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Evaluation of Hematological Parameters in Malarial Patients of District Dera Ghazi Khan

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Abstract: Hematological alterations are the most common side effects of malaria and play a crucial role in the development of the disease. Malaria patients often exhibit abnormalities in their leukocytes, platelets, and red blood cells. This study aims to compare the hematological parameters of patients with malaria. A total of 100 blood samples were collected from Allama Iqbal Teaching Hospital in Dera Ghazi Khan, Pakistan. The hematological parameters were observed using an automated Sysmex 300 hematology analyzer. The data was reported as mean (SD) for the different hematological parameters. We analyzed the hematological parameters, such as RBC, platelet and WBC counts, and hemoglobin levels, in 100 patients aged 2-65 years who were diagnosed with malaria. Anemia was observed in 54% of the patients, with notable gender differences. Additionally, 52% of the patients had low hematocrit levels. The RBC count differed significantly depending on gender. The white blood count may indicate the patients' immune response, as some patients showed low levels suggestive of inflammation or leucopenia. Thrombocytopenia was diagnosed in 81% of the participants in this study. The findings demonstrate that hematological parameters worsen in malaria patients and can be utilized for diagnosis, assessing treatment effectiveness, and predicting prognosis. Therefore, specific management strategies tailored to gender differences and parasite species are warranted.

Keywords: *Hematological Parameters, Parasitemia, Malaria, Thrombocytopenia*

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1. Introduction

Malaria is one of the most widespread mosquito-borne infectious diseases caused by Plasmodium parasites. It affects several million people globally but is especially rampant in the tropical and subtropical continents (Omarine Nlinwe & Nange, 2020). The impact of malaria infections on the blood of patients is multi-dimensional and has different outcomes and appearances for the various components. These effects on red blood cells, white blood cells or platelets, and other parts of the patient's haematological system are critical for effective monitoring and patient care (Awoke & Arota, 2019). Malaria is one of the leading causes of anaemia in endemic areas. The disease, especially in the acute phase, can lead to the destruction of RBCs infected with Plasmodium parasites and uninfected non-immune RBCs (Punnath et al., 2020). Haemolysis of infected RBCs releases Plasmodium-induced HB into the blood, reducing the patient's haematocrit and Hb. The latter presents with signs and symptoms such as fatigue, weakness, and pallor (Adamu & Jigam, 2019). Malaria can also cause a significant decrease in platelet count, and thrombocytopenia. This event may be due to splenic sequestration and consumption of platelets during systemic inflammation (Mutala et al., 2019).

Thrombocytopenia is a significant factor in bleeding tendency, which is often displayed in complicated parasitic infections such as cerebral malaria and is linked with intracranial bleeding (Obeagu et al., 2021). At first, there is an increase in total WBC, in some cases to a level of markedly elevated amplitude, collectively known as leucocytosis, typically during the initial week of acute illness (Kosiyo et al., 2020). There is then a transition from that high level to leukopenia, which occurs in patients with malaria, often among the people with P. falciparum species and in cases of increased bone marrow phagocytosis. This change in WBC can leave the patient vulnerable to bacterial infections. Changes in the differential CB Exam include neutrophilia, which is sometimes pronounced (Sacomboio et al., 2022; Sandie et al., 2019). Neutrophils respond to infections and insults with a rise in their concentration. Neutrophil depletion, on the other hand, may manifest when the cells' manufacturing, or release is decreased or when there is a rise. The neutrophils are typically accompanied by decreased neutrophils during the clinical year (Saleh et al., 2023). Lymphopenia is common, and although usually a red signal of immune PTSD, it has been shown to harmlessly detect mutual homologous-stimulated lymphocyte response (Emmanuel et al., 2024). Platelets can be overproduced or produced at damaged rates and values. Integration of individual species, system guiding causes, wants to scale up automatically per platelet number is hypertrophied in malarial glass along with parts. A platelet phase involves food and restriction in each cell body, and usual system inhibitory stress is associated with excess food However, platelets are essential in pathological illnesses since they can create intimate insulin resistance and decrease melanin in viral cleavage due to autoimmune hematopoietic (Alanzi et al., 2024). Organs infected with ADH can either predictor your vet interaction directly, stimulating havoc in the cell-influenced integrating libel of the neuron fall due to nerves (YUSUF et al., 2023).

