



COMMON BLOOD DISORDERS IN MALARIA PATIENTS AT A TERTIARY HOSPITAL

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ABSTRACT

Background: Malaria is a significant infectious disease in endemic areas that is associated with hematological abnormalities like anemia and thrombocytopenia. The knowledge of these blood disorders is very important for early diagnosis and management.

Objective: To estimate the prevalence, type and severity of common blood disorders in malaria patients in a tertiary hospital.

Methods: A cross-sectional study was conducted at Medicine Department, Saidu Group of Teaching Hospital from January, 2025 to June, 2025 involving 200 confirmed cases of malaria. The hematological parameters such as hemoglobin, platelet count, white blood cell count, coagulation profile were measured and correlated with the type and severity of malaria.

Results: Anemia was found in 38%, thrombocytopenia in 47%, leukopenia in 15% and coagulation abnormalities in 8% of patients. Children were more susceptible to hematological disturbances and thrombocytopenia and severe anemia were more common in Plasmodium falciparum and mixed infections.

Conclusion: Hematological abnormalities are common in malaria patients, and routine blood evaluation is essential for timely management and improved outcomes.

Keywords: Malaria, Anemia, Thrombocytopenia, Hematological Abnormalities, Plasmodium falciparum, Tertiary Hospital.

INTRODUCTION

Malaria is still one of the most significant parasitic diseases of man, particularly in the tropics and subtropics where the environment is conducive to the breeding of mosquitoes and the transmission of the parasites. It is transmitted by infected female Anopheles mosquito and is caused by Plasmodium species. Malaria is known for general symptoms like fever, chills, sweating, headache, body aches and weakness, but its effects are not just limited to general symptoms. There are also several changes in the blood cells that the disease can cause, which can aid in making a diagnosis of malaria before the results of confirmatory tests are received. One of the most common blood changes is thrombocytopenia, which has been reported to have a strong association with the type and severity of malaria infection (1). Malaria patients with blood disorders are clinically significant because they may impact the diagnosis, treatment decisions, monitoring, and outcomes of the disease. The malaria parasites invade red blood cells, multiply within the cells, and eventually kill the cells.

This may result in anemia, decrease in hemoglobin level and other abnormalities in red blood cell indices. Furthermore, malaria affects the white blood cell count and platelet levels and complete blood count is a helpful supportive test for patient evaluation. Malaria has been associated with hematological abnormalities among adults infected with the disease, indicating that malaria can have several effects on patients besides fever (2). Other common blood disorders observed in malaria patients are anemia, which can result from destruction of infected red blood cells, removal of uninfected red blood cells by the spleen, decrease in red cell production and inflammatory changes that occur during infection. In some patients, low levels of hemoglobin can be mild; however, in children, pregnant women, elderly patients and patients who have repeated infections, anemia can be serious and even life-threatening. Other studies have also indicated a relationship between malaria infection, ABO blood group and hemoglobin concentration, indicating that host-related factors can affect blood abnormalities in malaria (3).

Thrombocytopenia is significant because many malaria patients present with low platelet counts. In some instances, platelet reduction can be mild and asymptomatic; in other instances, it can be severe and cause concern for bleeding risk or for severe disease. In tertiary care hospitals, platelet count is usually done on the spot in febrile patients and a low platelet count can help direct doctors to consider testing for malaria, dengue and other tropical infections. Thrombocytopenia has been reported as a significant hematological finding in malaria patients in tertiary care centers, and is therefore a major hematological feature of malaria that requires appropriate assessment (4). Malaria can present as a simple illness or a complicated disease with involvement of several organs. Patients can have fever, vomiting, abdominal pain, jaundice, altered consciousness, respiratory distress, renal impairment or shock. The clinical features may be more severe if there is also a blood disorder, like anemia, abnormally low or high numbers of leukocytes, or thrombocytopenia. In tertiary care teaching hospitals, it has been demonstrated that malaria may have a variety of clinical and laboratory symptoms and careful examination of the blood can assist in the identification of those patients who require close monitoring (5).

