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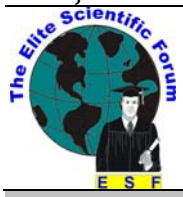


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**RESEARCH ARTICLE**

# A Study on Dengue Knowledge, Attitude, Practices and their Impact on *Aedes aegypti* Population in Lahore, Pakistan

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**ABSTRACT**

A study was conducted to investigate the awareness, attitude and practices of common people about dengue vector and its impact on control of *Aedes (A.) aegypti* population in Lahore, Pakistan. Data were collected during 2010 to 2011 by a questionnaire method. In total, 1000 open ended questionnaires were distributed among different houses, teachers, employees, workers and students. Out of the total, 940 filled questionnaires were received back from the respondents, of which, 400 were from different houses and 540 from students (graduates, post graduates, intermediate, and secondary schools), teachers, employees and workers of different institutions. The results showed significantly different ($P<0.05$) demographic characteristics of Dengue Fever/ Dengue Hemorrhage fever (DF/DHF) patients for age and sex. Significant ($\chi^2 = 366.29$) differences between alive DF/DHF susceptible patients were found, whereas the differences between dead DF/DHF susceptible patients were non-significant ($P=0.13$). Area-wise distribution revealed maximum prevalence of DF/DHF at Allama Iqbal Town, whereas minimum prevalence (1.8%) was observed at Aziz Bhati and Wahga Towns of Lahore. Similarly, overall patients of DF/DHF were greater in 2011 compared with those in 2010. Regarding gender, female patients were greater than male patients and children. The patients between 16 to 25 years of age had highest percentage of DF/DHF. The preventive practices from dengue mosquito adopted by the respondents were sprays (66.7%), coils (51.38%) and mosqoils (36.81%). In conclusion, this study suggests conducting these types of studiesfor generation of data bases from public that may serve as a baseline for controlling *A. aegypti* population and formulating policies against epidemics by the competent authorities.

## INTRODUCTION

The common vector of yellow and dengue fevers; *Aedes (A.) aegypti* (Linnaeus) mosquito belongs to order Diptera: *Culicidae* (Roberts and Janovy, 2005). *A. aegypti* mosquito, after spreading in the new world, causes many epidemics. It has characteristic white marks on the legs and a layer of white color markings (violin shaped) on the thorax that marks its identity while white markings of *A. albopictus* are different from *A. aegypti* has only one white layer present in the middle of the thorax and white markings on legs and is more black in color (Becker et al., 2013). The males are smaller in size with brushier antennae than the females. The body is divided into head, thorax and abdomen with a pair of wings that helps in flying (Gillies and De Meillon, 1968). The last segment of the abdomen is modified for oviposition in females. The male mosquitoes do not bite humans or animals and only feeds on fruits juices as they do not require blood meal (Gillies and De Meillon, 1968). The female of *A. aegypti,* in contrast, feed not only on fruit, but also on blood meal to nourish her eggs. *A. aegypti* females, however, while taking the blood meal, transmit parasites/pathogens, including dengue virus, to the human body.

Now a day dengue fever is one of the burning health issues in Pakistan since after the onset of monsoon period the dengue mosquito can be found inside as well as outside the houses. An increase in dengue mosquito population results in an increase in human susceptibility. The first confirmed outbreak of dengue

fever in Pakistan was reported in 1994 (Chan et al., 1995; Rai and Khan, 2007). A sudden rise in cases and the annual epidemic trend, however, occurred in Karachi during November, 2005 (WHO, 2015). Later on, Jamil et al. (2007) reported 20-25 patients of DH/DHF admitted to Agha Khan Hospital, Karachi, Pakistan. Pakistan has experienced an epidemic of dengue fever that caused 16,580 confirmed cases and 257 deaths in Lahore and nearly 5000 cases and 60 deaths from the rest of the country during 2010 (WHO, 2015).A dengue fever outbreak has also been reported in Swat, a district of Khyber Pakthunkhwa (KPK) province, Pakistan during August 2013. In total, 6376 suspected cases, including 23 deaths (fatality rate 0.36%), were reported during this outbreak, (WHO, 2015).

