fortune Journals

Research Article

FORTUNE JOURNAL OF HEALTH SCIENCES

ISSN: 2644-2906

Epidemiology of *Plasmodium falciparum* in Dera Ismail Khan District, Khyber Pakhtunkhwa, Pakistan

Nadir Akhtar*[,1], Abdus Sami[2], Faisal Saeed[3], Hafiz Faizan Saleem[4], Sikander Sher[5], Muhammad Azaz Ali Khan[6], Saqib Muhammad[7], Muhammad Omer[8]

Abstract

Objective: The primary goal of the current study was to determine the prevalence of Plasmodium falciparum, the malaria parasite, in Dera Ismail Khan.

Methodology: Various factors about the study's respondents (n=200) were examined in the current study. The patient's age, job, degree of education, hospital visit history, malaria treatment history, use of long-lasting insecticidal nets (LLINs), surrounding area cleanliness, and whether or not they had been sprayed with insecticides were considered. The research study was conducted using a questionnaire and basic microscopic analysis to determine the illness index.

Results: Based on the findings, microscopy was used to test 200 patients (n=200) for P. falciparum malaria. Although 85 percent of the patients tested positive for falciparum malaria (170 out of 200). Out of 170 participants, 114 (or 67% of the total) were men and 56 (or 33% of the total) were women. Laborers made up 29.4 percent of the plasmodium-affected workforce. Although over 70% of those afflicted with malaria had received treatment, just 15.29% made it to the clinic. Furthermore, a scant 12.94% of the respondents reported using LLINs, while just 2.35% of them had employed insecticidal spray.

Conclusion: According to this study, malaria is a public health concern in D.I. Khan and successful management of the illness depends on quick diagnosis and suitable treatment. Diverse climates in different provinces and towns affect the frequency of malaria.

Keywords: Malaria, *Plasmodium falciparum*, D.I. Khan, Microscopy, LLINs

Introduction

Malaria is a parasite disease spread by insects and caused by a species of Plasmodium. A lot of people get sick and die from it in developing countries. The illness has been steadily spreading, and Pakistan is among the countries hit by the worst [1]. The Phylum Apicomplexa is a heterogeneous group comprising several species, notably parasites, including the Plasmodium family, which is accountable for malaria transmission. There are around 250 recognized kinds of Plasmodia, and out of them, five are known to cause diseases in humans. These five species are known as *Plasmodium: falciparum* (Pf), *vivax* (Pv), *anomalum* (Po), *malariae* (Pm), and *knowlesi* (Pk) [2]. *Plasmodium knowlesi* is a zoonotic parasite that sporadically affects people and is transmitted by animals. *P. falciparum* is the main culprit behind most deaths caused by malaria. The species is highly prevalent in sub-Saharan Africa and Southeast Asia, exhibiting a significant level of dominance. The dissemination of *Plasmodium falciparum* poses a significant risk to the worldwide management of malaria. Pakistan has around 500,000 cases of malaria infection each year [3].

The same parasite, Plasmodium, causes both short-lived and long-lasting cases of malaria. Malaria is most well-known among humans to cause a high fever and chills. The bite of a female Anopheles mosquito is the vector for the transmission of the disease[4]. The onset of malaria symptoms typically occurs between the seventh and twenty-fifth day following a mosquito bite. The typical manifestations of malaria include pyrexia, asthenia, cephalalgia, emesis, rigor, and coughing. Malaria may be misdiagnosed as several other illnesses, such as influenza, dengue fever, and typhoid, because of

Affiliation:

[1]Department of Zoology, Quaid I Azam University Islamabad, Pakistan

[2]Department of Zoology, Qurtuba University of Science & Information Technology D.I. Khan, KPK, Pakistan

[3]House Officer, Capital Hospital Islamabad, Pakistan

[4]Medical Officer, Accident and Emergency, Ch. Rehmat Ali Memorial Trust Hospital, Lahore, Pakistan

[5]Senior Associate, Health Department, Edge Services, Islamabad, Pakistan

[6]Cardiology, KMU Institute of Medical Sciences Kohat, Pakistan

[7]MBBS Student, Kabir Medical College, Gandhara University Peshawar, Pakistan

[8]MBBS Student, Allama Iqbal Medical College Lahore, Pakistan

***Corresponding author:**
Nadir Akhtar, Department of Zoology, Quaid I Azam University Islamabad, Pakistan

Citation: Nadir Akhtar, Abdus Sami, Faisal Saeed, Hafiz Faizan Saleem, Sikander Sher, Muhammad Azaz Ali Khan, Saqib Muhammad, Muhammad Omer. Epidemiology of Plasmodium falciparum in Dera Ismail Khan District, Khyber Pakhtunkhwa, Pakistan. Fortune Journal of Health Sciences. 7 (2024): 665-669.