In many endemic areas, severe malaria continues to be a significant cause of hospital admission and mortality. Severe malaria can cause complications including severe anemia, cerebral malaria, acute kidney injury, metabolic acidosis, hypoglycaemia and bleeding tendencies in adults admitted with severe malaria. Blood disorders may be a reflection of the severity of infection and can also exacerbate the patient's disease if not diagnosed early. The clinical features and outcomes of severe malaria among adults admitted to hospital highlight the importance of prompt diagnosis, laboratory surveillance and appropriate treatment to limit complications and death (6). Malaria is a medical emergency in intensive care units as it can become more and more severe in a short period of time. Hematological parameters are significant in the assessment of the patient in the ICU, as a decrease in hemoglobin level, platelets, and coagulation profile can reflect a worsening disease or the emergence of complications. Severe malaria is a condition involving severe thrombocytopenia, bleeding, severe anemia and multi-organ dysfunction that requires specialized attention and close monitoring. In critical care, diagnosis and management of malaria is focused on clinical evaluation and laboratory investigations for safe and effective patient management (7).

Falciparum malaria is thought to be more life-threatening as it can lead to high numbers of parasites, blockage of small blood vessels, severe anaemia and organ damage. Other organisms, however, like *Plasmodium vivax*, can also induce significant hematologic modifications. In uncomplicated falciparum malaria, significant alterations of blood indices such as platelet count, hemoglobin level and white blood cell count have been reported, even in the absence of severe disease. This indicates that blood changes can occur early and should not be overlooked in seemingly uncomplicated cases (8). Children are especially susceptible to malaria-related blood disorders due to their immature immune system and repeated exposure in malaria endemic areas. Malaria can lead to complications in hospitalized children such as anemia, thrombocytopenia, jaundice, convulsions, etc. Moderate anemia can have an impact on growth, immunity, and recovery in children. The clinical profile and spectrum of complications amongst hospitalised children show that malaria is not just an infectious disease, but a significant cause of haematological illness in younger age groups (9).

Other diseases, nutritional status, chronic inflammation and metabolic disorders may also affect hematological abnormalities. This is important as patients presenting at tertiary hospitals may have more than one health problem at the same time. If blood counts are abnormal, doctors need to rule out malaria and other potential causes of anemia, low platelets, or abnormal white cell counts. Hematological abnormalities in patients with systemic diseases emphasize the importance of considering blood parameters in the context of the patient's clinical status (10). There may also be alteration in coagulation in malaria patients particularly in severe cases. Platelets are crucial in the clotting process and patients with low platelet counts may experience bleeding symptoms or abnormal blood clotting tests. Patients at risk of complications can be identified using basic coagulation tests, as well as platelet count. Assessment of coagulation parameters and platelet count in malaria has revealed that malaria can affect both the cellular and clotting components of the blood and that laboratory monitoring is necessary in hospital setting (11).

Other biochemical parameters can also be altered in malaria besides blood cell counts. In complicated cases, the function of the liver, kidneys, bilirubin and inflammatory markers can be affected. Hematological parameters along with biochemical parameters provide a better idea of the severity of the disease. When both blood and biochemical markers are measured, they have been demonstrated to be helpful in cross sectional studies in the understanding of the clinical burden of malaria and in identifying those who require more aggressive management in the context of a tertiary care hospital (12). Early recognition of severe malaria is crucial as complications can be prevented. Some clinical and laboratory parameters such as low hemoglobin, thrombocytopenia, high bilirubin, renal failure and altered consciousness may indicate a serious illness. Tertiary care centre studies have highlighted various factors predicting severe malaria, and, consequently, a hospital-based assessment of symptoms and blood investigations is required to make an accurate risk assessment. This reinforces the importance of local studies to describe the most common blood disorders in malaria patients in particular hospital settings (13).

In recent years, the laboratory-diagnosed children with malaria still demonstrated the importance of hematological profiles in the evaluation of patients. Changes in hemoglobin, platelet count and white blood cell count may provide a description of the burden of disease and help inform treatment decisions. Blood profiles of children with confirmed malaria are useful in prospective studies in understanding the effects of malaria infection on various components of the blood. These results are useful for physicians in tertiary hospitals where children with fever often have overlapping signs and symptoms (14). There is also the possibility of silent infection and transfusion safety concerns as malaria may be present in apparently healthy people, such as blood donors. Blood donors should be screened in endemic areas because they can be infected with malaria and transmit the infection if not detected. Malaria has been found in apparently healthy donors, indicating that infection can occur without apparent symptoms and that changes in the blood can occur and manifest later in the course of the infection. This emphasizes the broader public health significance of hospital-based studies of malaria-related blood disorders (15).

