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# Clinicoserological Diagnosis of Dengue Fever in Correlation with Platelet Count and Abnormal Liver Function Test in a Tertiary Care Centre

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## ABSTRACT

**Background**: Dengue fever, caused by the dengue virus (DENV), is a significant global public health challenge. Hepatic involvement is a frequent complication, often serving as a marker for disease severity. This study aimed to evaluate the correlation between serologically confirmed dengue, platelet counts, and liver function parameters in the Kota region of Rajasthan.
**Methods**: A laboratory-based cross-sectional study was conducted at Govt. Medical College, Kota, from September 2022 to December 2023. A total of 500 IgM-ELISA positive dengue patients (classified by WHO 1997 criteria) were enrolled. Patients with pre-existing liver disease or co-infections (Malaria, Typhoid, Viral Hepatitis) were excluded. Hematological profiles (CBC) and Liver Function Tests (LFT) were analyzed using automated analyzers.
**Results:** Of the 500 patients, 63.6% were male, with the 21–30 year age group (31.4%) most commonly affected. Cases were classified as Dengue Fever (DF, 68.2%), Dengue Hemorrhagic Fever (DHF, 25.8%), and Dengue Shock Syndrome (DSS, 6.0%). Fever was universal (100%), while hemorrhagic manifestations were exclusive to DHF (52.7%) and DSS (43.3%) groups. Hepatic dysfunction correlated significantly with disease severity. Elevated Aspartate Transaminase (AST) was more prevalent than Alanine Transaminase (ALT), appearing in 100% of DHF and 96.6% of DSS cases. Hypoalbuminemia (<3.5 g/dl) was observed in over 55% of all patients, while hypoglobulinemia was most frequent in the DSS group (30%).
**Conclusion:** Hepatic dysfunction, characterized by elevated transaminases (AST > ALT) and hypoalbuminemia, is highly prevalent in dengue infection and scales with disease severity. These biochemical markers, alongside platelet counts, serve as critical prognostic indicators for early identification of DHF and DSS, facilitating better clinical management in endemic regions like Kota.

***Keywords:*** Dengue Fever, AST, ALT, Thrombocytopenia, Hepatic Dysfunction, Kota.

## INTRODUCTION

Dengue is a major global public health concern caused by the dengue virus (DENV), a mosquito-borne member of the Flaviviridae family [1]. Transmitted primarily by the Aedes aegypti and Aedes albopictus mosquitoes, DENV was historically classified into four distinct serotypes (DENV-1 to DENV-4) [2,3]. In October 2013, a fifth variant, DENV-5, was

announced following its isolation from a 37-year-old farmer in Sarawak, Malaysia, in 2007 [4]. While DENV-5 is currently thought to follow a sylvatic (forest-based) transmission cycle among non-human primates, its emergence—likely driven by genetic recombination and natural selection—highlights the high mutation rates characteristic of RNA viruses compared to DNA genomes.

The global prevalence of dengue has increased dramatically in recent years, fuelled by explosive population growth, unplanned urbanization, inadequate vector control, and increased international travel to endemic regions [5].

Clinically, infection presents a broad spectrum ranging from asymptomatic illness to life-threatening Dengue Shock Syndrome (DSS) and Dengue Hemorrhagic Fever (DHF). While primary infection with one serotype typically provides long-term immunity to that specific variant, subsequent infection with a different serotype (secondary infection) significantly increases the risk of severe disease.

Hepatic involvement is a frequent feature of dengue infection, with manifestations ranging from mild transaminase elevation and hepatomegaly to jaundice and fulminant hepatic failure [6]. Liver injury in dengue is often characterized by aspartate transaminase (AST) levels exceeding alanine transaminase (ALT) levels, a pattern that distinguishes it from typical viral hepatitis. Severe hepatic dysfunction has been established as a poor prognostic factor, directly correlating with increased morbidity and mortality

In India, the rising incidence of dengue and its associated hepatic complications often mimic other endemic conditions such as viral hepatitis, enteric fever, and malaria. Early differentiation is critical, as clinical management differs significantly. The Kota region of Rajasthan is particularly vulnerable due to its high population density, large student community, and high mosquito density in both urban and rural areas. Given the poor public awareness of vector control in this zone, this study aims to evaluate hematological profiles—specifically platelet counts—and liver function tests in patients admitted to hospitals attached to Govt. Medical College, Kota, to determine the role of hepatic dysfunction as a prognostic marker in dengue.

