

A TRAINING PROGRAM ON DENGUE FEVER AMONG SECONDARY SCHOOL STUDENTS, JAZAN, SAUDI ARABIA

By

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Abstract

Dengue fever (DF) is commonest rapidly spreading *Aedes*-borne viral fever worldwide. In the last decade several confirmed dengue cases were reported in Jazan Province. The study assessed the knowledge, attitudes and preventive practices of dengue fever among the secondary schools students in Jazan. A cross-sectional study was conducted among students of six secondary schools in Jazan. Multistage stratified random sample method was used and seven hundred forty two (742) were taken as respondents in study. The data on the socio-demographic characteristics of the respondents about their knowledge, attitude and practice towards DF were collected by using a pre-structured and self-administered questionnaire.

The results showed a poor DF knowledge among the students, regarding attitudes towards DF, prevention and control, the majority of the participants' had good attitudes and believed that DF could be controlled and prevented (93.2%), DF control was the responsibility of government and community (83.1%) and they themselves have an important role to play in DF prevention (78.5%). The most common practice to prevent mosquito breeding were found to be the disposing of water from breeding containers (85.5%) and covering of water containers (68.6%). A significant association between the practice of DF preventive and control measures and sex of the participants' was ($P < 0.005$). The top two common sources of DF knowledge was identified as primary health care centers and television (48.1% & 44.5%, respectively)

Key words: Saudi Arabia, Dengue fever, Knowledge, Attitudes and Practices, Schools, Jazan.

Introduction

Dengue is a viral disease transmitted to humans by the bite of infected female vector *Aedes aegypti* and to lesser extent *Aedes albopictus* mosquitoes (WHO, 2009). The WHO (1997) classified dengue into three categories according to its severity; Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF), and Dengue Shock Syndrome (DSS). Severe dengue (DHF & DSS) causes lethal complications that included severe hemorrhage, plasma leakage, organ impairment, fluid accumulation, or respiratory distress (WHO, 2015). The four genetically related viruses that cause dengue are single-stranded RNA, belonging to the Flaviviridae family and genus *Flavivirus* (Heinz *et al*, 2000). These four viruses were designated as DEN-1, DEN-2, DEN-3, DEN-4 (WHO,

1997) and DEN-5 (Mustafa *et al*, 2015).

The incidence of DF increased more than 30 fold over the last five decades, thus, the dengue virus (DENV) infection has globally become a major public health threat. DF is now endemic in 128 countries (Brady *et al*, 2012). Bhatt *et al* (2013) mentioned that 390 million DENV infections were estimated to occur annually. Although some progresses were achieved towards the development and clinical evaluation of vaccines against DENV infection, neither such vaccine is on the market yet (Halstead, 2012) nor specific treatment. Thus, controlling the DENV vector *Aedes aegypti* and *Aedes albopictus*, and limiting their dispersal to new regions is crucial to prevent DENV transmission (WHO SEARO, 2011).

In Saudi Arabia, Jeddah has witnessed the

first case of DF was in 1994 with DENV-2. Shortly after that, virus surveillance revealed 3 dengue serotypes (Fakeeh and Zaki, 2001). Endemicity of DF in Jeddah was confirmed by Ministry of Health in the last decades and 1551 positive cases were notified in 2006 - 2007 with 1.1% and 0.5 % of DHF and DSS cases, respectively (Almusharaf and Akbar, 2008). Ibrahim *et al* (2009) investigated knowledge, attitudes and practices (KAPs) relating to dengue fever among females in Jeddah high schools and concluded that KAPs towards DF was deficient among target populations, especially students.

Jazan Province had registered 832 confirmed DF cases from 2005 to 2014 with the highest peak in 2010 (290 cases). Alazragi *et al* (2013) measured seroprevalence of dengue virus infection among 965 persons found 31.7 % (306/965) for DENV specific IgG and the significant risk factors were: age ≥ 20 years, being male, lack of electricity and having water basins in the house. Therefore, assessment of people's knowledge, attitude, and practice is an important tool in preventing the DF and it is also a vital component of the integrated vector control programmes (Degallier *et al*, 2000). In Jazan, variation in local, community-level, environmental and socio-behavioral drivers have rarely been carefully investigated. In particular, the importance of people's knowledge, attitudes and practices (KAP) concerning DF prevention in these local contexts is poorly understood. In addition, there is a lack of relevant studies on the KAPs in Jazan region. Only Bani *et al* (2009) published on DF but focused primarily on households KAPs. So, significant gaps was in the knowledge on levels of awareness on KAPs of dengue fever are existed. Thus, the present study evaluated the knowledge, attitudes and practices regarding dengue infections among students of secondary schools in Jazan Province.

