Original Article

Dengue Fever Epidemiological Investigation In The District Rawalpindi, Punjab, Pakistan

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Abstract

The mosquito-borne virus that causes dengue fever has emerged as a major public health problem in recent decades. Dengue fever prevalence in District Rawalpindi was investigated in this study, between August to October, 2022. About 160 blood samples were taken from patients at the Islamabad Medical Lab (Rawalpindi, Punjab) who were suspected of having dengue fever based on their symptoms. Dengue IgM, IgG, and NS1 (Nonstructural protein antigen of virus) serology tests were carried out. About 116 males and 44 females were found to have contracted dengue fever. The 21-30 age group was the largest single demographic, 78 people from Rawalpindi, 47 people from Taxila and 35 people from Kahuta were the worst hit in the district Rawalpindi. As a result, the health department needs to take charge and start spreading awareness about the importance of keeping public spaces clean. Efforts to combat diseases and infections spread by vectors should actively involve the local populace.

Keywords: Demographic, dengue fever, mosquito-borne, occurrence, serological test

Introduction

Dengue fever is a viral infection that is transmitted to humans by the bite of an infected mosquito. Flavivirus, a genus of RNA viruses transmitted to humans by the Aedes mosquito, includes four serotypes that can cause dengue fever: DEN1, DEN2, DEN3, and DEN4. The dengue virus's ability to persist in the environment is significantly influenced by climatic factors, such as temperature. Dengue fever is a febrile serious illness that presents a wide range of clinical conditions, from oligosymptomatic to numerous clinical cases with bleeding and shock that can result in death (Srikiatkhachorn et al. 2011; Waseem et al. 2022).

The Aedes mosquito is the vector for the virus that causes dengue fever. There are four serotypes of this virus that have been identified in the wild. The Aedes species is present in some parts of Cameroon, as described by Amarasinghe et al., 2011, and additional studies show that this vector only attacks during the day. As a result of the prevalence dengue is a major issue for public health, nearly three billion individuals are in at-risk locations. Extremely high rates of movement and mortality have been attributed to this virus in highly endemic urban and suburban settings (Ebi & Nealon, 2016a). There have been dengue epidemics in various African nations since 2010. Dengue is endemic in every member state of the region, and the region accounts for more than half of the dengue burden worldwide. India,

Pakistan, Indonesia, and Sri Lanka are three of the thirty nations with the highest levels of endemic disease in the world (Ebi & Nealon, 2016b; Setiono Basuki et al., 2010). Even if case management has improved and the CFR has been reduced, the number of dengue cases has steadily increased over time despite control measures. Dengue cases in the Southeast region grew by 46% from 2015 to 2019 (from 451,442 to 658,301), although mortality fell by 2% over that time (from 1,584 to 1,555) (Khan et al., 2018; Srikiatkhachorn et al., 2011). High rates of population growth, insufficient water supply and poor storage techniques, sewer, and wastewater treatment systems, growth in international trade and tourism, climate change, changes in public health policy, and the emergence of hyper-endemicity in urban areas are just a few of the factors that contribute to the expansion and transmission of dengue mosquito vectors and viruses in SEAR. The existing scenario of a high burden of dengue incidence is accompanied by a lack of extensive sustainable vector control and efficient treatment (Khan et al., 2018; Qamash et al., 2021).