*A. aegypti* exists in three polytypic forms: domestic, sylvan, and peri-domestic (Kandyata, 2013). The domestic form breeds in urban habitat, around or inside houses, whereas the sylvan form is a more rural and breeds in tree holes, generally in forests and the peri-domestic form thrives in environmentally modified areas such as coconut groves and farms (Jayapriya and Gricilda, 2015). These mosquitos are usually found between the latitudes of 35° north and 35° south below an elevation of 1000 meters (3,300ft) (WHO, 2009). The mosquito rests indoors, in attics, cabinets and other dark places, whereas in outdoors rest in cool and shady places (Jayapriya and Gricilda, 2015).

The quick geographic expansion of the *A. aegypti* and dengue virus, regularity of epidemics, and increased incidence of DF and DHF are the causes for great concern (Ahsan, 2008), particularly in Pakistan, high frequency of infection has been observed in recent years (Syed et al., 2010). The fatality rate of DHF and DF is around 20,000 to 500,000 peoples per year in Pakistan (Ahsan, 2008). It has been reported that knowledge, attitude, and practice (KAP) survey and extensive entomologic surveys are very important in controlling *A. aegypti* population throughout the world (Syed et al., 2010; Hafeez et al., 2012; Gunasekara et al., 2012). Van Benthem et al. (2002) emphasized the need of knowledge and community participation in controlling dengue epidemics. Since the community involvement in mosquito management programs provides more sustainable and effective organization (Grantham et al., 2009)

Keeping in view the recommendations and significance of previous work carried out by the later authors, this study was conducted to investigate the awareness, attitude and practice of common people regarding dengue vector and its impact on control of *A. aegypti* population in Lahore, Pakistan. It was assumed that the outcomes of the study will help in controlling *A. aegyoti* population and provide a baseline data for designing factual strategies of dengue control in Pakistan.

## MATERIALS AND METHODS

In total, 1000 open ended questionnaires were distributed in different houses, among doctors, teachers, employees, workers and students in Lahore (31˚ 32‘59N; 74˚ 20‘37 E) with population of 6,318,745 (District Census Report of Lahore, 1998), Pakistan.

The study design was purposive with convenient random sampling. A questionnaire was designed to collect the data of the dengue affected patients during the epidemics of dengue fever from April, 2010 to September, 2011. The areas with high prevalence of dengue affected patients (through news forecast) were selected for questionnaire distribution. Demographics of dengue affected patients were collected through the questionnaire that was very much helpful in the installation of ovitraps during the entomological survey, carried out immediately after the completion of the primary data collected from the questionnaire. The questionnaire was designed in English language and later on translated in Urdu language for those respondents who could not understand English language. Data were also collected from illiterate people (affected by DF) by asking questions in Urdu and Punjabi Languages.

About 940 questionnaires were received out of 1000, out of which approximately 400 were from different houses and 540 belong to different students (graduates, post graduates, intermediate, and secondary schools), teachers, employees and workers of different institutions. Demographics of the respondents were collected i.e. age, sex, education and occupation. Knowledge of the respondents was tested by asking questions about the number and condition of dengue affected patients in their houses during the year 2010 to 2011, gender, age, etc. The questions were asked regarding the symptoms of dengue fever observed in dengue patients. These symptoms include head-ache, nausea, red spots on body, muscular pain, bone breaking pain, bleeding gums, status of the patients (dead/alive), medical history of the patients (diabetic, liver patients, hepatitis, hypertension or heart patients). Questions were asked from the respondents by showing visual aids. The questions were also asked about the life stages of the dengue mosquito and their sources of awareness about dengue vector.

The attitudes were tested by asking questions regarding their observations in and around their house. For instance, the observation of mosquitoes both indoors and outdoors after spraying, the type of water storages at their house. Practice of the respondents were observed by asking different questions such as about the treatments they used to cure DF and preventive measures adopted to protect themselves. The knowledge of the respondents was compared with their practice of protecting themselves from dengue vector

and their attitude against the surveillance of dengue vector inside and outside their houses and nearby areas.

**Data analysis:** The collected questionnaires data, including demographics characteristics of respondents and patients affected with DF/DHF, ratio of dead/alive patients, town wise distribution of dengue affected patients, were analyzed using Chi-square test with software statistix version 8.1 (analytical software, 2005). The rest of information gathered through data generated by questionnaire method was presented through pie charts and histograms.

