Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Shah Fahad
1) Department of Zoology, Government College University Faisalabad, Pakistan
2) Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan

Luqman Khan
1) Department of Zoology, Government College University Faisalabad, Pakistan
2) Graduate School of Life Sciences, Tohoku University, Sendai, Japan

Attiya Iqbal
Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan

Imad Khan
Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan

Arshad Umar
Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan

Syed Hifza Muneer
Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan

Institutional based prevalence and occurrence of dengue disease in capital city Peshawar of province Khyber Pakhtunkhwa (KPK), Pakistan

Shah Fahad, Luqman Khan, Attiya Iqbal, Imad Khan, Arshad Umar and Syed Hifza Muneer

Abstract
The present research work was designed to focus on Dengue disease in Peshawar KPK, Pakistan to address the problem properly. Two months' data of Dengue disease patients from 14 Sep 2011 to 15 Nov 2011, who visited Lady Reading Hospital, Khyber Teaching Hospital & Hayat Abad Medical Complex for diagnosis. An informative Questionnaire was designed for data collection from mentioned hospitals. In LRH, 140 Dengue patients were recorded, in which 93.57% were male and 6.42% were female, of which the recorded mortality were 1.42%. In age wise prevalence, the people most affected fall in the age group of 21-30 years, which is 44.28% of the total population. In KTH, a total of 85 individuals were tested for Dengue fever with 56.64% positive cases, 14.11% negative and 28.23% were suspected. In gender wise prevalence the people more affected were 48.23% males and 9.11% females. The same age group was severely affected by dengue virus with 42.35% of the total population. In HMC, 363 individuals were examined in which 20.11% were positive and 79.88% were negative. In gender wise prevalence the people more affected were 68.87% male and 21.12% were females. The present research study will provide reports and recommendations to the concerned field and will make awareness of Dengue Disease among patients and the public of KPK for their safety. Moreover, same study should be conducted in large population size to determine the other risk factors.

Keywords: *Aedes aegypti,* LRH, KTH, HMC, dengue & Prevalence

1. Introduction
Dengue fever causes 50 million infections and 20,000 deaths worldwide each year [1]. *Aedes aegypti* mosquitoes are amongst the anthropophagic insects because they feed on human blood. Adult *Aedes aegypti* mosquito is the best known primary vector of dengue fever. Dengue infection is caused by any of four distinct serotypes of virus viz. DEN-I, DEN-II, DEN-III and DEN-IV [2]. *Aedes aegypti* is tropical and subtropical specie which cause a huge medical and financial burden by spreading Dengue fever, Yellow fever, Chikungunya and Zika virus [3].

Aedes aegypti transmits the dengue virus to humans through blood-feeding of an infected person. Later, that virus is transmitted to non-infected person. The adult female *Aedes aegypti* are the vectors of dengue fever exclusively [3]. Humans are not directly infected by male *Aedes aegypti* mosquitoes although; they play a significant part in the transmission cycle [4].

1.1 Morphology of *Aedes aegypti*
The morphology of *Aedes aegypti* body parts of head, neck, thorax and abdomen like mouth brush, spines, compound eye, antenna, comb spines, siphon tube, pectin teeth and anal papilla are described by various researchers. The antennae of adult *Aedes aegypti* are smooth and cylindrical in shape. It has a single hair [5]. *Aedes aegypti* adults have white scales that form the shape of a violin, on the dorsal (top) surface of the thorax. The abdomen is generally dark brown or black which may possess white scales [6]. Female *Aedes aegypti* are larger than males. Males have plumose antennae which is dense while females have less dense pylose antennae (sparse short hairs). Male *Aedes aegypti* mosquito mouthparts are modified for nectar feeding, and female *Aedes aegypti* mouthparts are modified for blood feeding. The proboscis of both sexes is dark [7].

Correspondence
Shah Fahad
1) Department of Zoology, Government College University Faisalabad, Pakistan
2) Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan

Fig 1: (a) Adult male *Aedes aegypti* (b) Adult female *Aedes aegypti*

1.2 *Dengue Fever (DF)*

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), rash, joints and muscles pain, hence it's named "break bone fever. Dengue fever is the most significant mosquito-borne viral disease today in tropical and sub-tropical countries mainly in Southeast Asia, the Pacific and the Americas. Illness is produced by any of the four dengue virus serotypes (DENV-I, DENV-II, DENV-III and DENV-IV) [8].