Dengue typically presents with a rapid high fever, vomiting, nausea, headache, joint and muscular discomfort, and a rash resembling measles after 2–7 days of incubation. In most cases, symptoms improve for 3–4 days, worsen for a week, and then resolve suddenly after a week. Extreme forms of dengue fever include the potentially fatal hemorrhagic form and dengue fever with shock syndrome. Dengue infection needs to be diagnosed as soon as possible, as doing so can cut down on the number of fatalities caused by the disease. The NS1 antigen detection allows for a rapid dengue diagnosis, while IgM antibody testing must wait until day 6 following the beginning of fever (Andries et al., 2016; Khan et al., 2018). Direct diagnosis can be confirmed through the detection of viral genomic DNA or its SN1 antigen, whereas indirect diagnosis can be confirmed through the detection of particular antibodies (IgM and IgG) in the blood. This may make it possible to tell the difference between initial and subsequent acute dengue infections. Gene amplification (RT-PCR) or detection of the virus's NS1 antigen can provide an early diagnosis. From day one to five after the onset of symptoms, NS1 antigen can be identified by immunoenzymatic or immunochromatographic methods as a glycoprotein protein (Andries et al., 2016; Halsey et al., 2014). This protein appears to be essential for the virus's survival and reproduction and an intense humoral reaction is triggered by this. Even when viral RNA is not detectable by RT-PCR, NS1 antigen can be found in the blood from the first day following the onset of fever up to day 7. This is true even when IgM antibodies are present. Acute dengue infection can be diagnosed with the simultaneous detection of NS1 protein and IgM antibodies. This research aims to quantify the prevalence of acute dengue infection in feverish children younger than 15 years old who present to hospitals in a subset of Cameroonian regions (Alidjinou et al., 2022; Tchuandom et al., 2019).

The Aedes aegypti mosquito is responsible for the rapid spread of the Dengue virus spread throughout most of the Americas, Africa, China, and Australia in 1980, and this epidemic has continued in regions that are highly exposed to the mosquito ever since. Many nations in the South and Southeast Asian region have recorded dengue cases, including India, Sri Lanka, and Thailand. There were 44,456 cases registered in Sri Lanka in 2012, with 10,000 of those being filed in the city of Colombo alone (Lashgari et al., 2019; Liu et al., 2020). Five thousand cases and ninety-three deaths were reported in 2000 and 2012, while six thousand, one hundred and four cases, and fifty-eight deaths were reported in 2002 in Bangladesh. In Pakistan, the dengue virus caused multiple epidemics between 1994 and 2011. Only 12 people out of 174 were diagnosed with dengue fever in Pakistan's initial case report in 1982 (Ejaz Alam, 2014; Halsey et al., 2014). Travelers are largely responsible for the spread of dengue fever, which was first observed in 1994 in Karachi and first recorded in Khyber Pakhtunkhwa's Swat district in August 2013. In 2013, 3177 dengue cases were reported in Khyber Pakhtunkhwa, making it the province with the highest number of dengue infections in Pakistan. During the period between August 2013 and November 2016, 5,569 people in Swat were diagnosed with dengue fever; 37 of them would ultimately succumb to the disease. From 2013 to 2015, those between the ages of 16 and 30 and those between the ages of 31 and 45 were the most frequently affected by dengue fever. According to previous research in the Khyber Pakhtunkhwa province, males had twice the infection rate as females, with a male to female ratio of 2:1 (Liu et al., 2020; Qamash et al., 2021). From Swat, the epidemic spread to the neighboring districts of Malakand, Kohat, Mansehra, the lower and upper Dir, Peshawar, and eventually to Mardan, Nowshera, and Swabi. As of November 7th (2017), Dawn News reported 7 deaths and 11,685 confirmed cases in Peshawar. In Mardan, there have been a total of 12 cases of dengue fever as of August 25. As of August 22, 2017, 18 instances had been reported in

Nowshera. With the current state of dengue fever in Khyber Pakhtunkhwa in mind, this study aimed to determine the typical prevalence of dengue in various parts of Swabi and the factors that contribute to the spread of dengue. According to Dawn NEWS published on October 7th (2022), as many as 80 people were infected with dengue in the capital in the last 24 hours, taking the tally of the season to 2,759 with six casualties. Moreover, 277 cases emerged in the district Rawalpindi (Bessoff et al., 2010; Qamash et al., 2021). According to a document, during the current season, 1,628 cases have been reported from the rural areas and 1,131 from the urban areas of Islamabad. Two people each died in Tarlai and Rawat, and one each in F-7 and I-8. As many 277 confirmed dengue patients were admitted to three government hospitals - 73 in Holy Family Hospital (HFH), 118 in Benazir Bhutto Hospital (BBH) and 86 in the District Headquarters (DHQ) Hospital. Officials said 215 of the patients were from Rawalpindi, 44 from Islamabad, seven from Attock, two from Chakwal, Haripur and Kotli and one from Abbottabad, Nowshera and Mansehra and Karachi. Of the new cases, 33 cases were reported from Potohar Town, 22 cases from Rawalpindi Cantonment, 13 cases from the city, eight cases from Chaklala Cantonment, five cases from rural areas, four cases from Taxila, and one each case from Kalar Syedan and Kahuta (Halsey et al., 2014; Khan et al., 2018).

