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Shah Fahad

Department of Animal Science,
Quaid-i-Azam University 45320
Islamabad, Pakistan

Maryam Butt

General Hospital Ghulam
Muhammad Abad Faisalabad,
Pakistan

Attiya Iqbal

Department of Animal Science,
Quaid-i-Azam University 45320
Islamabad, Pakistan

Mian Naveed Shah

Department of Zoology, Abdul
Wali Khan University Mardan,
KPK, Pakistan

Lal Muhammad

Registrar Nephrology Rehman
Medical Institute Peshawar,
Pakistan

Nasim Kousar

Department of Zoology, GC
University Faisalabad, Pakistan

Farid Ulhaq

Department of Bioinformatics &
Biotechnology, GC University
Faisalabad, Pakistan

Correspondence

Shah Fahad

Department of Animal Science,
Quaid-i-Azam University 45320
Islamabad, Pakistan

Institutional analysis of 2017 dengue outbreaks of Peshawar, Khyber Pakhtoonkhwa, Pakistan

Shah Fahad, Maryam Butt, Attiya Iqbal, Mian Naveed Shah, Lal Muhammad, Nasim Kousar and Farid Ulhaq

Abstract

The present study was conducted from August to December 2017 to elucidate the frequency of dengue fever in district Peshawar considering five main hospitals. In LRH 1067 dengue patients were recorded having 704 (66%) male and 363 (34%) female. Age group 16-30 (N=448, 42%) was severely affected while high dengue incidence were found in October (N=457, 43%). In KTH 4867 dengue patients with 51 deaths were reported, 2915 (60%) were male and 1942 (40%) were female. Age group 16-30 (43%) was severely affected while September (N=1704, 35%) was heavy affected. In HMC 5767 dengue patients with 42 deaths were registered, 3321 (58%) were male and 2446 (42%) were female. Age group 16-30 (N=2653, 46%) was severely affected while high dengue patients were recorded in October 2845 (49%). In RMI 224 (2%) dengue patients were found with 141 (63%) male and 83 (37%) female. Age group 16-30 (N=85, 38%) was highly affected while 112 (50%) dengue patients were reported in October. In KTH 867 (7%) dengue patients with 5 deaths were reported, 512 (59%) male and female 355 (41%). Age group 16-30 (N=372, 43%) was highly affected while 381 (44%) dengue patients were reported in October (N=381, 44%). Overall age group 16-30 (44%) was exceedingly affected followed by 31-45 (22%) and male population was highly affected (59%) than females (41%). It is concluded that Peshawar is the most prevalent in KPK for dengue infection therefore the present study provides recommendations to DG Health and hospitals to control DF in Peshawar and elsewhere.

Keywords: dengue, Peshawar, KPK, LRH

1. Introduction

Dengue is clinically important systemic arboviral infection of humans [5]. The most recent study showed that 390 million DENV infections occur annually round the globe; with a death rate of up to 5% among them most suffered were children [7, 17]. Dengue viruses has four distinctive serotypes (DENV-I, DENV-II, DENV-III and DENV-IV) transmitted among humans by adult female *Aedes* mosquitoes [5, 13].

Dengue virus causes dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). These terms are known in the medical literature for over 200 years [1]. Dengue fever is an acute high grade febrile illness ranging to 40°C or 104°F, associated with severe headache especially retro orbital pain (behind the eyes), joints and muscles pain, hence it's named "break bone fever" [5, 7]. The recent demographic developments and rapid transport of huge numbers of people across the countries have caused the shift of this disease to the non-endemic zone of the world [4].

Dengue is a global health problem throughout the tropical, subtropical and temperate regions of the world. But, recent demographic developments and standardized living styles have caused the shift of this disease to the non-endemic zone of the world [4]. Climate variables like temperature and rainfall in a region are major suitability factors in establishing vector habitat for DENV propagation [9]. In Pakistan first case of DHF was narrated in 1994 at Agha Khan University Hospital due to DENV-2 and subsequently later its incidence has been increased dramatically. From last two decades dengue is one of the emerging public health concerns in the country and till October 2014, 48910 cases of dengue with 566 deaths were recorded [5, 11, 12, 16]. The first deadly dengue outbreak in the Pakistan was recorded in 2011 Lahore with 21685 cases of dengue and 350 deaths [3, 6]. One year after the Lahore, Punjab dengue outbreaks, another massive outbreak was recorded in Swat with 6000 confirmed dengue cases and 48 deaths [2, 13].