The four serotypes of dengue virus are responsible for up to 50-100 million cases of dengue fever (DF); approximately 500,000 cases progress to the more severe dengue hemorrhagic fever (DHF) and acute vascular permeability syndrome known as dengue shock syndrome (DSS), resulting in around 24,000 deaths, are reported annually [9]. Infection by one serotype does not confer immunity to the other 3, and sequential infections may predispose one to developing DHF and DSS. Thus, severe dengue disease has been traditionally associated with the human host's immune response (immunopathogenesis) rather than with viral genetic or phenotype differences. Currently, dengue viruses are maintained in a human-mosquito-human cycle, with *Aedes aegypti* serving as the principal vector [10]. Correct vector identification is very important to design strategies for managing vector-borne diseases because detailed taxonomic studies have focused on mosquitoes that are vectors of human disease while other species have received little attention.

1.3 *Epidemiology*

The most recent and updated estimate on dengue shows that each year 50 million infections and 20,000 deaths occur by dengue. According to the facts and figures mentioned above, it is thought that a dengue vaccine could be licensed in the coming next 5 years [11]. For the 1st time in history dengue has been reported since 18th century [12]. After Second World War due to urbanization of South East Asia, where millions of people migrated to cities from large villages and increasing economic growth, the epidemiology of dengue changed. The size of urban centers grew up rapidly with rapid increase in sewage systems and in polluted water reservoirs which provide a perfect environment for the breeding of *Aedes* mosquito. Thus, the dengue virus spread rapidly, and the disease leads to more severe forms, the Dengue Hemorrhagic Fever (DHF) and dengue shock syndrome (DSS) [13].
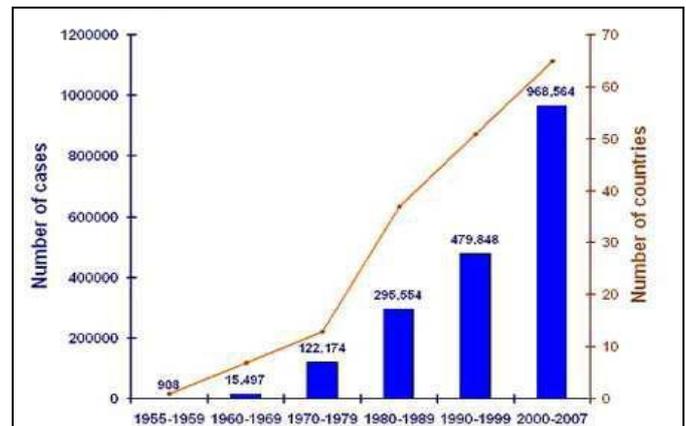

Fig 2: Average annual number of Dengue Fever (DF) and Dengue Hemorrhagic Fever (DHF) cases reported to WHO and average annual number of countries reporting dengue

Dengue is now endemic in over 100 countries of the world throughout the tropical and subtropical regions. It has been estimated that 100,000 cases of Dengue Hemorrhagic Fever (DHF), mainly in children are caused by any of the four serotypes of dengue virus in tropical Asia and Caribbean. In East Africa, dengue epidemics were increased in the 1980s, and recently all four serotypes of dengue virus have been found all over the continent Africa [13].
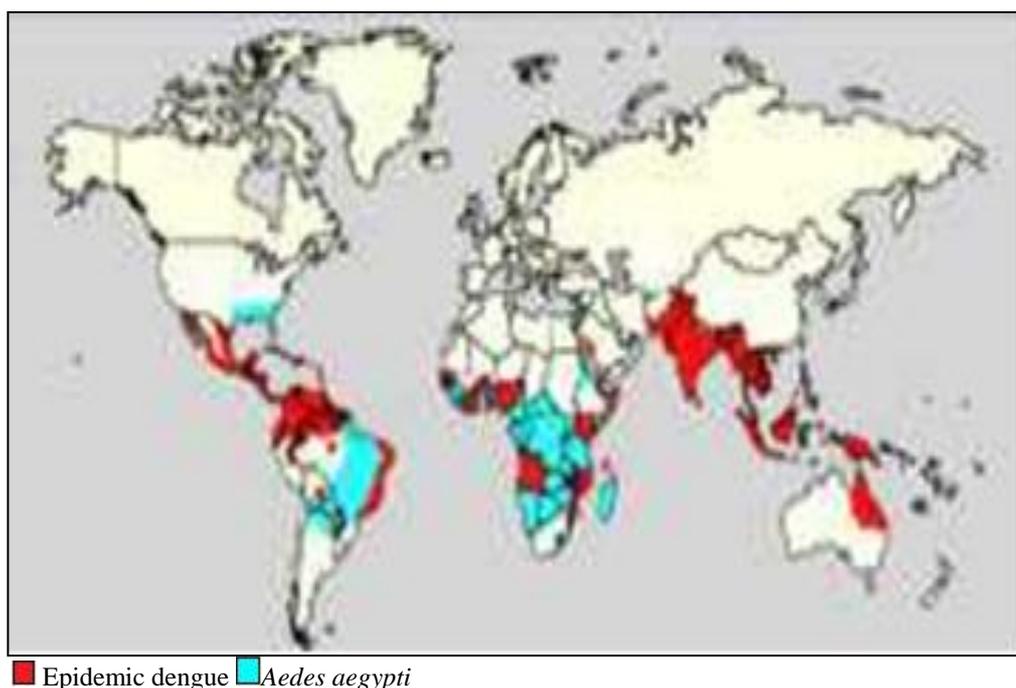

