention and control. The table shows that 70.6% of the respondents would go to the physician if one of their family members was suspected of having DF. Regarding the students' actions, if they found stagnant water, 70% said they would call the authorities to report its presence. Table 5 also shows that 47.2% of the students tried to increase their knowledge about DF. Regarding the actions against the vector, most of the students reported using insecticide sprays, emptying or covering unused containers, and

Table 5: Frequencies of correct and incorrect students' self-reported practices before the educational program at high schools in Makkah City

Self-reported practice	No.	%
Go to doctor if one of the family has a suspected DF		
Correct practice	278	70.6
Incorrect practice	84	29.4
Call municipality in case of stagnant water collection		
Correct practice	254	70.2
Incorrect practice	108	29.8
Strengthening his/her knowledge about DF		
Correct practice	171	47.2
Incorrect practice	191	52.8
Empty or cover unused containers		
Correct practice	281	77.6
Incorrect practice	81	22.4
Cleaning the yard of tires and empty bottles		
Correct practice	300	82.9
Incorrect practice	62	17.1
Use of insecticide sprays		
Correct practice	271	74.9
Incorrect practice	91	25.1
Inspect and remove stagnant water from air-conditioners		
Correct practice	248	68.5
Incorrect practice	114	31.5
Use mosquito-repellent vapor		
Correct practice	239	66.0
Incorrect practice	123	34.0
Use mosquito-repellent creams		
Correct practice	215	59.4
Incorrect practice	147	40.6
Wear protective clothes with long sleeves		
Correct practice	193	53.3
Incorrect practice	169	46.7
Do nothing		
Correct practice (do something)	265	73.2
Incorrect practice (not do anything)	97	26.8
Total	362	100

DF, dengue fever.

inspecting and removing stagnant water from air-conditioning units. About half of the students stated that they would protect themselves by wearing long-sleeved clothes.

By studying the factors that affected the students' mean self-reported practices scores in relation to DF, it was found that the only significant factor was the knowledge level (Student's t test = 3.16, $p < 0.01$) as the students who obtained poor knowledge scores obtained lower self-reported practices scores (16.27 ± 4.14) compared with those who obtained fair and satisfactory knowledge scores (17.49 ± 3.13).

Discussion

Community awareness and participation is vital to prevent and control the spread of DF.[2] Findings from a cross-sectional study conducted in Karachi, Pakistan, determined that the most important source of information about DF was the media, which included television and the newspapers.[17] Another study conducted within 20 high schools in Jeddah in the year 2009, also found that television was the main source of information for 74% of the high school students.[3] In this

study, the main sources of information for both sexes were street advertisements, followed by primary health care for boys (12.7%), and television for girls (10.6%). The causes of the discrepancies in the findings might be related to different populations being targeted or the increase in street advertising in recent years.

This study showed that knowledge about DF was deficient as 59%, 32.6%, and 8.3% of the students obtained poor, fair, and satisfactory knowledge scores, respectively. The percentage of poor scores obtained during this study was slightly higher than that obtained during the study in Jeddah in which 42.3% of the students obtained a poor knowledge score.[2] Similarly, a publication from a cross-sectional study undertaken in secondary schools in Bangkok, Thailand,[18] reported that only 18.0% of the students had a good level of overall knowledge about DHF.

Regarding the district, students from the central district students obtained the highest mean knowledge score compared with students from other districts. This may be due to the location of health education department in central district and this may have attributed to the increase in health education activities in this district.

