The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 10, 2025

ASSESSMENT OF HEMATOLOGICAL PARAMETER IN MALARIA INFECTED PATIENTS VISITING KHYBER TEACHING HOSPITAL PESHAWAR

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DOI: https://doi.org/10.5281/zenodo.17383495

Keywords
Malaria; Plasmodium vivax; Plasmodium falciparum; Prevalence

Article History
Received: 22 August 2025
Accepted: 05 October2025
Published: 18 October 2025

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Abstract

BACKGROUND AND OBJECTIVE

A major global health concern is malaria. It still poses a risk to developing nations. The purpose of this study was to evaluate the various hematological parameters in patients with malaria.

METHODOLOGY

From May 2025 to July 2025, this cross-sectional study was carried out at Khyber Teaching Hospital in Peshawar. Following a thorough history and informed consent, 108 blood samples were taken. Three milliliters of venous blood are drawn, and an ICT technique is used to analyze the blood samples for malaria. We do a complete blood count (CBC) if the ICT indicates that the patient has malaria.

RESULT

Males had a higher malaria prevalence (57.4%) than females (42.6%). Infection rates by age were 42% (1–25 years), 40% (26–50 years), and 18% (51–75 years). Plasmodium vivax *was the predominant species (87%), followed by* P. falciparum *(13%). Thrombocytopenia (low platelets) was observed in 82% of cases, anemia (low hemoglobin) in 68%, leukopenia (low WBC) in 16%, and low RBC levels in 46% of patients.*

CONCLUSION

Hematological parameters are significantly correlated with malaria infection, with thrombocytopenia, anemia, and leukopenia being the most prevalent abnormalities. Among these, thrombocytopenia is the most affected and serves as a key diagnostic indicator, especially in severe cases.

INTRODUCTION

In 1753, the Italians gave the disease the name malaria, which was derived from the Italian words "mala" (bad) and "aria" (air). This suggests that the disease was brought on by noxious fumes from marshy areas(1). In tropical and subtropical regions, malaria is a deadly protozoan infectious disease. Plasmodium, the causative agent of this illness, is transmitted by the bite of an infected anopheline vector. Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, and Plasmodium knowlesi are among the species that are found throughout the world and belong to the genus Plasmodium (2).

The majority of malaria infections are caused by P. falciparum and P. vivax. The World Health Organization (WHO, 2020) reports that malaria killed 627,000 people and infected 241,000,000 people globally in 2020. With 70% of infections, Plasmodium vivax (p. vivax) is the most prevalent parasite in Pakistan. In contrast, Plasmodium falciparum (P. falciparum) was responsible for the remaining 30% of infections during the peak period of transmission.(3). The disease is usually caused by five different species of Plasmodium: Plasmodium viva x, Plasmodium falciparum, Plasmodium malariae, Plasmodium knowlesi, and Plasmodium ovale. Malaria is one of the most common diseases in Pakistan, where it is endemic. The primary malarial pathogens that cause the parasitic infection in Pakistan are P. vivax and P. falciparum (4).

Hematological abnormalities are believed to be a hallmark of malaria (5). Malaria is primarily linked to a range of hematological complications, including thrombocytopenia and anemia. Anemia can be caused by a variety of factors, such as hemolysis, comorbidities, such as parasite infections, folate, iron, and vitamin B12 deficiencies in endemic areas, antimalarial drugs, and the presence of thalassemia and other hemoglobinopathies (6).According to multiple studies, P. falciparum infection has been linked to a number of hematological parameter abnormalities. White blood cell (WBC)-related indices, such as the total WBC count, and its differentials, such as the neutrophil count, are among these hematological parameters. Hemoglobin (HB) level, mean corpuscular HB (MCH), mean corpuscular HB concentration (MCHC), width of red cell distribution (RDW), and mean corpuscular volume are indicators associated with red blood cells (RBCs).(MCV) (7).

Early diagnosis is essential for timely and efficient disease management and treatment (8).Hematological abnormalities are one of the most common complications in malaria, because it effects the main cell lines. Anemia, leukocytosis/leucopenia, thrombocytopenia, and disseminated intravascular coagulation are hematological abnormalities linked to malaria. The degree of these changes varies with the degree of malaria endemicity, background haemoglobinopathy, nutritional status, environmental factors and malaria immunity.Asymptomatic malaria parasitemia (ASMP) has been shown to act as a reservoir for malaria through gametocyte transmission and may be one of the many different disease routes(9).

The blood routine examination is a common test for malaria patients. The WBC and neutrophil counts may rise during the acute infection, but they usually return to normal once the attack has passed. After repeated attacks, the WBC count decreases and the monocyte count increases. Additionally, the Hb and PLT will be decline to variable degrees (10).

METHODOLOGY

This study used a cross-sectional design to assess hematological parameter in malaria infected patients visiting khyber teaching hospital Peshawar.Data were collected from the people during the period of April 2025 to July 2025. The research was conducted at single sites khyber teaching hospital Peshawar.Ethical approval was obtained and informed consent was secured from all participants prior to data collection.

A non-probability convenience sampling technique was adopted, selecting individuals who were readily available and willing to participate. The sample size was calculated using WHO sample size calculator with the claims of 95 percent confidence level, 5% percent margin of error, and projected prevalence of malaria was estimated 7.8% percent, and 7.7% percent according to previous prevalence. the resulting sample size is 108. Inclusion criteria included People resident of District Peshawar.Exclusion criteria included People resident of other than District Peshawar and Patients with

other hematological abnormalities were excluded from this study.