■ Epidemic dengue ■ *Aedes aegypti*

Fig 3: Worldwide dengue distribution (WHO 2011)

2. Materials and Methods

2.1 Study Area
Khyber Pakhtunkhwa, previously known as N.W.F.P is one of the five provinces of Pakistan located in the North-West of the country. Its total population was found 20.21 million (World Gazette 2009). Khyber Pakhtunkhwa, previously known as NWFP is in the North-West part of Pakistan and is one of the most legendary places on Earth. The total area of Khyber Pakhtunkhwa is 74,521 km2 (28,773 sq. mi).

In the present study, only those people were considered from Khyber Pakhtunkhwa who visited the Lady Reading Hospital (LRH), Khyber Teaching Hospital (KTH) and Hayatabad Medical Complex (HMC), referred by doctors or having some problems to perform tests for dengue disease.

Fig 4: Map of Peshawar Khyber Pakhtunkhwa (KPK), Pakistan

2.2 Study type and Sampling
The study is descriptive type and after visiting hospitals samples were collected from LRH, KTH

HMC Peshawar city respectively. The permission was granted by institutions authorities to have access to the patient files and to the concern Dengue patient wards of the hospitals.

2.3 Tests for detection of Dengue Fever
Following test was performed for Dengue Fever in patients that consulted the three hospitals.
BIOLINE Dengue NS 1 Ag + Ab Combo Test (Standard Diagnostics, INC, Korea)

2.3.1 Principles
The Dengue NS 1 Ag test device result window has two pre-coated lines, "T" (NS 1 Ag test Line) and "C" (Control Line). Both the Test Line and Control Line in result window are not visible before applying any samples. The Control Line is used for procedural control and should always appear if the test procedure is performed correctly. The Dengue NS 1 Ag can identify the dengue virus NS 1 antigen in serum, plasma or whole blood specimens with a high degree of sensitivity and specificity. Dengue IgG / IgM rapid test is designed to simultaneously detect and differentiate IgG and IgM antibodies to dengue virus in human serum, plasma or whole blood. This test can also detect all four Dengue serotypes by using a mixture of recombinant dengue envelope proteins. Dengue IgG / IgM test device has three pre-coated lines, "G" (Dengue IgG Test Line), "M" (Dengue IgM Test Line) and "C" (Control Line) on the surface of the device. All three lines in result window are not visible before applying any sample. The "Control Line" is used for

procedural control. Control Line should always appear if the test procedure is performed properly and the test reagents are of the Control Line are working. A purple "G" and "M" lines will be visible in result window if there are enough IgG / IgM antibodies to Dengue virus in the sample. If IgG / IgM antibodies to Dengue virus are not present in the sample, there is no color appearance in "G" or "M". When a specimen is added to the sample well, anti-dengue IgGs and IgMs in the specimen will react with recombinant dengue virus envelope proteins-colloidal gold conjugates and forms a complex antibodies-antigen. As this complex migrates along the length of the test device by capillary action, it will be captured by the relevant anti-human IgG and anti-human IgM immobilized in two test lines across the test device and generate a colored line (Shu and Huang, 2004)

2.3.2 Dengue NS 1 Ag
This test was used for the detection of Dengue disease. The three drops (about 100μl) of serum, plasma or whole blood was added into the sample well (S). After 15-20 minutes' results of the test are ready.

2.3.3 Positive
The presence of only one-color line within the result window indicates a positive result.

2.3.4 Negative
The presence of two color lines ("T" band and" C" line) within the result window on the left side, no matter which line appears first, indicates a negative result.

2.3.5 Invalid
No control ("C") line in the result window indicates an invalid result and it is recommended that the specimen may be re-tested.

