

RESEARCH PAPER

STUDY OF HEMATOLOGICAL PARAMETERS IN DENGUE PATIENTS

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ABSTRACT

Background

Dengue fever is a viral disease transmitted by mosquitoes which is a major public health problem in tropical and sub-tropical countries. Thrombocytopenia, leukopenia and increase in hematocrit are common hematological abnormalities among dengue patients, which are often associated with disease severity. These blood parameters are essential to monitor for early diagnosis, prognosis and clinical management of dengue infection.

Aim

The objective of this study was to study Blood Parameters and their relation with the severity of the disease and prognosis of Dengue.

Methodology

The secondary qualitative approach was taken and published journal articles and clinical studies from 2022 to 2025 were used. The data was retrieved from the academic databases such as PubMed, Wiley Online Library, and Heliyon. Studies related to the platelet count, white blood cell count, hematocrit and hemoglobin levels of dengue patients were reviewed and analysed.

Results

Results revealed that the most frequent hematological abnormality among dengue patients were thrombocytopenia. The platelet and white blood cell counts were significantly lower in severe cases of dengue, while hematocrit was higher in severe dengue cases. Mild abnormalities were seen in healthy children while severe abnormalities and slow recovery were seen in elderly and ill children.

Conclusion

Hematological parameters are useful indicators in order to assess the severity of dengue and to direct the patient management. Monitoring of blood parameters can help in early intervention, minimisation of complications and clinical outcomes in dengue cases.

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1. Introduction

1.1 Background of the Study

Dengue fever is an infectious disease caused by dengue virus and transmitted mainly through *Aedes aegypti* mosquitoes. It is considered to be a serious health issue in tropical/sub-tropical regions, particularly south Asian countries (Mekuriaw *et al.* 2022). When there is no complication, it is dengue fever; however, the complication of this disease is known as dengue haemorrhagic fever (DHF) or Dengue Shock Syndrome (DSS). Blood-related anomalies (such as decreased platelets, WBCs, increased hematocrit level, etc.) are some characteristics of dengue infections.



Figure 1: *Aedes aegypti*

(Source:

https://www.ecdc.europa.eu/sites/default/files/styles/col_1g_12/public/images/Aedes-aegypti2_B.jpg.webp?itok=2_XkcDm4)

1.2 Problem Statement

Healthcare personnel continue to find it challenging to recognise severe case of dengue early. Hematological parameters are commonly used in the care and treatment of dengue, but the significance of different studies have given varying results and it is challenging to find out which are the best parameters for severity (Hunais, Shiffana and Udayangani, 2024). For this reason, further investigations are

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needed to determine the haematological alterations occurring in patients with dengue.

1.3 Research Aim and Objectives

Aim: To study hematological parameters in dengue patients and their association with disease severity.

Objectives:

- To identify common hematological abnormalities in dengue patients.
- To examine the relationship between hematological parameters and dengue severity.
- To evaluate the role of hematological findings in dengue diagnosis and management.

1.4 Research Questions

- What are the common hematological abnormalities among dengue patients?
- How are hematological parameters associated with dengue severity?
- How can hematological findings help in dengue diagnosis and management?

2. Literature Review

2.1 Theories and Models

The pathophysiological theory of dengue suggests that dengue infection results in abnormalities in bone marrow function and blood vessels resulting in hematological abnormalities such as thrombocytopenia and leukopenia (Naderian *et al.* 2025). Immune response which ultimately causes an increase in vascular permeability results in plasma leakage and serious complications. It is therefore important to use haematological monitoring to determine the course of progression of the disease.

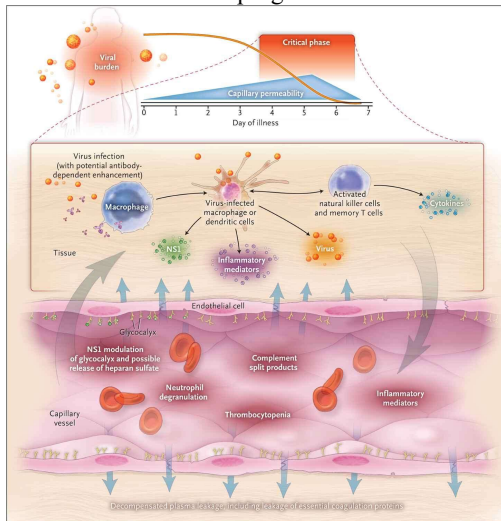


Figure 2: Pathophysiology of Dengue Infection
(Source: <https://www.prescribingcompanion.com/media/1795/pathophysiology-of-dengue-infection.jpg>)

The other important models are classification model developed by World Health Organization (WHO) which classifies dengue into three classes: dengue without warning, dengue with warning signs, severe dengue (Karyanti *et al.* 2024). This model

emphasizes the importance of the laboratory parameters (platelet count, haematocrit and white blood cell count) in assessing the severity of the disease and treatment.