## RESULTS

The comparison of demographic characteristics of the respondents is shown in Table 1. Results indicated that male (48.0%) and female (52.13%) out of 940. Percentage of the respondent's age was calculated by dividing them in different age groups. The respondents of age group of 11 to 20 years were highest (57.2%), whereas the age group >50 years was lowest (1.6%) in (Table 1). With respect to occupation, the results indicated that students were maximum (53.2%) respondents, whereas professors were minimum (3.20%).

The results regarding knowledge of the respondents, tested through the demographics of the patients, are shown in Table 2. The gender/sex was divided into three categories namely; male, female and paeids (children). The demographic characteristics of the genders were compared by chi-square analysis ($\chi^2$ = 39.29) and results were considered significant at $P<0.05$. As far as age is concerned, it was revealed that for three age groups through Chi-square analysis ($\chi^2$ =61.93), the male age range who suffered from DF/DHF were significantly different in two years record (2010 to 2011). Similarly for female age range ($\chi^2$ = 127.06) and paeids ($\chi^2$ = 20.42), the results were significantly different for both years ($P<0.05$) (Table 2). The seasonal prevalence of DF/DHF was also statistically analyzed for the years 2010-11 and *Chi-square* results ($\chi^2$ =372.32) showed *P* value to be significant i.e. both years had different number of cases in different seasons (winter, spring, summer and autumn) (Table3).

The results regarding alive and dead DF/DHF susceptible patients during 2010-2011 are shown in Table 3. Chi-square analysis revealed significant ($\chi^2$ =366.29) difference between alive DF/DHF susceptible patients during 2010-2011, whereas non-significant ($P=0.13$) differences between dead DF/DHF susceptible patients during 2010-2011 were observed. Areas wise distribution of DF/DHF indicated maximum (23.1%) prevalence at Allama Iqbal Town, whereas minimum prevalence (1.8% at each) was observed at Aziz Bhati Town and Wahga Town (Table 4).

**Table 1: Demographic Characteristics of the Respondents of Lahore, Pakistan**

| Demographics | Variables | n (%) |
|---|---|---|
| Sex | | |
| | Male | 450 (48.0) |
| | Female | 490 (52.13) |
| Age (years) | | |
| | 0-10 | 12 (1.30) |
| | 11-20 | 537 (57.2) |
| | 21-30 | 297 (31.6) |
| | 31-40 | 61 (6.50) |
| | 41-50 | 18 (1.90) |
| | >50 | 15 (1.60) |
| Occupation | | |
| | Student | 500 (53.2) |
| | Teacher | 80 (8.51) |
| | Professor | 30 (3.20) |
| | Worker | 140 (14.9) |
| | Shopkeeper | 100 (10.6) |
| | Employer | 90 (9.60) |
| Socioeconomic Status | | |
| | Poor | 170 (18.1) |
| | Middle Class | 470 (50.0) |
| | Upper Middle | 300 (31.9) |

Awareness of the respondents, similarly, was also tested by asking questions about the symptoms observed in the DF/DHF patients (n=1109). The symptoms including yellow eyes (19.21%), red spots on body (29.94%), bone breaking pain (29.94%), high fever (52.93%), muscular pain (30.48%), bleeding from gum (7.84%), bleeding from nose (8.48%), vomiting (33.81%), nausea (19.21%), weakness (49.41%) and bitter taste of tongue (27.95%) were. The results indicated that high fever was more frequent in DF cases and bleeding gums and nose was least showing in DHF patients (Fig. 1). The good preventive practice from dengue mosquito adopted by the respondents were sprays (66.7%), coils (51.38%), mosqoils (36.81%) and repellents (31.81%) (Fig. 2). A relation between demographic, knowledge and practices against *A. aegypti* population are shown in Fig. 3.

