International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-09-36*

Pattern of clinical, hematological and biochemical parameters in children with dengue fever.

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Received: 20-07-2026
Revised: 01-08-2026
Accepted: 18-08-2026
Published: 05-09-2026

Abstract

Background: Dengue fever is a major public health problem throughout the world. To effectively manage dengue epidemics, it's crucial to understand the clinical presentation and biochemical parameters Aim: The aim of this study was to determine the Pattern of clinical, hematological and biochemical parameters in children with dengue fever. ***Materials and method***: The present comparative observational study was conducted at the Department of Paediatrics Medicine, Khalifa Gul Nawaz Teaching Hospital, Bannu from December 2025 to May 2026 after taking approval from the ethical committee of the hospital. Children age 1-15 years of both genders with fever clinically suspected of dengue were included in this stud. A total of 200 individuals which were labeled as probable , confirmed dengue and suspected as per Dengue GCP guideline. Patients with confirmed dengue were classed as having dengue fever or dengue hemorrhagic fever (grade I-IV) according on Dengue GCP criteria. The automatic blood analyzer tested common hematological tests, including total leukocyte count (TLC), differential leukocyte count, platelet count, hemoglobin (Hb), and hematocrit (Hct). The automated biochemistry analyzer determined transaminases levels for liver function tests and total serum protein. Cutoff values for each test were based on the laboratory's reference ranges. Plasma leakage was monitored by CXR and abdominal USG. SSPSS version 23 was used for data analysis. ***Results***: A total of 200 children enrolled in this study out of which 118 (59.0%) children were male and 82 (41.0%) were females. Hematological profile of children showed that thrombocytopenia was the most common hematological condition followed by leucopenia. The most common biochemical anomaly was elevated AST followed by raised ALT, elevated transaminases deranged PT/APTT and hypoproteinemia. Individuals with DHF had higher frequency of Severe thrombocytopenia, elevated transaminases as compared to DF which was statistically significant ($p<0.001$). Similarly, hemoglobin levels below 11 g/dL did not differ substantially between both of these groups. Leukopenia was common in each group, although the difference wasn't statistically significant ($p=0.110$). ***Conclusion***: The present study concluded that the most common hematological and biochemical parameters in children with dengue fever were thrombocytopenia, leucopenia, elevated AST, ALT, transaminases deranged PT/APTT and hypoproteinemia. These parameters were most prevalent in dengue hemorrhagic fever.

Keywords: dengue fever, DHF, DF, hematological and biochemical parameters,

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INTRODUCTION

Dengue fever is an infection of arbovirus transmitted to individuals by arthropod vectors, mainly Aedes aegypti. It is caused by four genotypes of dengue virus (from DENV 1to DENV 4).1 According to the World Health Organization (WHO), this highly prevalent illness affects up to 390 million people worldwide each year, with only 96 million developing dengue clinically, primarily in subtropical and tropical urban or semi-urban regions in America and Asia. Since of 2021, dengue is still prevalent in Vietnam, Kenya South America, India, Peru, the Philippine Republic, and certain European nations.2 The mechanism of action of all DENV serotypes may be the same, resulting in symptoms ranging from moderate fever to deadly dengue shock syndromes. Consequently, their virological properties have classified the DENV infection into three primary forms known as dengue shock syndrome (DSS), dengue fever (DF) and dengue hemorrhagic fever (DHF).3

