Abasyn Journal of Life Sciences

Prevalence of dengue fever among patients visiting Dogra Hospital District Khyber, Pakistan

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Abstract

Dengue Fever holds immense importance as a critical public health concern, both in Pakistan and globally, necessitating thorough investigation and innovative approaches for its management and treatment. This study aimed to investigate the prevalence of Dengue Fever among patients visiting Dogra Hospital in District Khyber, Pakistan. A total of 108 patients were included in the study, comprising 69 (63.88%) males and 39 (36.11%) females. The study population was categorized into four distinct age groups: 1 to 20 years, 21 to 40 years, 41 to 60 years, and above 60 years. Notably, the highest incidence of Dengue patients was found in the 21-40 age group. Gender-based differences in clinical manifestations were observed, with fever, nausea, vomiting, body aches, and headache being more prevalent in males, while no patients exhibited bleeding symptoms. Furthermore, serological tests were conducted to gauge the prevalence of Dengue-specific markers. Results indicated that 67.5% of patients tested positive for NS1 Antigen, 4.6% for Dengue IgM antibodies, and 1.8% for Dengue IgG antibodies. Age-stratified analysis revealed a higher NS1 antigen positivity rate among patients aged 1-20 years and 41-60 years, whereas IgM antibodies were more prevalent within the 1-20 years age group. Interestingly, Dengue IgG antibodies were notably prominent among individuals in the 20-39 age group. In light of these findings, it is imperative to acknowledge that Dengue Fever continues to be a significant health concern in the Khyber region of Pakistan. To complement these insights, it is worth mentioning that ongoing research and medical advancements have led to the development of new and promising treatment modalities for Dengue Virus. These innovative approaches include antiviral medications, supportive care, and vaccine developments. As the understanding of Dengue management evolves, the incorporation of these emerging remedies holds promise in mitigating the impact of this disease on affected populations.

Keywords: Dengue Fever, prevalence, serological tests, clinical manifestations, age distribution, Pakistan

1. INTRODUCTION

Dengue is a communicable illness induced by one of the four dengue virus strains, namely Dengue Virus (DENV) serotypes 1 through 4[1]. Dengue is a disease transmitted through mosquitoes, primarily by the female Aedes mosquito. The infection is largely prevalent in tropical and subtropical areas, posing a risk of infection to nearly one-third of the global population[2]. Dengue virus (DENV) infection can lead to a wide spectrum of health outcomes, spanning from mild, asymptomatic cases known as dengue fever (DF) to severe conditions such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), which have the potential to be life-threatening[3]. The global spread of DENV has experienced a significant increase, attributed to rapid urbanization, the rise in international travel, limited mosquito control measures, and the process of globalization[4].

Dengue is a viral infection transmitted by mosquitoes and is known to afflict approximately 390 million individuals annually[5]. Dengue is a viral infection transmitted by mosquitoes, and it impacts approximately 390 million individuals annually[6]. The first case of dengue in Pakistan was reported from Hub, in Baluchistan in 1960, at that time Pakistan population was 45.9 million. From 1960 to 1980, there were only 12 dengue cases reported in Pakistan[7]. Dengue is considered endemic in numerous tropical and subtropical nations, and a significant factor contributing to its spread is the extensive human migration. While the *Aedes aegypti* mosquito is originally native to Africa, global movements of people have facilitated the dissemination of dengue, leading to *Aedes aegypti* becoming one of the primary vectors responsible for the transmission of the disease[8].

These viruses are transmitted by female Aedes mosquitoes (Diptera: Culicidae), particularly the *Aedes aegypti* (Linnaeus) and, to a lesser extent, the *Aedes albopictus* (Skuse). These mosquitoes feed on human blood both indoors and outdoors from dawn to dusk and are prevalent in tropical and subtropical regions, especially in urban environments. They have also been observed to spread to rural areas. In addition to dengue, these mosquitoes are capable of transmitting other diseases such as chikungunya, Zika infection, and yellow fever[9]. Aedes mosquitoes thrive in environments with stagnant water, which can include various sources such as water containers, puddles, water tanks, plant vessels, tree holes, old tires, and locations with inadequate sanitation practices. These water sources provide breeding grounds for Aedes mosquitoes, contributing to their proliferation[10].