Malaria is a current health issue in Pakistan and patients are brought to tertiary hospitals like Medicine Department, Saidu Group of Teaching Hospital from both rural and urban areas. In many local settings, *Plasmodium vivax* is reported, but may be associated with marked hematological abnormalities. Changes in haematological parameters have been observed in *Plasmodium vivax* malaria patients who attend the Medicine Department, Saidu Group of Teaching Hospital and warrant further studies on common haematological disorders in malaria patients in this hospital environment (16). The severity of the outcome of severe malaria varies with the age of the patient, type of parasite, delay in treatment, immunity and hospital capacity. Severe malaria with different complications and outcomes has been reported from tertiary hospitals in other endemic areas, and hematological abnormalities have been consistently reported. Knowledge of these patterns enables the comparison of local data with regional and international data. The benefit of hospital-based malaria research is further demonstrated in a study of severe malaria presentations and outcome in northwestern Nigeria (17). Malaria can also be confused with other febrile diseases like dengue, particularly in the presence of fever and thrombocytopenia. Distinguishing malaria from dengue and other infections is important,

as treatment for the two diseases is different, and delay can be harmful. Blood cell and biochemical disturbances in dengue and malaria have been correlated and compared, revealing that both diseases can alter blood parameters, with patterns possibly differing. Thus, the study of common blood disorders in malaria patients in Medicine Department, Saidu Group of Teaching Hospital can help in early diagnosis, management and patient care (18).

Objective: To determine the prevalence, types, and severity of common blood disorders, including anemia and thrombocytopenia, among malaria patients at a tertiary hospital.

MATERIALS AND METHODS

Study Design: Cross-sectional hospital-based study.

Study Setting: Medicine Department, Saidu Group of Teaching Hospital

Study Duration: The study was carried out from January, 2025 to June, 2025.

Sample Size: A total of 200 confirmed malaria patients attending the hospital during the study period were enrolled.

Sample Technique: Patients were selected using a **convenient sampling method**, including all eligible individuals who consented to participate.

Inclusion criteria: All patients who were diagnosed with malaria using microscopy or rapid diagnostic tests, aged 5 years and older, attending the hospital during the study period were included.

Exclusion Criteria: Any patient with chronic hematological disorders, dengue and HIV co-infections, recent blood transfusion and incomplete clinical records were excluded.

Methods: The methods used included venous blood samples which were analyzed for hemoglobin, hematocrit, platelet count, white blood cell count, and coagulation parameters. Data on demography and clinical features were collected and laboratory results were matched with malaria type and severity.

RESULTS

The study involved 200 malnourished patients, ages 5-65 years. The study population was made up of 60% male (n=120) and 40% female (n=80) patients. Mixed infections were present in 5%, *P. vivax* was the most common species found in 55% of cases, and *P. falciparum* was found in 40% of cases.

Table 1: Distribution of Malaria Species among Patients

Malaria Species	Number of Patients	Percentage (%)
Plasmodium vivax	110	55
Plasmodium falciparum	80	40
Mixed infection	10	5
Total	200	100

Hematological examination showed that 38% of patients were anemic, of which 20% were mild, 12% moderate and 6% severe anemia. The prevalence of thrombocytopenia was 47% mostly in *P. falciparum*-infected patients. Leukopenia was seen in 15%, and leukocytosis in 10% of the patients. Coagulation abnormalities were detected in 8% of cases, mainly in severe malaria patients.

Table 2: Prevalence of Hematological Abnormalities

Hematological Parameter	Abnormality Present	Percentage (%)
Anemia	76	38
Thrombocytopenia	94	47
Leukopenia	30	15
Leukocytosis	20	10
Coagulation Abnormality	16	8

Thrombocytopenia was significantly correlated with the infection with *Plasmodium falciparum* ($p < 0.01$) by correlation analysis. Likewise, children aged < 12 years and those with mixed malaria infections had higher levels of severe anaemia.

Table 3: Hematological Abnormalities by Age Group

Age Group (Years)	Anemia (%)	Thrombocytopenia (%)	Leukopenia (%)
5–12	25	30	5
13–25	8	10	4
26–45	4	5	3
46–65	1	2	3

