



Prevalence of Malaria in Blood Smears of Human Population in District Mardan

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Declaration

Authors' Contribution

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ABSTRACT

Background: Malaria is a vector-borne disease caused by *Plasmodium* parasites and transmitted by *Anopheles* mosquitoes, posing a significant health risk to nearly half of the world's population. It is particularly endemic in Pakistan, where it remains a major public health concern. **Objective:** The present study aimed to determine the prevalence of malaria infection in District Mardan. **Methodology:** A descriptive study was conducted from January to April 2021, and data on malaria patients were collected from the District Headquarters Hospital, Mardan. The data were analyzed by month, age group, and gender. A total of 2,843 blood samples were collected between January 11 and April 6, 2021. Statistical analysis was performed using Microsoft Excel (2013) and Microsoft Word (2013). **Results:** Out of the 2,843 samples, 29 (1.02%) tested positive for malaria. Females accounted for a higher proportion of cases (55.1%) compared to males (44.8%). The highest prevalence was recorded in the 21–40 years age group (62%). In terms of monthly distribution, the majority of cases occurred in March (37.9%), followed by January (31%), February (24%), and April (6.8%). **Conclusion:** The study found a higher prevalence of malaria among females and individuals aged 21–40 years, with the peak occurrence in March. These findings highlight the need for targeted malaria control measures in District Mardan, especially among the most affected age group and during high-risk months.

INTRODUCTION

Malaria is a disease caused by the eukaryotic protist of the genus, *Plasmodium* [1]. *Plasmodium* is a parasite [1] and it is principally a vector-borne disease [2]. Among the different species of *Plasmodium*, four species are known to cause Malaria in human i.e. *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale* [3]. *Plasmodium falciparum* and *Plasmodium vivax* are more frequent and common [4] causing a severe form of malaria and high mortality rate, whereas *Plasmodium ovale* and *Plasmodium malariae* are not much fatal and cause a mild form of malaria [5].

Malaria fever is most common in children of age less than five years contributing to somewhat 60% of the cases of malaria [6]. Malaria is the most predominant parasitic infection in the world and is among the five blood infections that can easily infect a human population. In Pakistan, malaria has been reported as the second most infectious disease among the public [7].

Malaria is particularly endemic in Pakistan found in almost all of the provinces as Khyber Pakhtoon Khwa,

Baluchistan, Sindh, and Federal Administrated Tribal Areas (FATA) [8]. The main reason for the prevalence of the disease in these areas is the presence of large bodies of stagnant water which provide the medium for the breeding of *Plasmodium* [9]. In 2004, the lowest number of cases of malaria has been reported in the Punjab and Azad, and Jammu Kashmir while in Baluchistan and Federally Administrated Tribal Areas (FATA), the high frequency of malaria has been reported. In Sindh and KPK, a moderate number of cases appear [10]. The climate of Pakistan being tropical having seasonal rainfalls. After the monsoon rainfall the canals and trenches filled with large volumes of stagnant water, being space for mosquito breeding, [4].

Malaria is mainly a disease of poverty and most prevalent in the rural areas, where a majority of the country's population live. This disease mostly occurs in the month of July and August in Pakistan [1]. In Pakistan, malaria is endemic in 91 districts out of 123 districts in the past years [7]. *Plasmodium falciparum* and *Plasmodium vivax* are the most common species of malaria in Pakistan. Each year 1.5 million cases of malaria has been reported in Pakistan [10].

Malaria is the main cause of high mortality and death rate in tropical and subtropical countries, causing 85% of the world's infection rate [2]. The mortality rate due to malaria worldwide is about 438,000 and about 3.5 million cases in Pakistan [11]. Malaria is gaining global importance due to its high risk to about 3.3 billion people in 97 countries, estimating a total of 200 million cases and about 600,000 deaths [12]. About half of the population of the world is at risk of malaria. An estimated rate of 243million cases was reported in 2008 and about 863000 deaths were also due to malaria [9].