**Objectives**

The purpose of this study was to determine the correlation of Dengue fever with platelet count and to evaluate the prevalence and severity of hepatic dysfunction in patients with serologically confirmed dengue infection and to assess its value as a prognostic marker for disease in out-patient department and wards in hospital attached to Govt Medical College, Kota.

## MATERIALS & METHODS

The present study was conducted in the Department of Microbiology, Govt. Medical College & associated group of Hospitals, Kota during the study period from September 2022 to December 2023. This was a laboratory based cross sectional study. The study was approved by ethical committee of Govt Medical College, Kota (Letter No.F.3() Acad/Ethical Clearance/Batch 2021/2022/62 dated 15/12/2022). Serologically confirmed (IgM positive) dengue fever patients came in both OPD and IPD to the Govt. Medical College & associated hospitals, Kota were included in this study. Patients with serologically negative (IgM negative) dengue like illnesses, patients with pre-existing liver disease, patients having associated infections known to cause hepatic involvement like Viral Hepatitis, Malaria, Enteric fever etc and patients who refuse to be included in study were excluded from the study.

Blood sample of clinically suspected cases of Dengue fever was collected in plain vial. Sample labelled with name, age and registration number. Serum was separated and sent to microbiology lab for detection of IgM antibody by ELISA. IgM detection for

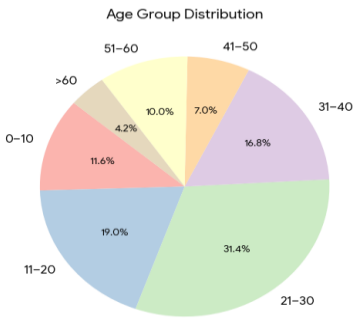
dengue virus was done in serum by IgM antibody capture ELISA using commercially available kits. A total of 500 Blood samples of ELISA positive patients were collected in labelled EDTA and plain vial separately by venipuncture under all aseptic precautions. Informed consent was taken from the patient for sample collection. EDTA vial was sent to pathology department for complete blood count (CBC) and serum sample was sent to biochemistry department lab for Liver function test (LFT). CBC was carried out by automated cell counter method. LFT (Total bilirubin, direct and indirect bilirubin, AST, ALT, Alkaline phosphatise, total protein, serum albumin and serum globulin) were carried out by biochemical analyser XL1000. Data were analyzed using SPSS software. Descriptive statistics (frequencies and percentages) summarized demographic and clinical data. The Chi-square test was used for categorical comparisons, while the One-way ANOVA followed by Tukey's post-hoc test compared mean values of biochemical markers (AST, ALT, Platelets, and Albumin) across clinical categories (DF, DHF, and DSS). Pearson's correlation coefficient evaluated the relationship between platelet counts and liver enzymes. Statistical significance was set at $p < 0.05$.

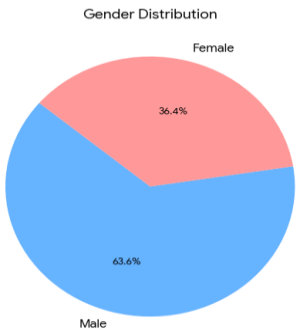
## RESULT

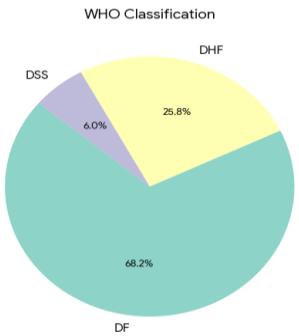
A total of 535 patients with serologically confirmed dengue infection (per WHO 1997 criteria) were screened. After applying exclusion criteria, 500 patients were enrolled. The study showed a male predominance (n=318, 63.6%) with a male-to-female ratio of 1.7:1. The most affected age group was 21–30 years (n=157, 31.4%), while the lowest incidence was observed in those aged >60 years (n=21, 4.2%). Maximum number of cases (n=341, 68.2%) was found in Dengue fever category, 25.8%(n=129) in Dengue Haemorrhagic fever category and 6% (n=30) in Dengue shock syndrome category (Table 1).