Methods and Materials

Study design

This epidemiological investigation of dengue fever in the District Rawalpindi was observed by department of Zoology, Rawalpindi Women University, Rawalpindi. The total patients of dengue fever were studied with age group and gender division (Nighat et al., 2022).

Locations description

The data was collected from clinical labs of Rawalpindi, Taxila and Kahuta from June to September, 2022 (Fig. 1). The data was collected from the patients via questionnaire, about 160 blood samples were taken from patients who were suspected of having dengue fever. This was done so that a serological test could be performed to determine the true frequency of dengue fever in District Rawalpindi. Eligibility requirements Regardless of gender, race, or ethnicity, all children aged 4 months to 15 years old who had a clinic record of an oral temperature of 38°C or higher and a fever of 7 days or longer with at least one of the following symptoms were included in the study. The patients were grouped by age from 4 months to 85 years (Nighat et al., 2022).

Figure 1. Rawalpindi district sampling locations.

Dengue virus detection

The Dengue Duo test was used for the detection of Dengue virus in this study (SD Biosensor, Republic of Korea), an immunochromatographic assay for the detection of NS1 antigen and Dengue virus-specific IgM and IgG antibodies in human serum, plasma, and whole blood. Dengue virus-specific IgM and IgG could be detected alongside the original infection by using the NS1 antigen as a marker. Results from the screening test were available in about 15 minutes, and they were very sensitive and specific. For dengue testing, 2 mL sterile Eppendorf tubes were used to collect all the possible blood samples. All of the contents of the sample tubes were transferred to the centrifuge and centrifuged for 1 minute. After adding one drop of NS1 buffer to 100 l of test serum on an NS1 quick test strip and waiting 15 minutes, a positive result is indicated if the line turns from blue to red. After adding 2 drops of IgM, IgG buffer to 100 l of test serum on an IgM, IgG antibody quick test strip and waiting 15 minutes, a positive result was determined if the test line turned red. To analyze the data, we used Microsoft Excel 2010 and displayed the results numerically and graphically as percentages (n%) (Lashgari et al., 2019; Pal et al., 2014).

Results

Out of confirmed 160 dengue cases, 116 (44%) were male and 44 (27.5%) were female (Fig. 2). The highly affected age group was 16-25 years, 25-45 years, followed age group 46-55 years, 56-65 years, 66-75 years, 0-15 years, 76-85 years (Fig. 3). The highly affected area in District Rawalpindi was city Rawalpindi followed by Taxila and Kahuta (Fig. 4).