2.3.6 Dengue IgG / IgM
By using capillary pipette, add 10 μl of serum, plasma or whole blood into the sample well (S). The four drops of assay diluent were put into the assay diluent well round shaped. After 20 minutes' results of the test are ready.

2.3.7 Positive
The positivity indicates primary dengue infection, secondary dengue infection and late primary or early secondary dengue infection.

2.3.8 IgM Positive (primary dengue infection)
The two lines "C" and "M" in the result window indicates that IgM is positive. It is positive even if "M" line is weak.

2.3.9 IgG Positive (secondary dengue infection)
The two lines "C" and "M" in the result window indicates that IgM is positive. It is positive even if "G" line is weak.

2.3.10 IgG and IgM Positive (late primary or early secondary dengue infection)
The three lines "C", "M" and "G" in the result window indicates that IgM and IgG are positive.

2.3.11 Negative
The only one line "C" in the result window at right indicates that the results are negative and there is no Dengue infection found.

2.3.12 Invalid
No control ("C") line in the result window indicates an invalid result and it is recommended that the specimen may be re-tested.

3. Results
The present study was designed to determine the frequency of Dengue disease in the inhabitants of different parts of Khyber Pakhtunkhwa, who accessed to the three main Government hospitals of Khyber Pakhtunkhwa, LRH, KTH and HMC for diagnosis and treatment. For this purpose, these hospitals were visited for data collection of two months (15 September 2011-15 November 2011). Data from each institution/hospital has been presented separately as follows;

3.1 Khyber Teaching Hospital (KTH)

KTH is in Sherpao on University road and opposite to the University of Peshawar. This institution was selected for the collection of data because of its convenience, and most of the dengue patients of the province have an easy access to it. The permission was granted by the Head of the Ward of KTH to review the record files of the Dengue patients. The record files were searched for dengue patients and data were also provided by the computer operator, IT section, KTH.

3.2 Hayat Abad Medical Complex (HMC)

HMC is in Hayatabad, Phase 2, on the main Jamrud road leading to Torkhum border, Afghanistan. Most patients for hospitalization chose this hospital because of the clean and clear environment, vast green gardens, well equipped operation theaters, highly qualified doctors, advance research laboratories and qualified molecular biologists. The application of collecting data was accepted by the authorities and the data were provided from the hospital.

Administrative help was provided by the staff of these hospitals. The computer operators of these institutes guided how to collect data and explained the terms and codes used in patient's files. The store keepers and computer operators provided the record files of dengue patients. Data from 15 September 2011 to 15 November 2011 was collected from these three main institutions of Khyber Pakhtoon Khwa.

3.3 Age Wise Occurrence of Dengue in LRH, KTH and HMC

In LRH, total 140 Dengue patients were registered, and the collected data were divided into eight age groups. Out of 140 total registered patients, 2 (1.42%) were in age group of 0-10 years, 31 (22.14%) were in age group of 11-20 years, 62 (44.28) were in age group of 21-30 years, (18.57%) were in age group of 31-40 years, 7 (5%) were in age group of 41-50 years, 9 (6.42%) were in age group of 51-60 years, 2 (1.42%) were age group of 61-70 years and 1 (0.71%) was in age group of above than 70 years of age. The percentage wise occurrence has been shown in table no 1. Results revealed that there are high percentage of Dengue patients in age group of 21-30 years and 11-20 years. It showed that Dengue fever effects the younger age as compared to the rest of the ages. In KTH total 49 Dengue patients were registered. Here also the data were divided into eight (8) age groups, out of 49, no dengue patient was present in age group of 0-10 years, 8 (16.32%) were in the age group of 11-20 years, 24 (48.97%) were in the age group of 21-30 years, 9 (18.36%) were in the age group of 31-40 years, 6 (12.26%) were in the age group of 41-50 years, 2 (4.08%) were in the age group of 51-60 years, 0 (0%) were in the age group of 61-70 years and 0 (0%) were in age above 70 years. The result showed that there was high occurrence rate in age group of 31-40 years. There was no record of age of any patients in HMC. The results have been mentioned in table no 1.