**Table 1: Demographic and clinical Classification of Study Subjects (N=500)**

| Variable | Subgroups | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age Group (Years)** | 0–10 | 58 | 11.6 |
| | 11–20 | 95 | 19.0 |
| | 21–30 | 157 | 31.4 |
| | 31–40 | 84 | 16.8 |
| | 41–50 | 35 | 7.0 |
| | 51–60 | 50 | 10.0 |
| | >60 | 21 | 4.2 |
| | **Total** | **500** | **100 %** |
| **Gender** | Male | 318 | 63.6 |
| | Female | 182 | 36.4 |
| | **Total** | **500** | **100 %** |
| **WHO Classification (1997)** | Dengue Fever (DF) | 341 | 68.2 |
| | Dengue Hemorrhagic Fever (DHF) | 129 | 25.8 |
| | Dengue Shock Syndrome (DSS) | 30 | 6.0 |
| | **Total** | **500** | **100 %** |



Fever was the universal presenting symptom (100%). Headache (77.4% in DF; 86.7% in DSS) and body ache/myalgia were the next most frequent symptoms. Notably, hemorrhagic manifestations were absent in the DF group but present in 52.7% of DHF and 43.3% of DSS cases. Conversely, joint pain and retro-orbital pain were more characteristic of the DF group. Plasma leakage signs, such as facial puffiness and pedal edema, were most prevalent in the DHF group (61.2%) (Table 2).

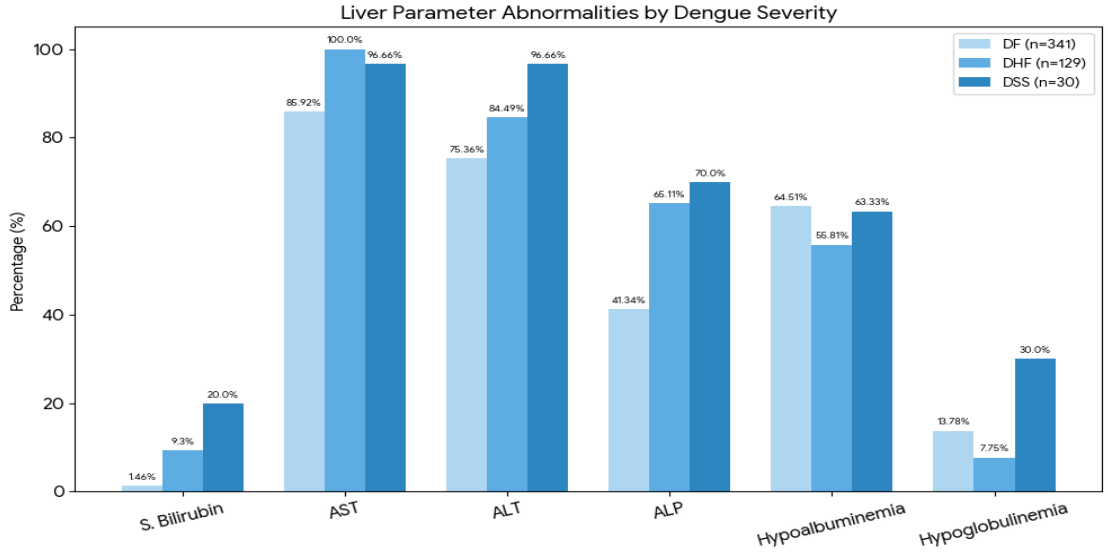
**Table 2: Comparison of clinical symptoms in DF, DHF and DSS Groups**

| Parameter | DF(n=341) | DHF(n=129) | DSS(n=30) |
|---|---|---|---|
| **Fever** | 341 (100%) | 129 (100%) | 30 (100%) |
| **Pain abdomen** | 186 (54.54%) | 67 (51.93%) | 17 (56.66%) |
| **Vomiting** | 149 (43.69%) | 41 (31.78%) | 16 (53.33%) |
| **Bodyache/Myalgia/Fatigue** | 221 (64.80%) | 42 (32.55%) | 14 (46.66%) |
| **Headache** | 264 (77.41%) | 82 (63.56%) | 26 (86.66%) |
| **Joint pain** | 164 (48.09%) | 14 (10.85%) | 2 (6.66%) |
| **Retro-orbital pain** | 63 (18.47%) | 7 (5.42%) | 0 (0%) |
| **Rash** | 21 (6.15%) | 48(37.20%) | 17 (56.66%) |
| **Facial puffiness/ Pedal edema** | 72 (21.11%) | 79(61.24%) | 15 (50%) |
| **Bleeding** | 0(0%) | 68 (52.71%) | 13 (43.33%) |

