

# Hematological and Biochemical Profile of Dengue Seropositive Children Attending in Selected Institute of Bangladesh

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## Abstract

**Background:** Dengue, a most important arthropod borne human viral disease is endemic in more than 100 countries worldwide including Bangladesh. The hematological and biochemical profile are necessary for diagnosis, assessment of progression of disease as well as management and hence, crucial for reducing overall morbidity and mortality.

**Objective:** To assess by hematological and biochemical profiles of Dengue syndromes.

**Methods:** It was cross-sectional analytical study conducted between July, 2022 to June, 2023 in Department of Laboratory Medicine, ICMH among children of both gender between the ages of one month to 15 years and with clinical manifestations of suspected seropositive dengue (NS1) antigen and/or dengue antibody serology IgM. Here the study will deal with different aspect of hematological parameters such as hemoglobin (Hb), hematocrit (HcT), total leucocyte count, Absolute neutrophil, lymphocyte count and total platelet count, mean platelet volume (MPV). At the same time, the study was elaborated the important biochemical variables like CRP and SGPT value of all participants were recorded related with dengue fever and analyzed by SPSS software version 26.

**Results:** Mean age was 7.10±4.13 years. The present study showed that the month with the highest percentage of dengue patients (43.1%) was November 2022, followed by 25.5% in October 2022, 17.7% in December 2022, 8.8% in September 2022, and 4.9% in August 2022. The present study observed hemoglobin range 6.3gm% to 16.40gm%. Based on hemoglobin level 62.7% patients were anemic and raised hematocrit was observed in 20.6% cases, 20.6% of dengue

patients had an increased mean platelet volume (MPV) and 76.5% of them developed thrombocytopenia. Based on biochemical parameters, in this study 69.4% patients increase in serum glutamic pyruvic transaminase (SGPT) levels, and 88.2% of cases had an increased C-reactive protein (CRP) level.

**Conclusion:** Hematological parameters such as hemoglobin, hematocrit, and mean platelet volume were found to be affected in dengue patients, with a high percentage of patients being anemic and developing thrombocytopenia. Biochemical parameters such as SGPT and CRP were also found to be elevated in a high percentage of cases.

**Key words:** igm antibody; ns1 antigen; thrombocytopenia; dengue; leucopenia; hematocrit

**Introduction**

Dengue made its debut as early as 1780, when Benjamin Rush described the condition as a “break bone fever”. Since its first recognition during the last quarter of eighteenth century, outbreaks have been reported from both developed and developing countries with Asia always remaining the area of highest endemicity.1 Dengue is an acute febrile disease caused by a Flavi virus with four known serotypes (DENV-1, DENV-2, DENV-3 and DENV-4).2 The infection is transmitted by the bite of female mosquitoes of the genus Aedes aegypti and Aedes albopictus. Rainy season and post rain season favor the collection of water in various sites which act as a potential source of mosquito breeding. Hence there is increasing frequent outbreaks of dengue especially in regions of endemicity in the monsoon season.3 Human re the main reservoir for the dengue virus. Urbanization, substandard living conditions, lack of vector control and climatic changes are some of the important causes for dengue infection.1 Infection with one dengue serotype confers lifelong homotypic immunity to that serotype and a very brief period of partial heterotypic immunity to other serotypes, but a person can eventually be infected by all 4 serotypes. Several serotypes can be in circulation during an epidemic.4 Secondary infection with another serotype or multiple infections with different serotypes enhance the chances of severe form of disease.5The global prevalence of dengue has grown dramatically in recent years. Not only the number of cases increasing as the disease is spreading in new areas, but explosive outbreak of the disease is occurring as its epidemiological pattern is gradually changing.6 A study of prevalence of dengue (2012), estimates that 3.9 billion people in 128 countries are at risk of infection with dengue viruses.5 Bangladesh is situated in tropical and sub-tropical regions like other South-East Asian (SE) countries and like them has become a suitable habitat for the dengue vector and its increased transmission.7 It has been observed that a drop in platelet counts with a rise in haematocrit occurs after the 3rd day of illness. The platelet counts serve as a predictive and recovery parameter of DHF/DSS. However, it has been noted that the other hematology parameters like total white cell count, atypical lymphocyte count and haematocrit too aid in diagnosis and prognosis in dengue. While a few studies emphasised the utility of platelet counts in association with serology. Occasional studies only have evaluated the utility of other hematology parameters in association with serology.8 Of biochemical variables, the most frequent changes occur in inflammatory marker and liver specific enzyme SGPT. On the other hand, CRP measured in the first 3 days of illness could be a useful biomarker for early dengue risk prediction and may assist differentiating dengue from other febrile illnesses. So the major hematological and biochemical variables are necessary for diagnosis, progression of disease as well as management and hence, crucial for saving life. Hence this hospital based study was an attempt to elucidate the hematological and biochemical profile among the children of dengue syndromes diagnosed in Department of Laboratory Medicine, Institute of

