Original Article

Frequency of Malaria in Flood Affected Areas of Jhang District

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Abstract: Malaria remains a persistent public health concern in Pakistan, particularly in flood-affected regions where stagnant water creates ideal breeding grounds for mosquitoes. This study aimed to assess the frequency of malaria in flood-hit areas of the Jhang district and to examine the role of environmental factors in its transmission, with a focus on *Plasmodium vivax* and *Plasmodium falciparum* infections.

Material and Methods: A cross-sectional study was conducted over three months in flood-affected communities of Jhang. A total of 100 participants were selected using a random sampling method. Rapid Diagnostic Tests (RDTs) were used to detect malaria infection, and data were analyzed using SPSS. Ethical clearance was obtained, and informed consent was secured from all participants. The study also collected data on symptoms and the use of protective measures such as bed nets.

Results: Out of 100 individuals tested, 9% were found positive for malaria. All positive cases exhibited symptoms like fever, headache, and chills. However, the use of preventive practices was inadequate; 44% of participants reported not using bed nets, and only 34% of malaria-positive individuals were aware of malaria prevention methods.

Conclusion: The low positivity rate may reflect the effectiveness of early detection and treatment, yet the gaps in prevention highlight a need for improved community education. Strengthening health awareness campaigns and promoting the consistent use of protective tools like bed nets are essential to reduce the risk of malaria, especially in flood-prone and environmentally vulnerable areas.

Keywords: Malaria, Jhang, Flood affected areas, Awareness

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Introduction

Malaria, one of the oldest known human diseases, is caused by the Plasmodium parasite, with the most severe strain, Plasmodium falciparum, believed to have originated in Central Africa around 165 million years ago. Malaria transmission is considered to be unstable, with major *P. vivax* transmission peaking from June to September and again in April to June, when relapses of infections acquired the previous season are observed. It gradually spread toward the Mediterranean after the last Ice Age. Historical accounts from Hippocrates and Galen in Graeco-Roman times describe periodic fevers consistent with malaria, and DNA analyses of Egyptian mummies confirm *P. falciparum* infections as early as 3200 BCE. Ancient societies associated the disease with stagnant water and bad air, but it wasn't until the 19th century that mosquitoes were identified as the actual vectors.1 The name "malaria," from the Italian mal'aria (bad air), was coined by Giovanni Lancisi in 1717. In 1880, Alphonse Laveran discovered the parasite, earning a Nobel Prize, and Camillo Golgi later linked its blood cycle to fever patterns. Ronald Ross proved mosquito transmission in 1897, while Giambattista Grassi identified the Anopheles mosquito as the primary vector. These discoveries laid the foundation for modern prevention strategies, including the use of mosquito nets and better housing.2 Among the 200+ species of Plasmodium, only five infect humans: *P. falciparum, P. vivax, P. malariae, P. oval, and P. knowlesi. P. knowlesi* is zoonotic, transmitted between monkeys and humans, especially in Southeast Asia. *P. vivax* can relapse after treatment due to dormant liver-stage parasites.3 Malaria transmission depends on a complex interaction of mosquito vectors, human hosts, and environmental factors such as temperature, rainfall, and humidity. People have low immunity and are more susceptible to malaria in Pakistan than are permanent residents. Urbanization, deforestation, and poor housing also contribute to the spread. Transmission rates are influenced by mosquito lifespan, biting frequency, and parasite development time.4,5 The disease typically progresses through three fever stages: chills, high fever with headache, and then sweating, often accompanied by fatigue, muscle aches, nausea, and vomiting. In severe cases, it can cause anemia, seizures, and organ failure.6 Preventive measures such as insecticide-treated bed nets (ITNs), indoor residual spraying (IRS), and artemisinin-based combination therapies (ACTs) have proven effective, though resistance to treatment is growing. Newer approaches include vaccine development and biological controls like Wolbachia-infected mosquitoes.7 In Pakistan, around 7% of the population is at risk, with an estimated 1.6 million cases annually. P. vivax accounts for 75% of infections, while P. falciparum causes 25%. Epidemics are most common in Balochistan, Sindh, Khyber Pakhtunkhwa, and tribal regions, driven by migration, poor infrastructure, irrigation systems, and environmental disasters.8 The 2022 floods significantly worsened the situation, creating widespread mosquito breeding grounds and doubling malaria cases in high-risk areas, especially in Sindh and Balochistan. Despite efforts such as distributing bed nets and awareness campaigns, limited healthcare resources and diagnostic challenges hinder effective control [9]. Globally, malaria continues to pose a major health threat, particularly in developing countries, with nearly half the world's population at risk and P. falciparum responsible for the majority of deaths. Comprehensive international cooperation and innovative strategies remain vital to tackling this enduring disease.9 Pakistan faces several challenges in the management and control of malaria, including misdiagnosis, lack of diagnostic facilities, use of presumptive treatments and unavailability of artemisinin-based combination therapy. Jhang is an agricultural district where floods destroy crops and displace communities, forcing people to live in temporary shelters with poor sanitation. Overcrowding and lack of mosquito nets increase exposure to malaria. High malaria incidence further impoverishes affected families due to medical costs and lost productivity. This study can inform socioeconomic support programs alongside disease control measures. Floods often damage healthcare facilities, disrupt supply chains for antimalarial drugs, and limit access to medical services. This exacerbates malaria cases due to delayed diagnosis and treatment. Assessing malaria frequency in Jhang's flood-hit areas can highlight gaps in healthcare delivery and emergency response, ensuring better preparedness for future disasters.