The treatment for the DF/DHF affected peoples indicated that 86.11% patients used Panadol, 7.30% Paracetamol, 1.44% Ponston and 5.14% of the patients used other medicines. The respondents were also asked about the use of herbal treatments (use of papaya leaves extracts). It was observed that 52.93% used papaya leaves extracts and 28.49% find it effective for DF, whereas 24.44% find it ineffective. The practice of the liquid intake knowledge of the respondents (n=1109) showed that 34% affected people were drinking more than six glasses of waters/juices per/hour, whereas 27.7% were drinking six glasses of water/juices per hour. It was also revealed that 22.8% affected patients were drinking four glasses of water/juices per hour and 15.5% others. These results suggest that the respondents were aware of a proper liquid intake during

**Table 2: Demographic Characteristics of DF/DHF Patients**

| Characters | 2010 | 2011 | Total | P | $\chi^2$ |
|---|---|---|---|---|---|
| | n (%) | n (%) | n (%) | | |
| Sex | | | | | |
| Male | 85 (46.70) | 383 (41.32) | 468 (42.0) | 39.29 | 0 |
| Female | 74 (40.70) | 426 (45.96) | 500 (45.1) | | |
| Paeids | 23 (12.64) | 118 (12.73) | 141 (12.7) | | |
| Age (years) | | | | | |
| Male | | | | | |
| 16-25 | 31 (36.5) | 163 (42.56) | 194 (41.5) | 61.93 | 0 |
| 26-35 | 11 (12.9) | 96 (25.07) | 107 (23.0) | | |
| 36-45 | 21 (24.7) | 65 (16.97) | 86 (18.4) | | |
| 46-55 | 11 (12.9) | 42 (10.97) | 53 (11.3) | | |
| > 56 | 11 (12.9) | 17 (4.44) | 28 (6.00) | | |
| Female | | | | | |
| 16-25 | 41 (55.4) | 279 (65.5) | 320 (64.0) | 127.06 | 0 |
| 26-35 | 12 (16.2) | 60 (14.1) | 72 (14.4) | | |
| 36-45 | 12 (16.2) | 46 (10.8) | 58 (11.6) | | |
| 46-55 | 7 (9.5) | 28 (6.60) | 35 (7.00) | | |
| > 56 | 2 (2.7) | 13 (3.10) | 15 (3.00) | | |
| Paeids | | | | | |
| 0-5 | 2 (8.70) | 15 (12.71) | 17 (12.06) | 20.42 | 0.0255 |
| 6-10 | 5 (21.7) | 33 (27.97) | 38 (27.00) | | |
| 11-15 | 16 (69.6) | 70 (59.32) | 86 (61.00) | | |

*The demographic characteristics of the patients of DF/DHF are significant (P<0.05); 2010-11, after Chi-square analysis.

**Table 3: Effects of seasonal variation on the DF/DHF case**

| Season | 2010 n (%) | 2011 n (%) | Total n (%) | $\chi^2$ | P |
|---|---|---|---|---|---|
| Winter | 49 (27) | 117 (13) | 166 (15.0) | 372.32 | 0 |
| Spring | 2 (1) | 26 (3) | 28 (2.53) | - | - |
| Summer | 130 (71) | 780 (84) | 910 (82.1) | - | - |
| Autumn | 1 (1) | 4 (0.43) | 5 (0.451) | - | - |
| Alive DF/DHF susceptible patients 2010-2011 | | | | | |
| Winter | 47 (27) | 113 (12) | 160 (14.7) | 366.29 | 0 |
| Spring | 2 (1) | 24 (3) | 26 (2.40) | - | - |
| Summer | 24 (71) | 771 (85) | 895 (82.41) | - | - |
| Autumn | 1 (1) | 4 (0.4) | 5 (0.50) | - | - |
| Dead DF/DHF susceptible patients 2010-2011 | | | | | |
| Winter | 4 (27) | 2 (25) | 6 (27.3) | 20.1 | 0.13* |
| Spring | 2 (13) | 0 (0) | 2 (9.10) | - | - |
| Summer | 9 (60) | 6 (75) | 14 (64.0) | - | - |
| Autumn | 0 (0) | 0 (0) | 0 (0) | - | - |

*P valve is non-significant (P<0.05) which shows that there is no difference between the dead %age of the DF/DHF cases 2010-11.