Child and Mother Health Hospital, Matuail, Dhaka. The incidence and severity of dengue in children is changing every year in Bangladesh, but the outbreak of dengue fever has become an issue of significant public health concern in recent year. The burden of huge number of cases, diversity of clinical symptoms, severity of presentation and unpredictable clinical course and subsequent outcomes are different from previous outbreaks. The children are the most vulnerable group affected by the dengue syndromes. So the findings of this study can be used to assess the importance of different hematological variables and biochemical parameters in the management of seropositive dengue children.

**Methods**

This was a cross-sectional study carried out at the Department of Laboratory Medicine, ICMH, Dhaka from September 2022 to June 2023. All seropositive dengue children of both gender aged from 01 month to 15 years attending in Laboratory Medicine Department of ICMH. This analytical cross-sectional study was conducted in the Department of Laboratory Medicine, ICMH from September 2022 to June 2023. All attending children of both gender between the ages of one month to 15 years with seropositive dengue antigen was included in the study. Then they were screened for study eligibility based on afore mentioned inclusion and exclusion criteria. Parents of selected patients were approached to participate in the study and informed written consent was taken. Ethical approval was obtained from the Institutional Board of ICMH. Laboratory investigations such as NS1 antigen, IgM antibody by rapid immunochromatography test (RCT) and hematological parameter such as complete blood count by automated hematology analyzer (sysmex, XN 550) was done in the laboratory medicine department, ICMH. Biochemical tests such as C-reactive protein by latex method, SGPT was done by Biochemical autoanalyzer, Selecta (ProM) in laboratory medicine department, ICMH. All of the information was collected in data sheet, using a semi-structured questionnaire and all the reports were stored. After completion of data collection necessary coding and editing was done. Then statistical analysis was done by using the statistical package for social science (SPSS-26) program. Data was presented as table and charts. Quantitative data were expressed as the mean ± standard deviation and categorical data were presented as frequency and percentage.

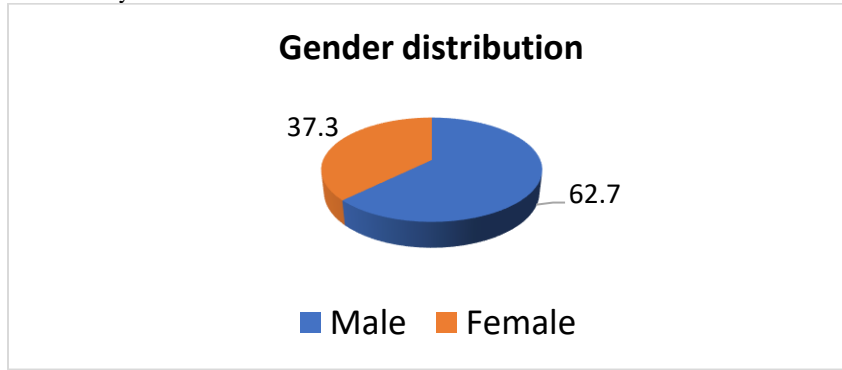
**Results**

Of the total 102 clinically suspected dengue cases, 100% were laboratory-confirmed dengue cases (positive by NS1 antigen). This observational prospective study was carried out consists of 102 patients age upto 15 years, both male and female reported to ICMH, Dhaka for a period of 5 months from August 2022 to December 2022. Different observations are shown as below.