Subjects, Materials and Methods

The present study was conducted in August 2015 using a cross-sectional approach.

This study design is appropriate as the main objective of this investigation was to assess knowledge, attitudes, and practices regarding DF among school students. Six secondary schools were randomly selected (5 in Jazan; 3 schools for boys, 2 schools for girls and 1 in Samtah about 60km south from Jazan).

Multistage stratified random sample method was used to select the students sample by dividing schools according to geographic districts (north, south, east and west of Jazan City, in addition to Samtah to represent suburban schools), educational grade (first, second & third year). Also, all available teachers were selected schools on the day of interview and who agreed to participate. A total of 742 respondents participated (great majority were students and few teachers).

The research team followed the ethical standards of confidentiality and freedom to participate. The respondents were informed that the study was voluntary and they were assured that their privacy and confidentiality would be protected. Also, they had the right to withdraw anytime.

Questionnaire: In addition to the socio-demographic information (age, sex, marital status, education level and employment), the questionnaire consists also of: Participants' knowledge: Multiple choices questions (MCQs) consisted of 32 items concerning prior history, transmission methods, symptoms, treatment, main vectors, mosquito's biting time, mosquito's breeding sites and vector's controlling were used.

Participants' attitudes: As the dengue fever is a significant public health problem in Jazan region, respondents attitudes on their roles in DF prevention and control, responsibility of DF control, and their agreement on other preventive and control measures of DF were sought.

Participant' self-reported practices: Participating with his or her community in DF control campaigns, investigation and cleaning breeding sites in water filled containers under air conditions, covering water con-

tainers, disposing larvae from breeding containers, investigating *Aedes* larvae in cans or bottles water, and outdoors, weekly changing of animal drinking water and disposing garbage in allocated garbage bins were reported by the respondents.

Statistical analysis: Data were analyzed using SPSS, version 18 (SPSS Inc, Chicago, Ill., USA). Frequencies and percentages (descriptive statistics) were used for analyzing selected socio-demographic data, while the means and t-test were used to assess their responses on questionnaire regarding practice scores in relation to demography. Chi-squared test determined the significant relationship between socio-demographic characteristics and DF knowledge, also, to assess responses to information sources on DF. A P- equal to or less than 0.05 was significant.

Results

A total of seven hundred forty two (742) participants were recruited to participate (555 or 74.8%) male & (187 or 25.2%) female. Majority of them were of age group of 16 to 20 years old (n=664, 89.5%) and not married (n=686, 93%). As to education, majority were at secondary level (n=686, 92.5%). Of all participants, 94.1% were unemployed & 5.9% were employed (Tab. 1).

Table 1: Socio-demographic characteristics of the respondents (N=742)

Variable	Frequency	Percentage
Age: Less than 15 years	32	4.3
Age: 16 - 20 years	664	89.5
Age: 20-35 years	30	4.0
Age: More than 35	16	2.2
Female	187	25.2
Male	555	74.8
Married*:	43	5.8
Unmarried	686	93
Divorced	9	1.2
Education: Intermediate	18	2.4
Education: Secondary	686	92.5
Education: University	35	4.7
Education: Postgraduate	3	.4
Employed	44	5.9
Unemployed	698	94.1

*Four replies missing (n=738)

Attitudes towards dengue fever (Tab. 3): Great majority of them believed that DF could be prevented and controlled (n=680, 93.2%) and they also cited that the control of DF is the responsibility of both govern-

ment and community (n=599, 83.1%). The majority did not think that breeding sites elimination of vector was complicated and time consumer (n=527, 71.7%). Less than half of them did not know whether fogging Knowledge on dengue fever items (Tab. 2): Only 26 (3.5%) of the research participants had prior history with DF. More than half of the respondents knew that dengue was caused by a mosquito bite (n=430, 58%), and it was more likely to feed/bite in the night (n=403, 56%). While, 42% of participants did not know what are the methods of DF transmission. Less than half of participants cited that a person with dengue infections may develop typical symptoms of fever (n=343, 46.7%), similarly less than half also (n=348, 47.4%) do not know what are the symptoms of DF. As to knowledge on DF treatment, 440 of (60%) knew that DF is curable, whereas 40% of them did not know.