Received: October 09, 2024
Accepted: October 18, 2024
Published: November 15, 2024

Akhtar N., Fortune J Health Sci 2024
DOI:10.26502/fjhs.235

similar symptoms. Patients presenting with fever/pyrexia of unidentified cause should also be evaluated for possible malarial infections. Do not begin treatment for malaria unless microscopic examination has shown the presence of malarial parasites [5].

Malaria is a major issue in Pakistani public health due to factors such as heavy irrigation, a lack of proper transportation, and the possibility of an endemic outbreak during the monsoon season[6]. Malaria poses a threat to 177 million out of Pakistan's 180 million population. The annual estimated and confirmed cases of malaria in Pakistan are over 3.5 million, making the nation an endemic zone for the disease. *Plasmodium vivax* is more common than *Plasmodium falciparum* in Pakistan. Baluchistan, southern Punjab, and Sindh province are the most common locations for *Plasmodium falciparum* to be detected. Malaria is most common in areas close to the Iranian, Pakistani, and Afghan borders. For the most part, *P. vivax* and *P. falciparum* tend to congregate in these regions [7].

The provinces of Khyber Pakhtunkhwa, Sindh, and Baluchistan, as well as the tribal territories under federal authority, are the region's most severely impacted. The prevalence of malaria in this location can be attributed to the abundant stagnant water, which serves as an ideal breeding ground for Plasmodium. Despite the implementation of a well-established malaria control program in Pakistan, an annual fatality rate of 50,000 owing to malaria has been calculated. The reason for this is the recurring floods in recent years, the emergence of resistance in *P. falciparum* to Chloroquine, and the ongoing influx of Afghan refugees to Pakistan who are carriers of the *P. falciparum* organism, which is prevalent in Afghanistan [8]. Malaria cases are consistently recorded in District Dera Ismail Khan throughout the year, with a decrease in numbers during winter and a higher frequency during summer. Of the several Plasmodium species, *P. vivax* is recognized for its very destructive impact and is the most prevalent species.[9] This study aimed to analyze the spread of Falciparum malaria in Dera Ismail Khan, KPK, Pakistan between 2023 and 2024, considering the patients' demographic, socio-economic, and educational attributes.

Material and Methods

Study Area

The research was conducted in District Dera Ismail Khan, in the Khyber Pakhtunkhwa province. The research region was chosen based on the accessibility of data. The district of Dera Ismail Khan is situated at a latitude of 31.7448N and a longitude of 70.6217E.

Study design and data collection

The cross-sectional investigation was carried out between December 2023 and May 2024. All patients were required to provide an informed written agreement to participate in the trial. Data were gathered from the Malaria laboratory of the District Health Officer in Dera Ismail Khan, as well as from the D.H.Q. Hospital in the same location. The government sector responsible for dengue and malaria control primarily handles the admission of patients with malaria.

Inclusion and Exclusion Criteria

The study excluded pregnant or lactating women and children under the age of two. The study involved people who had evident clinical signs of malaria and were subsequently diagnosed with *P. falciparum* malaria by microscopic testing Their elevated body temperature (> 37.5 ^{O}C) was measured using a thermometer.

Data Collection Procedure

The researchers administered surveys utilizing questionnaires to collect data on several factors such as gender, age, occupation, education, knowledge of malaria, living conditions, treatment, and attitudes toward malaria.

Malaria infections in a total of 200 individuals were diagnosed using microscopy, and 3 ml of intravenous blood was obtained from each patient by vein puncture. The thick and thin films were stained with a 10% Giemsa solution and seen using an oil immersion lens. Malaria screening included the use of thick slides, whereas species identification required the use of thin slides. Laboratory technicians or technologists, who received training following the criteria established by the World Health Organization, evaluated malaria smears [10]. 200 individuals with malaria infections were subjected to microscopic confirmation, and 5ml of whole blood was obtained from each patient using EDTA tubes.

Quantitative data analysis

The data was input into Microsoft Excel 2021 and analyzed using the Statistical Package for the Social Sciences, 12th Edition. Information is displayed in tabular form with percentages and means.

