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RESEARCH ARTICLE

Malaria Parasite Prevalence and Diagnostic Strategies in Khyber Pakhtunkhwa, Pakistan.

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ABSTRACT

The study to determine the incidence of malarial parasite infections in the population of Dera Ismail Khan District was conducted at the District Headquarter Hospital between January and June 2023. Using standard parasitological procedures, both thick and thin blood films were prepared and stained. Overall, 228 (15.53%) of the 1,468 study participants were found to have malaria infections. *Plasmodium vivax* was identified as the dominant species, accounting for 97.36% of the cases. The age group of 1–15 years exhibited the highest infection rate at 21.85%. Males and females were equally affected. The prevalence was highest among illiterate individuals, with a rate of 20.58%.

1. Introduction

Malaria is the world's most deadly illness [1]. Malaria is a tropical illness that is widespread worldwide [2]. The blood parasite Plasmodium, which is spread by vector mosquitoes, is the cause of this illness. Malaria is a dangerous illness that can occasionally be fatal [3]. Symptoms include a sharp increase in body temperature, frequent shivering, and excessive perspiration [2].
There are four different species of *Plasmodium* that cause malaria in humans, *Plasmodium vivax, P. falciparum, P. ovale and P. malariae*. In these *plasmodia, P. falciparum* malaria is dangerous and is more common in sub-Saharan Africa where it causes high rate of mortality [4]. An estimated 500 million people are afflicted with this disease annually out of an estimated 2 billion people exposed to the global endemic [1,2].

In the developing countries, malaria continues to be a threat, every day with more than 3000 deaths [5]. *Plasmodium vivax* is more common in different regions of the world. More than half of malaria cases in Asia and Latin America are caused by *P.vivax* [2]. *Plasmodium falciparum* is closely associated to the presence of transmission vectors in some areas of the world and also to marshy places which provide favourable conditions for their development. Some endemic areas of the world like Cameroon, transmission of malaria is permanently and intense [6]. Plasmodium falciparum resistance to antimalarial medications is on the rise, necessitating efforts to find new medications with novel mechanisms of action [7]. Severe malaria is 4.2 times

less common in patients with mixed P. vivax and P. falciparum infections than in those with P. falciparum malaria alone [2].

Malaria is the leading cause of death worldwide, especially in Africa [3]. Malaria is a severe issue in Sudan, where there are an estimated 7–7.8 million cases each year, with a 20% fatality rate (Robert et al., 2004). In northern Nigeria, female patients were substantially more likely than male patients to contract P. falciparum malaria (Bello et al., 2005). Due to restricted access to treatment, malaria has an 80% fatality rate in tropical Africa, affecting both young and old [2,8].

Climate (temperature, relative humidity, elevations, and rainfall) and socioeconomic factors are examples of epidemiological factors. All of these elements have a part in the availability of mosquitoes, which serve as the major host for parasites and sustain the spread of malaria [2]. Malaria is fairly common in Pakistan, and epidemiological data from various regions of the country are insufficient to fully assess the incidence of different malaria types [9]. Choloroquine-resistance is a major issue in many countries, accounting for over 90% of malaria cases [2]. The three known methods of malaria transmission are vector transmission, blood transfusion, and congenital transmission [2,10]. Resistance to chloroquine is increasing in Pakistan and in case of *P. falciparum* is reported 16-62% [11].

2. Materials and methods

2.1 Study Subject

The study individuals consisted of 1468 males and females who came for check up to District Headquarter Hospital of District D.I.Khan, Khyber Pakhtunkhwa Pakistan, between Janurary-june 2023. The study participants were selected randomly. The individuals were of varying age group ranging from 01-60 years.

2.2 Blood Collection

70% alcohol was used to swab the area to be sampled. After letting the region dry, cautious methods were used to collect finger prick blood samples. Both thin and thick blood films were created on sanitized slides. These slides have been labeled in accordance with WHO recommendations [1].

2.3 Microscopic analysis

The method of microscopy was used to diagnose malarial parasites. After carefully fixing the thin film with methanol, Giemsa's stain, diluted 1 in 10 with buffer pH 7.2, was poured onto every slide. Thin blood smears were used to identify several Plasmodium species, while thick blood smears were utilized to detect the presence of parasites. Because various species require different treatments, species identification is essential. Since the gametocyte of Plasmodium falciparum is shaped like a banana, each species of Plasmodium has a unique form. Twenty minutes were spent staining the slides. The x 100 objective lens (immersion oil) was used to examine the dyed slides under a light microscope [12].

3. Results

A total 1468 blood smears were studied of which 228 were found positive for malarial parasites. Screening of all the individuals showed that *P. vivax* (97.36%) was more common than *P. falciparum* (2.19%). *P. vivax* and *P. falciparum* mixed infections was found (0.43%) (Table 1).

3.1 Gender and Age wise Prevalence of Malaria

Out of 1468 blood slides, 975 were collected from male subjects having a total 150 (15.38%) Plasmodium positive where as remaining 493 blood samples were collected from female individuals having a total 78 (15.82%) plasmodium positive, showing that malaria was equally prevalent among the male and female individuals (Fig.1). Malaria prevalence was apparently higher among the age group 1-15 years (21.85%) as compared to that in age group 16-30 years (14.79%) , 31-45 years (13.27%) and 46-60 years (8.14%) (Table: 2).

3.2 Malarial parasite distribution by patient educational status:

Table 3 displays the malarial parasite distribution with respect to patient educational status. The largest incidence rate is found among the illiterate (20.58%). The educated infected persons had the lowest prevalence percentage (8.62%). Patients with only a high level of education had an infection rate of 15.28 percent.