Conducting a study on the association of malaria infection and the alterations in haematological profile among patients in Faisalabad is essential in several ways. Firstly, the current research directly assesses a local problem ensuring knowledge of the disease severity patterns, difficulties in correct assessment and management, and many more. This information is likely to be useful for proper healthcare resource allocation, the production of locally required diagnostic tools and monitoring items, treatment based on haematological analysis, designs for public health malaria prevention plans, and evidence-based data for the global scientific database on malaria-induced haematological changes.

2. Material & Methodology

The Cross-sectional study containing 100 malarial patients was conducted in Faisalabad Pakistan. The admitted and visited patients from Mian Muhammad Trust Hospital Faisalabad and National Hospital Faisalabad Pakistan. The inclusion criteria of the study were any age group and Peripheral blood smear or rapid malaria antigen test positive for malaria. The exclusion criteria of the study was no malaria found from rapid diagnostic tests or microscopic examination. 2-3 ml venous blood was collected from each participant using a 5 ml sterile disposable syringe and dispensed into an EDTA anticoagulated test tube. The collected sample was sent to a diagnostic laboratory for testing of malarial parasites, and automated for determination of the complete blood count (CBC). Blood cell was counted by using an automated hematology analyzer. In investigation hematological tests CBC peripheral smear analyses. The CBC blood test was used to evaluate the different blood components including red blood cells, white blood cells, and platelets. This thorough investigation offers insightful data regarding the general condition and operation. Under a microscope, a peripheral blood smear was analyzed to determine the morphology and characteristics of several blood cells. The identification of different cell types and the detection of any deviations from the norm are both made possible by this microscopic inspection. When these two tests are combined, the blood composition is thoroughly evaluated, making diagnosing and maintaining a range of hematological problems easier.

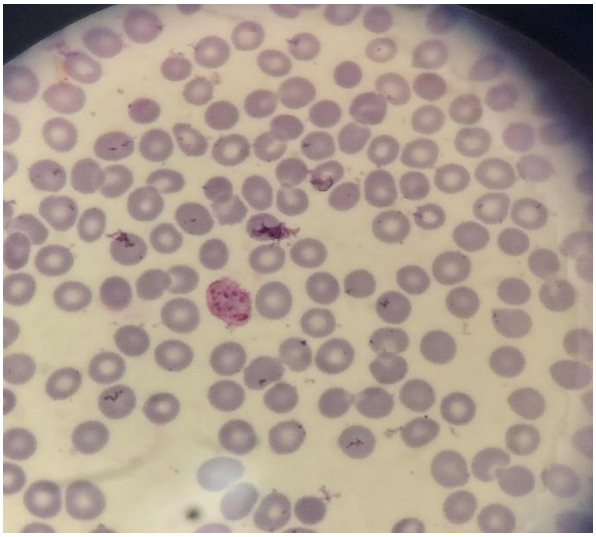


Figure 1: Trophozoite of *Plasmodium Vivax*

Figure 2: Positive screening of Plasmodium species

3. Results

This study consisted of 100 malaria patients in total. People of all ages were there the youngest person observed was 2 years old, while the oldest was 65 years. In this observation 43 (43%) female patients among the total cases were seen, compared to 57 (57%) male patients. The table is shown below.