**Table 4: Area wise distribution of the DF/DHF cases during 2010-2011**

| Name of Town | 2010 | 2011 | Total | $\chi^2$ | P |
|---|---|---|---|---|---|
| Data Gunj Baksh Town | 25 (13.74) | 196 (21.14) | 221(20.0) | | |
| Aziz Bhatti Town | 7 (3.85) | 6 (0.70) | 13 (1.20) | 355.48 | 0 |
| Gulberg | 17 (9.34) | 101 (10.9) | 118 (11.0) | | |
| Allama Iqbal Town | 46 (25.3) | 210 (22.7) | 256 (23.1) | | |
| Johar Town | 19 (10.44) | 64 (7.00) | 83 (7.50) | | |
| Model Town | 5 (2.75) | 38 (4.10) | 43 (3.90) | | |
| New Muslim Town | 8 (4.40) | 17 (2.00) | 25 (2.30) | | |
| Nishter Town | 3 (1.65) | 28 (3.021) | 31 (2.80) | | |
| Ravi Town | 3 (1.65) | 26 (2.81) | 29 (2.62) | | |
| Samanabad Town | 23 (12.64) | 114 (12.3) | 137 (12.4) | | |
| Shalimar Town | 18 (9.90) | 70 (7.60) | 88 (8.00) | | |
| Wagha Town | 1 (0.55) | 19 (2.10) | 20 (1.80) | | |
| Cantt./DHA/Walton | 7 (3.85) | 38 (4.10) | 45 (4.10) | | |

*Chi-square analysis (P<0.05) was performed to check the variation in areas wise distribution of DF/DHF epidemic 2010-11 and the results were significant showing variations in the area wise distribution of DF/DHF in both years.