Material and Methods

This cross-sectional study was conducted from September 2024 to November 2024 in the flood-affected areas of Jhang district. The rationale behind this study lies in the increased risk of malaria outbreaks following floods, where stagnant water creates ideal conditions for mosquito breeding. Therefore, the study was designed to determine the frequency of malaria cases in flood-affected communities and to assess associated symptoms and the use of protective measures, such as bed nets, to provide evidence for more effective intervention and control strategies.

A total of 100 participants were selected using a simple random sampling technique. Individuals of all ages and genders residing in flood-affected areas during the study period were included. Those residing outside the affected areas, those previously diagnosed with malaria before the floods, and individuals with chronic conditions that could affect diagnosis—such as autoimmune disorders or chronic anemia were excluded.

Data collection targeted areas with visible stagnant water and high mosquito breeding potential. Participants were informed about the study's purpose and were enrolled after providing written informed consent. Information on demographics, including age, gender, and place of residence, was recorded. Participants were evaluated for symptoms such as fever, chills, headache, and fatigue, and were asked about mosquito exposure and prior malaria infections. Protective behaviors, especially the use of bed nets, were also documented.

On-site screening was conducted using Rapid Diagnostic Tests (RDTs) to detect *Plasmodium vivax* and *Plasmodium falciparum*, administered through finger-prick blood samples by trained healthcare professionals. Data were analyzed using SPSS version 20.0. Quantitative variables were expressed as means and standard deviations, while categorical variables, such as symptom presence, bed net usage, and malaria prevalence, were reported as frequencies and percentages. Relationships between stagnant water presence and malaria incidence were assessed using chi-square tests. Ethical approval was obtained from the institutional review board, and informed consent was taken in both English and Urdu from all participants.