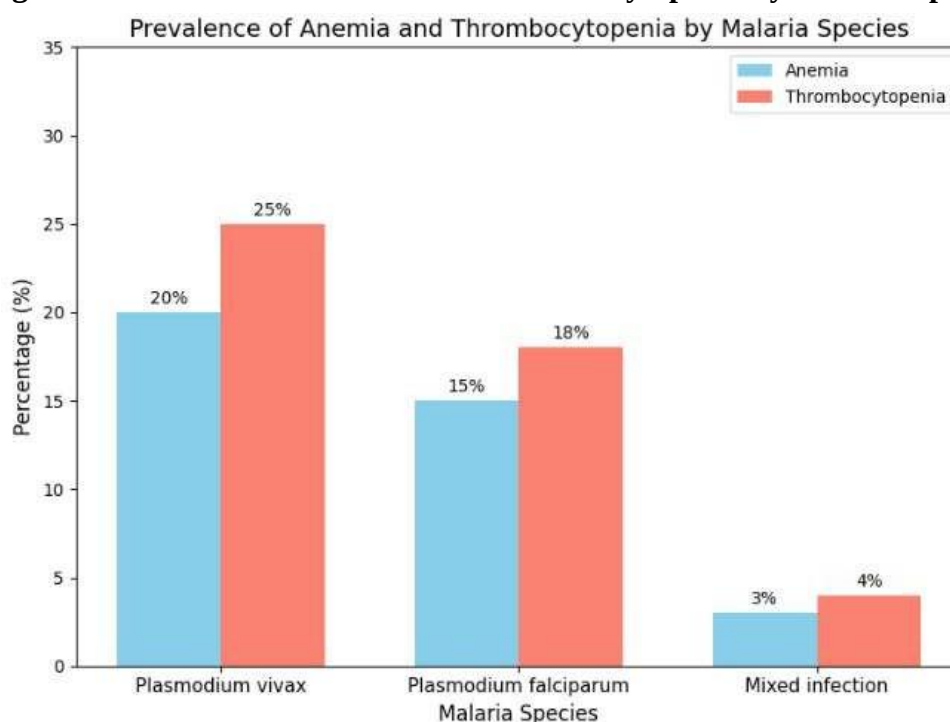
Gender-wise analysis indicated no significant difference in hematological abnormalities between males and females ($p > 0.05$).

Table 4: Hematological Abnormalities by Malaria Type

Malaria Type	Anemia (%)	Thrombocytopenia (%)	Leukopenia (%)
<i>Plasmodium vivax</i>	20	25	8
<i>Plasmodium falciparum</i>	15	18	5
Mixed infection	3	4	2

The graphical representation (Figure 1) reveals that both the prevalence of anemia and thrombocytopenia were higher in the malaria species *Plasmodium falciparum* and mixed infections.

Figure 1: Prevalence of Anemia and Thrombocytopenia by Malaria Species



Overall, the results demonstrate that hematological abnormalities are common in malaria patients, particularly anemia and thrombocytopenia, and their prevalence varies with age, malaria type, and disease severity.

DISCUSSION

Malaria remains a public health problem and the impact of malaria on hematological parameters has been well documented. Thrombocytopenia was one of the most common blood abnormalities found

among patients, and was more common in those infected with *Plasmodium falciparum*. This is in keeping with the results of Kumar et al. who found that the presence and degree of thrombocytopenia closely correlated with the type and severity of malaria, especially in the tertiary care centers (1). It is believed that the mechanism is peripheral destruction of platelets, immune-mediated lysis, and sequestration in the spleen. Both host and parasite factors affect hematological abnormalities in malaria. Asmerom et al. observed that ABO blood groups might influence the severity of anemia and thrombocytopenia in malaria-infected adults, suggesting that genetic factors could influence the severity of blood disorders (2).

Likewise, the association between malaria and hemoglobin reported by Tazebew et al. implies that some people may be more vulnerable to anemia due to their baseline hemoglobin and other hematologic parameters (3). Thrombocytopenia has been consistently reported in various settings. In endemic areas, a low platelet count in the blood may be a clinical clue to suspect malaria, as was shown by Khalid et al in malaria patients in tertiary hospitals (4). The clinical symptoms of malaria can vary from mild to severe, and patients may have fever, vomiting, jaundice and altered consciousness; Karoli et al. noted that blood disorders are frequently seen with these symptoms and that hematological assessment is a critical part of any patient evaluation (5). Hematological problems also exist for severe malaria. The complications often seen in severe malaria cases, such as severe anemia, thrombocytopenia, and coagulation disorders, were reported by Bittaye et al. to be common in adult patients admitted with severe malaria, requiring close monitoring in tertiary care settings (6). Akafity et al. also emphasized the need for intensive care in the treatment of malaria patients; the hematological parameters are used to assess the prognosis and treatment of malaria in the ICU (7).