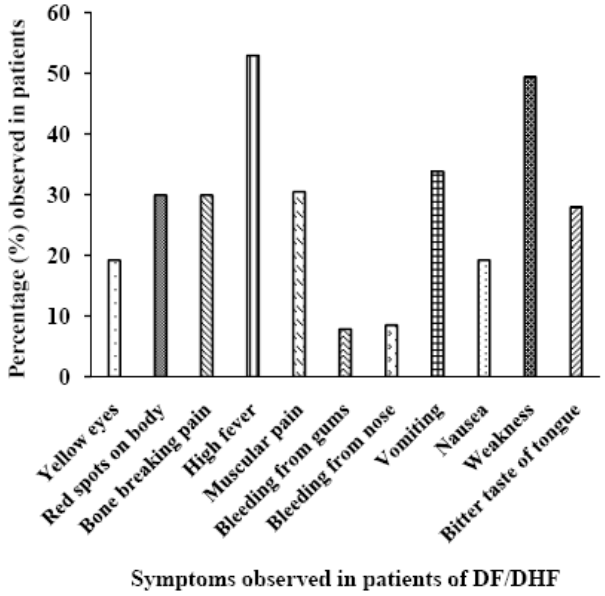


**Fig. 1: The percentage of symptoms of DF/DHF affected patients from 2010 to 2011.**

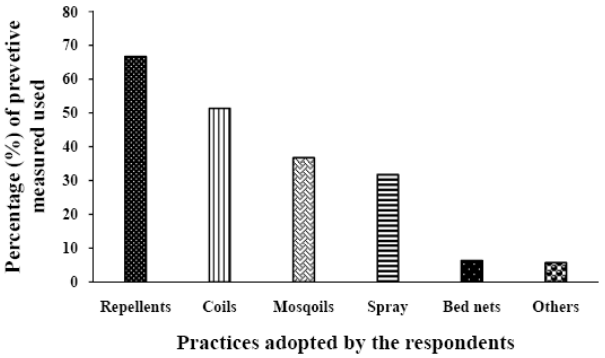


**Fig. 2: The preventive practice of the respondents against DF/DHF.**

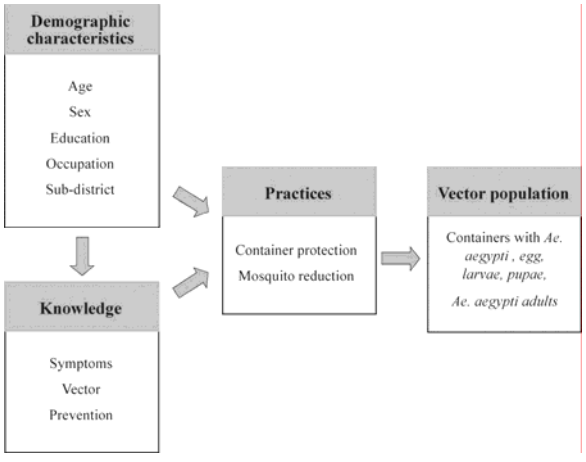


**Fig. 3: Relation between knowledge of the respondents and their practice against dengue vector.**

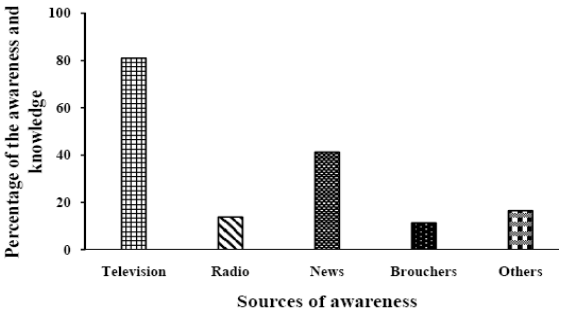


**Fig. 4: Sources of the knowledge and awareness of respondents regarding DF/DHF.**

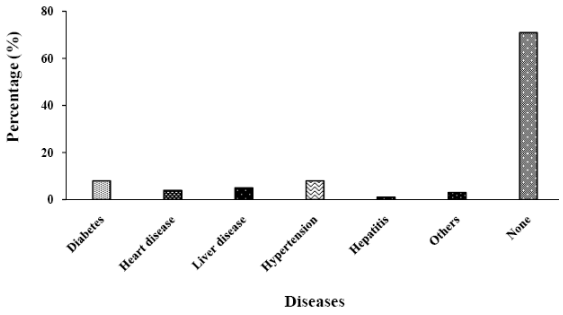


**Fig. 5: Medical history of the patients suffering from DF/ DHF.**

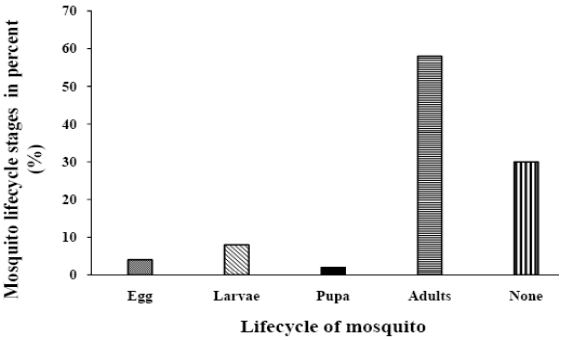


**Fig. 6: Knowledge of the respondents regarding mosquito and its immature stages.**

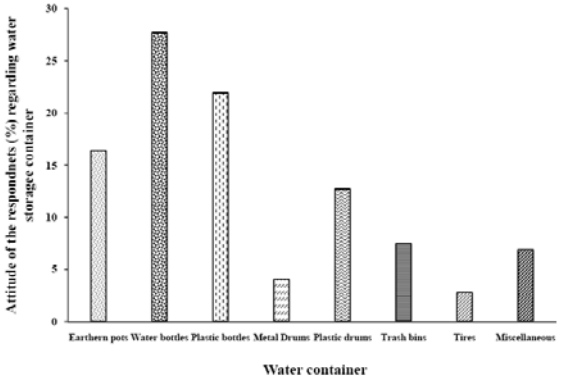


**Fig 7: Attitude of the respondents regarding water storages at various house hold.**

**Table 5: Prevalence of mosquitoes observed indoor and outdoor after spray**

| Days after spray | Indoor n (%) | Outdoor n (%) | Total n (%) | $\chi^2$ | P |
|---|---|---|---|---|---|
| 3 | 495 (59) | 372 (62.1) | 867 (60.3) | | |
| 5 | 199 (24) | 154 (26.0) | 353 (24.6) | 81.4 | 0 |
| 7 | 84 (10) | 47 (7.85) | 131 (9.11) | | |
| 10 | 61 (7.3) | 26 (4.34) | 87 (6.50) | | |

* Chi-square analysis is performed to check the prevalence of mosquitos outdoor and indoor showing P ($P<0.05$) value significant as there is difference in the outdoor and indoor readings.

DF/DHF period. Regarding the sources of awareness, maximum (81.1%) respondents got awareness through television, whereas minimum (11.38%) respondents through brochures (Fig. 4).

Regarding the medical history of the patients, maximum patients were diabetic (80%) and minimum were suffering from hepatitis (1%), whereas 71% patients were without any medical history (Fig. 5). The results regarding knowledge of the respondents about black mosquito and its immature are shown in Fig. 6.