Age (years)	Frequency	Percentage
1month -2 years	39	38.2
3-9 years	37	36.3
10-15 years	26	25.5
Total	102	100.0
Mean±SD Range (min-max)	7.10±4.13 (0.50 – 15) years	

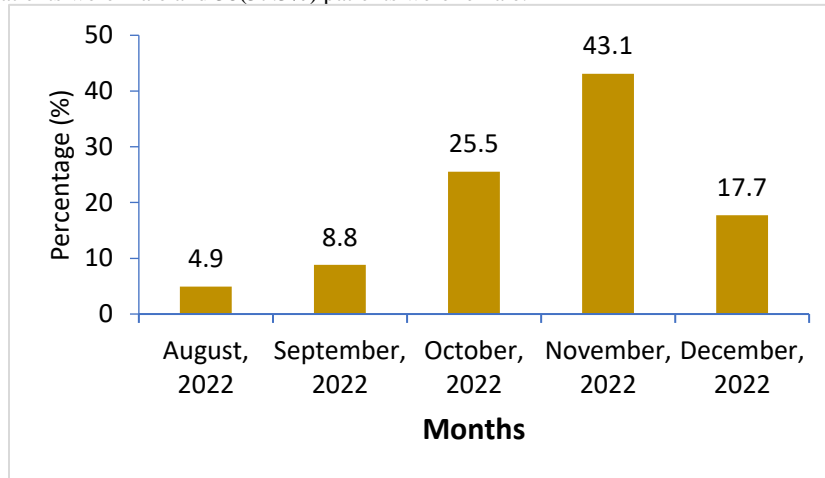
**Table1:** Distribution of patients according to age (n=102).

Maximum 39(38.2%) patients were in the age group of 1-2 years followed by 37(36.3%) patients in age 6-10 years. Mean age was 7.10±4.13 years, minimum age 1 months and maximum 15 years.



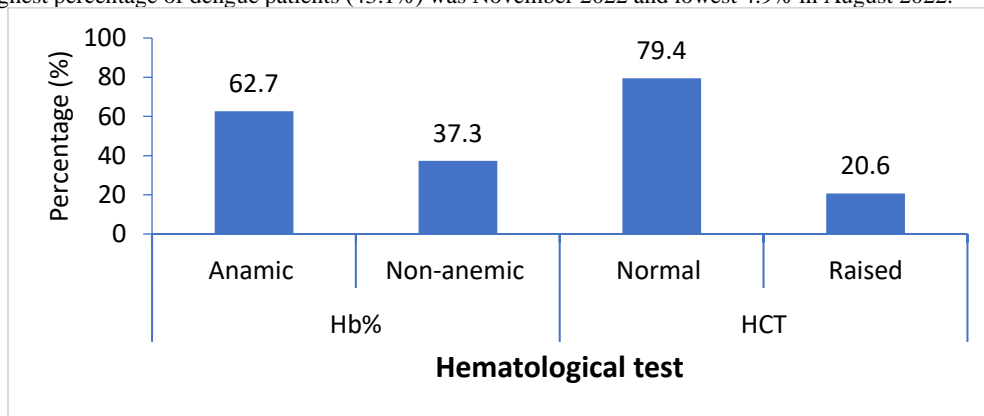
**Figure 1:** Sex distribution of the study subjects (n=102).

Out of 102 dengue patients, 64(62.7%) patients were male and 38(37.3%) patients were female.