Table 1: Institutional Based Age Wise Occurrence of Dengue Disease in Khyber Pakhtunkhwa

S. No.	Age Groups (years)			Total No. of Patients			
			LRH		KTH		HMC
		Total	Percentage	Total	Percentage	Total	Percentage
1	0-10	02	1.42%	0	0%		
2	11-20	31	22.14%	8	16.32%		
3	21-30	62	44.28%	24	48.97%		
4	31-40	26	18.57%	9	18.36%		
5	41-50	07	5%	6	12.26%		
6	51-60	09	6.42%	02	4.08%		
7	61-70	02	1.42%	0	0%		
8	70 plus	01	0.71%	0	0%		

3.4 Gender Wise Occurrence of Dengue in LRH, KTH and HMC

In LRH, 140 Dengue patients were admitted in which 131 (93.57) were male and 9 (6.42%) were female. It showed that the Dengue occurrence rate is higher in male as compared to the female. In KTH, total 49 Dengue patients were enrolled in which 41 (83.68%) were male and 8 (16.32%) were female. These results showed that the Dengue occurrence rate was higher in male as compared to female. In HMC 73 patients were registered. Out of these 73 dengue patients, 62 (84.94%) were male and 11 (15.06) were female. These results indicated that the Dengue occurrence rate was higher in male as compared to female. (Table No 2).

Table 2: Institutional Based Gender Wise Occurrence of Dengue in Khyber Pakhtunkhwa

S. No.	Institute	Gender					
		Total	Male	Percentage	Female	Percentage	
1	LRH	140	131	93.57%	09	6.43%	
2	KTH	49	41	83.67%	08	16.33%	
3	HMC	73	73	84.93%	11	15.07%	

3.5 Month Wise Occurrence of Dengue Disease in LRH, KTH and HMC

The collected data were further split down for analysis of male to female ratio during each month.

It confirmed the percentage of occurrence of Dengue disease each month.

3.6 Month Wise Occurrence of Dengue in Gender at LRH

There were 140 Dengue patients in the Government Lady Reading Hospital. In these 140 Dengue patients, 96 (68%) were male and 6 (4.28%) were female from 15 September to 15 October and 35 (25%) were male and 3 (2.01%) were female from 15 October to 15 November. The highest difference was observed in male to female ratio was 63.72% in the month 15 September to 15 October. The highest dengue occurrence rate in male was 68% in the month from 15 September to 15 October. The lowest difference in male to female ratio was calculated 22.9% from 15 October to 15 November. It shows that the Dengue occurrence ratio was higher in male as compared male in these two months. Same results were also found in the second month of study in which there was a high occurrence of Dengue in male as compared to female. (Table No 3)

Table 3: Institutional Based Month Wise Dengue Occurrence in Male and Female in LRH

Dengue Patients of LRH				
Month	Male	Percentage	Female	Percentage
15 Sep-15 Oct	96	68%	6	4.28%
15 Oct-15 Nov	35	25%	3	2.01%

LRH=140

3.7 Month Wise Occurrence of Dengue
The collected data were further split down for analysis of male to female ratio during each month.
It confirmed the percentage of occurrence of Dengue disease each month.

3.8 Month Wise Occurrence of Dengue in Gender at LRH
There were 140 Dengue patients in the Government Lady Reading Hospital. In these 140 Dengue patients, 96 (68%) were male and 6 (4.28%) were female from 15 September to 15 October and 35 (25%) were male and 3 (2.01%) were female from 15 October to 15 November.
The highest difference was observed in male to female ratio was 63.72% in the month 15 September to 15 October. The highest dengue occurrence rate in male was 68% in the month from 15 September to 15 October. The lowest difference in male to female ratio was calculated 22.9% from 15 October to 15 November. It shows that Dengue occurrence ratio was high in male as compared male in these two months. Same results were also found in second month of study where high occurrence of Dengue in male as compared to female. (Table No 3)

Table 4: Institutional Based Month Wise Dengue Occurrence in Male and Female in LRH

Dengue Patients of LRH				
Month	Male	Percentage	Female	Percentage
15 Sep-15 Oct	96	68%	6	4.28%
15 Oct-15 Nov	35	25%	3	2.01%

LRH=140

3.9 Month Wise Occurrence of Dengue in Genders at KTH
In KTH 49 patients were registered as dengue affected individuals, out of these 49 Dengue patients 22 (44.89%) were male and 7 (14.28%) were female during the first month and 18 (36.73%) were male and (2.04%) were female during the second month. The highest dengue occurrence rate in male was 44.89% in the month during the first month. The lowest dengue occurrence rate in female was 1 (2.04%) in females during the second month. It showed that the Dengue occurrence ratio was high in male as compared to male in these two months. (Table no 4).