In this study, a majority (97.5%) of the students had heard of DF and 90% knew that the mode of DF transmission was through mosquito bites. These results concur with those from a study undertaken in 2013 in Puerto Rico, which found that 100% of the target population knew about DF, and 90% knew that it was transmitted by a mosquito.[19] Similarly, focus group discussions undertaken in 2014 in Dhaka, Bangladesh, determined that the majority (91.3%) of the community members had heard about DF and that 93.7% knew that mosquitoes act as the primary vector for its transmission.[20] These findings are in line with those from a study conducted in Vietnam, which found that 97% of the participants had heard of DF.[21] A cross-sectional study conducted in interior Sindh, Pakistan, in 2012, found that 94.6% of the participants had heard of DF.[22]

Our results showed that there was a gap in the knowledge about the mode of transmission with 39.2%, 54.6%, and 58.5% of the students wrongly identifying that DF fever could be transmitted by flies, fleabites, and food, respectively. The findings from a recent Dhaka focus group discussions in 2015 also determined that there was a knowledge gap about DF transmission.[20] The corresponding rates from the study in Jeddah[3] regarding transmission by flies, flea bites, and food were 66.1%, 74.9%, and 71.3%, respectively. More number of incorrect answers from the students who participated in the study in Jeddah compared with those from the students who participated in this study could be attributed to the timings of the studies, because the number of health education programs about DF increased between 2009 and 2015. In this study, 51.6% of the students correctly identified that a virus is the causative agent of DF. Similar findings were reported from a Colombian study undertaken in 2014 and it showed that 49.7 % of the participants did not know that a virus causes DF.[23]

A study that used a mixed method design was carried out in Thailand in 2015 and it was found that the participants were aware of the presence of mosquitoes and that mosquitoes served as a potential vector for the transmission of DF. However, the researchers found specific knowledge gaps, because at each study site they also identified factors that may influence human exposure to infected mosquitoes.[24]

In this study, a small percentage of the students knew about the diagnosis, prognosis, and treatment of DF. Other surveys undertaken in Brazil and Colombia found that the participants knew about the DF vector, but they had little knowledge about the diagnosis, prognosis, and treatment of DF.[25]

More than three-quarters (78.8%) of the students in this study knew that headache is one of the most recognizable symptoms associated with DF. Another study that was conducted in Florida, USA, in response to a DF outbreak, compared knowledge about DF attitudes, perceptions, and prevention practices among residents living in subsidized public housing with that of the general population living in the Florida Keys. The residents who lived in subsidized public housing were less likely to correctly identify how DF transmission occurs (61% vs. 89%) or to correctly identify any signs or symptoms associated with DF (36% versus. 64%).[26]

Findings from a study that was undertaken in Vientiane,[21] determined that there was a lack of in-depth knowledge about DF, and that 36% of the study participants could not correctly state that mosquitoes of the species *Aedes* bite most frequently at sunrise and sunset, and less than 10% of the participants knew that indoor water containers could be breeding sites for *Aedes* mosquitoes. This study determined that 28.4% of the high school students did not know when the mosquitoes are active, but 81% of the participants knew that exposed open water containers could be breeding sites for *A. aegypti.*

A study was undertaken to explore young people's KAP regarding DF in Trinidad and Tobago. The study involved interviews and focus groups with young people who were studying at the University of Trinidad and Tobago. All the participants had some knowledge about DF, but the extent of this knowledge varied immensely, the participants' knowledge levels were highest in relation to the manner in which DF was spread and its symptoms.[27] The result concurs with the findings from this study that demonstrated that most of the students knew about the mode of transmission and that the most recognizable symptom was headache.

Focus group discussions carried out in Malaysia revealed that awareness about DF and its prevention measures was high. However, the pathophysiology underlying DF and, especially, DHF and dengue shock syndrome (DSS) was rarely known, and, consequently, the disease was considered deadly by some and perceived as being easily curable by others who did not have any understanding of the disease. Young adults and elderly participants had a low level of perception regarding susceptibility to DF. In general, the perceived low susceptibility to DF emerged as two themes, namely, a perceived natural ability to withstand infection and a low risk of being in contact with the mosquitoes that transmit DENV, namely, *A. aegypti*.[26]

Another study from Malaysia found that television was a common source of information about DF (97.0%). The participants in the Malaysian study responded incorrectly to 4 out of 15 items that tested their knowledge. There were no significant associations between the knowledge scores and sociodemographic factors. About one-quarter of the respondents (24%) believed that immediate treatment is unnecessary for DF, and most of them (96.0%) were not afraid of the disease.[28]