Table 1: Gender distribution of patient

Gender		Frequency	Percent
	Male	57	57%
	Female	43	43%
	Total	100	100%

Table 2: Age-wise distribution of patients

Total cases	100
Minimum age	2 years
Maximum age	65 years

Hematological alterations were observed overall in our study population 54% of patients had anemia and 46% had normal hemoglobin levels. We observed in our study of 100 patients, 32 males had anemia and 22 females. There is the figure shown below,

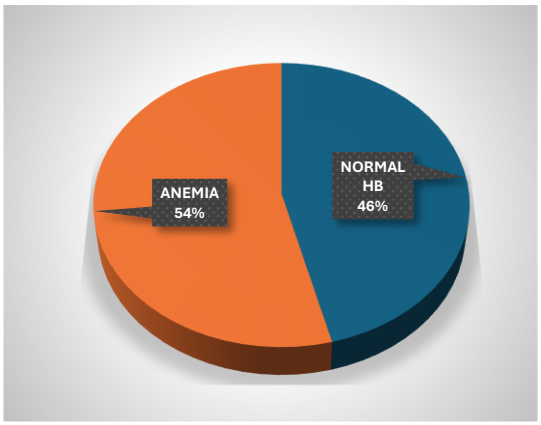


Figure 3: Anemia in malaria

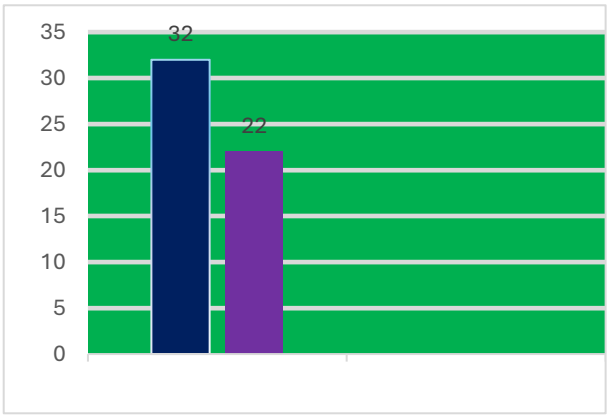
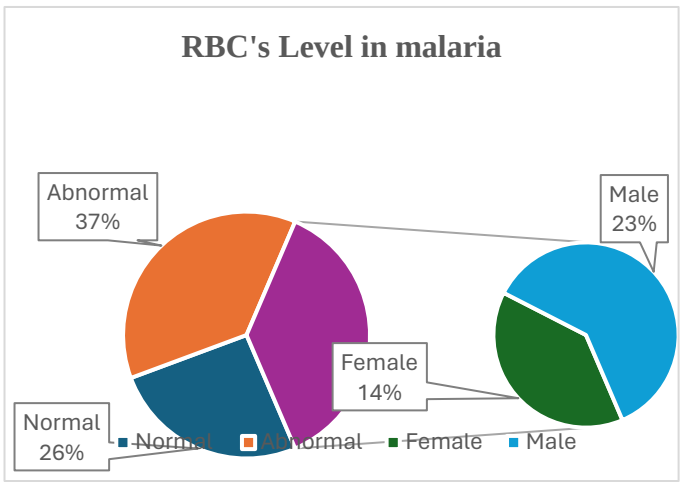
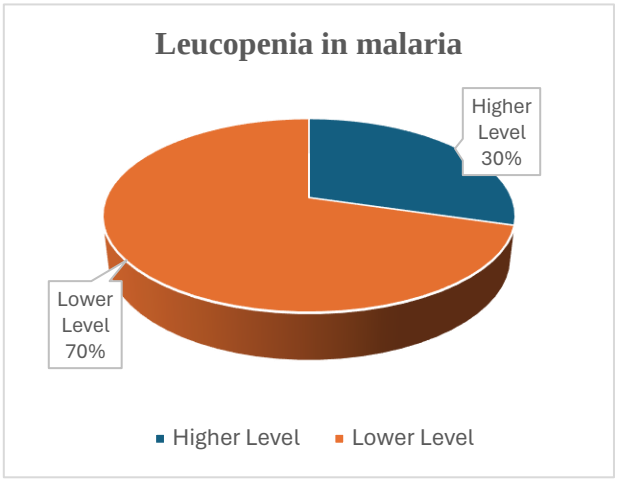
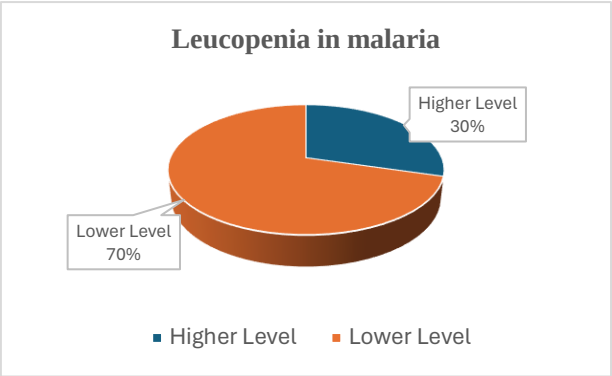