The results indicated that most (66%) of the respondents had a knowledge about breeding sites of the mosquitos, whereas 34% did not know that household water storages can be a site for mosquito breeding. The public attitude towards the vector control was also judged through their household water storages practices (Fig. 7).

Chi-square analysis was performed to investigate the prevalence of mosquito‘s indoor and outdoor after spraying. The results are shown in Table 5.

As the present study showed that the overall high prevalence of the DF/DHF was calculated in female than male and paeids. The college and university girls with the age between 16 to 25 years had highest percentage of DF/DHF fall The male respondents, similarly, of age group 11to 15 years also had the same pattern of disease. During data collection it was observed that the *A. aegypti* female was more attracted towards young blood.

## DISCUSSION

The present study was conducted to investigate awareness, attitude and practice of common people regarding dengue vector and control of *A. aegypti* population in Lahore, Pakistan.

During the present study, the highest prevalence of DF was observed in females (45.1%) and lowest in paeid (12.7%) are in accordance with results reported by Jamaiah et al. (2005), Anker and Arima (2011) and Ali et al. (2015). In Pakistan, dengue fever is an emerging disease and the population at large, however, is not immune, therefore, all age groups are found to be infected (particularly the young adults) (Munir, 2011). The greater prevalence of DF/DHF, during the present study, in the post monsoon period (September to November) coincides with the findings of Tahir et al. (2010). The later authors reported an increase in dengue cases from September to December with peak during November, in Lahore. Greater prevalence of dengue fever in the Allama Iqbal Town may be attributed to abundance of dengue vector found in the area that was further confirmed by ovitrap installation in Lahore city. The lowest percentage of patients in Aziz Bhatti town (1.2%) may be attributed to the better awareness of the respondents of the area regarding the symptoms of DF /DHF. The respondents were able to differentiate between the symptoms of DF/DHF. The highest percentage was of high fever (52.93%), weakness (49.41%) and the least were of DHF/DSS i.e. bleeding gums and bleeding from nose (7.84%, 8.84 respectively). The highest prevalence of DF with respect to sex was observed in males (89%).

The use of attitude by urban inhabitants to manipulate their vicinity for reduction of mosquito density by making breeding habitats with good consequence of planning a safe, sound and eco-friendly strategy. These findings are in accordance with those reported by Snehalatha et al. (2003). Similarly, emphasized the need for. Since the source reduction can control the *Aedes* population in a better way than the use of chemicals (Phuanukoonnon et al., 2005). The better guidance in urban individuals through TV/Radio and print media about DF suggests educating people so that they can adopt adequate measures against epidemics like dengue. During 2005–2006, however, there was an unprecedented increase in DF epidemic activity in the Pakistan, with >3640 patients with signs and symptoms of dengue fever admitted to several hospitals in the country. There were 40 deaths recorded, making it the biggest and most severe outbreak of DF in the country. According to sources, the recent (in 2011) wave of dengue fever hitting Pakistan’s eastern province of Punjab killed at least 365 people and 21,597 cases of DF have been reported, making it the world’s biggest epidemic of DF ever (Choudary, 2011).

The upcoming year 2012 is predicted to be even worse (Ayeshar, 2012). The highest numbers of hospital admissions for suspected dengue cases are seen in September and October following the monsoon season (2011) (Shakoor et al., 2012). This complies with the dengue epidemic season in other countries, such as India and Bangladesh, sharing the same climatic patterns. This timing can be attributed to increased mosquito breeding and more available breeding sites (rainfall) due to ambient temperature and humidity

present in the preceding months. Now the facts are indicating that mosquitoes in Pakistan are developing resistance to agrochemicals (Brulliard, 2011). Extra outreach campaigns for mosquito control must be conceded out in towns where mosquito fogging is persisitent (Chandren et al., 2015). Proper knowledge, education and awareness of communities on practice and on the reduction of *A. aegypti* breeding sites may provide a community based strategy for dengue mosquito control. There is a dire need to use the appropriate pesticide and adequate knowledge to completely eradicate the DF in the community.

**Authors' contributions**

FM, ZK and HF have made significant ontributions to conception, design, acquisition of data, analysis and interpretation of data. FB corrected tables, designed graphs and scientifically improved the writing of the manuscript. FB revised the manuscript critically. FM gives final approval of the version to be submitted. FM and FB have read and approved the galley proof.

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