Results

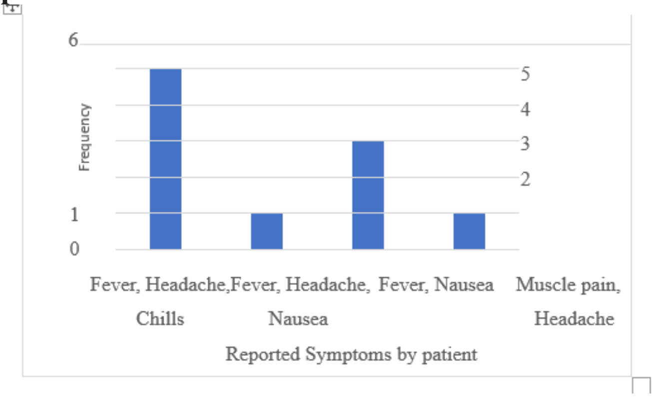
A total of 100 samples were collected from the flood-affected areas of Jhang, where Rapid Diagnostic Tests (RDTs) were performed to detect malaria. Out of these, 91 samples (91.0%) tested negative for malaria, while 9 samples (9.0%) tested positive.

Table 1: Frequency and Percentage of Malaria Cases

Variable	Frequency	Percent
Negative	91	91.0%
Positive	9	9.0%
Total	100	100.0%

The most common combination was fever, headache, and chills (5 cases), followed by fever and nausea (3 cases). Less frequently reported were fever, headache, nausea and muscle pain with headache (1 case each)

Figure 1: Bar chart of reported symptoms by patient



According to the findings of this study, all tested positive patients [9 (100%)] reported experiencing symptoms potentially related to malaria, whereas only 40 (44%) of the tested negative patients reported such symptoms (p-value = 0.001). Among the malaria-positive patients without symptoms, 4 (44%) reported using bed nets, compared to 42 (47%) of the malaria-negative patients (p-value = 0.895). Additionally, awareness about malaria prevention methods was found in 3 (34%) of the malaria-positive patients, while 51 (56%) of the malaria-negative patients were aware of such methods (p-value = 0.192). Table 2

Table 2: Comparison of awareness about malaria, use of bed nets and symptoms among tested positive/negative status of the patients

Variable		Positive		Negative		p-value
		n	%	n	%	
Have you experienced any symptoms that you think might be related to malaria?	Yes	9	100	40	44	0.001*
	No	0	0	51	56	
How often do you use bed nets?	No, sometimes	4	44	42	47	0.895 NS
	Rarely	3	33	35	38	
Awareness of malaria prevention methods	Yes	3	34	51	56	0.192 NS
	No	6	66	40	44	

Discussion

Study found that out of 100 samples collected from flood-affected areas in Jhang, 9.0% tested positive for malaria, while 91.0% tested negative. This low positivity rate aligns with effective testing and treatment. A similar study conducted by Zafar *et al*. (2019) in Multan reported a positivity rate of 8.5%, demonstrating the impact of early interventions in malaria management.[23]

Among patients reporting malaria-related symptoms, 9 % tested positive, A study in Sindh by WHO observed a 55% positivity rate among symptomatic patients, further emphasizing the role of symptom-based diagnostics.[18]

The most commonly reported symptom combination was fever, headache, and chills (5 cases), followed by fever and nausea (3 cases). A similar study in endemic regions also identified fever and headache as the most prevalent symptoms of malaria, consistent with findings in the current study.[19]

Among respondents, 32.0% did not use any protective measures, 38.0% used them rarely, and 30.0% used them sometimes. A similar study conducted by RBM in Africa showed a 50% reduction in malaria prevalence with consistent use of bed nets, emphasizing the need for regular adoption of protective measures.[20]

Awareness of malaria prevention methods was low, with 3 (34%)of respondents were aware of these methode, and 6 (64%) not aware of these methods tested positive. A study conducted in Pakistan by the National Malaria Control Program found that a higher awareness level of 30% was associated with a 20% reduction in malaria prevalence, reinforcing the importance of health education campaigns.[21]

Conclusion

On the basis of this study it was revealed a low positivity rate of 9.0%, with 91.0% testing negative, highlighting the effectiveness of early testing and treatment. The findings highlight the importance of strengthening public health education and promoting consistent use of protective measures, particularly in vulnerable, flood-affected communities, to further reduce the risk of malaria transmission.

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