The available treatment choices are quite restricted and mainly involve providing supportive care. Researchers have been exploring innovative therapeutic approaches, including antiviral drugs and monoclonal antibodies, aimed at targeting the dengue virus directly[11]. Monoclonal antibodies have shown promise in the treatment of dengue virus infections. These antibodies are designed to specifically target and neutralize the dengue virus, which can help reduce the severity of the disease and improve patient outcomes[12]. The development of new antiviral drugs for dengue is an active area of research, and several promising candidates have emerged in recent years. These antivirals are designed to target the dengue virus directly and inhibit its replication within the human body. Some of the approaches and compounds being explored for dengue antiviral development include NS5 polymerase inhibitors and NS3 protease inhibitors[13].

In recent years, the prevalence of dengue virus in District Khyber and its neighbouring regions has become a pressing concern. The rapid urbanization, increased international travel, and challenges in effective mosquito control have contributed to the expansion of this mosquito-borne disease. The study was conducted to find out the prevalence of dengue fever in district Khyber.

2. MATERIALS AND METHODS

2.1 Studied Area

Khyber District, situated in the north-western region of Pakistan, is characterized by its diverse geographical features, encompassing a mix of rugged mountainous terrain and fertile valleys. The district experiences a semi-arid climate, marked by pronounced seasonal variations. Summers are typified by high temperatures, often exceeding 40°C (104°F), while winters are comparatively mild. Humidity levels in Khyber District display seasonal fluctuations, with lower relative humidity observed during the hot, dry summer months and potential increases during the monsoon season

2.2 Study design and period

The study in question was conducted at DHQ Hospital Dogra District Khyber, located in the province of Khyber Paktunkhwa (KP), Pakistan. For this study, the research team included all individuals who tested positive for the Dengue Virus, irrespective of their age and gender. This inclusive approach aimed to comprehensively assess the impact and prevalence of the virus within the community served by DHQ Hospital Dogra. To maintain the study's focus and relevance, individuals who exhibited fever and related symptoms but tested negative for the Dengue Virus were excluded from the research study. This rigorous methodology ensures that the study's findings are specifically related to Dengue Virus-positive cases, providing valuable insights into the disease's prevalence and impact in the region. A total of 108 patients were included in the study from DHQ Hospital Dogra from 1st August 2021 to 30 October 2021.

2.3 Sample collection and processing

Blood samples of approximately 2 millilitres were obtained in 5cc sterile syringes from patients using red-tubes containing citrate. The patients were briefed about the research study through a written consent research performa.

The current study consisted of two different parts; the diagnosis of Dengue virus infection through ICT and haematological assessment of platelet counts in Dengue Virus patients. The samples were then subjected to centrifugation at speeds ranging from 3000 to 4000 rotations per minute for a duration of 5 minutes. The centrifugation process effectively separated the denser components, leaving behind the serum, which was then ready for testing. To ensure accurate testing conditions, both the collected serum and the test components were brought to room temperature. When ready to perform the test, the ICT kit was removed from its packet, placed on a clean, flat surface, and a dropper was filled with the patient's serum. This dropper was held vertically to transfer precisely one full drop of serum, followed by the addition of one drop of buffer solution to the mixture, ensuring the absence of any air bubbles. A timer was set, and the test results were read within a 10-minute timeframe. Haematological assessment of the platelet count was carried out on special automated analyzer SYSMEX XP 100 using EDTA tubes.

2.4 Data analysis

Microsoft Excel and OriginPro was used for creating tables and graphs, analysis and descriptive analysis.

3. RESULTS AND DISCUSSIONS

Dengue fever is a significant public health concern in many parts of the world, including Pakistan. This study aimed to assess the prevalence of dengue fever among patients visiting Dogra Hospital in District Khyber, Pakistan. The findings of this study provide valuable insights into the burden of dengue fever in this region and can inform public health interventions to control and manage the disease. In this study, a total of 108 patients were included in which 69 (63.88%) were male and 39 (36.11%) were female. One notable finding in our study, consistent with several other studies in the field[14–17], is the observation of a higher prevalence

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of dengue fever among male patients compared to females. This gender disparity in dengue fever cases could be due to behavioural differences, travel history, biological factors and but not limited to health-seeking behavior[18].