Dengue illness development begins with a febrile phase in which patients endure severe fever, headaches, vomiting, flu, and arthralgia for about 7 days. The critical phase follows, which is a potentially fatal set of acute signs, such as internal hemorrhage and plasma leaking. Yet, the person being treated improves if the vascular permeability is restored; yet, aberrant permeability may cause a sudden hypovolemic shock (DSS) if the crucial stage is not managed.4 Though clinical symptoms can be used to identify dengue, there are several tests available to confirm diagnosis, including anti-DENV antibodies IgG, DENV-specific nucleic acid detection, and the most common, non-structural protein 1 (NS1) antigen test. This will make healthcare and therapy more inexpensive, particularly for people with unusual symptoms. According to WHO, dengue-specific tests are typically not necessary for acute treatment patients, but should still be performed.5-6 To minimize complications from this illness, an accurate and prompt diagnosis is critical for appropriate therapy. In poor developing countries, health care institutions might not have advanced diagnostic equipment; thus, simple blood tests can nevertheless aid in delivering useful clinical insights through key hematological and biochemical information. 7 Individuals suffering with dengue have been described with a constant changed biochemical profile that includes, but is not limited to: coagulopathy, leukopenia, thrombocytopenia, high hematocrit, and abnormalities in lipid profile and liver enzymes. These criteria are useful for making clinical choices and can aid in the evaluation of the severity and categorization of illnesses such as dengue fever, dengue hemorrhagic fever, and dengue shock syndrome.8 The present study was carried out to determine the Pattern of clinical, hematological and biochemical parameters in children with dengue fever.

MATERIALS AND METHODS

The present comparative observational study was conducted at the Department of Paediatrics Medicine, Khalifa Gul Nawaz Teaching Hospital, Bannu from December 2025 to May 2026 after taking approval from the ethical committee of the hospital. Children age 1-15 years of both genders with fever clinically suspected of dengue were included in this study. Children with history of chronic liver disease, hematological diseases, other conformed cause of cause of acute febrile sickness and those using drugs that have been shown to dramatically affect platelet count were excluded. A total of 200 individuals which were labelled as probable , confirmed dengue and suspected as per Dengue GCP guideline. Patients with confirmed dengue were classed as having dengue fever or dengue hemorrhagic fever (grade I-IV) according on Dengue GCP criteria. During the hospital stay, data was collected using a pre-designed patient proforma that included epidemiology, clinical, and laboratory parameters. A doctor carried out clinical examinations on each participant and recorded all details in a structured questionnaire. Hematological & biochemical tests were performed at admission and continued on a daily or bi-daily basis, if it was necessary. On day five, all parameters were examined and compared for this study. The automatic blood analyzer examined common hematological tests, including total leukocyte count (TLC), differential leukocyte count, platelet count, hemoglobin (Hb), and hematocrit (Hct). The automated biochemistry analyzer determined transaminases levels for liver function tests and total serum protein. Cutoff values for each test were based on the laboratory's reference ranges. Plasma leakage was monitored by CXR and abdominal USG. To avoid confusion with similar epidemic febrile diseases, certain individuals underwent specific investigations such as cerebrospinal fluid analysis, neuroimaging, viral markers, peripheral smear, and serology for Plasmodium falciparum, blood culture, and sensitivity testing. Categorical variables, including clinical characteristics and biochemical markers, were reported as numbers and percentages. The main laboratory characteristics in each group were noted and analyzed for statistical significance. SSPSS version 23 was used for data analysis. The t-test was used to compare two groups, and p-values < 0.05 were considered statistically significant.

RESULTS

A total of 200 children enrolled in this study out of which 118 (59.0%) children were male and 82 (41.0%) were female. Fever was seen in all 200 children (100%)**.** among other clinical features the most common was vomiting 167 (83.5%) followed by abdominal pain 137 (68.5%), myalgia 106 (53.0%), headache 94 (47.0%) bleeding48 (24.0%) and hepatomegaly 36 (18.0%) respectively**.** Dengue fever (DF)**,** was noted in 134 (67.0%) individuals and 66 (33.0%) had dengue hemorrhagic fever (DHF). The most prevalent age group was 11–15 years 90(45.0%) followed by age group 6-10 years 68(34.0%) and 6–10 years 42 (21.0%) as shown in **table 1.**