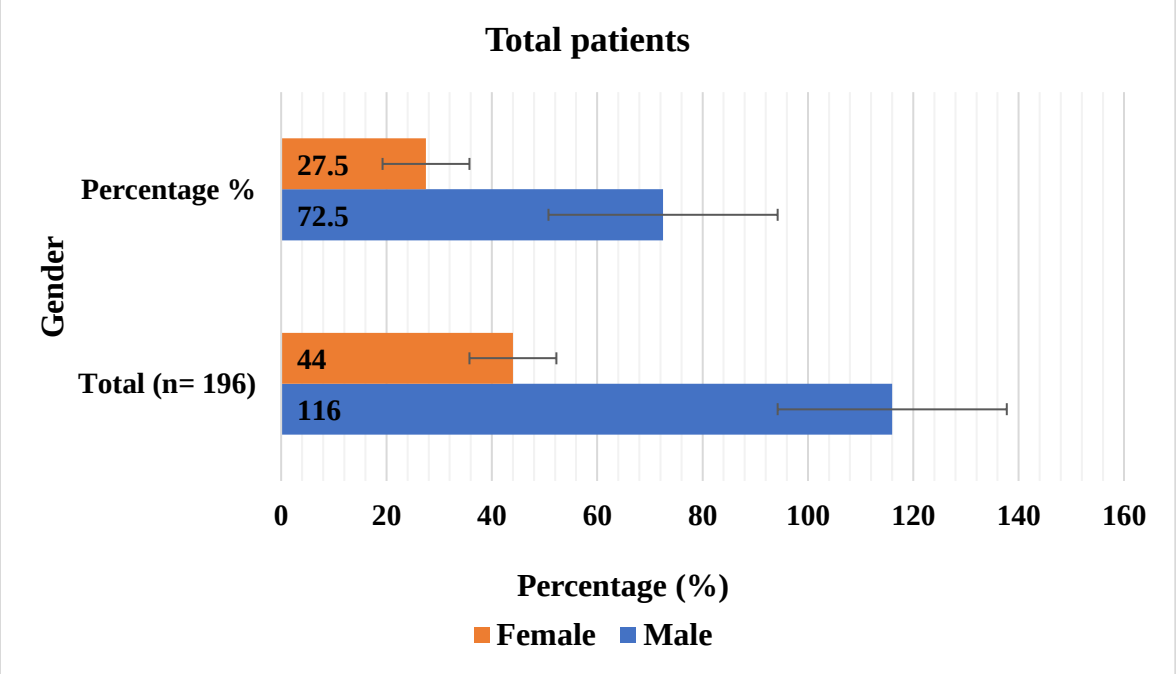

Figure 1. Total number of dengue cases in males and females.