 The study population was categorized into four distinct age groups: 1 to 20 years, 21 to 40 years, and 41 to 60 years and above 60. Specifically, there were 35 patients in the 1 to 20 years age group, comprising 21 males and 24 females. In the 21 to 40 years age group, there were 53 patients, consisting of 30 males and 23 females. Lastly, 20 male patients fell into the 41 to 60 years age group as depicted in Figure 1. Our study revealed a noteworthy distribution of dengue fever cases across various age groups, with a prominent observation being the highest incidence of dengue patients within the 21-40 age group. The reasons could be active lifestyle and mobility, occupational and environmental factors, socioeconomic dynamics and health-seeking behavior[19,20]. In a study conducted in Sheikhupura, it was similarly found that the age group 21-40 exhibited the highest prevalence of dengue patients, accounting for a substantial proportion of cases (44.2%)[21]. Another study, conducted in Swabi city of Khyber-Pakhtunkhwa, yielded similar results, indicating that the age group 21-40 was the most affected, with 45.4% of patients falling within this category, aligning closely with our own findings[14].
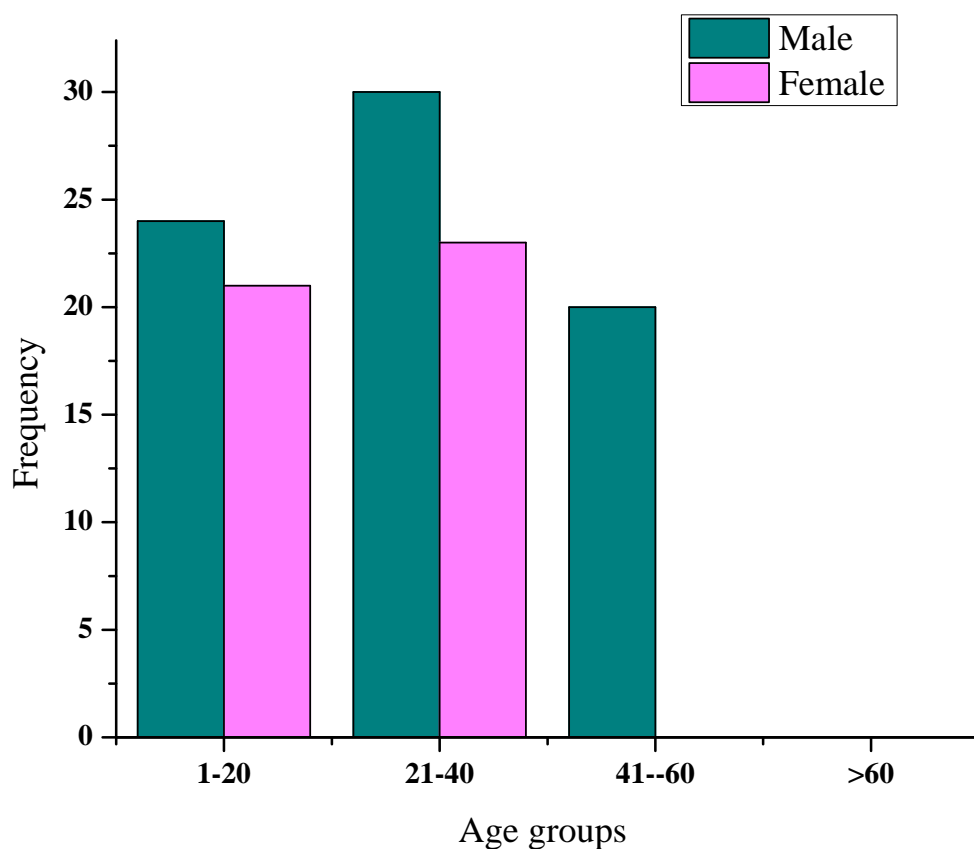