Table 5: Institutional Based Month Wise Dengue Occurrence in Male and Female in KTH Dengue

patients of KTH				
Month	Male	Percentage	Female	Percentage
15 Sep-15 Oct	23	46.93%	7	14.28%
15 Oct-15 Nov	18	36.73%	1	4.08%

KTH = 49, Total male = 41, Total female = 8

3.10 Month Wise Occurrence of Dengue in Gender at HMC
In HMC 73 patients were registered. Out of these 73 Dengue patients, 30 (41.09%) were male and 8 (10.95%) were female in first month and 32 (43.38%) were male and 3 (4.10%) were female in the second month. The highest Dengue occurrence rate in male was 43% in first month. The lowest dengue occurrence rate in female was 3 (4.10%) in female in the second month. It shows that dengue occurrence ratio was higher in male as compared male in these two months (Table no 5).

Table 6: Institutional Based Month Wise Dengue Occurrence in Male and Female in HMC

Dengue Patients of HMC				
Month	Male	Percentage	Female	Percentage
15 Sep-15 Oct	30	41.09%	8	10.95%
15 Oct-15 Nov	32	43.38%	3	4.10%

HMC = 73, Total male = 62, Total female = 11

3.11 Age Groups and Gender Wise Occurrence of Dengue
Age groups and gender wise occurrence of Dengue disease was also sorted out from the collected data.

3.12 Age Groups and Gender Wise Occurrence of Dengue in LRH
In LRH out, of 140 Dengue patients2 (1.42%) were male and no female were present in age group of 0-10 years, 29 (20.71%) were male and 2 (1.42%) were female, in age group of 11-20 years, 58 (41.42%) were male and 4 (2.85%) were female, in age group of 21-30 years, 24 (17.14%) were male and 2 (1.42%) were female, in age group of 31-40 years, 7 (5%) were male and no female, in age group of 41-50 years, 7 (5%) and 1 (0.71%) were female, in age group of 51-60 years, 2 (1.42%) were male and no female, in age group of 61-70 and 2 (1.42%) were male and no female in age group of 70 plus (Table 6). The highest Dengue occurrence 58% in male was in age group of 21-30 years. The highest Dengue occurrence (2.85%) in female was also observed in age group of 21-30 years. From the results it is clear that Dengue infection was high in young age male and female

Table 7: Age Groups and Gender Wise Occurrence of Dengue disease in LRH

Dengue Patients of LRH				
Age Groups	Male	Percentage	Female	Percentage
0-10	2	1.42%	0	0%
11-20	29	20.71%	2	2.85%
21-30	58	41.42%	4	2.85%
31-40	24	17.14%	2	1.50%
41-50	7	5%	0	0%
51-60	7	5%	1	0.71%
61-70	2	1.42%	0	0%
70 plus	2	1.42%	0	0%
Total	131	92.82%	9	7.83%

LRH= 140, Total male = 131, Total female = 9

3.13 Age Groups and Gender Wise Occurrence of Dengue in KTH

In KTH out of 49 patients no male or female was present in age group of 0-10 years, in age group of 11-20 years, 6 (12.24%) were male and 2 (4.08%) were female, in age group of 21-30 years, 19 (38.77%) were male and 5 (10.20%) were female, in age group of 31-40 years, 9 (18.36%) were male and 2 (4.08%) were female, in age group of 41-50 years, 5 (10.20%) were male and 1 (2.04) were female, in age group of 51-60 years, 2 (4.08%) and no female was present, in age group of 61-70 years, 4 (8.16%) were male and no female was present in age group of 70 plus, 4 (8.16%) were male and no female was present (Table 6). The highest Dengue occurrence (38.77%) in male was in age group of 21-30 years. The highest Dengue occurrence (10.20%) in female was also recorded in age group of 21-30 years. From the results Dengue infection was high in young age male and female.

3.14 Age Groups and Gender Wise Occurrence of Dengue in HMC

The age of patients was not present in registered files of HMC, therefore, the results of this parameter is absent.

Table 8: Age Groups and Gender Wise Occurrence of Dengue in KTH

Dengue Patients of KTH				
Age Groups	Male	Percentage	Female	Percentage
0-10	0	0%	0	0%
11-20	6	12.24%	2	4.08%
21-30	19	38.80%	5	10.20%
31-40	9	18.36%	0	0%
41-50	5	10.20%	1	2.04%
51-60	2	4.08%	0	0%
61-70	0	%	0	0%
70 plus	0	%	0	0%
Total	41	85.72%	8	14.28