Hepatic dysfunction was significantly more severe in patients with DSS and DHF compared to those with DF. Elevated liver enzymes were most prevalent in the DSS group. Notably, 100% of DHF cases and 96.66% of DSS cases exhibited elevated AST levels. While hypoalbuminemia was common across all groups ($>$55%), hypoglobulinemia was significantly more frequent in the DSS group (30.0%) compared to DF (13.78%) and DHF (7.75%) (Table 3).

**Table 3: Frequency of Abnormal Liver Function Parameters**

| Parameter | DF (n=341) | DHF (n=129) | DSS (n=30) |
|---|---|---|---|
| **Raised S. Bilirubin (>1.3 mg/dl)** | 5 (1.46%) | 12 (9.30%) | 6 (20.0%) |
| **Elevated AST** | 293 (85.92%) | 129 (100%) | 29 (96.66%) |
| **Elevated ALT** | 257 (75.36%) | 109 (84.49%) | 29 (96.66%) |
| **Elevated ALP** | 141 (41.34%) | 84 (65.11%) | 21 (70.0%) |
| **Hypoalbuminemia (<3.5 g/dl)** | 220 (64.51%) | 72 (55.81%) | 19 (63.33%) |
| **Hypoglobulinemia (<2.3 g/dl)** | 47 (13.78%) | 10 (7.75%) | 9 (30.0%) |
| **Elevated AST** | 293 (85.92%) | 129 (100%) | 29 (96.66%) |
| **Elevated ALT** | 257 (75.36%) | 109 (84.49%) | 29 (96.66%) |



Mean levels of Serum Bilirubin, AST, ALT, and ALP showed a progressive increase with disease severity ($p < 0.001$). Elevated AST was observed in 100% of DHF cases and 96.7% of DSS cases. Mean albumin levels did not differ significantly across groups (p = 0.7171), hypoglobulinemia (<2.3 g/dL) was significantly associated with DSS (30% of cases) compared to DHF (7.75%) and DF (13.78%) (Table 4).

**Table 4: Comparison of Biochemical Parameters Across Groups**

| Parameter | DF (n=341) | DHF (n=129) | DSS (n=30) | *p*-value |
|---|---|---|---|---|
| **Mean AST (U/L)** | 123.4 | 198.0 | 472.0 | <0.0001 |
| **Mean ALT (U/L)** | 92.3 | 124.6 | 313.6 | <0.0001 |
| **Mean ALP (U/L)** | 106.3 | 220.9 | 276.2 | 0.0003 |
| **Mean S. Bilirubin >1.3 mg/dl (%)** | 1.5 | 9.3 | 20.0 | 0.0006 |
| **Mean Serum Albumin** | 3.41 | 3.42 | 3.38 | 0.7171(ns) |

In this study, significant differences were observed in the hematological profiles of patients with varying dengue severity. Thrombocytopenia was a universal finding in more severe cases, present in 100% of patients in both the DHF and DSS groups, compared to 72.16% in the DF group. Median platelet counts at admission were significantly lower in the DSS (19,500 cells/mm³) and DHF (21,000 cells/mm³) groups than in the DF (75,000 cells/mm³) group (P <0.0001). Furthermore, evidence of hemoconcentration increased with disease severity. Mean Hematocrit (HCT) levels were highest in the DSS group (48.9 ± 4.1), followed by DHF (46.6 ± 4.7) and DF (42.4 ± 4.5) (P = 0.0129). A high HCT (>45%) was notably more prevalent in DSS patients (63.33%) than in DHF (55.8%) and DF (47.76%) patients. No statistically significant variation was observed in the Total Leukocyte Count (TLC) between the three clinical categories (P = 0.1710) (Table-5)