Results

200 patients (n=200) were screened for *P. falciparum* malaria using microscopy. While *falciparum* malaria was confirmed in 85% of the individuals (170/200). There were 170 participants, with 114 (67%) being male and 56 (33%) being female (Table 1).

Table 1: The gender-wise distribution of individuals affected by *Plasmodium falciparum*

Gender	No. of Cases	Percentage (%)
Male	114	67
Female	56	33
Total	170	100

Citation: Nadir Akhtar, Abdus Sami, Faisal Saeed, Hafiz Faizan Saleem, Sikander Sher, Muhammad Azaz Ali Khan, Saqib Muhammad, Muhammad Omer. Epidemiology of *Plasmodium falciparum* in Dera Ismail Khan District, Khyber Pakhtunkhwa, Pakistan. Fortune Journal of Health Sciences. 7 (2024): 665-673.

Akhtar N., Fortune J Health Sci 2024
DOI:10.26502/fjhs.235

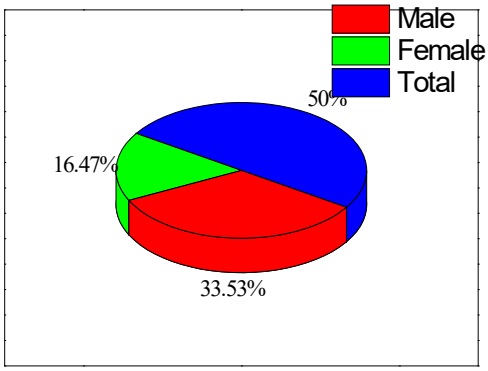

Figure 1: The gender-wise distribution of individuals affected by *Plasmodium falciparum*

Most of the cases reported (n=50, 29.4%) were laborers, while the remaining cases (n=14, 8.2%) were students, self-employed (n=34, 20%), chauffeurs (n=33, 19.4%), and labors (n=39, 22.9%) (Table 2).

Table 2: *Plasmodium falciparum* population by occupation

Professions	No. of cases	Percentage
Students	14	8.2
Self-Employed	34	20
Drivers	33	19.4
Unemployed	39	22.9
Labors	50	29.4
Total	170	100

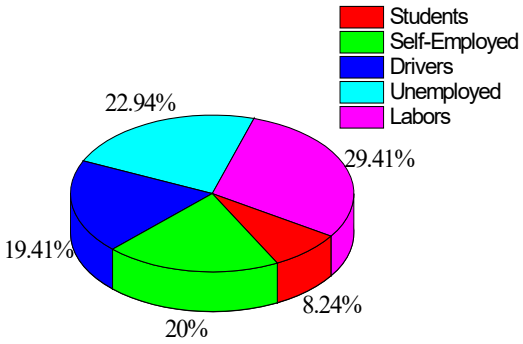

Figure 2: *Plasmodium falciparum* population by occupation

Of the total (n=170), 26 individuals (15.29%) had previously visited the institution, while 144 individuals (84.70%) had not. (Table 3).

Table 3: Affected people's distribution according to their previous hospital visits

Priorly attended hospital patients	No of the affected individuals	Percentage (%)
Yes	26	15.29%
No	144	84.70%
Total	170	100%

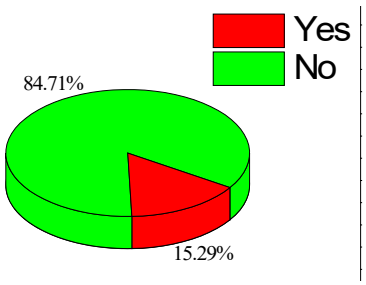

Figure 3: Distribution of those impacted based on their prior hospital visitsA

Table 4: The distribution of individuals affected by the insecticidal application

Insecticidal Spray	No of the affected individuals	Percentage (%)
Yes	4	2.35%
No	166	97.64%
Total	170	100%

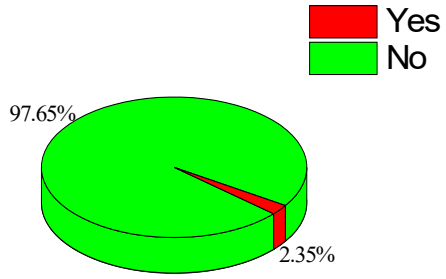

Figure 4: The distribution of individuals affected by the insecticidal application.

Out of 170 participants, 4 (or 2.35% of the total) reported the use of insecticide spraying, whereas 166 (or 97.64%) said that no such spraying had taken place in their areas (Table 4).

Out of the total of 170 individuals, 22 individuals (12.94%) used Long-Lasting Insecticidal Nets (LLINs), whereas the remaining 148 persons (87.05%) did not use them (Table 5).