Hematological profile of children showed thrombocytopenia was the most common condition. In 125 (62.5%) children, platelet counts were less than 100,000 cells/mm³, whereas 63 (31.5%) had levels between 100,000 – 150,000 cells/mm³. Only 12 (6.0%) exhibited platelet counts of ≥150,000 cells/mm³. 188 (94.0%) children had platelet counts < 150,000 cells/mm³, indicating thrombocytopenia was the most common hematological condition. In the lymphocyte examination, 187 (93.5%) children had counts below 3,000 cells/mm³, whereas only 13 (6.5%) had levels over 3,000 cells/mm. 142 (71.0%) children had TLC below 4,000 cells/mm³, and 58 (29.0%) had TLC above this level. In terms of neutrophils, 179 (89.5%) children exhibited counts more than 1,500 cells/mm³, whereas 21 (10.5%) had count below this level. In terms of hemoglobin levels, 104 (52.0%) children had levels less than 11 g/dL, while 96 (48.0%) had levels greater than 11 g/dL. A hematocrit > 50% was detected in 92 (46.0%) children as presented in **table 2.**

Radiological results revealed pleural effusion or abdomino-pelvic ascites in 82 (41.0%) children. Pericholecystic edema was detected in 42 (21.0%) children. The most common biochemical anomaly was elevated AST, which was identified in 130 (65.0%) children. Raised ALT was detected in 118 (59.0%) children. Overall, elevated transaminases were observed in 139 (69.5%). Deranged PT/APTT was detected in 55 (27.5%) youngsters, suggesting coagulation disorders. 47 (23.5%) children had hypoproteinemia (serum protein <5.5 g/dL) as presented in **table 3.**

Radiological evaluation of the participants showed that pleural effusion/ascites was more common in DHF 56(84.8%) compared to DF (2619.4%) of DF patients. Similarly pericholecystic edema was recorded in 28(42.4%) and 14(10.4%) respectively (P value <0.001). Individuals with DHF had higher frequency of Severe thrombocytopenia 68**(**87.9%) as compared to DF 58(50.7%) which was statistically significant (p<0.001). Elevated transaminases were prevalent in each group, occurring 70.1% of DF & 68.2% of DHF patients, although the variance was not statistically significant. However, hypoproteinemia and coagulation disorders were strongly associated with DHF. 57.6% of DHF patients had hypoproteinemia, compared to 6.7% of DF patients. 68.2% of DHF patients had unstable PT/APTT, compared to 7.5% of DF patients. Both relationships were statistically significant (p < 0.001). Similarly, hemoglobin levels below 11 g/dL did not differ substantially between both of these groups. Leukopenia was common in each group, occurring in 78.8% of DHF and 67.9% of DF subjects, although the difference wasn't statistically significant (p=0.110) as described in **table 4.**

Table 1.Clinical and demographic features of the study population n=200

Features	**Frequency**	**Percentage**
Sex		
Male	118	59.0
Female	82	41.0
Age group		
1–5 years	42	21.0
6–10 years	68	34.0
11–15 years	90	45.0
Clinical features		
Fever	200	100.0
Vomiting	167	83.5
Abdominal pain	137	68.5
Myalgia/body pain	106	53.0
Headache	94	47.0
Bleeding manifestations	48	24.0
Hepatomegaly	36	18.0
Disease classification		
Dengue fever	134	67.0
Dengue hemorrhagic fever	66	33.0

Table 2. Hematological Profile of Children with Dengue n=200

Hematological parameter	**Frequency**	**Percentage (%)**
Platelets		
>100,000–<150,000 cells/mm³ (120,000 ± 10,000 cells/mm³)	63	31.5
<100,000 cells/mm³ (55,000 ± 20,000 cells/mm³)	125	62.5
≥150,000 cells/mm³	12	6.0
Hemoglobin		
<11 g/dL (9.5 ± 0.7 g/dL)	104	52.0
≥11 g/dL (11.2 ± 0.6 g/dL)	96	48.0
Hematocrit		
>50% (54 ± 2%)	92	46.0
Total leukocyte count (TLC)		
<4,000 cells/mm³ (2,800 ± 500 cells/mm³)	142	71.0
>4,000 cells/mm³ (4,800 ± 600 cells/mm³)	58	29.0
Neutrophils		
>1,500 cells/mm³	179	89.5
<1,500 cells/mm³	21	10.5
Lymphocytes		
>3,000 cells/mm³	13	6.5
<3,000 cells/mm³	187	93.5