We collect 3 ml of blood sample with disposable syringes and draw it in EDTA (Ethylene diamine tetra-acetic acid) anticoagulant-coated tubes after informed consent. Designed questionnaires were filled from suspected patients, contained limited variables including gender, age. The malaria were detected by ICT (immune chromatographic techniques) methods, and if result is positive then we perform CBC (complete blood count) test through hematology analyzer (Mindray BC-30s) to assess different hematological parameters. SPSS version 22 were used for the analysis of data and descriptive statistic were applied, Table and Graph was draw for all variables such as gender, frequency, percentage of male and female positive cases and also draw a tables and graph for all hematological parameters.

RESULTS

A total of n=108 individual in the current study was divided into three age groups. The frequency between age 1 to 25 years consist of n=45 (42%), 26 to 50 years consists of n=43 (40%), and 51 to 75 years include n=20 (18%).), with 62 (57.4%) males and 46 (42.6%) females out of 108. A total on n=108 malarial infected patients were divided according to different species in which only two species were identified. The frequency of plasmodium vivax is n=94 (87%) and plasmodium falciparum is n=14 (13%). (TABLE 1)

A total of 108 patients in which the frequency of patients having low WBC level is n=17 (16%), having high WBC level is n=12 (11%) and having normal WBC level is n=79(73%). Level of RBC in this study frequency of patients having low RBC level is n=51(47.2%), having high RBC level is n=02(1.9%) and having normal RBC level is n=55 showing (50.9%).. A total of 108 patients in which the frequency of patients having low platelets level is n=88 (82%), and normal platelets level is n=20(18%).. A total of 108 patients in which the frequency of patients having low HB level is n=74 (68%), high HB level is n=01 (01%) and normal HB level is n=33(31%). (TABLE 1)

Level of platelets is the most affected parameter by malaria which low in 82% of patients leading to thrombocytopenia. And level of Hb is the second most affected parameter by malaria parasites leading to anemia.

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	1–25	45	42.0
	26–50	43	40.0
	51–75	20	18.0
Gender	Male	62	57.4
	Female	46	42.6
Types of Malaria species	Vivax	94	87.0
	Falciparum	14	13.0
WBCs level	Low	17	16.0
	High	12	11.0
	Normal	79	73.0
RBCs Level	Low	51	47.2
	High	2	1.9
	Normal	55	50.9
Platelets level	Low	88	82.0
	Normal	20	18.0
Hb level	Low	74	68.5
	High	1	0.9
	Normal	33	30.6

Table 1

DISCUSSION

Due to mosquito exposure, malaria primarily affects individuals between the ages of 10 and 30. According to our research, 45% of those affected were between the ages of 1 and 25. Zeeba S et al. and Kumbhar SS et al. both produced similar findings. Younger people who are frequently exposed to mosquitoes through their jobs, travels, etc., were more likely to contract malaria. Since the majority of infected individuals were men due to their outside lifestyles, men made up 57% of the most affected sex in our study(11).

Plasmodium vivax is the most common malaria species in our study, accounting for 87% of cases, whereas Plasmodium falciparum accounts for 13%. This discovery was also documented. However, 76.7% of P. vivax-positive cases were reported in a number of other Indian studies, which found much higher incidences of P. vivax. It is difficult to diagnose and treat P. vivax malaria because it typically has a lower parasitemia than P. falciparum(12).

Eighty-four percent of the malaria patients in another study had thrombocytopenia (platelet count <140,000/µL), while the remaining sixteen percent had normal platelet counts. Anemia was the second most frequent hematological abnormality observed in malarial infection cases. Anemia affected 60% of malaria patients, while 40% had normal Hgb levels. Thrombocytopenia was the most common hematological abnormality in the study associated with malaria infection(13)

Hematological alterations are widely known to occur in malarial infections and are regarded as a sign of a malarial clinical suspicion. Anemia and thrombocytopenia were the main hematological abnormalities found in this investigation; these results are also consistent with several other studies. For instance, it has been discovered that thrombocytopenia is a strong indicator of malaria(14)

According to the current study, 50% of both male and female cases had low RBC counts, which is comparable to 50.8% of P. vivax cases. According to our study, 47% of patients with malaria have low red blood cell counts, which can result in anemia because of red blood cell destruction(15).

Conclusion

We found that hematological parameters and malaria infection are significantly correlated. Among them, hematological abnormalities like leukopenia, anemia, and thrombocytopenia are prevalent. Hematological parameters most affected are thrombocytopenia (low platelets). In individuals with a severe malaria infection, each of these metrics provides a diagnostic clue and acts as a malaria predictor.

Recommendations

To assess the impact of malaria on blood cells, a comprehensive analysis of hematological parameters such as complete blood count (CBC) and differential counts is recommended. Comparing these parameters between healthy individuals and malaria patients can help identify significant differences. Additionally, examining variations in hematological profiles between *Plasmodium vivax* and *Plasmodium falciparum* infections provides valuable insights. Given their prognostic importance, thrombocytopenia and anemia should be closely monitored in malaria cases.

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