Unprecedentedly, in 2017 another massive dengue outbreak was recorded in the Provincial headquarter Peshawar with 23541 dengue confirmed cases and 108 deaths. In the course of 2005-2011 the figures of verified positive cases and deaths intensely increased to 55,946 and 539 respectively targeting 105 out of 146 districts and later then, the disease has become widely admitted as one of the worldwide admitted and the leading public health burden in Pakistan [15].

The very essence of the current study was to highlight the most severely affected areas of district Peshawar through institutional analysis. Based on the present study, it is highly significant to enterprise approaches effectively for controlling dengue diseases in Peshawar and elsewhere.

2. Materials and Methods

2.1 Study Area

Peshawar is the provincial headquarter and largest city of province KPK, Pakistan. Based on a 30-year record, the average 30-year annual precipitation has been recorded as 16 inches (400 mm). Peshawar is the 6th most populated city of the country with a total Population of 1,970,042 (2017 Census of Pakistan by Pakistan Bureau of Statistics). The 2017 dengue outbreaks were observed in the central parts of Peshawar (Fig 1). Total 23541 dengue cases with 108 deaths were reported in the city of which 12782 dengue patients visited Govt. Lady Reading Hospital (LRH), Khyber Teaching Hospital (KTH), Hayat Abad Medical Complex (HMC), Rehman Medical Institute (RMI) and Kuwait Teaching Hospital (KTHT) Peshawar for treatment and diagnosis purposes.