Table 3. Biochemical and radiological profile of the individuals with dengue fever

Parameter	Frequency	Percentage
ALT >45 IU/L	118	59.0
AST >35 IU/L	130	65.0
Raised transaminases	139	69.5
Serum protein <5.5 g/dL	47	23.5
Deranged PT/APTT	55	27.5
Pleural effusion/ascites	82	41.0
Pericholecystic edema	42	21.0

Table 4.Biochemical and hematological comparison between DF and DHF in the study population

Features	Total n (%)	DF n=134 (%)	DHF n=66 (%)	*p*-value
Hematological factor				
Platelets <100,000/mm³	126 (63.0)	68 (50.7)	58 (87.9)	<0.001
Hematocrit >50%	88 (44.0)	30 (22.4)	58 (87.9)	<0.001
TLC <4,000/mm³	143 (71.5)	91 (67.9)	52 (78.8)	0.110
Hemoglobin <11 g/dL	104 (52.0)	67 (50.0)	37 (56.1)	0.410
Biochemical features				
Elevated AST	130 (65.0)	88 (65.7)	42 (63.6)	0.780
Elevated ALT	118 (59.0)	80 (59.7)	38 (57.6)	0.780
Elevated transaminases	139 (69.5)	94 (70.1)	45 (68.2)	0.790
Low protein	47 (23.5)	9 (6.7)	38 (57.6)	<0.001
Abnormal PT/APTT	55 (27.5)	10 (7.5)	45 (68.2)	<0.001
Pleural effusion and ascites	82 (41.0)	26 (19.4)	56 (84.8)	<0.001
Pericholecystic edema	42 (21.0)	14 (10.4)	28 (42.4)	<0.001

DISCUSSION

Dengue fever is a viral infection that is caused by arbovirus which is transmitted by female Aedes aegypti mosquitos. Dengue infection has quickly spread globally in recent decades. Seasonal transmission occurs throughout the monsoon and post-monsoon seasons (3-4 months).9-10 WHO estimates that two-thirds of the world's population is at risk of dengue virus infection, especially in tropical and subtropical nations Dengue fever is prevalent in many countries, although most cases are reported in Southeast Asia and the Western Pacific regions.9 The first DHF epidemic in Pakistan occurred in Karachi in 1994, with 145 cases and one mortality documented.11 For almost a decade, Punjab has been experiencing this illness, which is currently causing hyperendemic conditions.12 To effectively manage dengue epidemics, it's crucial to understand the clinical presentation, epidemiology, and test results. Several studies have been conducted to monitor changes in dengue transmission patterns by geographical mapping of severe cases. This has helped anticipate future outbreaks and target public health systems.

Dengue virus infection is often diagnosed based on clinical symptoms and laboratory results. Non-specific testing (e.g., hematological parameters, liver function tests, serum protein concentration) and specific tests (e.g., viral antigen test & serology for antibody detection) are utilized for diagnosis.13 Efforts should be made to uncover new criteria for early illness detection and prompt treatment of patients. Although there is no specific treatment for dengue, early disease detection, fluid replacement therapy, antipyretics and analgesics, and skilled nursing care can reduce the risk of severe cases leading to fatality.14 Understanding the risks of dengue epidemics and the disease's biochemistry is critical for effective resource use .Naturally, this illness resurfaces after the monsoon season. A hospital-based research in children was undertaken to assess trends in laboratory markers for DF and DHF. This work sheds information on the biochemical properties of dengue fever, perhaps improving disease management in the future. In our study Hematological profile of children showed thrombocytopenia was the most common condition, 62.5%) of the children had platelet counts less than 100,000 cells/mm³ and 31.5% had levels between 100,000 – 150,000 cells/mm³.