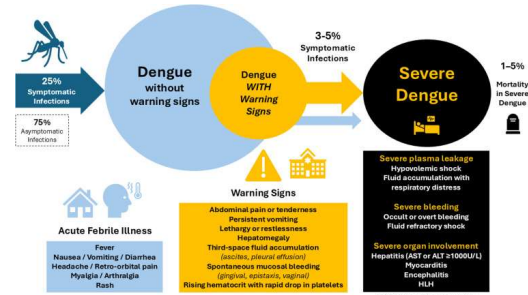


Figure 3: Approach to dengue fever

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Based on the hematological diagnostic model, the blood parameter abnormalities can be used as a biomarker to predict the progression of dengue (Huy and Toàn, 2022). In practice, lower platelet counts and higher hematocrits (Hct) are often correlated with severe dengue, and these are applied to manage patients and to predict disease severity.

2.2 Empirical Studies

In Haq *et al.* (2023) study, the severity of disease was investigated by clinical and hematological parameters of dengue infected patients in Pakistan. The study determined that the significant association with severe dengue infection was increased hematocrit, leukopenia and thrombocytopenia. Platelet count was found as one of the prominent parameters of the disease severity. Those who had lower platelet counts were at higher risk of bleeding complications and hospitalisation. The authors highlighted the need for the regular haematological follow up for the management of dengue.

Zeb *et al.* (2024) studied the hematological parameters in relation to age, gender and infectivity status in Dengue patients. They found that platelets, hemoglobin and leukocytes were significantly different in the various demographic groups. The hematological abnormalities were more pronounced in male patients and older age group than in other patients. The study pointed out the importance of taking demographic parameters into account when analysing hematological parameters of dengue patients.

The study by Pokhrel *et al.* (2024) was a cross sectional study in Nepal to assess hematological and liver functions of dengue patients. Common abnormalities were reported to be thrombocytopenia, leukopenia, and increased hematocrit. A rise in liver enzymes was also seen which implied the liver involvement in the dengue infection. The study indicated that the use of both hematological and biochemical markers in the diagnosis and monitoring of dengue might be more beneficial.

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Anwar et al (2022) studied the epidemiology and haematology of dengue virus infection. The study revealed that significant decrease in platelets and WBC counts occurred in the acute stage of dengue infection. The process of the disease and the immune response was associated with the variation in hematological parameters. The scientists found that blood profile analysis could be helpful and cost-effective tool for diagnosis and prognosis of dengue. During a dengue outbreak, Hossain et al (2025) found that clinical and hematological parameters of dengue patients were studied. Common findings were fever, thrombocytopenia, leukopenia and headache. The platelet count was significantly decreased and haematocrit was significantly increased in patients with severe dengue. The authors noted that it is important to recognize, early, haematological abnormalities to minimize complications and deaths.

In general, the reviewed studies have indicated that haematological parameters are suitable parameters for diagnosing and monitoring dengue infection. The number of platelets, hematocrit and white blood cells are repeatedly reported to be important predictors of disease severity. The results are not consistent, however, across populations and demographic groups, calling for further research.

2.3 Literature Gap

Various studies have focused on hematological changes of patients with dengue, but there is a lack of literature. Most studies have a limited geographical scope and findings are not easily generalisable. Further, most of the scientists are interested in platelet count and hematocrit, but do not pay much attention to the combined effect of various hematological parameters. There is also limited exploration of variations in age, gender and disease severity. Hence, more in-depth investigations are needed to give a thorough knowledge of hematological parameters in dengue infection.