The malarial infection is usually transmitted from females Anopheles mosquito, which is affected by the parasite *Plasmodium*. This parasite resides in the saliva of the mosquito. When the mosquito bites a person, the parasite then moves from the saliva into the person's blood which then causes malaria, showing a number of symptoms like fever, headache, and in severe cases lead to deaths [14]. So, females Anopheles mosquitoes are termed as malarial vectors. The mosquitoes have about 3,000 species of which 100 are the carriers of human diseases. For the development and nourishment of its eggs, the female anopheles feed on the blood of a person and by this way transmits the disease [1]. The infection usually starts with the introduction of sporozoites by infected mosquitoes. These sporozoites invade the hepatocytes in the liver and start their multiplication for about a week. At this stage, the disease does not appear. The infection becomes apparent at the erythrocytic cycle when the red blood cells get affected. The sporozoites develop into the merozoites which then burst out of the cells and attack erythrocytes (RBCs), showing symptoms of the disease at this stage [15].

The malaria can be diagnosed by performing the rapid diagnostic tests or using blood smears which will be examined under the microscope. A large number of molecular techniques such as Polymerase chain reaction is also used to detect the DNA of the malarial parasite, but these method are less common due to various complications and its high cost [16]. The treatment of malaria include the use of most common drugs such as injecting quinine and quinidine. After the patient becomes clinically stable, the oral treatment is started. People with severe form of malaria has been suggested for the blood transfusions [17]. The current study is conducted with the aim to investigate the prevalence of Malaria in District Mardan.

MATERIALS AND METHODS

Literature searching strategy

In order to integrate data, we searched various research articles on malaria and its prevalence. For this purpose we surf various search engines like google scholar, PubMed, EBSCO and NCBI to view and download numerous research papers on malaria.

Study Area

The data for this study was collected from District Head Quarter (DHQ) Hospital Mardan. Mardan District is the city in the province of Khyber Pakhtunkhwa, Pakistan. It is the second largest city of KPK which is located in the valley of Peshawar. It has a population of 3810000 by 2020.

Study Design

A quantitative study was designed from 11 January 2021 to 6 April 2021. The secondary data regarding malarial patients was collected from District Head Quarter Hospital Mardan to check the prevalence of malarial infection in males and females.

Study Population

Patients of all age groups who visited the District Head Quarter Hospital with signs and symptoms of malaria like Fever, Chills, Headache, Sweats, Fatigue, Nausea, Vomiting, were included in the study.

Data Collection

Data of suspected malarial patients will be collected from District Head Quarter Hospital Mardan from the months of 11 January 2021 to 6 April 2021.

The whole information relating to malarial patients regarding age, sex, address, occupation, will be included in the data. The collected data will be analyzed statistically age-wise and gender-wise.

RESULTS

Distribution of Malaria in District Mardan:

In our study, we considered the period of January, February, March, and April during which 2843 patients visited the hospital with malaria symptoms in which 860 samples were taken during the month of January and 840, 1010 and 133 samples from February, March and April respectively. Of these cases, 29 were found positive for malaria, comprising about (1.02%) prevalence rate. 2814 cases were diagnosed as negative as shown in table 1 and figure 1.

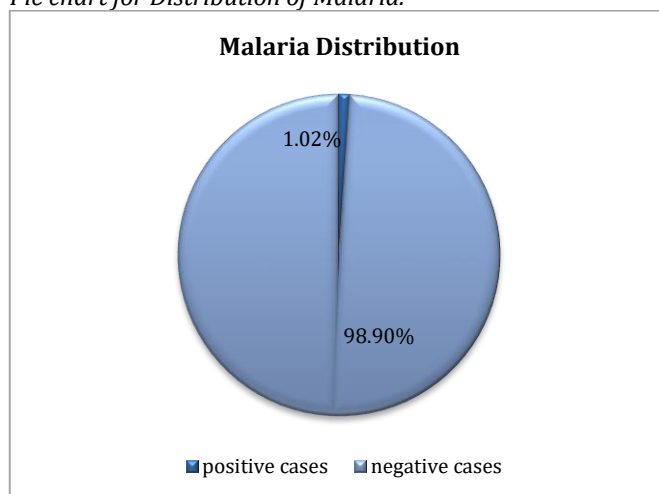
Table 1

Distribution of Malaria in District Mardan (11 January-6 April, 2021).