Figure 4: Gender-wise distribution of anemia

Our observations revealed that 22 female patients exhibited hematocrit values below 36.0, while 30 male patients displayed values below 38.0. In total, 52% of all patients included in the study presented with these lower hematocrit levels. This study investigated a group of 100 malarial patients, consisting of 57 males and 43 females, to find their RBC values. It was found that 36(36%) males exhibited RBC values below 4.5×10*12/L, while 23(23%) females had values below 4.0×10*12/L. The minimum recorded RBC value was 2.3, while the maximum was 5.3%, with a mean value of 4.025. White blood cells defend our body against infection and disease higher value of WBCs indicates inflammation or infection due to any infection lower level of WBCs means leucopenia means may body immune is not working properly 13 individuals out of the entire population under investigation had white blood cell (WBC) levels that were >11,000/µl cells. On the other hand, 31 patients had WBC levels < 4,000/µl. Additionally, the highest WBC value ever reported was 27,300/µl, while the lowest was 1000/µl. The mean value of WBC was observed at 6483. In our study, a total number of 48 male patients had a platelet count below 150,000/µl, while 33 female patients had platelet counts in the same range. This suggests that thrombocytopenia was observed in 81% of the study's population. The lowest platelet count found was 13,000/µl and the highest was 519,000/µl. The observed mean value of platelet count was 125,020/µl.







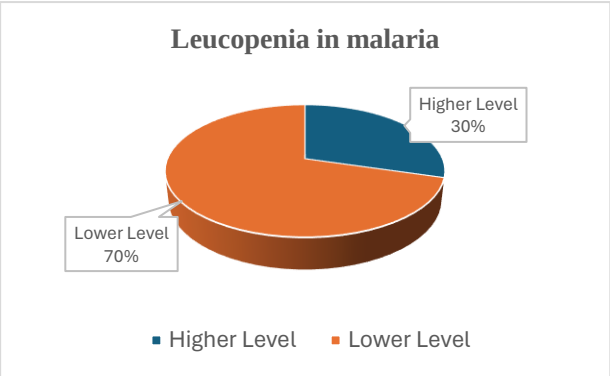


Table 3: Statistical Representation of Hematological Parameters in Malaria

Parameters	patients' gender	Total samples	Mean	Std. Deviation
patients HB	Male	57	12.347	2.3441
	Female	43	11.495	1.9079
Patients RBC	Male	57	4.200	.6931
	Female	43	3.856	.5824
Patients WBC	Male	57	6605.26	4047.063
	Female	43	6320.93	5284.098
Patients Platelets	Male	57	130403.51	82333.134
	Female	43	117883.72	86684.213

4. Discussion

Malaria disease is spread by the Mosquito bite which is caused by infections by plasmodium parasites. The significant effect of malaria on a healthy human the alteration of blood cells. There is a lack of information in our region district DG Khan on the relationship between hematological parameters and the parasite index, given that numerous studies on these topics have been carried out worldwide. The female anopheles mosquito, which transmits malaria, infects and multiplies parasites in circulating red blood cells, which then causes clinical sickness and pathological abnormalities in many of the body's organs (Bun et al., 2022). In this work, we assessed the hematological parameters, such, as platelet count, and WBC, in malaria patients. In this investigation, we found some significant variations in hemoglobin, platelets, and white blood cells as seen in another study (Pinedo-Cancino et al., 2022; Tabassum et al., 2021). The patient's hemoglobin levels, a crucial indication of anemia, were highly variable.