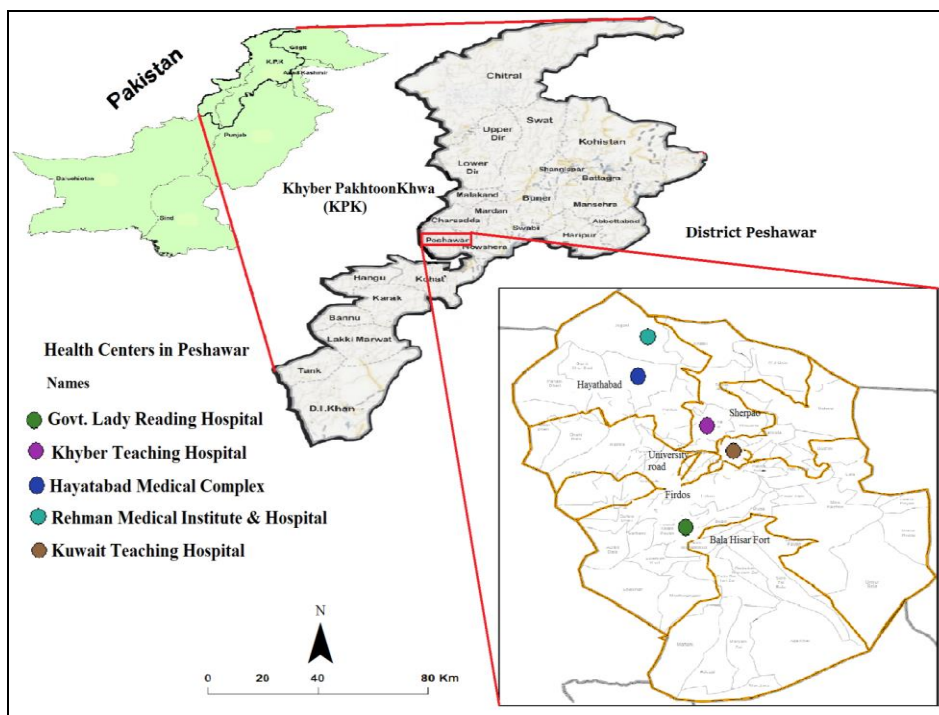


Fig 1: Map of district Peshawar showing Health Centers

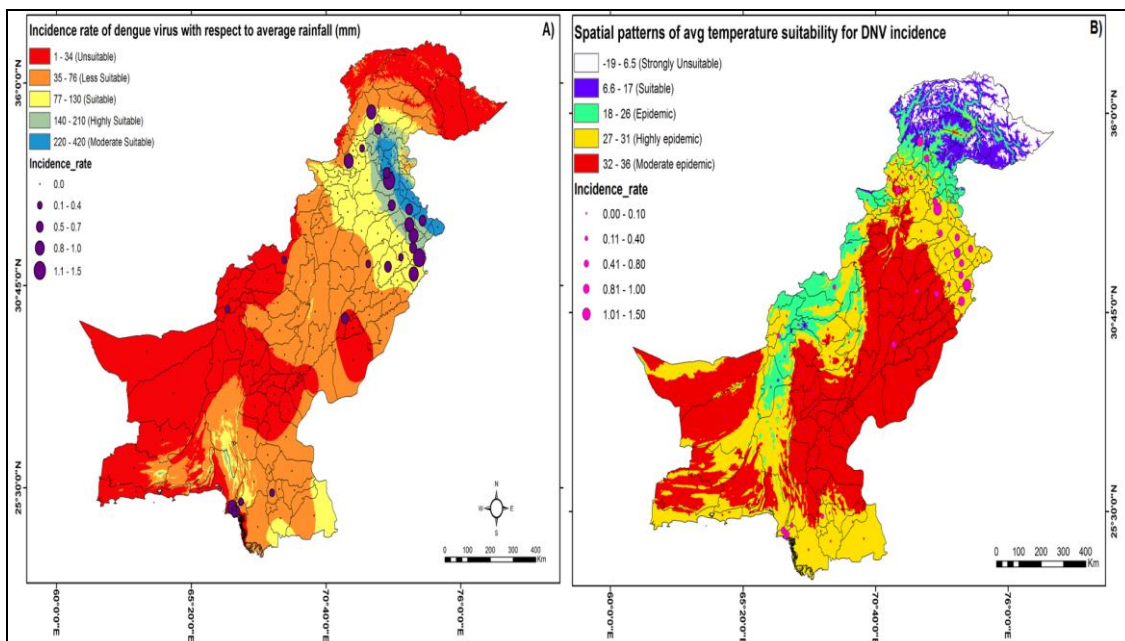


Fig 2: Incidence rate of dengue virus and suitability analysis with respect to average rainfall (A) and temperature (B) across the country

2.2 Study type

The present research study is descriptive and institutional based to carefully investigate various aspects of 2017 dengue outbreak of district Peshawar, KPK, Pakistan. The Dengue patient's line lists were obtained from Lady Reading Hospital (LRH), Khyber Teaching Hospital (KTH), Hayat Abad Medical Complex (HMC), Kuwait Teaching Hospital Tehkal (KTHT) and Rehman Medical Institute (RMI) through written permission letters by the concerned RMOs respectively. Most of dengue patients choose these five hospitals for treatment because of clean environment, highly qualified doctors, advanced Operation Theaters, well equipped laboratories and expert molecular biologists. Complete history was present in

the obtained line lists of dengue positive patients who visited the above mentioned hospitals for dengue tests, treatment and diagnosis purposes. The computer operators of these institutes explain the terms and codes used in dengue patients files.

2.3 Ethical statement

The study and accompanying protocols were reviewed and approved by medical superintendents and the ethics committee of LRH, KTH, HMC, RMI and KTHT Peshawar. All line lists were collected after written consent was obtained from the above mentioned institutes. The participant in the figure is the author (SF) himself who visited the hospitals and collected all the data and is willing to publish his image.

Table 1: Month wise, Age wise and Institutional distribution of dengue in 2017 district Peshawar, KPK, Pakistan*

Month wise dengue incidences of 2017 dengue outbreak Peshawar					
Month	August	September	October	November	December
Incidences	17%	30%	42%	9%	2%
Age wise distribution of dengue					
Age groups	01-15	16-30	31-45	46-60	Above 60
Total patients N=12782 (%)	N=2305 (18%)	N=5626 (44%)	N=2802 (22%)	N=1405 (11%)	N=644 (5%)
Institutional Incidence in district Peshawar					
Hospitals/Institutes	Lady Reading Hospital (LRH)	Khyber Teaching Hospital (KTH)	Hayatabad Medical Complex (HMC)	Rehman Medical Institute & Hospital (RMI)	Kuwait Teaching Hospital (KTH)
Total registered dengue patients N=12782 (%)	N=1067(8%) M=704 (66%) F=363 (34%)	N=4857 (38%) M=2915 (60%) F=1942 (40%)	N=5767 (45%) M=3323 (58%) F=2446 (42%)	N=224 (2%) M=141 (63%) F=83 (37%)	N=867 (7%) M=512 (59%) F=355 (41%)
Total Mortality(108)	5	51	42	5	5

3. Results

The current study was conducted from August-December 2017 to determine the frequency of dengue patients. In this study those dengue patients of district Peshawar (12782) were considered who visited Lady Reading Hospital (LRH), Khyber Teaching Hospital (KTH), Hayatabad Medical Complex (HMC), Rehman Medical Institute (RMI) and Kuwait Teaching Hospital Tehkal (KTHT) Peshawar for treatment and diagnosis purposes. Dengue patient's line lists were obtained from LRH, KTH, HMC, RMI and KTHT through written permission letters by the concerned Hospital Directors (HD) and RMOs respectively. Results of each institute/hospital are presented separately as follows;

3.1 Lady Reading Hospital (LRH)

In Lady Reading Hospital total 1067 (9%) dengue patients with 5 deaths were registered during 2017 dengue epidemics Peshawar, 704 (66%) were male and 363 (34%) were female. Age group 16-30 (N=448, 42%) was severely affected followed by 31-45 (N=286, 27%), 1-15 (N=181, 17%), 46-60 (N=107, 10%) and 60 plus (N=45, 4%). In month wise incidence high dengue patients were recorded in the month of October (N=457, 43%) followed by September (N=369, 34%), August (N=178, 17%), November (N=63, 6%) and no dengue patient was registered in the month of December during 2017 in LRH Peshawar.