KTH= 41, Total male = 41, Total female = 8

Discussion

Dengue is an infectious disease caused by a specific virus of the genus *Flavivirus* which belongs to the family *Flaviviridae*. There are four distinct serotypes of Dengue virus which are DEN-I, DEN-II, DEN-III and DEN-IV. The primary infection of Dengue virus results in Dengue Fever (DF) which leads to more severe form of the disease like Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS) [14]. Dengue is now endemic in over 100 countries of the world throughout the tropical and subtropical regions. Commercial air travels also increased greatly in these areas. The most dengue affected areas are Asia, Africa, South and Central America, Mexico, Caribbean, Pacific Islands, Hawaii and Australia. It has been estimated that 100,000 cases of Dengue Hemorrhagic Fever (DHF), mainly in children are caused by any of the four serotypes of dengue virus in tropical Asia and Caribbean. The highest increasing trend of the dengue disease has been noted in South East Asia, West Pacific, South America and the Caribbean [15]. Present study is based on occurrence and identification of risk factors of Dengue in Khyber Pakhtunkhwa Pakistan. For this purpose, total 588 tests were performed in which 262 were positive (234 male patients and 28 female patients) different hospitals were visited, data was collected, and different parameters were sorted out. Each parameter has been discussed as under:

All the patients were divided into eight different age groups. A comparison was made between all groups. The occurrence rate was high (45.50%) in middle age group of 21-30 years of age and lowest (0.52%) in the age group of 70 plus years. The present results showed that occurrence was high in middle age people. The results of [16] are also in correlation with present results. They confirmed 185 dengue cases in different cities of Delhi. There was 105 (71.8%) patients having age of 15 plus. Lowest number (3, 3.2%) was found in children having age less than five years. The present results are not in agreement with findings of [17] who conducted a three years study of 1,671 confirmed dengue cases in three Nicaraguan hospitals (California). There was high occurrence rate in children (74.47%) and low in adults (20.70%). This deviation may be due to the reason that adults in Khyber Pakhtunkhwa mostly spend their time in outdoor environment and persistently exposed to risk factors. It has been concluded that adults are at more risk to Dengue in Khyber Pakhtunkhwa as compared to other age groups.

In the present study, total 262 persons were found positive for Dengue disease. It has been concluded that males were more (89.32%) affected than females (10.68%). Same results have been found by Sharma et al. 2005. 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 external activities while females are limited to home and consequently less affected. Same results have also been found [18]. They studied total 6,577 cases of Dengue Fever in which 58.90% (3,874) were male and 41.09% (2,703) were female. The most probable reason is that in Malaysia, males are mostly exposed to all external activities while females are restricted to home hence having limited infection. The present findings are not in agreement with the study of [18] who found a high occurrence rate in female (54%) as compared to male (46%). This deviation may be due to difference in customs and traditions. The females in Sweden are also involved in outdoor activities, therefore, exposed to risk factors regularly. It has been concluded that Dengue Fever is more common in all those people who are exposed to risk factors; males in Khyber Pakhtunkhwa 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 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, 18.51% in age group of 31-40 years, 6.87% in age group of 41-50 years, 5.82% in age group of 51-60 years, 1.05% in age group of 61-70 years and 0-10 years. The lowest occurrence rate (0.52%) was in age group of 70 plus. The highest occurrence rate (89.54%) in male was observed in age group of 21-30 years. The highest occurrence rates (10.46%) in female was also observed in age group of 21-30 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. There was less occurrence of dengue in female (21.6%) as compared to Male. Same results have been found by (Khalid & Ghaffar, 2015) 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.

The present study was conducted between the duration of 2 months from 15 September 2011 to 15 November 2011. These results were analyzed for month wise occurrence of

Dengue Disease. A total of 262 patients were registered to LRH, KTH and HMC from 15 September to 15 November 2011. Out of 262 total patients, 169 (64.50%) were registered during the first month of study i.e. from 15th September to 15th October and 93 (35.50%) were registered during the second month of study i.e. from 15th October to 15th November. In the first month, out of 169 total patients, 148 (87.57%) were male and 21 (12.43%) were female. In the second month, out of 93 total patients, 85 (91.40%) were male and 8 (8.60%) were female. In present data analysis high incidence was found in post-monsoon period 169 (64.5%) and similar observation was also observed by Sharma *et al,* 2005 that high incidence was seen in the post-monsoon period suggesting that this period is highly suitable time for the dengue infection.

It has been 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, *Aedes aegypti.*

Conclusion

It was concluded that the Khyber Pakhtunkhwa province of Pakistan is highly epidemic for Dengue infection and male patients were more susceptible to infection as compared to female patients. Moreover, young age people were more affected compared to young age group and old aged subjects. Our study strongly recommended that an awareness program, educative efforts and prevention and control strategies is very necessary on urgent basis to prevent this deadly infection up to some extent.