More than half of them did not know the principal vector of dengue fever (n=477, 65%), while few of them knew vector (n=256, 35%). Major of them cited swamps and ponds to be DF mosquito's breeding sites, followed by sewage water and containers under air conditions (n=509, 70.1%; n=264, 36.3%; n=164, 22.6%), respectively.

As to DF's vector control, most of participants reported insecticides (n=426, 72.3%), then covering water tanks (n=193, 32.8%) and using repellents (n=183, 31.1%).

was the only control method against DF or no, whereas more than third disagreed that it does. High percentage of them thought that it was possible to recover from DF infection (n= 545, 74.5%). About 41% disagreed that healthy person cannot be infected by DF, while one third of them agreed. Others did marked role in DF prevention.

Self-reported preventive measures against DF: Majority employed environmental preventive measures to reduce *Aedes* and hence dengue fever. The majority disposed larvae from breeding containers (n=618, 85.5%), covered water containers (n=502, 68.6%), disposed garbage in allocated garbage bins (n=400, 66%), and participate with community in DF control campaigns (n=457, 63.6%). About one third investigated *Aedes*

larvae in water of cans, bottles and outdoors or weekly changes animal drinking water (Tab. 4).

Practice vs. Socio-Demographic characteristics (Tab. 5): Sex characters was predictor of practice against DF (female, 1.7672±0.25, male, 1.6287±0.33), with highly significant difference between females & males ($t = 4.247, P < 0.005$).

Source of knowledge on DF (Tab. 6): 48.1% and 44.5% cited Primary Health Care (PHC) and television as main sources of information on dengue fever, respectively, without significant difference was among them regarding answers on PHC ($P > 0.005$). Third of them got information from Pamphlets. Also, few of them obtained such information from Radio, Friends or Relatives.

Table 2: Knowledge of participants*

Variable	Yes	No. (%)	Don't know
Having prior history with DF	26 (3.5)	710 (96.5)	-
1- Knowledge of transmission methods of DF:			
Direct contact	20 (2.7)		-
Cough	30 (4)		-
Mosquitoes (<i>Aedes</i> sp.)	430 (58)		-
Don't know	-	-	262 (35.3)
2- Symptoms of DF:			
Fever	343 (46.7)		-
Nausea and vomiting	36 (4.9)		-
Rash	45 (6.1)		-
Hemorrhage	25 (3.4)		-
Don't know	-	-	348 (47.4)
3- knowledge on DF treatment:			
Curable	440 (60)		-
Non-curable	16 (2.2)		-
Don't know	-	-	277 (37.8)
knowledge on main DF vectors	256 (35)	35 (4.7)	442 (60.3)
4- knowledge on the mosquito's biting time:			
Morning	48 (6.7)		-
Evening	52 (7.2)		-
Sunset	88 (12.2)		-
Night	403 (56)		-
Don't know	-	-	129 (17.9)
5- knowledge on the mosquito's breeding sites:			
Sewage water	264 (36.3)		-
Containers under air conditions	164 (22.6)		-
Swamps and ponds	509 (70.1)		-
Discarded utensils	118 (16.3)		-
Tyres	84 (11.6)		-
Uncovered water tanks	157 (21.7)		-
Don't know	-	-	16 (2.2)
6- knowledge on the vector's controlling methods:			
Insecticides	426 (72.3)		-
Mosquito nets	97 (16.5)		-
Repellent	183 (31.1)		-
Covering water tanks	193 (32.8)		-
Appropriate disposal of empty bottles & cans	115 (19.5)		-
Changing animal drinking water periodically	106 (18)		-
Don't know	-	-	153 (20.6)

* Multiple responses.

Table 3: Attitudes of respondents

Statements	Agree	Disagree	Don't know
Believing that DF could be prevented and controlled	680 (93.2)	50 (6.8)	-
Responsibility of DF control			
Government	60 (8.3)	661 (91.7)	-
Community	62 (8.6)	559 (91.4)	-
Government & community	599 (83.1)	122 (16.9)	-
Elimination of breeding sites complicated & time consumer	209 (28.3)	527 (71.7)	-
Believing that fogging only DF control method	128 (17.6)	263 (36.2)	336 (46.2)
Possibility to recover from DF infection	545 (74.5)	24 (3.2)	163 (22.3)
Healthy person cannot be infected by DF	233 (31.7)	300 (40.9)	201(27.4)
You have an important role in DF prevention	573 (78.5)	157 (21.5)	-