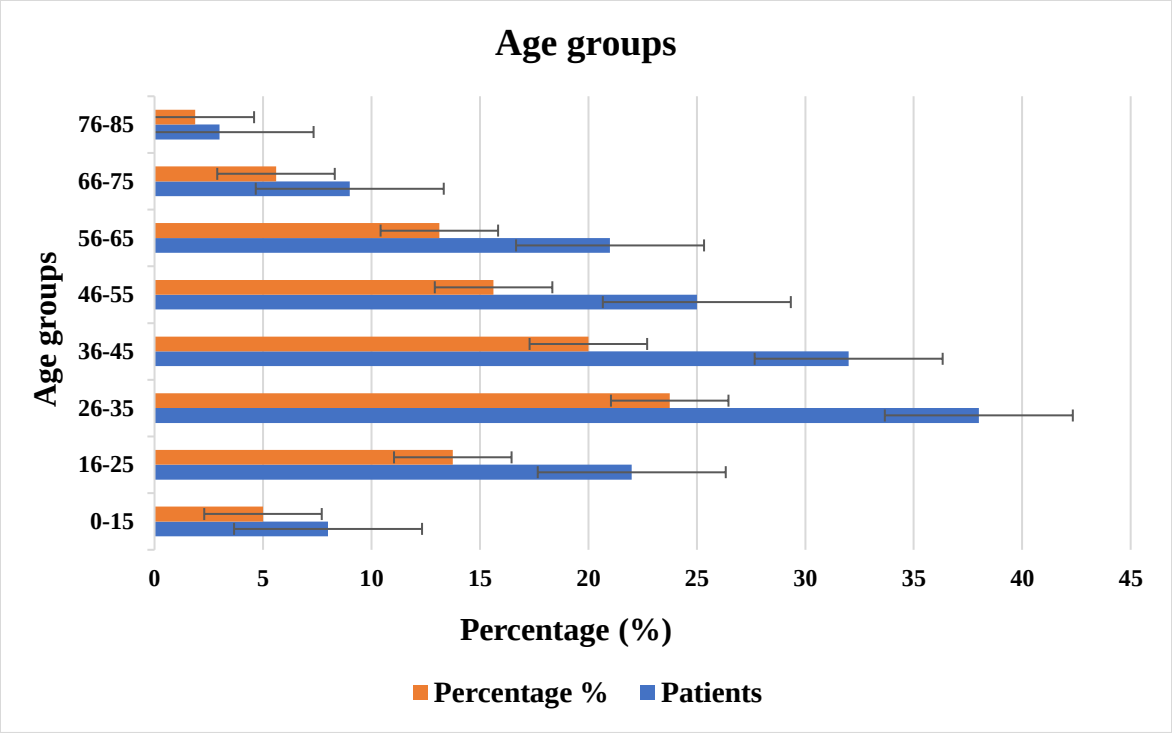

Figure 2. Distribution of dengue cases in age groups in percentage.

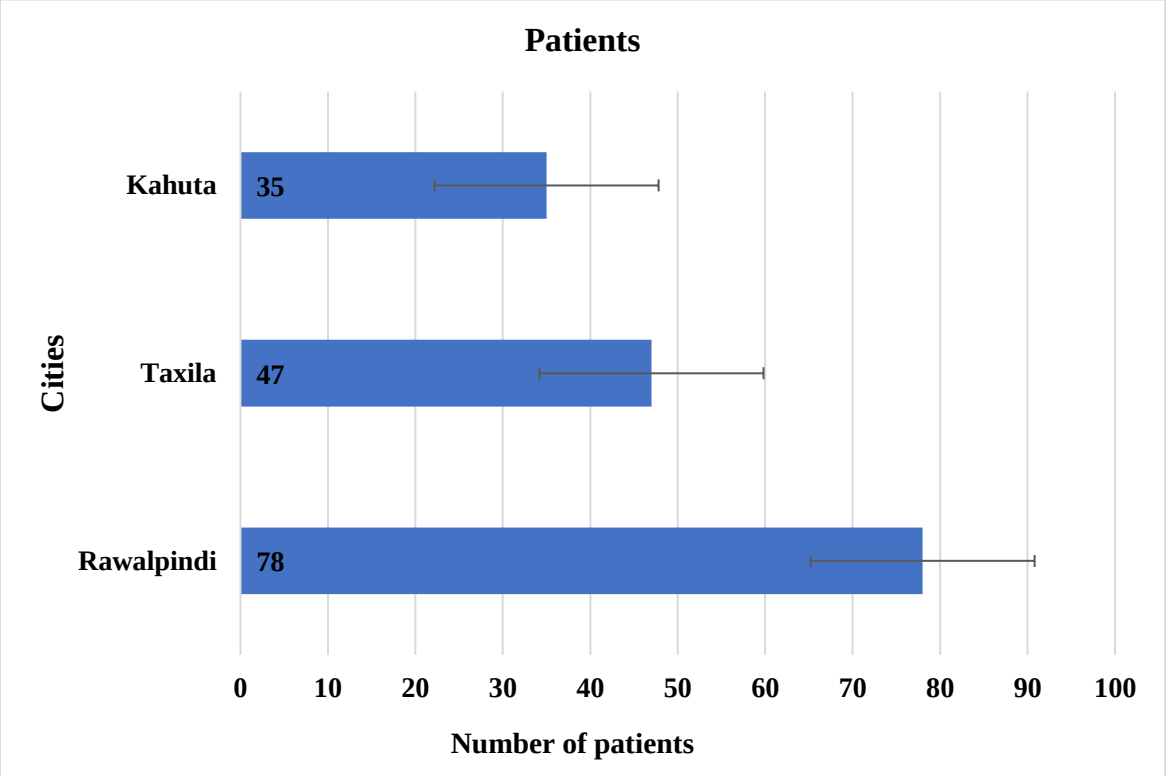

Figure 3. Dengue cases in different cities.