Positive cases	29	29 (1.02%)
Total cases	2843	2843

Figure 1

Pie chart for Distribution of Malaria.

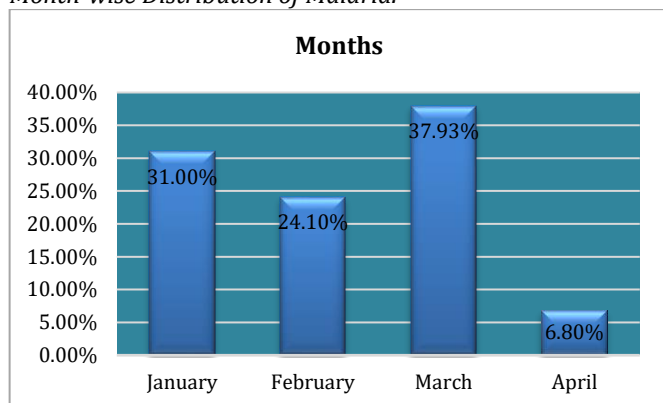


Month-Wise Distribution of Malaria

We study the data for the months of January, February, March and April. Prevalence was highest in the month of March (37.9%) followed by January (31.0%), February (24.1%) and lowest in the month of April (6.8%) as shown in the table 2 and figure 2.

Table 2*Month-Wise distribution of Malaria in District Mardan.*

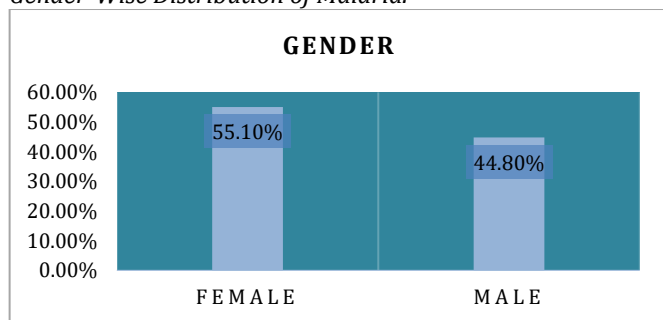
Months	Positive cases	Total
January	9 (31.0%)	860
February	7 (24.1%)	840
March	11 (37.93%)	1010
April	2 (6.8%)	133

Figure 2*Month-wise Distribution of Malaria.***Gender-Wise Distribution of Malaria**

Prevalence was highest in females (55.1%) than males (44.8%). The total 2843 samples comprises 1605 (56.4%) females and 1238 (43.5%) males. Of these, 16 (55.1%) were positive in females and 13 (44.8%) in males as shown in table 3 and figure 3.

Table 3*Sex-Wise Distribution of District Mardan.*

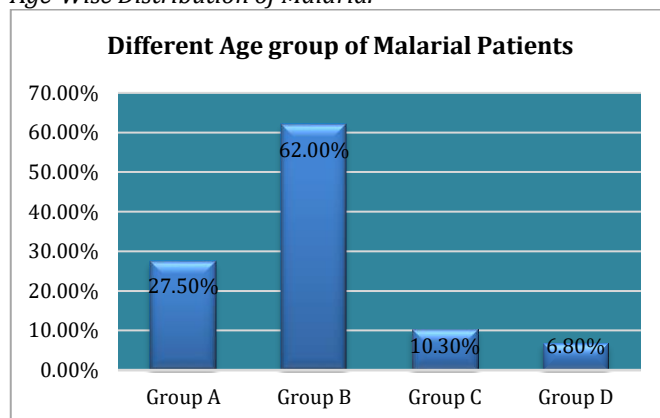
Gender	Positive cases	Total
Female	16 (55.1%)	1605 (56.4%)
Male	13 (44.8%)	1238 (43.5%)
Total	29	2843

Figure 3*Gender-Wise Distribution of Malaria.***Age-Wise Distribution of Malaria**

In our study, different age group patients were analyzed. Prevalence was highest in the age group 21-40 years recorded 18 (62%) cases. The second highest prevalence was observed in age group 0-20 years listed 8 (27.5%) cases, followed by 3 (10.3%) cases in age group 41-60 years. No cases were observed in age group 61 and above as shown in table 4 and figure 4.