Table 4:Self-reported prevention practices among the respondents

Statements	Yes	No.	Not applicable
Covering water containers	502 (68.6)	63 (8.6)	167 (22.8)
Investigating and cleaning breeding sites in water filled containers under air conditions	253(34.6)	478(65.4)	-
Disposing water from breeding containers	618 (85.5)	105 (14.5)	-
Weekly changing of animal drinking water	234 (32.3)	42 (5.8)	448 (61.9)
Investigating <i>Aedes</i> larvae in water of cans and bottles around home	152 (20.9)	244 (33.6)	331 (45.5)
Disposing garbage in allocated garbage bins	400 (66)	206 (34)	-
Participating with community in DF control campaigns	457 (63.6)	262 (36.4)	-

Table 5: Prevention Practice Vs. Socio-Demographic characteristics

Variables	Mean ± SD	Test statistics	95% CI for Mean	
			Lower	Upper
1- Age (years):		1.819 (P>0.005)		
Less than 15	1.6713±.35719		1.5300	1.8126
16 - 20 years	1.6645±0.31257		1.6369	1.6920
20-35 years	1.5750±0.32036		1.4251	1.7249
More than 35	1.4792±0.38374		1.2354	1.7230
2- Sex:		4.247 (P<0.005)	0.07446	0.20263
Male	1.6287±0.32636			
Female	1.7672±0.25318			
3- Marital status:		2.751 (P>0.005)		
Married	1.5259±0.32967		1.4005	1.6513
Unmarried	1.6660±0.31476		1.6389	1.6932
Divorced	1.6964±0.35250		1.3704	2.0224
4- Education:		2.157 (P>0.005)		
Intermediate	1.6667±0.40900		1.4633	1.8701
Secondary	1.6619±0.31176		1.6348	1.6890
University	1.6050±0.34172		1.4639	1.7461
Postgraduate	1.1250±0.17678		-0.4633	2.7133
5-Employment:		-1.389 (P>0.005)	- 0.19360	0.03323
Employed	1.5820±0.35442			
Unemployed	1.6622±0.31473			

Table 6: Sources of knowledge on DF

Source of information	No. (%)		χ^2 (P-value)
	Yes	No	
TV	318 (44.5)	396 (55.5)	8.521 (P<0.005)
Radio	123(17.2)	591(82.8)	306.756 (P<0.005)
Newspapers and Magazines	169 (23.6)	546 (76.4)	198.782 (P<0.005)
Pamphlets	234(32.8)	480 (67.2)	84.756 (P<0.005)
Primary Health Care (PHC)	344 (48.1)	371 (51.9)	1.020 (P>0.005)
Friends	179 (25)	536 (75)	178.250 (P<0.005)
Relatives	163 (22.8)	552 (77.2)	211.638 (P<0.005)

Discussion

The present study evaluated the knowledge, attitude and preventive practices regarding dengue fever among secondary schools students in Jazan Province.

The present results showed that only 3.5% of the participants had a prior history of DF. This presumably justify that the respondents could not point out typical symptoms of dengue because they had not witnessed a case from a close relative or community's member nor had they personally experienced the disease. This in turn means that the disease may easily be undetected or confused with other similar causes of fever like influenza, typhoid, etc. leading to delays in accessing health care centers and eventually to DF complications (Shuaib *et al*, 2010).

More than half of them (58%) in the present study have correctly identified mosquito bites as a transmission route. This result was in close relation to other studies done in Brazil (60.8%) (Degallier *et al*, 2000) and in Philippines (68.7%) (Mahilum *et al*, 2005).

In contrast, higher percentages of correct answers than those of the present study were reported from Jeddah (88.8%) (Ibrahim *et al*, 2009) and 95.8% obtained from Hong Kong (Ho *et al*, 2006). More than third of participants did not know what is the method of DF transmission indicating the need for educational campaigns?

Less than half of the participants cited fever as the commonest symptom of DF. This agreed with Degallier *et al*. (2000) in Brazil, Van Benthem *et al*. (2002) in northern Thailand Ho *et al*. (2006) in Hong Kong, Khun and Manderson (2007) in Cambodia, Itrat *et al*. (2008) in Pakistan Ibrahim *et al*. (2009) in Saudi Arabia and Jeelani *et al*. (2015) in India. It is also worthy to note that 47.4% of the respondents do not know the DF symptoms although 60% of them agreed that DF is curable. However, isolated knowledge on symptoms may be considered somewhat adequate. Good knowledge of signs and symptoms of DF was essential in identifying the

disease and to seeking early appropriate health care to save life (Yoba and Labrague, 2013).