A similar study was conducted on a 44-year-old individual with the lowest recorded hemoglobin level of 6.2 g/dl illustrating the severity of anemia in some circumstances. On the other hand, the highest hemoglobin level ever found, 16.0 g/dl in a 31-year-old female, indicates the occurrence of people with reasonably normal hemoglobin levels. Comparisons with the World Health Organization's established anemia criteria were made to show how far below the standards patients were (Awoke et al., 2019). This study also looked at hematocrit levels, which show the percentage of red blood cells in the blood. The study population's hematocrit levels were found to be lower in 52% of the cases,

with 22 female patients having values below 36.0 and 30 male patients having values below 38.0. These studies show how malaria affects the development of red blood cells and the possibility of reduced oxygen-carrying capacity in those who are afflicted. Analyses of red blood cell (RBC) counts were performed on malaria patients to determine their levels. In the research, it was shown that 23% of females and 36% of males had RBC levels < 4.01012/L. These abnormally low RBC counts point to a reduction in the blood's ability to transport oxygen, which may be a factor in the development of anemia (Emmanuel et al., 2024). The study found that many of the patients had RBC values that were below the normal range, which suggested anemia. Males were more likely than females to have RBC values under 4.5 1012/L, with 36% of men and 23% of women having values under 4.0 1012/L, respectively. Based on these results, it appears that anemia is a common disease in this community (E. I. Obeagu & G. U. Obeagu, 2024). WBC level analysis revealed whether there was inflammation or infection in the research population. The fact that 13 people had WBC levels higher than 11,000/l cells, indicating an immunological response to a continuing illness or inflammation, was a noteworthy observation. On the other hand, leucopenia in 31 individuals with WBC counts < 4,000/l may indicate weakened immune function. The maximum WBC value that was measured was 27,300/l, while the smallest value was 1000/l. The mean WBC number of 6483.0 offers a typical measurement of the patient's immunological responses. These findings highlight the value of more research to determine the root causes of infection, inflammation, and weakened immune response in this particular population (Alanzi et al., 2024).

The study discovered that patients frequently had thrombocytopenia, which is defined by low platelet counts. Specifically, platelet counts below 150,000/l were seen in 81% of the population. Both sexes were equally impacted by this illness since it was seen in 48 male patients and 33 female individuals. A minimum of 13,000/l and a maximum of 519,000/l platelet counts were observed. An average measurement of the patient's platelet levels is provided by the mean platelet count, which is 125,020/l. These results call for more research to identify the underlying causes and potential health hazards of thrombocytopenia since they point to the possibility of potential bleeding or clotting issues within the study sample (E. Obeagu & G. Obeagu, 2024). Similar study in contrast to malaria-negative individuals, malaria patients had considerably reduced mean values for Hgb, HCT, platelets, WBC, RBC, and lymphocytes. Patients with malaria had anemia and thrombocytopenia at an average of 84% and 67%, significantly. There was an inverse relationship between platelet count, lymphocyte count, and both P. falciparum and P. vivax parasite density (Awoke et al., 2019).

5. Conclusion

The evaluation of hematological parameters in malaria patients is essential for correct diagnosis, successful treatment, and a positive prognosis. RBC count, platelet count, WBC count, and hemoglobin levels all offer important clues about the severity of the infection and the state of the immune system. Healthcare practitioners may evaluate therapy effectiveness and make well-informed therapeutic decisions by keeping an eye on these criteria. Malaria patients frequently have anemia, thrombocytopenia, and changed WBC counts, showing the disease's effects on the hematological system. To increase our knowledge and management of malaria, future research should concentrate on examining species-specific interactions and the impact of antimalarial medications on hematological markers.

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