**Figure 2:** Bar diagram showing the month wise dengue patients distribution (n=102)

The month with the highest percentage of dengue patients (43.1%) was November 2022 and lowest 4.9% in August 2022.



**Figure 3:** Distribution of dengue patients at the time of hospital visit by Hb% and hematocrit (n=102).

The data presented in Figure 3 indicates that out of the 102 dengue patients included in the study, 62.7% were found to have anemia and 20.6% had a raised hematocrit (HCT) level.

Table-2 Distribution of the dengue cases at the time of hospital visit by MPV and platelet count (n=102).

Hematological test		No. of patients	Percentage
MPV (fL)	Increased	21	20.6
	Normal	81	79.4
Platelet count (cells/cumm)	Normal	24	23.5
	Thrombocytopenia	78	76.5

**Table 2:** displays the results indicating that 20.6% of dengue patients had an increased mean platelet volume (MPV) and 76.5% of them developed thrombocytopenia.

Biochemical test		No. of patients	Percentage
SGPT	Increased	71	69.6
	Normal	31	30.4
CRP	Normal	12	11.8
	Increased	90	88.2

**Table3:** Biochemical parameters of dengue cases at the time of hospital visit (n=102).

Table 3 presents the biochemical parameters of the study population, where 69.4% of cases showed an increase in serum glutamic pyruvic transaminase (SGPT) levels, and 88.2% of cases had an increased C-reactive protein (CRP) level.

## Discussion

Dengue is hemorrhagic viral fever which can prove fatal therefore this study is aimed at analyzing hematological and biochemical parameters for dengue positive patients. Thrombocytopenia, leucopenia, increased hematocrit,

lymphocytosis with reactive lymphocytes along with altered liver function tests are the hematological and biochemical abnormalities that appear in dengue fever. Hematological and biochemical profile of serologically confirmed 102 dengue cases were done in this study. The present study showed maximum 39(38.2%) patients were in the age group of 1 month–2 years followed by 37(36.3%) patients in age 3-9 years, 26(25.5%) patients in age group 10-15 years. Mean age was 7.10±4.13 years. In accordance this study Islam et al.,<sup>9</sup> reported the mean age of the participant was 7.3±4.1 (SD) years, with school-age (6–10 yrs.) and early adolescents (11–13 yrs.) comprising more than half of the cases (62.6%). Sastry et al.<sup>2</sup> reported age group for dengue fever studied was from 0-12 years. Majority of the patients, almost 50% were among 6-8 years, next common age group was among 9-11 years having 24.5% cases, 3.6% (15/110) in the age group of 3–5 years, and 4.5% (5/110) were infants. Mishra et al.<sup>10</sup> reported mean age of hospitalized patients was 8.7 years. 63.9% of patients were admitted in the hospital for 3–6 days. Seven children out of 13 severe dengue patients were admitted for more than 6 days. In the study by Alam et al.<sup>11</sup> noted the age ranged from 6 months to 15 years with a mean of 6.5± 3.5 years and about half (51.9%) of them were between 5-10 years age. Other similar studies done by Srinivasa et al.<sup>11</sup>, Kumar et al.<sup>12</sup>, Jain et al.<sup>13</sup> Our findings compare well with the above observations. In the present study showed 64(62.7%) patients were male and 38(37.3%) patients were female. Male: female ratio was 1.7:1. In accordance this study Sastry et al.<sup>2</sup> reported majority of the patients were boys 59% (65/110) compared to girls 40.9% (45/110). In the study by Mishra et al.<sup>10</sup> there were 75 (77.31%) males and 22 (22.68%) females. For both the groups of severe and non-severe dengue, males had higher incidence. The male to female ratio was 3.4:1. The male to female ratio was 1.1:1, and 1:1 in the studies by Srinivasa et al.<sup>12</sup> and Alam et al.<sup>11</sup> respectively. The present study showed that the month with the highest percentage of dengue patients (43.1%) was November 2022, followed by 25.5% in October 2022, 17.7% in December 2022, 8.8% in September 2022, and 4.9% in August 2022. Concordance this study Sastry et al.<sup>2</sup> reported, most of the cases 75 (68.1%) were recorded in the month of September and October and slightly less number, 35(31.8%) were seen in November and December. Mishra et al.<sup>10</sup> observed that most of their cases were admitted in the rainy and winter seasons between the months of July and November. The peak of admission was seen in the month of September with 59 cases (60.8%). The least admissions were seen in the summer season, specifically in the month of April, consisting of 4 cases (4.1%). The present study observed hemoglobin range 6.3gm% to 16.40gm%. Based on hemoglobin level 62.7% patients were anemic and raised hematocrit was observed in 20.6% cases, 20.6% of dengue patients had an increased mean platelet volume (MPV) and 76.5% of them developed thrombocytopenia. In accordance this study Sastry et al.<sup>2</sup> reported hemoglobin range of less than 5 gm% to more than 15 gm%. Hemoglobin of 5- 10gm% was seen in 36.3% cases and 10-15gm% range was seen in 50.9% cases. Raised hematocrit