Surprisingly, more than half of participants (56%) were unaware that dengue mosquitoes are more likely to bite in the afternoon; instead they reported night as the mosquito's biting time. Only 6.7% of participants correctly identified the morning time. WHO (2009) pointed out that *Aedes* mosquito usually bites during the day. Moreover, majority of participants (70.1%) correctly cited swamps and ponds as mosquitoes' breeding sites, while 36.3% of them were unaware and reported sewage water. Bridging this gap in knowledge in vector biology is important in planning and designing programs and activities to educate rural residents on preventive measures to combat dengue.

Regarding the knowledge on the mosquito controlling methods, it was found that the use of insecticides sprays, covering water tanks and use of mosquito repellents were the most commonly preferred preventive practices (72.3%, 32.8% and 31.1%, respectively). This finding is in accordance with the study conducted in Jazan (Bani *et al*, 2009) where it revealed that 81.2% of the participants prefer to use spray to keep mosquitoes away. Itrat *et al* (2009) in Pakistan revealed that mosquito sprays was considered the most common choices for prevention. Conversely in Philippines, only a little proportion of the participants reported the use of pesticides (Yoba and Labrague, 2013).

This investigation showed a poor overall DF knowledge among the secondary school students in Jazan. This may be attributed to the fact that the disease is only recently emerged in Jazan, Saudi Arabia, compared with other countries where the disease has been endemic for decades. This result coincides with the findings of Ibrahim *et al* (2009) in Jeddah.

As to attitudes towards DF prevention and

control, the majority of participants had good attitudes and believed that DF could be controlled and prevented (93.2%), DF control is the responsibility of government and community (83.1%) and they themselves have an important role to play in DF prevention (78.5%). This on the other hand shows that the majority of the students had perceived a risk and health threat of DF and seemed supportive towards DF control and prevention (Dhimal *et al*, 2014).

Concerning the self-reported prevention practices against DF, the most common practice to prevent mosquito breeding was found to be the disposing of water from breeding containers (85.5%). This agreed with Dhimal *et al*. (2014) in Nepal where 91% of the participants cited this practice to be useful in reducing the number of mosquitoes. While in Brazil, the most commonly reported preventive practice was elimination of water containers (Degallier *et al.*, 2000). The second common DF preventive measure used by the current participants was the covering of water containers (68.6%). In Thailand, a survey of KAP of the prevention of DHF pointed out that covering water containers were the most common practice to prevent mosquito breeding in drinking-water containers (Swaddiwudhipong *et al*, 1992). Disposing garbage in allocated garbage bins (66%) and participating with community in DF control campaigns (63.6) were also some of the preventive practices reported by participants in the present study.

There was a significant association between the practice of DF preventive and control measures and the participants sex ($P < 0.005$). Dhimal *et al* (2014) in central Nepal revealed that education level was associated with good practices among participants who had completed secondary or higher secondary education. Miljković *et al*. (2014) in Serbia assessed whether an educational program would have impact on changes of attitudes and sun-protective behaviors of high school students. They concluded that educational program had an im-

pact, but broader activities involving schools, local communities and media were needed for significant changes in sun behavior and attitude. El-Bahnasawy *et al*. (2015) in Egypt found that the difference between the total nurses' attitude changed and the total knowledge scores throughout the study was significant on the pre, the post, and the follow-up tests and that education program had successfully raised nursing knowledge regarding the VHF's. Fildes *et al*. (2015) in Australia reported that to have positive change in the teaching practice of teams that service large numbers of diverse students from multiple degree programs provided many challenges. Changing attitudes must involve training staff in new teaching and learning approaches and strategies, and creating a collaborative, supportive team-based teaching environment, where the planned changes could be implemented and evaluated.

Contrary to the present study, a lack of significant association between socio-demographic factors and practice level was observed in Malaysia and in Jamaica (Hairi *et al*, 2003; Shuaib *et al*, 2010) respectively.