2.4 Conceptual Framework

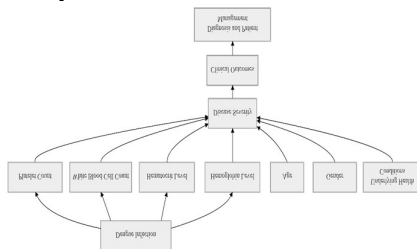


Figure 4: Conceptual Framework (Source: Draw.io)

Conceptual framework of the study is the relationship between the dengue infection and hematological parameters. Dengue infection is the independent variable and the other dependent variables are platelet count, white blood cell count, hemoglobin and hematocrit level. Changes in these parameters affect the severity of the disease and

clinical consequences. Hematological changes in dengue patients could also depend on their demographic risk factors like age and gender.

3. Methodology

3.1 Research Approach

The approach to this study was a qualitative research technique to study the hematological parameters of the patients who were suffering from dengue (Bhangu, Provost and Caduff, 2023). The quantitative approach is suitable as it will enable the analysis of the blood parameters including platelets, hematocrit, hemoglobin and white blood cell count in a numerical way. It also helps to establish the correlation between the hematological changes with the severity of dengue.

3.2 Research Design

This study is of descriptive secondary type. This design allows the investigator to study and interpret the haematological parameters of dengue patients during a given time frame (Ratajczak *et al.* 2025). The design is appropriate for the detection of typical haematological abnormalities and for making comparisons between different patients.

3.3 Research Method

The method of study is secondary-research which is based on published journal articles and clinical studies related to hematological parameters in dengue patients. Studies published in relevant journals were selected to assess common hematological changes and the correlation with disease severity. Secondary research is inexpensive and readily available data from scientific sources.

3.4 Data Collection

Published academic papers, medical literature, and electronic databases such as PubMed, Wiley Online Library, and Heliyon have been used to gather data. Literature within the time period of 2022-2025 has been considered for this study. The search terms utilized in searching were dengue, hematological parameters, platelets count, leukopenia, and hematocrit.

3.5 Research Ethics

This study is conducted within the framework of ethical research which uses reliable and journal sources (Pauley and McDaniel, 2023). Academic integrity and avoiding plagiarism has been maintained by adhering to proper citation and referencing. As it is a secondary study, no involvement of the patients and no personal information was included.

4. Results

4.1 Demographic Characteristics of Patients

The study results showed that everyone in the age group and gender groups were affected by dengue infection. But most cases were found in young adults, aged 18 to 40. It was observed that male patients were slightly more affected than female patients (Kakde and Khatib, 2024). Most patients had presented in the acute febrile stage of the disease when admitted to the health care services. The

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symptoms mentioned by the patients were high fever, severe headache, muscle pain, joint pain, weakness, nausea, vomiting, and skin rash. A smaller proportion of patients had abdominal pain and mild bleeding manifestations and were dehydrated.

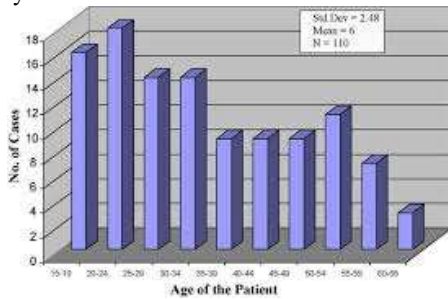


Figure 5: Demographic profile of dengue cases
(Source: <https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQFGXz1kGoDeBZRwmYOaYH6fL4VXyrqHqqQyg&s>)

Hospitalisation duration depended on the severity of the disease and the hematological condition. While those who had mild-type dengue, recovered in a shorter time, those who had severe dengue were treated with an extended duration of hospitalisation and continuous monitoring (Prattay *et al.* 2022). Elderly patients and patients with underlying medical conditions (such as diabetes and hypertension) had slower rates of recovery and more clinical complications. These results indicate that there may be demographic- or clinical-related differences in severity and progression of dengue infection.

4.2 Platelet Count Abnormalities

Thrombocytopenia was found to be the most frequent hematological abnormality of Dengue patients. The platelet count decreased gradually in most of the patients during the course of infection (Huy and Toàn, 2022). The platelet levels in mild dengue were moderately reduced and critically low platelet levels were observed in severe dengue. During the acute stage of the disease, several patients had a decrease in platelet count below normal limits.