Fig 1. Gender wise distribution of dengue fever

In our study on the clinical features of dengue fever among patients visiting the hospital, we observed notable gender-based differences in several symptoms (Table 1). Fever, a common hallmark of dengue fever, was reported in 63.88% of male patients compared to 36.12% of female patients. Interestingly, none of the patients exhibited rashes during the course of the disease. Nausea and vomiting were reported more frequently in male patients, with 29.62% experiencing these symptoms, in contrast to 11.11% of female patients. Body aches were prevalent among 60.18% of male patients compared to 34.25% of female patients. Headache, another common symptom, was reported by 11.11% of males and 5.55% of females. Remarkably, none of the patients in our study presented with bleeding symptoms. These findings shed light on the gender-specific variations in clinical manifestations of dengue fever, which can be valuable for

improving diagnostic and management strategies. Dengue fever, which is caused by the DENV virus, exhibits a higher prevalence in urban regions characterized by lower socio-economic status. This pattern suggests that the disease tends to disproportionately impact communities with limited economic resources and access to healthcare services, highlighting the complex interplay between socio-economic factors and the spread of dengue in urban settings[22]. No rashes were found in any patients affected by dengue virus which is in accordance with the results of study conducted by Qureshi et al., 2023[22]. Results similar to our have also been reported by researchers in Pakistan[23,24] other parts of the world such as India[25], Iran[26], Nepal[27], Tanzania[28], Brazil[29] and China[30].

Table 1: Clinical features of dengue fever among patients visiting Dogra Hospital, Khyber Agency

Variables	Gender	Clinical features		p-value
		Yes %	**No %**	
Fever	Male	69 (63.88%)		
	Female	39 (36.12)		
Rashes	Male		69 (63.88%)	
	Female		39 (36.12)	
Nausea and/or vomiting	Male	32 (29.62%)	37 (34.55%)	
	Female	12 (11.11%)	27 (25)	
Body aches	Male	65 (60.18%)	04 (3.70%)	
	Female	37 (34.25%)	02 (1.85%)	
Headache	Male	12 (11.11%)		
	Female	6 (5.55%)		
Bleeding	Male		69 (63.88%)	
	Female		39 (36.12)	

In our study, a total of 108 patients underwent evaluation for the NS1 Antigen test, revealing that 67.5% tested positive while 32.4% tested negative. Similarly, in the case of the Dengue IgM antibody test, which also involved 108 patients, 4.6% tested positive, while the majority, accounting for 95.3%, tested negative. Furthermore, for the IgG antibody test, the results showed that 1.8% tested positive, with the remaining 98.1% testing negative. Results similar to ours have been reported by Mukhtar et al., 2020[21] where the percentage of IgG positive patients were 4.2%. Another study conducted by Ali et al., 2013[31] also reported low prevalence of IgG (20.25%) as compared to prevalence of IgM (31.86%).

The age-based analysis of Dengue NS1 antigen results, as presented in Table 2, demonstrated that 77.7% of patients within the 1 to 20 years age group tested positive for NS1 antigen. In the age group of 21 to 40 years, the prevalence of NS1 antigen positivity was 58%, while it was 72.7% among patients aged 41 to 60 years. Turning our attention to the age-specific distribution of Dengue IgM antibodies, we found that 8.3%

of patients aged 1 to 20 years tested positive for Dengue IgM. In the 21 to 40 years age group, the prevalence of Dengue IgM antibodies was 2%, while in the 41 to 60 years age group, it was 4.5%. Examining the age-wise distribution of Dengue IgG antibodies, we observed that 2.7% of patients in the 1 to 20 years age bracket were Dengue IgG positive. In the 21 to 40 years age group, the prevalence of Dengue IgG antibodies stood at 2%, while in the 41 to 60 years age group, there were no reported cases of Dengue IgG positivity. In our study, we observed a striking similarity in the prevalence of IgG reported by Peyerl-Hoffmann et al., 2004[32], particularly in the age group 20-29. This finding underscores the consistency and reliability of the data presented by Peyerl-Hoffmann et al., 2004 and lends further support to the validity of our own research. The high prevalence of IgG antibodies in the 20-29 age group is an intriguing and noteworthy result. It suggests that individuals in this age bracket may have been particularly exposed to the antigen in question or have mounted a robust immune response