**Table 5: Haematological profile of DF, DHF, and DSS groups**

| Parameters | DF (n=341) | DHF (n=129) | DSS (n=30) | P-value |
|---|---|---|---|---|
| **TLC (Median, Range)** | 5250 (1600–11300) | 5022 (1400–15000) | 5740 (2300–11800) | 0.1710 |
| **Platelet Count (Median, Range) *** | 75000 (2000–150000) | 21000 (6000–65000) | 19500 (3000–48000) | <0.0001 |
| **Thrombocytopenia, n (%)** | 210 (72.16%) | 129 (100%) | 30 (100%) | — |
| **Hematocrit (Mean ± SD)** | 42.4 ± 4.5 | 46.6 ± 4.7 | 48.9 ± 4.1 | 0.0129 |
| **Hematocrit > 45%, n (%)** | 139 (47.76%) | 72 (55.80%) | 19 (63.33%) | — |

## DISCUSSION

The present study provides a comprehensive analysis of the clinical, biochemical, and hematological profiles of 500 patients diagnosed with dengue infection. Our findings underscore the significant hepatic involvement and hematological shifts that occur as the disease progresses from simple Dengue Fever (DF) to more severe forms like Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS).

The study observed a peak incidence in the 21–30 years age group (31.4%), suggesting that the young adult population, often the most mobile and economically active, is at the highest risk. This aligns with several regional studies indicating a shift in dengue demographics from children to adults. A study by Pooja P. S. et al. in Nagpur reported similar age group among dengue patients [7]. A notable male preponderance (63.6%) was observed, which may reflect higher outdoor exposure or differences in healthcare-seeking behavior. This result is similar to other Asian studies, such as by Rahul Gandhi et al [8], Teena Jasmin D'Souza et al. [9] and Manisha Joshi et al [10].

Clinically, fever was universal (100%), while headache and bodyache remained hallmark symptoms. Interestingly, specific symptoms like facial puffiness/pedal edema

and bleeding manifestations were significantly more frequent in DHF and DSS groups, serving as vital clinical red flags for plasma leakage and disease severity. A study from Singh Arunesh Bhanupratap [11] and Sanjay T Patil et al [12] showed similar result.

One of the most striking findings in this study is the correlation between liver enzyme elevation and disease severity. Elevated AST was found in 100% of DHF and 96.66% of DSS cases. The mean levels of AST and ALT were significantly higher in the DSS group compared to DF ($P < 0.0001$). AST levels were generally higher than ALT levels across all groups. This pattern is characteristic of dengue-induced hepatic injury, where the enzyme release may originate not only from hepatocytes but also from myocytes and damaged blood cells. While ALP and Bilirubin also showed significant rises in severe cases, the degree of elevation was less pronounced than that of transaminases. This suggests that while cholestasis occurs, the primary hepatic insult in dengue is hepatocellular necrosis. Various studies such as Dr Manasi Mishra et al [13], & Srividya G. M et al [14], showed similar correlation between liver enzyme elevation and disease severity.

Hypoalbuminemia was prevalent across all groups (approx. 55–65%), likely reflecting both decreased synthesis and capillary leak. However, hypoglobulinemia was significantly more pronounced in DSS (30%) compared to DHF (7.75%). This suggests that in the shock phase, the protein loss becomes more generalized, further compromising oncotic pressure and exacerbating circulatory collapse. A similar study done by Sunil Kumar Gupta et al [15] also stated that hypoalbuminemia was prevalent across all groups.

The hematological profile remains a cornerstone of dengue diagnosis and monitoring. Thrombocytopenia was Present in 100% of DHF and DSS cases, reinforcing its role as a mandatory criterion for severe dengue. The median platelet counts were significantly lower in the shock group ($P < 0.0001$). A mean Hematocrit (HCT) > 45% was observed in 63.33% of DSS cases. This rising HCT serves as a critical proxy for plasma leakage and is an essential trigger for aggressive fluid resuscitation. In a study conducted by Dr Richa Giri et al [16] 118 (out of 120) Dengue hemorrhagic fever and 7 (out of 8) dengue shock syndrome patients were thrombocytopenic.

## CONCLUSION

Our study demonstrates that hepatic dysfunction is an integral feature of dengue infection, with the magnitude of transaminase elevation directly reflecting the severity of the disease. Monitoring AST, ALT, and HCT levels, alongside clinical signs like facial edema, is crucial for the early identification of patients likely to progress to DSS. These biochemical markers provide objective evidence that can guide clinical intervention and potentially reduce mortality in severe dengue cases.

### *Declaration by Authors*

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**Conflict of Interest:** The authors declare no conflict of interest.

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