In the current study, the most common source of DF knowledge came from primary health care centers (PHCs) and television. These selected sources of disseminated information may reflect the impact of Saudi Arabian DF public educational campaigns launched in Jazan region. A round 45% of participants cited television as a source of their information, correlated with data gathered from Thailand (Swaddiwudhipong *et al*, 1992), Kuala Lumpur (Hairi *et al*, 2003) and Jazan Saudi Arabia (Bani *et al*, 2009), but partially coincided with Ibrahim *et al* (2009) in Jeddah. Conversely, lower percentages of participants cited radio, newspapers and magazines, friends and relatives as their primary sources of information about the disease. This may reflect the importance of targeting future educational campaigns in these areas by the government in order to change behaviors and effectively communi-

cate DF preventive measures throughout the information, education and skill communication (IECs).

Generally speaking, the viral hemorrhagic fevers present the greatest threat in the absence of both vaccines and specific treatment and abundance of the vectors (El-Bahnasawy and Morsy, 2015). Shibl *et al.* (2012) stated the annual Hajj pilgrimage in Saudi Arabia serves as a model for the control of infectious disease in mass gatherings. As most of the countries from which the pilgrims or employee come constantly experience a uniquely dynamic population influx in the form of expatriate workers, tourists, or pilgrims, concerted regional and international collaboration to address these public health concerns in a region that lies at the crossroads for the global spread of infectious pathogens is imperative. Moreover, Azhar *et al.* (2015) reported isolation and first complete genome sequence of a DENV-1 strain (DENV-1-Jeddah-1-2011) isolated from a patient from Jeddah, Saudi Arabia in 2011. Whole genome sequence alignment and phylogenetic analysis showed high similarity between DENV-1-Jeddah-1-2011 strain and D1/H/IMTSSA/98/606 isolate (Asian genotype) reported from Djibouti in 1998. Further analysis of the full envelope gene revealed a close relationship between DENV-1-Jeddah-1-2011 strain and isolates reported between 2004-2006 from Jeddah and recent isolates from the Somalia, suggested the widespread of the Asian genotype. They concluded that these data suggested that strains belonging to the Asian genotype might have been introduced into Saudi Arabia long before 2004 most probably by African pilgrims and continued to circulate in western Saudi Arabia at least until 2011. Most importantly, these results indicate that pilgrims from dengue endemic regions can play an important role in the spread of new DENVs in Saudi Arabia and other countries worldwide. Thus, availability of complete genome sequences would serve as a reference for future epidemiological

studies of DENV-1 viruses. El-Kafrawy *et al.* (2015) stated that the close clustering of DENV-2 isolates reported from Saudi Arabia between 1992 and 2014 with strains from countries providing the highest numbers of pilgrims attending either Hajj or Umrah pilgrimages (Indonesia, Pakistan, India) clearly suggests a role for pilgrims or expatriates coming from DENV endemic countries in DENV-2 importation into Saudi Arabia. Accordingly, continuous monitoring of the circulation of DENVs in Saudi Arabia must be implemented to undertake effective control and management strategies in the Kingdom. Screening of the pilgrims coming to perform Hajj and Umrah might help prevent the introduction of new DENV strains, which is expected to increase the burden of the disease not only in Saudi Arabia but also in other countries.

Conclusion

Nowadays, there is a marked increase in many insect-borne infectious diseases, including some newly-circulating ones (HIV/AIDS, Hanta-virus, hepatitis C, SARS, Zika virus (ZIKV), etc.), and what else? This reflects the combined impacts of rapid demographic, environmental, social, technological and other changes in the humans ways-of-living.

The outcome data showed that the low prevalence of sufficient knowledge was evident among secondary school students in Jazan Province. But, isolated knowledge on symptoms, attitudes and prevention measures was somewhat adequate. Good practice to prevent DF was related to sex. Popular preventive measures were mainly the disposing of water from breeding containers and covering water containers.

The primary health care centers (PHCs) and television were the most important source of information on DF among the studied population. Based on this result, the Governmental Authorities should strengthen its programs on massive educational campaign to increase awareness and knowledge regarding dengue and preventive measures

to reduce mosquito and prevent dengue. Information, education and communication (IECs) materials maybe provided in areas like schools and health centers to make it more accessible for the residents to obtain. Knowledge of dengue, vectors and transmission of disease may be incorporated into the school and university curriculum especially in areas where dengue is highly prevalent like Jazan. More intersectoral coordination should be obtained to identify possible partners for public education dengue control campaigns.

Training of school teachers and community health workers should be conducted regularly to improve their technical skills and capabilities to supervise prevention and control activities.

Conflict of interest: The authors declare that they did not have any competing interests.

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