Our study findings are similar to the study conducted by Waseem et al in which majority of the individuals with dengue fever had thrombocytopenia.15 Thrombocytopenia may be caused by viral bone marrow suppression, dengue antigen binding, or antibody-mediated platelet destruction. Tejas discovered 92.68% thrombocytopenia among dengue patients based on their biochemical profiles.16 Jayant's study indicated that thrombocytopenia was consistently present in 84% of classical dengue patients and 100% of dengue hemorrhagic fever cases.17 In our study the lymphocyte examination, 187 (93.5%) children had counts below 3,000 cells/mm³, whereas only 13 (6.5%) had levels over 3,000 cells/mm. 142 (71.0%) children had TLC below 4,000 cells/mm³, and 58 (29.0%) had TLC above this level. In terms of neutrophils, 179 (89.5%)

children exhibited counts more than 1,500 cells/mm³, whereas 21 (10.5%) had count below this level. In terms of hemoglobin levels, 104 (52.0%) children had levels less than 11 g/dL, while 96 (48.0%) had levels greater than 11 g/dL. A hematocrit > 50% was detected in 92 (46.0%) children. These findings are similar to the study conducted by Awan et al .18 Dengue virus is hepatotrophic and damages other organs, causing excess release of AST from non-hepatic sources such as erythrocytes, brain and renal tissue, skeletal and cardiac muscle, and ALT linked with hepatocyte injury, resulting in more disordered AST than ALT.

In the present study most common biochemical anomaly was elevated AST, which was identified in 130 (65.0%) children. Raised ALT was detected in 118 (59.0%) children. Overall, elevated transaminases were observed in 139 (69.5%). Ferede et al found that 45.1% of patients had higher levels of AST and 17.6% had higher levels of ALT, with 20 times more AST than ALT.19 Excess AST release from injured muscle cells (non-hepatic source) during infection may explain the observed trend, resulting in more AST derangement than ALT. Deranged PT/APTT was detected in 55 (27.5%) youngsters, suggesting coagulation disorders. 47 (23.5%) children had hypoproteinemia (serum protein <5.5 g/dL). these findings are comaparable to the privous study.18 Radiological evaluation of the participants showed that pleural effusion/ascites was more common in DHF 56(84.8%) compared to DF (2619.4%) of DF patients. Similarly pericholecystic edema was recorded in 28(42.4%) and 14(10.4%) respectively (P value <0.001).

Individuals with DHF had higher frequency of Severe thrombocytopenia 68(87.9%) as compared to DF 58(50.7%) which was statistically significant (p<0.001). Elevated transaminases were prevalent in each group, occurring 70.1% of DF & 68.2% of DHF patients, although the variance was not statistically significant. However, hypoproteinemia and coagulation disorders were strongly associated with DHF. 57.6% of DHF patients had hypoproteinemia, compared to 6.7% of DF patients. 68.2% of DHF patients had unstable PT/APTT, compared to 7.5% of DF patients. Both relationships were statistically significant (p < 0.001). Similarly, hemoglobin levels below 11 g/dL did not differ substantially between both of these groups. Leukopenia was common in each group, occurring in 78.8% of DHF and 67.9% of DF subjects, although the difference wasn't statistically significant (p=0.110). all of these findings were similar to the study conducted by Awan et al they reported that the frequency of elevated ALT, hypoproteinemia , unstable PT/APTT, Leukopenia were higher in children with DHF as compared to DF patients which support our study.18

CONCLUSION

The present study concluded that the most common hematological and biochemical parameters in children with dengue fever were thrombocytopenia, leucopenia, elevated AST, ALT, transaminases deranged PT/APTT and hypoproteinemia. These parameters were most prevalent in dengue hemorrhagic fever. Understanding hematological and biochemical patterns can aid clinicians in early diagnosis and appropriate care of dengue fever patients. Further research in the pediatric age group will provide promising results.

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