Recommendations

1. To constitute a separate "Dengue Control Cell" on the district level.
2. There must be proper control of dengue vector i.e. *Aedes aegypti*, by Using of insecticides and larvicides to eradicate the vector breeding sources and its possible breeding sites.
3. In the male the risk of Dengue can be minimize by limiting their outdoor activities while the female should avoid the half sleeves clothes.
4. People must be educated about the transmission, clinical effects, diagnosis and its prevention, so that occurrence rate may be managed.
5. Bed nets and mosquito nets should be hanged properly on doors and windows.
6. Mosquito repellents should be used regularly to minimize risks of mosquito bites.
7. While performing outdoor activities full and complete dress should be used and all the expose body parts should be covered properly.
8. The Ministry of health and dengue expert committee Pakistan should use electronic and print media to create awareness in people.
9. Disease epidemiology and characterization of DENV is the demand of today to reduce the spread of dengue disease in Pakistan.

References

1. Ballenger-Browning, Kara K, Elder, John P. Multi-modal *Aedes aegypti* mosquito reduction interventions and dengue fever prevention. Tropical Medicine & International Health. 2009; 14(12):1542-1551.
2. Balmaseda, Angel, Hammond, Samantha Nadia, Pérez, Maria Angeles *et al*. Assessment of the World Health Organization scheme for classification of dengue severity in Nicaragua. The American journal of tropical medicine and hygiene. 2005; 73(6):1059-1062.
3. Carpenter, Stanley J, La Casse, Walter J. Mosquitoes of North America (North of Mexico): Univ of California Press, 1974.
4. Clements, Alan Neville. Development, nutrition and reproduction. The biology of mosquitoes. 1992; 1:509.
5. Ferreira, Germano LC. Global dengue epidemiology trends. Revista do Instituto de Medicina Tropical de São Paulo. 2012; 54:5-6.
6. Gibbons, Robert V, Vaughn David W. Dengue: an escalating problem. BMJ: British Medical Journal. 2002; 324(7353):1563.
7. Gubler, Duane J. The global emergence/resurgence of arboviral diseases as public health problems. Archives of medical research. 2002; 33(4):330-342.
8. Gubler, Duane J, Meltzer, Martin. Impact of dengue/dengue hemorrhagic fever on the developing world. Advances in virus research. 1999; 53:35-70.
9. Haider, Muhiuddin, Turner, Jamie. Variables that May Affect the Transmission of Dengue–A Case Study for Health Management in Asia Topics in Public Health: In Tech, 2015.
10. Halstead, Scott B. Neutralization and antibody-dependent enhancement of dengue viruses. Advances in virus research. 2003; 60:421-467.
11. Jahan, Fridous. Dengue fever (DF) in Pakistan. Asia pacific family medicine. 2011; 10(1):1.
12. Jamaiah I, Rohela M, Nissapatorn V, Hiew FT, Mohammad Halizam A, Noor Liani H *et al*. Retrospective study of dengue fever (DF) and dengue hemorrhagic fever (DHF) patients at University Malaya Medical Center, Kuala Lumpur, Malaysia in the year 2005. Southeast Asian Journal of Tropical Medicine and Public Health. 2007; 38:224.
13. Jiménez-Clavero Migue Á. Animal viral diseases and global change: bluetongue and West Nile fever as paradigms. Frontiers in genetics. 2012; 3.
14. Khalid, Bushra, Ghaffar, Abdul. Environmental risk factors and hotspot analysis of dengue distribution in Pakistan. International journal of biometeorology. 2015; 59(11):1721-1746.
15. Organization, World Health, Research, Special Programme for, Diseases, Training in Tropical, Diseases, World Health Organization. Department of Control of Neglected Tropical, Epidemic, World Health Organization, & Alert, Pandemic. (2009). Dengue: guidelines for diagnosis, treatment, prevention and control: World Health Organization.
16. Poulin, Brigitte, Lefebvre, Gaetan, & Paz, Leire. Red flag for green spray: Adverse trophic effects of Bti on breeding birds. Journal of Applied Ecology. 2010; 47(4):884-889.
17. Sharma SN, Saxena VK, Lal, Shiv. Study on susceptibility status in aquatic and adult stages of *Aedes aegypti* and *Ae. albopictus* against insecticides at international airports of south India. The Journal of

communicable diseases. 2004; *36*(3):177-181.

18. Tuiskunen Bäck, Anne, Lundkvist, Åke. Dengue viruses–an overview. Infection ecology & epidemiology. 2013; 3(1):19839.

19. Zettel, Catherine, Kaufman, Phillip. Yellow fever mosquito *Aedes aegypti* (Linnaeus) (Insecta: Diptera: Culicidae): Citeseer, 2012.