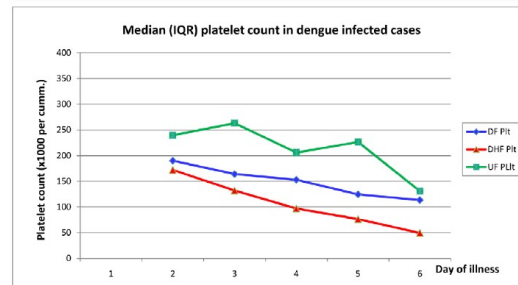
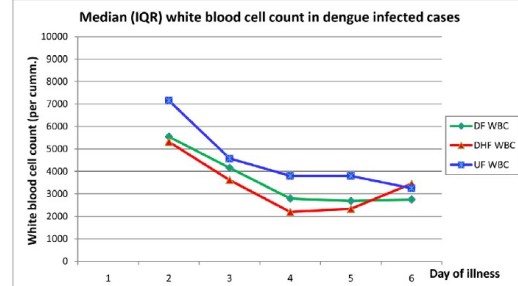
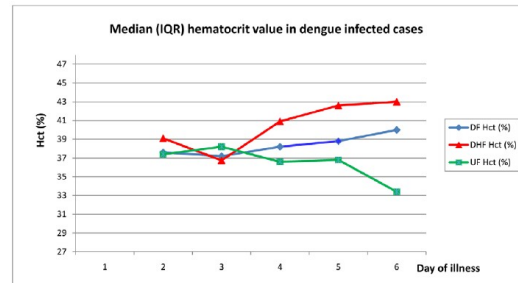


Figure 6: Hematocrit, peripheral white blood cell and platelet count

(Source:

<https://www.researchgate.net/publication/221887449/figure/fig2/AS:304726961868801@1449663977295/Hematocrit-peripheral-white-blood-cell-and-platelet-count-in-dengue-infected-patients.png>)

Patients with severe thrombocytopenia frequently suffered from bleeding problems such as gum bleeding, petechiae, nose bleeding, bruising and gastrointestinal bleeding (Altahan, 2025). In a small number of instances platelet transfusion and close medical supervision were required to prevent life-threatening situations. The recovery times and hospital stays were also longer in those with extremely low platelet counts.

The results also showed that during the recovery period after supportive treatment, hydration and medical monitoring, there was a gradual improvement in platelet counts (Ganguly *et al.*, 2025). Patients could be identified by medical practitioners as being in a higher risk group for complications and early clinical intervention was facilitated by regular monitoring of the patient's platelets. Platelet count was determined as one of the most reliable parameters to monitor the progression of the disease and to give an idea of the severity of the disease.

4.3 White Blood Cell and Hematocrit Changes

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Another significant hematological abnormality found among the patient with dengue was leukopenia. A significant drop in white blood cell count was observed in many patients at the febrile and critical stages of infection (Nanayakkara *et al.*, 2025). This decrease can be linked to the temporary reduction of the activity of bone marrow due to the presence of the dengue virus. It seemed that patients with severe leukopenia were more susceptible to weakness, fatigue and secondary infections.

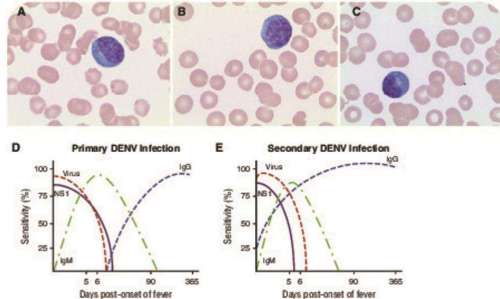


Figure 7: Plasmacytoid lymphocytes

(Source:

<https://imagebank.hematology.org/getimagebyid/61013?size=3>)

Leukopenia was also seen, and elevated hematocrit levels were seen in severe dengue patients. A higher hematocrit value suggested plasma leakage, dehydration and hemoconcentration; all of these are significant clues of severe dengue infection (Riaz *et al.*, 2024). Higher hematocrit values were associated with more intensive treatment and/or more prolonged hospital stays. Increased hematocrit was more prominent in patients with dengue haemorrhagic fever and shock related complications.

The levels of hemoglobin did not change significantly in mild cases but varied in severe cases, which was attributed to bleeding and fluid loss. These three parameters were combined to give a better overall picture of the patient's condition and disease progression.

4.4 Relationship Between Hematological Parameters and Disease Severity

The results of the study showed that there was a high correlation between severity of dengue and hematological abnormalities (George *et al.*, 2023). The platelet count was always less and the white blood cell count was always lower in patients with severe dengue infections than in those with mild infections, while the hematocrit value tended to be higher in the severe group. Hematological disturbances were more severe during the critical phase and gradually improved during the recovery phase of dengue.