Table 2: Distribution of NS1, IgM and IgG in different age groups

Age groups (years)	NS1		IgM		IgG	
	Positive	Negative	Positive	Negative	Positive	Negative
1 to 20	28 (77.7%)	08 (22.2%)	03 (8.3%)	33 (91.6%)	01 (2.7%)	35 (97.2)
21 to 40	29 (58%)	21 (42%)	01 (2%)	49 (98%)	01 (2%)	49 (98%)
41 to 60	16 (72.7%)	06 (27.2%)	01 (4.6%)	21 (95.4%)	0	22 (100%)
> 60	0	0	0	0	0	0
Total	73 (67.5%)	35 (32.4%)	05 (4.6%)	103 (95.3%)	02 (1.8%)	106 (98.1%)

Among the 69 male patients in our study, 68.1% of them tested positive for NS1 Antigen, while among the 39 female patients, 72.2% showed a positive result for NS1 Antigen. The overall prevalence of NS1 Antigen positivity across all patients was 67.5%, as summarized in Table 3. Regarding Dengue IgM antibody results, 5.7% of male patients and 2.5% of female patients were found to be positive. The collective prevalence of IgM Antibody positivity among all patients was 4.6%. When analyzing Dengue IgG antibody results, 2.8% of male patients tested positive, whereas none of the female patients showed positivity for IgG Antibody. The overall prevalence of IgG Antibody positivity was 1.8%, as detailed in Table 3.

Table 3: Gender wise distribution of NS1, IgM and IgG in dengue patients

Gender	NS1		IgM		IgG	
	Positive	Negative	Positive	Negative	Positive	Negative
Male	47 (68.2%)	22 (31.8%)	04 (5.7%)	65 (94.2%)	02 (2.8%)	67 (97.1%)

Female	28 (71.8%)	11 (28.2)	01 (2.5%)	38 (97.4%)	0	39 (100%)
Total	75 (69.4%)	33 (30.5%)	05 (4.6%)	103 (95.3%)	02 (1.8%)	106 (98.1%)

Our findings revealed a significant association between platelet count and Dengue IgM Antibody infection. Specifically, patients with platelet counts less than 150,000 exhibited prevalence rate of 5.5%% for Dengue IgM Antibody infection. Similarly, patients with platelet counts ranging from 150,000 to 400,000 showed a slightly low prevalence rate of 4.1%. Our findings demonstrated a noteworthy relationship between platelet count and Dengue IgG Antibody infection. Specifically, patients with platelet counts less than 150,000 exhibited a prevalence rate of 2.7% for Dengue IgG Antibody infection. Conversely, patients with platelet counts ranging from 150,000 to 400,000 showed a lower prevalence rate of 1.3%.

This study has some limitations. The study's sample size was relatively small, with 108 patients included. This may limit the generalizability of the findings to a larger population, and larger-scale studies would be needed to confirm the results. The research was conducted at Dogra Hospital in District Khyber, Pakistan. A single-center study may not fully represent the diversity of dengue cases in the entire region or country. A multi-center approach could provide a more comprehensive picture. Due to limited budget for the study, its was only limited to diagnosis of the infection rather than the identification of specific dengue serovars. The study's participants were limited to those who sought medical attention at the hospital. This may introduce selection bias, as individuals with milder or asymptomatic cases of dengue fever might not have been included.

4. CONCLUSIONS

In conclusion, our study at Dogra Hospital, District Khyber, Pakistan, highlighted a prominent Dengue Fever incidence in the 21-40 age group, potentially due to lifestyle and occupational factors. Gender-based variations in clinical symptoms were observed, favoring males. Serological tests indicated a significant presence of NS1 Antigen, with limited cases of IgM and IgG antibodies. These findings contribute valuable insights into Dengue Fever's regional prevalence and clinical characteristics, which can inform targeted healthcare strategies and future research endeavors.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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