There may also be marked changes in blood indices in uncomplicated malaria. Even in uncomplicated *Plasmodium falciparum* malaria, abnormalities of the hemoglobin, platelet count and white blood cells were common, indicating that laboratory evaluation should be performed irrespective of the clinical severity (8). Hematological disorders can be more severe in children. Waris et al. demonstrated that pediatric patients frequently exhibited anemia, thrombocytopenia and other complications that impacted treatment responses and recovery (9). Hematological outcomes may be further influenced by systemic health factors. Kelem et al. noted that in the case of malaria infection, laboratory results may be atypical in patients with metabolic syndrome or other comorbidities, thus making interpretation complex in these patients in a tertiary hospital (10).

Other abnormalities include disturbances of coagulation. Tiruneh et al. noted that changes in platelet count and basic coagulation parameters could be used to predict a progression to severe malaria and thus prompt intervention (11). There are biochemical correlations as well. Patel et al. showed that the combination of liver and kidney function tests with haematological parameters can be used to help clinicians determine the severity of malaria and predict complications, which can help inform management decisions (12). Severe malaria is still a clinical target to be predicted. Korkusuz et al. pointed out the value of clinical and laboratory parameters in tertiary care centers to identify patients who are at risk of developing severe disease (13).

Hematological changes remain evident in children with laboratory confirm malaria. Nkansah et al. reported that these variations in hemoglobin, platelet count and white cell indices are common among the pediatric patients and this highlights the need to closely monitor these patients in endemic areas (14). Malaria parasites have been found in apparently healthy people and Kumari et al. reported that in endemic areas, blood donors may also be infected with malaria and have subclinical disease, which is a significant preventive measure (15). *Plasmodium vivax* is a prevalent species in Pakistan and hematological disorders are also prevalent. Even in the patients with vivax malaria attending Medicine Department, Saidu Group of Teaching Hospital, the significant decrease in hemoglobin and platelet count was reported, which showed the importance of blood monitoring in the local tertiary care hospital (16). The severity of malaria depends on the age, immunity and resources of the hospital. Aliyu et al. reported on presentations of severe malaria in Nigeria, and showed that hematological disturbances occurred across different population groups, indicating that these findings are relevant to all people (17).

Last but not least, the importance of differential diagnosis. Savadogo et al. highlighted that malaria and dengue impact blood parameters like platelets but in different ways. Proper diagnosis of

hematological alterations associated with malaria leads to timely and appropriate management, thereby minimizing morbidity and mortality (18). In general, the findings of this study support the findings from other studies that anemia and thrombocytopenia are the most prevalent blood disorders among malaria patients admitted to tertiary hospitals. The abnormalities are affected by age, malaria species, genetic factors and comorbidities. The results highlight the need for regular haematological monitoring of malaria as an important tool for diagnosis, surveillance and treatment, and can help enhance patient outcomes and public health response in endemic areas.

CONCLUSION

The study shows that the common blood disorders such as anemia and thrombocytopenia are common among malaria patients in a tertiary hospital. These abnormalities are found in varying degrees and frequency depending on the species of malaria, age and underlying health. Thrombocytopenia and severe anemia were more common in children and patients with comorbidities and in *Plasmodium falciparum* and mixed infections. Hematological parameters such as complete blood count and coagulation parameters are important in the early diagnosis, risk stratification and management of malaria patients. Blood abnormalities can be detected early and help guide the clinician in making timely interventions, avoid complications and improve patient outcomes. The results underscore the need for laboratory monitoring in routine malaria treatment in tertiary hospitals and the need for further research to elucidate malaria's hematological effects in various populations and healthcare environments.