Table 5: The prevalence of persons who are impacted and are utilizing Long-Lasting Insecticidal Nets (LLINs)

Use of LLINs	No affected individuals	Percentage
Yes	22	12.94%
No	148	87.05%
Total	170	100%

Citation: Nadir Akhtar, Abdus Sami, Faisal Saeed, Hafiz Faizan Saleem, Sikander Sher, Muhammad Azaz Ali Khan, Saqib Muhammad, Muhammad Omer. Epidemiology of *Plasmodium falciparum* in Dera Ismail Khan District, Khyber Pakhtunkhwa, Pakistan. Fortune Journal of Health Sciences. 7 (2024): 665-673.

Akhtar N., Fortune J Health Sci 2024
DOI:10.26502/fjhs.235

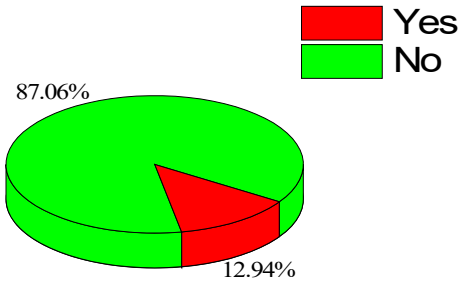

Figure 5: The prevalence of people who are impacted and are utilizing Long-Lasting Insecticidal Nets (LLINs)

Discussion

Malaria is a substantial public health concern in Pakistan, being the second most prevalent disease after Tuberculosis, as stated by the Malaria Control Program Pakistan. This disease mostly impacts tropical and subtropical areas, namely in Africa and Asia. Plasmodium exhibits considerable species diversity, with *Plasmodium vivax* and *Plasmodium falciparum* being prevalent in Pakistan. In countries with little resources, such as Pakistan, it is of utmost importance to have early intervention and quick diagnosis. In Pakistan, almost 1.6 million people are infected every year. Being the second most common disease in the nation, it contributes 16.5% to the overall infection burden. All of Pakistan's districts combined to record 0.3 million cases in 2018. *P. falciparum* was shown to be the causative agent of disease in one-third of these patients [11].

Quantifying the number of instances in the Pakistani population is challenging due to the wide variety of species present in this region. The objective of this study was to determine the current prevalence of malaria in Pakistan. This study examined the prevalence of malaria in the Swat and Lower Dir regions of K.P.K and found that it was 12.91%. The results resemble those of the study by Shah and coworkers. The percentage in Swat was 19.7 percent, so this one is a lot higher. Our findings are consistent with Ahmad's earlier reports of incidence rates of 17.32% and 39.5%. However, this new proportion is higher than the 9% recorded before in the same area, [12]. The World Health Organization reports that the prevalence of malaria infections caused by the *Plasmodium falciparum* parasite rose from 34% to 54% from 1984 to 1990. Between 1995 and 2006, the prevalence of malaria caused by *P. falciparum* consistently increased in Jhangara and Quetta, escalating from 45% to more than 68%. In 2010, *P. falciparum* was responsible for 73,857 out of the total 240,591 documented cases of malaria in the country.[13]

Over the previous decade, the National Malaria Control Program has observed a significant sixfold rise in *P. falciparum* infection. The rise in *P. falciparum* infection across the country can be ascribed to the emergence of resistance to the drug chloroquine. Moreover, the autumn temperature is somewhat higher, hence enhancing the probability of transmission. Moreover, the control approaches lack sufficiency and efficacy. The epidemiology of malaria is influenced by several environmental and socioeconomic factors that support the proliferation of the vector and, consequently, enhance the interaction between the parasite and the host [14]. In a nation like Pakistan, where economic limitations exist, malaria worsens poverty by hindering economic progress, thereby repeating a relentless cycle of misery. However, if one were to believe that reducing malaria transmission may be the most efficient way to promote economic development in malaria-stricken countries, this trend could be turned into an ethical circle [15].

Conclusion

This study concluded that malaria is a public health issue in D.I. Khan and that prompt diagnosis and appropriate treatment are essential for the successful control of the disease. The prevalence of malaria varies throughout different provinces and cities, depending on the varied climates.

Recommendation

It is important to promote the adoption of efficient water management measures among the public to prevent the development of disease-carrying organisms. Furthermore, more advanced methods of self-defense should be implemented. Applying sophisticated methods for evaluating vectors. The focus of control efforts should be directed towards the region examined in this study, particularly District Dera Ismail Khan, with a specific emphasis on the areas with the highest incidence of malaria.