The patients who were seropositive for the DENV-NS1 antigen (acute dengue: n = 23/160) were divided noticeably as follows, as shown in Table 1, patients who were positive to DENV-NS1 with antiDENV IgM or IgG antibodies were shown in table 1. The infant individuals did not test positive for the acute dengue marker (Table 1). Children over five-year old, however, tended to manifest acute dengue. However, there was no correlation between acute dengue and patients's age groups (P = 0.0815). (Table 2). The females (n=16) had acute dengue, which was substantially more than of males (n=43, P = 0.0488).

Table 1. The distribution of acute dengue and serological markers in patients.

Variables		**Patients with acute dengue**	**Dengue serological markers**			**P-value (Chi-square)**
			NS1	**NS1 + IgM**	**NS1 + IgG**	
Gender	Female (n = 44)	16	1	7	1	0.0488 (3.88)
	Male (n = 116)	43	2	12	3	
Age groups	4 months-5years (n = 2)	0	0	0	0	0.0815 (5.01)
	6–15 years (n = 8)	4	1	3	1	
	16–25 years (n = 22)	12	2	4	1	
	26-45 years (n= 70)	32	12	11	9	
	46-55 years (n=25)	8	2	2	2	
	56-65 years (n= 21)	12	4	3	2	
	66-75 years (n= 9)	6	1	2	2	
	76-85 years (n= 3)	1	1	0	0	

Discussion

The findings of this research showed that Dengue fever was extremely common in the Rawalpindi district in year 2022. The results of this investigation demonstrated that the arboviral pathogen is present in both rural and urban settings worldwide (Lashgari et al., 2019; Srikiatkhachorn et al., 2011). According to estimates from the city, there are 2,327,000 people living in the Rawalpindi district, and just 0.012 percent of them have contracted dengue fever. The recent research indicates that males make up a larger proportion of the population than females (Zhang et al., 2015). Male patients made up 13 (52%) of the total in a 2011 study of the same kind in the Mardan district, while female patients accounted for 12 (48%) of the total. In 2011, researchers found that 16 men (77% of those affected) and 5 women (23% of those affected) lived in the district of Nowshera (Ebi & Nealon, 2016a; Waseem et al., 2022).

The current study's findings are consistent with those of a previous study conducted in Rawalpindi district between August 2013 and November (WHO, 2019), which found that of the 5365 patients infected by dengue fever, 3778 (70.42%) were male and 1587 (29.58%) were female. Males have a higher mobility rate than females. For the most part, women in Pakistan stay at home, while men go out to work and travel for other errands. Sixty-two people (31.60%) between the ages of 21 and 30 and 28 people (14.30%) between the ages of 11 and 20 were affected severely in this study. For the years 2017, 2018, and 2019, a similar survey indicated that those between the ages of 16 and 30 were the most numerous. Dengue fever is most common in the most vulnerable age range because those people are more likely to be out and about in the mornings and evenings, when the virus is most active (Khan et al., 2018; Qamash et al., 2021).

Due to the fact that some of these authors, unlike the present study, relied on the detection of dengue-specific IgM to identify acute dengue cases, which in the absence of the NS1 antigen may refer only to a secondary dengue and thus a late diagnosis, it is possible that this is the cause of the differences seen (Alidjinou et al., 2022; Gyurech et al., 2016). Although areas of cross-reactivity with Zika virus have not yet been examined, false positive results of NS1

antigen detection for this dengue protein have been reported in a patient with acute Zika virus infection. In order to increase the rates of dengue diagnosis, it is preferable to combine the dengue-specific antigen (NS1) and specific antibodies (IgM and IgG) (Hu et al., 2011; Tchuandom et al., 2018).

Conclusion

According to the results of this study, males were more likely to contract dengue than females. Those between the ages of 26 and 45 made up the bulk of the population. In addition, Rawalpindi was identified as the most severely impacted location in the Rawalpindi district. Because of this, the health department needs to act by teaching people how to keep their homes and communities clean on a fundamental level. It's important to get people involved in the fight against vector-borne illnesses.

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