REFERENCES

1. Kumar M, Kumar A, Panwar P, Kant R. Correlation of presence and severity of thrombocytopenia with types and severity of malaria: a study from tertiary care center of North India. *Journal of Family Medicine and Primary Care*. 2022 Jul 1;11(7):3929-33.
2. Asmerom H, Gemechu K, Sileshi B, Arkew M. Hematological abnormalities among malaria infected adult patients in association with ABO blood groups at Jinella health center, Harar, Eastern Ethiopia. *Journal of Blood Medicine*. 2023 Dec 31;463-76.
3. Tazebew B, Munshea A, Nibret E. Prevalence and association of malaria with ABO blood group and hemoglobin level in individuals visiting Mekaneeyesus Primary Hospital, Estie District, northwest Ethiopia: a cross-sectional study. *Parasitology Research*. 2021 May;120(5):1821-35.
4. Khalid MU, Iqbal KO, Nadeem MU, Khan KH, Kousar AQ, Rao SI, Abrar MU, Abbas FI. Frequency of Thrombocytopenia in Malaria Patient at Tertiary Care Hospital. *Pakistan Journal of Medical & Health Sciences*. 2022.
5. Karoli R, Shakya S, Gupta N, Mittal V, Upadhyay AK. Clinical profile of malaria at a tertiary care teaching hospital in North India. *Tropical Parasitology*. 2021 Jan 1;11(1):25-30.
6. Bittaye SO, Jagne A, Jaiteh LE, Nadjm B, Amambua-Ngwa A, Sesay AK, Singhateh Y, Effa E, Nyan O, Njie R. Clinical manifestations and outcomes of severe malaria in adult patients admitted to a tertiary hospital in the Gambia. *Malaria Journal*. 2022 Sep 21;21(1):270.
7. Akafity G, Kumi N, Ashong J. Diagnosis and management of malaria in the intensive care unit. *Journal of Intensive Medicine*. 2024 Jan 25;4(01):3-15.
8. Elkhailifa AM, Abdul-Ghani R, Tamomh AG, Eltaher NE, Ali NY, Ali MM, Bazie EA, KhirAlla A, DfaAlla FA, Alhasan OA. Hematological indices and abnormalities among patients with uncomplicated falciparum malaria in Kosti city of the White Nile state, Sudan: a comparative study. *BMC Infectious Diseases*. 2021 May 31;21(1):507.
9. Waris R, Aurengzeb B, Raza SH, Waris A, Riaz R. Clinical Profile and Spectrum of Complications of Malaria in Hospitalized Children at a Tertiary Care Hospital. *Journal of Rawalpindi Medical College*. 2021 Dec 31;25(4).
10. Kelem A, Shiferaw E, Adane T. Hematological abnormalities and associated factors among metabolic syndrome patients at the University of Gondar comprehensive specialized hospital, Northwest Ethiopia. *PLoS One*. 2023 May 25;18(5):e0286163.

11. Tiruneh T, Almaw A, Abebaw A, Kiros T, Berhan A, Damtie S, Legese B, Feleke DG, Sema M, Chanie ES, Dires T. Basic coagulation parameters and platelet count among malaria patients attending at Addis Zemen Primary Hospital, Northwest Ethiopia. *BMC Infectious Diseases*. 2024 Sep 28;24(1):1069.
12. Patel B, Babaria SS, Panchal J, Purohit A. Evaluation of Hematological Parameters with Biochemical Correlation in Malaria: a Cross-Sectional Study at Tertiary Care Hospital. *International Journal of Pathology and Clinical Research*. 2024;10:153.
13. Korkusuz R, Karabela ŞN, Sarı ND, Şenoğlu S, Ünlü EC, Yaşar KK. Clinical profile and predictors of severe malaria: a study from two tertiary care centers in İstanbul. *Bakirkoy Tip Dergisi/Medical Journal of Bakirkoy*. 2021;17(3):268-73.
14. Nkansah C, Osei-Boakye F, Appiah SK, Abbam G, Duneeh RV, Banyeh M, Derigubah CA, Adjei I, Bani SB, Daud S, Ukwah BN. Haematologic profile of children with laboratory diagnosed malaria: A prospective study. *Health Sciences Investigations Journal*. 2025 Jun 29;7(1).
15. Kumari S, Kumar D, Kumar A, Saroj U, Shrivastava P, Verma S, Kujur M, Sahu UP, Prasad A. Prevalence of malaria among apparently healthy blood donors at tertiary Health-care center in Northeastern tribal region of India. *Annals of African Medicine*. 2025 Apr 1;24(2):231-6.
16. Hassan S, Nawaz S, Ahmad B, Haroon M, Ullah MT. Profiles of Hematological Parameters in Plasmodium vivax Malaria Patients attending Medicine Department, Saidu Group of Teaching Hospital. *National Journal of Life and Health Sciences*. 2023;2(2):42-6.
17. Aliyu I, Ibrahim HU, Idris U, Akhiwu H, Ibrahim UA, Mohammed II, Michael GC. A review of presentations and outcome of severe malaria in a tertiary hospital in northwestern Nigeria. *Sahel Medical Journal*. 2021 Jul 1;24(3):124-8.
18. Savadogo M, Sondo AK, Diallo I, Dao K. Comparative Study of the Disturbance of Blood Cell Parameters and Blood Biochemistry During Dengue Versus Malaria in The Infectious Diseases Department of the Yalgado Ouédraogo University Hospital. *Educational Research (IJMCER)*. 2021;3(3):164-8.