Table 1. Distribution of Malarial Parasite in D.I.Khan District (n=228)

S No	Plasmodium Species	Positive	Percentage
01	*P.vivax*	222	97.36
02	*P. falciparum*	05	2.19
03	Mixed infections	01	0.43
	Total	228	100

Figure 1. Gender-wise Prevalence of Malaria in Population of D.I.Khan

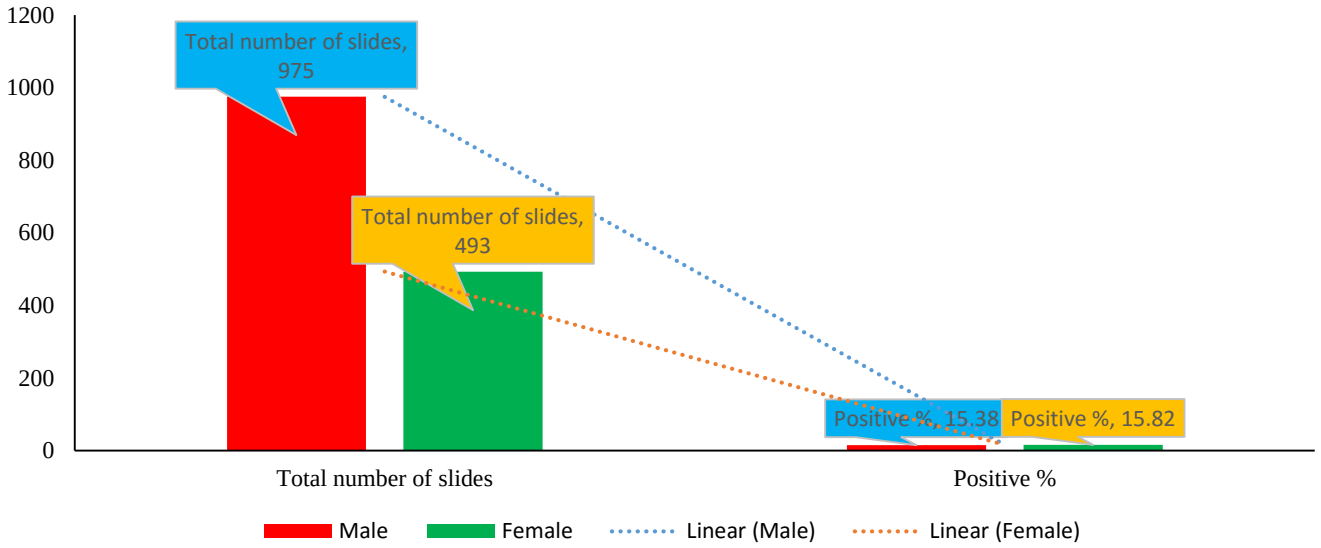

Table 2. Age-wise prevalence of Malaria patients in population of District D.I.Khan

Age Group Years	Positive	%	Total No. of samples
01-15 Years	99	21.85	453
16-30 Years	79	14.79	534
31-45 Years	28	13.27	211
46-60 Years	22	8.14	270

Table 3. According to educational status of the patients distribution of Malarial Parasite

Occupation	No. examined	No. Infected	% Infected
Educated	406	35	8.62
Semi. Educated	484	74	15.28
Illiterates	578	119	20.58

4. Discussion

In Pakistan, malaria is a fairly endemic disease. The prevalence varies from one province and one region to another. This study was carried out among the residents of Dera Ismail Khan (D.I. Khan) in the months of January and June 2023. D. I. Khan is located in a hot climate on the right bank of the Indus River. Data on the disease's incidence will be added by the current investigation. In the current study, the total malaria prevalence was 15.53%, which is consistent with a previous study by Inam and Awan [14], that found 17.35% of cases were positive in Bannu District.

The overall prevalence results of the current study are comparable to those of Khan et al. [15] who identified 98 (20%) cases of positive results in the adult population of D.I. Khan, Khyber Pakhtunkhwa, Pakistan. The current data is also consistent with a previous study by Yar et al. [16], which was carried out in Bannu District and found that the overall prevalence was 22%. The prevalence of P. vivax was 97.36% larger than that of P. falciparum (2.19%) and mixed infections (0.43%). According to Inam and Awan [14], a prior study conducted in Bannu District found that P. vivax accounted for 91.53% of cases, P. falciparum for 7.47%, and mix infections for 0.99%. Yar et al. [16], noted that the incidence of P. vivax was higher in Multan District (60.50%) than that of P. falciparum (37.20%). Similar findings were found in Kashmiri refugees in Muzaffarabad, where P. vivax was the most common species (6.33%) compared to falciparum (0.67%) [17]. The current investigation found that vivax malaria was more common than P. falciparum. According to Zahoor et al. [2], the first explanation is that whereas P. falciparum does not appear to have a second exothermic cycle, relapses do occur in P. vivax. The second explanation is that P. vivax species can live in the liver for up to three years, but P. falciparum species only last a year in the human body [2]. Malaria was observed to affect both males (15.38%) and females (15.82%) equally in the current study. Similar findings were made by Awn et al. (2012), who reported infection rates of 3.06% for males and 3.03% for females. The current study additionally examined the age group of 1–15 years old that was considered to be at high risk. Inam and Awan (2013) and Awan et al. [18], did similar investigations and found that the age groups of 5–14 and 5–15 years were more affected. In this age bracket (1–15 years), people of both sexes are equally susceptible to contracting malaria, which could be the cause.

5. Conclusions

The highest incidence rate, 20.58%, was found to be among illiterate people. Their lifestyles and the poor environmental conditions they are exposed to are most likely to blame for this malarial parasite.

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Conflicts of interest
There are no conflicts of interest.

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