The results from this study showed that the main predictors of good levels of knowledge about DF were hearing about DF, female gender, positive family history of DF, and students who tried to increase their Knowledge. These findings go in line with the results from the study conducted in Jeddah in 2009.[3]

Findings from a study undertaken in interior Sindh, Pakistan, showed that 58.6% of the participants reported that the *Aedes* mosquito was a vector of the DENV, and that there was a significant difference between the sexes in relation to this knowledge (37.5% men vs. 62.5% women, $p < 0.001$). That the *Aedes* mosquito breeds in "stagnant clean water" was reported by 47.6% of the participants, and this was known by 40.2% of the men and 59.8% of the women ($p = 0.003$). Regarding the symptoms of DF, "prolonged high fever" was reported by 52.6%, "muscle pain" by 39.6% ($p = 0.009$), "bleeding" by 41.3% ($p = 0.001$), and "headache, nausea, and vomiting" by 44.7% ($p = 0.001$) of the participants.[22] On the other hand, this study revealed better findings than the study conducted in Pakistan, as 89% of the students identified the mode of transmission of DF and 81% of the students knew where the mosquito breeds. We also found that the most recognizable symptoms identified by the students were headache (78.8%), followed by fatigue (65.4%). The differences in the findings may be a consequence of the different educational programs being unable to raise the awareness about DF. The findings from a study undertaken in Puerto Rico determined that the participants had good levels of knowledge about DF, but they had low levels of knowledge about the transmission of the DENV.[19]

This study showed that, in general, the students had good levels of perception about DF as over 95.4% of the students had positive attitudes regarding the importance of community participation in controlling DF. The findings from the study conducted in Bangkok[18] showed that although more than half of the students had good levels of perception about DHF, only 4.7% demonstrated good levels of preventive behavior, and 75.6% required greater levels of knowledge about preventive behavior. The findings from the study carried out in Colombia[23] showed that 80.5% of the people surveyed were not interested in receiving health education classes. Similarly, our results showed that 88.1% of the students were not interested in receiving health education.

The findings from this study showed that 92.4% of the participants agreed that DF is a public health problem in Makkah City, and that 99.4% agreed with the importance of conducting educational campaigns. The results from a study conducted in Vietnam showed that knowledge levels were moderately good and that a high proportion (96%) of the participants recognized that DF is a severe yet preventable disease. The majority (93%) of the interviewees did not believe that they were well informed about DF.[21]

Regarding the students' self-reported practices, this study revealed that 82.9% of the students cleared their yards of tires and empty bottles to avoid collections of stagnant water, and that 77.6% of the participants emptied or covered unused containers at home. The findings from the Colombian study[23] found that 24.8% of those surveyed stated that they avoided having or using stagnant water. Furthermore, the results from a study conducted in the West Indies showed that all of the participants did something to control the DF vector at home, and ensuring that no stagnant water was present in containers in the yard was the most popular method used to control the vector. All of the participants were aware that the government sprayed the neighborhoods to kill mosquitoes; however, most thought that the frequency of spraying was inadequate.[27]

The results from this study showed that the only factor that significantly affected the self-reported practices scores was the level of knowledge about the disease. This result agrees with the findings of Ibrahim et al.[3] who found that the only predictor of a high DF practice score was the presence of a high knowledge score (odds ratio = 2.06, 95% CI = 1.73–2.44). Similarly, the results of other study showed that only knowledge about DF had a significant direct positive effect on the practices.[29] Similarly, the study conducted in Vietnam also found that there was an association between good knowledge and better practices.[21]

School-based educational campaigns and social mobilizations are needed to raise the awareness and to translate knowledge into sound practice within all schools in Makkah City, and to control DF epidemics.

Conclusion

KAP toward DF was deficient among target populations. School-based educational campaigns and social mobilizations are needed to raise the awareness and to translate knowledge into sound practice within all schools in Makkah City.

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