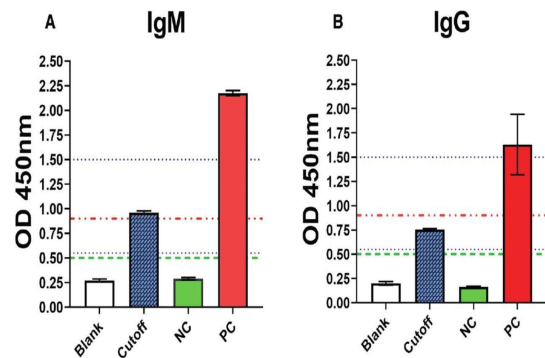


Figure 8: Hematological parameters in dengue infection

(Source:

<https://smj.org.sa/content/smj/46/5/515/F2.large.jpg>)

Hematological changes were more severe and recovery was slower in elderly patients and in patients with pre-existing medical conditions. Hematological monitoring allowed health care professionals to detect early warning signs and offer timely treatment interventions to decrease the incidence of complications and death.

5. Discussion

The results of this study are significant as it shows that the haematological parameters are important indicators to understand the progression and severity of the dengue infection. The most common and clinically important abnormality in the dengue patients was thrombocytopenia. Suppression of the bone marrow, immune destruction of platelets and increased platelet consumption during infection are all mechanisms that can lead to a decrease in platelets. Very low platelet counts may be associated with bleeding and careful monitoring of platelets is essential for patient care and to avoid serious complications.

There were also a lot of patients with dengue having low platelet count (thrombocytopenia). Viral suppression of bone marrow activity during the acute phase of infection may be responsible for the drop in the number of white cells (Cherie *et al.*, 2024). This change in the blood reduces the body's ability to fight infection and can make them more vulnerable to secondary infections. Hence leukopenia in the febrile phase could help health care workers in early diagnosis of Dengue infection. The other significant result of the study was the rise in the hematocrit values of patients with severe dengue. High hematocrit is usually associated with plasma leakage, dehydration and hemoconcentration which are the major warning signs of DHF and DSS. There was a significant increase in haematocrit requiring closer medical monitoring and longer hospital stay. The results indicate that hematocrit could be used as a useful predictor of the severity of the disease and clinical deterioration.

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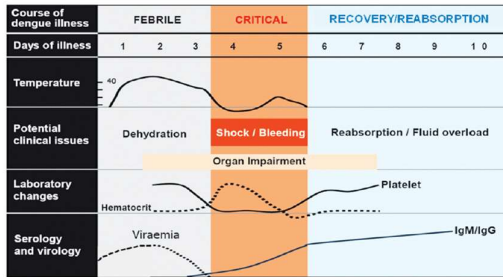


Figure 9: Dengue in Adults

(Source: https://www.myhouseman.my/wp-content/store/2022/09/IMG_0054_04.png)

The study also revealed age and pre-existing health status was found to affect the hematological changes of dengue patients. Severity of abnormalities and slower recovery was noted in elderly patients as compared to younger patients (Yang *et al.* 2025). This could be because of the diminished resistance of the body and immunity. In conclusion, the results indicate that routine hematological examinations are of great significance in the diagnosis, prognosis and treatment of dengue. Prompt identification of abnormal blood parameters can assist with timely clinical interventions, a decrease in complications and improved patient outcomes.

6. Conclusion

In this study, the haematological parameters were studied in dengue patients of varying severity and their relationship with the severity of the disease. This study showed that most common hematological abnormalities seen in dengue infection were thrombocytopenia, leukopenia, and high hematocrit. Of these, the lowest platelet count was found to be the most important characteristic associated with severe dengue and bleed.

The reviewed studies also revealed that the hematological changes were different depending on the different factors including age, gender, and stage of infection. Patients with more severe abnormalities and increased risks of complications were identified as male and elderly patients. These results suggest that demographic factors should be taken into account when assessing patients and in patient management.

Hematological monitoring is an important aspect during the early diagnosis, prognosis and treatment of dengue infection. Regular blood tests may help health care providers to recognize symptoms of serious illness and give prompt treatment. The study also showed the importance of the simultaneous use of hematological and biochemical parameters for better evaluation of the disease.

The studies reviewed gave valuable insights, however, geographical differences in the studies and methodologies suggest further research. Larger population sample size and standardisation of the methods are recommended for future studies to enhance understanding of hematological changes

that occur in dengue patients and for clinical management strategies.

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