Compliance with Ethical Standards:

Ethical Consideration: Ethical clearances for the current study were obtained from the Qurtuba University of Science & Information Technology D.I. Khan, Pakistan. Written consent was also obtained from the hospital visited for sample collections after discussing the objective of the study.

Acknowledgment

We Acknowledge Rizwana Ansari Program Manager “STREET” (rizwanaansari642@gmail.com) for her valuable advice and support in this study.

References

1. Oluwafemi, T., Azuaba, E., & Kura, Y. (2020). Stability Analysis of the disease-free equilibrium of Malaria, Dengue and Typhoid Triple infection Model. Asian Research Journal of Mathematics, 16(11).
2. Vythilingam, I., Chua, T. H., Liew, J. W. K., Manin, B.

O., & Ferguson, H. M. (2021). The vectors of Plasmodium knowlesi and other simian malarias Southeast Asia: challenges in malaria elimination. Advances in parasitology, 113, 131-189.

3. Organization, W. H. (2020). Report on antimalarial drug efficacy, resistance and response: 10 years of surveillance (2010-2019): World Health Organization.
4. Zeb, J., Khan, M. S., Ullah, N., Ullah, H., Nabi, G., & Aziz, T. (2015). Epidemiology of plasmodium species and prevalence of malaria on the basis of Age, Sex, Area, seasonality and clinical manifestation in the population of district lower Dir, Khyber Pakhtunkhwa, Pakistan. World Journal of Zoology, 10(2), 147-152.
5. Grandesso F, Nabasumba C, Nyehangane D, Page A-L, et al. Performance and time to become negative after treatment of three malaria rapid diagnostic tests in low and high malaria transmission settings. Malaria journal 15 (2016): 1-12.
6. Tasawer, Z., Mannan, F., & Arif, B. (2003). Prevalence of human malaria at Multan. Pak J Med Sci, 3, 123-126.
7. Rafique, M., Seher, K., Qureshi, K., Rizwan, W., Ishaq, F., & Zia, S. (2020). Clinical Spectrum of *Plasmodium vivax* Malaria in Children Presenting to a Tertiary Care Hospital, Lahore. Annals of King Edward Medical University, 26(3).
8. Khattak AA, Venkatesan M, Nadeem MF, Satti HS, Yaqoob A, et al. Prevalence and distribution of human Plasmodium infection in Pakistan. Malaria journal 12 (2013): 1-8.
9. Syed, H. H., Shah, M., Sherzada, S., & Babar, M. E. (2021). Expression of malaria in Swat valley, Pakistan.
10. Khan AQ, Hussain S, Babar N, Samad A, Badshah N, et al. Prevalent Occurrence of *Plasmodium falciparum* Malaria in Pakistan. Pakistan Journal of Medical & Health Sciences 17 (2023): 871-871.
11. Naqvi, S. W. A., Saeed, S., Rafique, A., Saeed, M. H., Khan, N., Khan, A., . . . Ahmad, R. (2020). Prevalence and distribution of malaria by sex, age groups and species in year 2019 in suspected malarial population of district DI Khan, Pakistan. Gomal Journal of Medical Sciences, 18(4), 164-173.
12. Zaman, N., Haq, F. U., Khan, Z., Uallah, W., Ualiyeva, D., Waheed, Y., . . . Mahmood, M. (2022). Incidence of malarial infection and response to antimalarial drugs at Districts Lower Dir and Swat of Khyber Pakhtunkhwa, Pakistan. Dialogues in Health, 1, 100035.
13. Zakeri, S., Kakar, Q., Ghasemi, F., Raeisi, A., Butt, W., Safi, N., . . . Salehi, M. (2010). Detection of mixed *Plasmodium falciparum* & *P. vivax* infections by nested-PCR in Pakistan, Iran & Afghanistan. Indian Journal of Medical Research, 132(1), 31-35.
14. Noreen, S., Gul, M., Gul, S., Rahim, S., Bibi, S., Bibi, T., & Shahdayi, A. A. (2023). Spatial Distribution of Malaria and its Vectors in Selected Districts of Khyber Pakhtunkhwa, Pakistan. NUST Journal of Natural Sciences, 8(1).
15. Nasir, S. I., Amarasekara, S., Wickremasinghe, R., Fernando, D., & Udagama, P. (2020). Prevention of re-establishment of malaria: historical perspective and future prospects. Malaria journal, 19, 1-16.