3.2 Khyber Teaching Hospital (KTH)

In Khyber Teaching Hospital total 4857 (38%) dengue patients with 51 deaths were registered during 2017 dengue epidemics Peshawar, 2915 (60%) were male and 1942 (40%) were female. Age group 16-30 (44%) was severely affected followed by 31-45 (30%), 1-15 (14%), 46-60 (9%) and 60 plus (3%). In month wise incidence high dengue patients were recorded in the month of September (N=1704, 35%) followed by October (N=1669, 34%), August (N=1030, 21%), November (N=373, 8%) and December (N=81, 2%) in KTH

during 2017 dengue epidemics Peshawar.

3.3 Hayatabad Medical Complex (HMC)

In Hayatabad Medical Complex total 5767 (45%) dengue patients with 42 deaths were registered during 2017 dengue epidemics Peshawar, 3321 (58%) were male and 2446 (42%) were female. Age group 16-30 (N=2653, 46%) was severely affected followed by 1-15 (N=1162, 20%), 31-45 (N=1044, 18%), 46-60 (N=636, 11%) and 60 plus (N=272, 5%). In HMC 2845 (49%) dengue patients were recorded in the month of October followed by September (N=1521, 26%), November (N=762, 13%), August (N=620, 11%) and December (N=19, 1%).

3.4 Rehman Medical Institute (RMI)

In Rehman Medical Institute total 224 (1%) dengue patients were registered having 141 (63%) male and 83 (37%) female. In RMI age group 16-30 (N=85, 38%) was severely affected followed by 1-15 (N=67, 30%), 31-45 (N=37, 16%), 46-60 (N=22, 10%) and 60 plus (N=14, 6%). In month wise incidence highest number of dengue patients 45 (49%) were recorded in the month of October followed by September (N=64, 29%), August (N=21, 9%), November (N=18, 8%) and December (N=9, 4%).

3.5 Kuwait Teaching Hospital Tehkal (KTHT)

In Kuwait Teaching Hospital total 867 (7%) dengue patients with 5 deaths were registered from August-December 2017. During our study we found male dengue patients 512 (59%) and female dengue patients 355 (41%). In Kuwait Teaching Hospital age group 16-30 (N=372, 43%) was highly affected followed by 31-45 (N=191, 22%), 1-15 (N=148, 17%), 46-60 (N=113, 13%) and 60 plus (N=43, 5%). Total 381 (44%) dengue patients were recorded in the month of October followed by September (N=250, 29%), August (N=105, 12%), November (N=95, 11%) and December (N=36, 4%).

4. Social factors affecting dengue virus transmission

The existing study indicates that several complex social factors associated with dengue virus transmission were noticed in the most urbanized areas of district Peshawar (Fig 2). Unplanned urbanization and increasing human population has resulted in unsatisfactory water sewerage system and substandard housing which provided best medium for the dispersion of vector mosquitoes (*Aedes*) in Peshawar. Similarly, the unrestricted movement of dengue patients from endemic to non-endemic areas also made the outbreaks more catastrophic. The unconstrained association of dengue patients and social factors has played a substantial role in the dispersal of dengue virus and its vector in Peshawar 2017.