Table 4*Age-Wise Distribution of Malaria infection in District Mardan.*

Age (Years)	Positive cases	Total
0-20 Years	8 (27.5%)	724
21-40 Years	18 (62.0%)	1266
41-60 Years	3 (10.3%)	749
61 and above	0 (0%)	104

Figure 4*Age-Wise Distribution of Malaria.***DISCUSSION**

Malaria still a global health issue. The present study was conducted to determine the prevalence of malaria in district Mardan. The study was carried out from 1 January to 6 April 2021. During these months, all the patients suspected of malaria visiting the hospital were analyzed. In our study the prevalence record for malaria was (1.02%) which was in comparison lower than other studies. Majid *et al* 2016 conducted a study in district Mardan to check the prevalence. It record (6.8%) malaria in Mardan. Bashir *et al* in 2019 reported (12.2%) positivity rate in Dera Ismail Khan. Umer *et al* research in 2017 at district Saifullah, Balochistan shows (20.0%) positive cases. In 2013, Nusrat jahan and Muhammad sajjad sarwar stated (26%) malaria in district Okara, Punjab.

In a study of Yasinzai *et al* in Turbat in 2012, (46.4%) samples were infected with malaria. Ullah *et al* 2019 stated (12.2%) prevalence ratio for malaria in District Dir Lower. In 2020, Qureshi *et al* in its survey of KPK reported (13.8%) prevalence ratio. Soomro *et al* in 2010, conducted study in Larkano district, Sindh. Its overall positivity ratio was (1.67%). Awan *et al* 2012 and Muhammad *et al* in 2001 reported (3.61%) and (6.86%) ratio in district Bannu respectively. The study of Hussain *et al* at Lal Qilla, Pakistan in 2015 recorded (10.29%) prevalence ratio. Rahim *et al* in 2014 conducted research in Ghalader district, Mardan. It records (13.9%) positive samples.

Syed *et al* in 2020 carried a study in the population of Swat valley, Pakistan. This article reports (10.07%) prevalence. A study in district Lower Dir by Zeb *et al* in 2015 reported (12.2%) ratio for malarial parasites. Khan *et al* in 2018 recorded a prevalence rate (13.8%) in KPK. In Malakand district the prevalence was (26.7%) by Khan *et al* 2019. Tareen *et al* in 2-12 reported (18.45%) positivity rate in Quetta, Pakistan.

Our study shows that females (55.5%) prevalence of malaria was higher than males (44.8%). Also among the different age groups, (62%) cases of malaria were found positive in the age of 21-40 and lowest (10.3%) in the 41-60 age group. Bashir *et al* in 2019 reported that males (68.9%) were infected more than females and is more obvious in age less than 14 (52.8%). Majid *et al* also stated that high prevalence occurs in females (56.27%) and in age group 0-20 years (47.4%).

Khan *et al*, 2006 conducted a study on the population of

Dera Ismail Khan, Pakistan. Of total, (20%) cases were positive with more prevalence observed in males (76.53%). According to the study of Rahman *et al*, 2016 in Shangla, prevalence of malaria was highest in males (65.24%) than females (34.76%). It also shows that the most prevalent age for malaria was 21-40 years.

Inayat Ullah in 2016 stated that infection was more common in males (53.50%) and in age group 31-45 years (53.07%) in Shergarh district. Khan *et al* 2019 presented the highest prevalence in males and in age group greater than 16 in Malakand district. Majid *et al* in 2016 in its survey on Mardan reported that females (56.27%) were infected more than males (43.73%). Infection appears more in the age of 0-20 years (47.4%).

In the current study, prevalence was highest in the month of March, followed by January, February and April.

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CONCLUSION

The whole study concludes that females were infected more as compared to males. Also Malaria is observed more in middle-aged individuals (21-40 years). It is also suggested that if the studies occur during the transmission season of *Plasmodium*, it will be more significant. It is also recommended that in future studies only positive cases should be targeted in order to point out the risk factors associated with the Malaria.

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