5. Discussion

In the last two decades interspersed dengue outbreaks have been reported in Pakistan especially from Punjab and Khyber PakhtoonKhwa. The present research study indicates that dengue is expanding its geographical range in Peshawar. Khyber PakhtoonKhwa has witnessed some severe dengue outbreaks associated with significant human morbidity and mortality since 2010. After 2010 massive floods in province Khyber PakhtoonKhwa, the 2012 Peshawar dengue outbreaks were recorded with confirmed 245 dengue cases with 15 deaths^[5], followed by 2013 Swat dengue outbreaks with 6000 confirmed dengue cases and 48 deaths^[13] and now in 2017 Peshawar 23541 dengue cases with 108 deaths subsequently (DG Health, KPK 2017). All the reported dengue patients were divided into five age groups. A comparison was made between all groups and dengue incidence rate were found high (44%) in young age group of 16-30 followed by age group 31-45 (22%), 1-15 age group (18%), 46-60 age group (11%) and lowest in 60 plus age group (5%). The results of^[5] are in correlation with present results. They confirmed 185 dengue cases in different cities of Delhi with 105 (71.8%) patients having age of 15 plus and lowest number (3, 3.2%) was found in children having age less than five years. This may be due to the reason that adults in Khyber PakhtoonKhwa mostly spend their time in outdoor activities and exposed to risk factors^[5]. It has been concluded that adults are at more risk to Dengue in Khyber PakhtoonKhwa as compared to other age groups. In the present study, male population was more (59%) affected than female (41%). Same results have been found by^[5]. They found male dengue patients (89.32%) and female dengue patients (10.68%) in their study. Sharma *et al.* 2005 also found the same results. They studied total 185 cases in different zones of Delhi in which 68.10% (126) were male and 31.90% (59) were female. The most probable reason is that in both countries males are responsible for all outdoor activities while females are limited to home and consequently less affected. It has been concluded that Dengue Fever is more common in all those people who are exposed to risk factors; males in Khyber PakhtoonKhwa are responsible for all outdoor activities, therefore they are persistently at risk to mosquito bites and hence occurrence rate is high male as compared to female. The present findings are not in agreement with previous research study^[23]. Females were more common than males, representing 57.5% (n=2,637) of the overall study population. Among adult participants, female participation (75.0%) was significantly higher than males ($P<0.0001$). The majority of participants (77.9%; n=3,571) were younger than 18 years of age. This deviation may be due to difference in customs and traditions. The females in Peru are involved in outdoor activities, therefore, exposed to dengue risk factors. In age wise

incidence same results have been presented by Fahad *et al* 2018. The highest occurrence rate (45.50%) was observed in age group of 21-30 years followed by 20.63% in age group of 11-20 years and 18.51% in age group of 31-40 years. The present results of Dengue occurrence in male to female ratio with respect to age groups shows similarities with (Sharma *et al.*, 2004) who mentioned that there is high occurrence of Dengue in male (78.94%) at age above 15 years. Same results have been found by Khalid *et al.*, 215 who studied incidence of Dengue Hemorrhagic Fever in local population of Lahore in which most of the patients (80%) were adults while below the age of 15 years were only 18% patients. These results were analyzed for month wise occurrence of Dengue Disease. A total of 12782 patients were registered to LRH, KTH, HMC, RMI and KTHT Peshawar from August-December 2017. High dengue incidence was found in the month of October 42% followed by September 30%, August 17%, November 9% and December 2%. In the current data analysis high incidence was found in post-monsoon period October (42%) and similar observation was observed by^[5,18]. They found high incidence in the post-monsoon period suggesting that this period is highly suitable time for the dengue infection. Fahad *et al* 2018 revealed that occurrence rate was high in the hot season (September to October) as compared with the less hot season (October to November). Sharma *et al.*, 2004 mentioned that there is high occurrence rate (96.75%) of Dengue in post monsoon period, followed by the monsoon period (2.16%) and the pre-monsoon period (1.08%). The most probable reason is that during the post monsoon period there is the plenty of water available on the ground due to heavy rain falls in monsoon period for better growth and development of Dengue vector mosquitoes (*Aedes*). Our results are not in agreement with^[22]. They age group most severely affected in their study was 5-9 years old (679/100000 in 1997). The present research study observed maximum dengue virus infection in human males than females; similarly the individuals having age group of 16-30 (44%) years had highest dengue virus infection followed by 31-45 (22%). Our results are in accordance with the previous published reports^[20, 21]. The highest dengue infection in young age group may be due to outdoor activities. Moreover, the low dengue virus infection in females may be due to minimum exposed body parts, in KPK women wear complete and long arms shirts and scarp due to which they are fully protected from mosquito bites.

6. Conclusion

It was concluded that district Peshawar was found highly endemic for dengue infection. Male population (59%) was more susceptible to female (41%). Young age group 16-30 (44%) was highly affected by dengue virus as compared to others age groups. The present findings verified that if the epidemics come next year in district Peshawar, the risk for dengue will upsurge in the region and the DG Health KPK should take proper consideration to sidestep dengue outbreaks in future.

7. Author's Contribution

All authors contributed to the Manuscript. SF did sampling, collected data and wrote the manuscript. MB contributed to the study design and revised the manuscript. All authors reviewed and commented on final draft.

8. Conflict of interest

On the behalf of all authors, the corresponding author states

that there exists no conflict of interest among the authors.

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