(>47%) was observed in 22.7% cases (25/110). The total WBC count was within normal limits (4000-11000/cumm) in 77.2% cases and leucopenia of less than 4000 cells/cumm was seen in 18.1% (20/110) cases. Only 4.5%

cases had leukocytosis with more than 11000/cumm count. Mild, moderate and severe thrombocytopenia was seen in 22.7%, 54.5% and 13.6% cases respectively. Mishra et al.<sup>10</sup> in their study reported that 58.76% of the cases had normal leukocyte count, while leucopenia was seen in 25.77% and leukocytosis in 15.46% of the cases. Ferede et al.<sup>14</sup> reported the most common hematological finding observed was thrombocytopenia (platelet count <140,000/cumm) in 61 (61/102; 59.8%), followed by anemia (hemoglobin level <11.5 g/dl) in 45 (45/102; 44.1%) and leucopenia (total leukocyte count <4,000/cumm) in 27(27/102; 26.5%) of the cases. Hematocrit >44% were noted in 10 (10/102; 9.8%) of the cases and it ranged between 9-51%. Neutrophil <1500 in 16 (16/102; 15.7%) and lymphocyte > 2900 in 2 (2/102; 2%) of the cases were noticed. According to the study by Srinivasa et al.<sup>11</sup> out of 200 cases, 194(97%) had thrombocytopenia, 189(94.5%) had hemoconcentration, 126(63%) had leucopenia< 4000/cumm and 83(41.5%) had raised liver enzymes Jain<sup>13</sup> observed evidence of raised hematocrit (>35%) in 84% of cases. Thrombocytopenia (<1 lakh) was observed in 80% of cases with 10% of patients having platelet count <20,000/ mm, most of the cases had platelet count between 50,000 and 1-lakh. Leucopenia (<5000) was observed in 44% of cases. Abnormal liver enzymes were observed in 38% of patients. Kumar et al.<sup>15</sup> observed 14.1% of their patients had a platelet count <20,000 and low platelet count had significantly correlated with the severity of dengue. The mean platelet recovery time was 2–5 days. In the study by Alam et al.<sup>11</sup> about one-third (32%) of the patients had positive tourniquet test. Five (9.3%) had low WBC count. One third (33%) of patients had platelet count, 51000 to 1 lakh, 25.9% had between 21000 to 50000 and 9.3% had <20000 platelet count and 31.5% patients had platelet count >1 lakh. All children exhibiting a packed cell volume (PCV) of less than 45% and over 40% had raised serum alanine aminotransferase (ALT). Based on biochemical parameters, in this study 69.4% patients increase in serum glutamic pyruvic transaminase (SGPT) levels, and 88.2% of cases had an increased C-reactive protein (CRP) level. Consistently, Sastry et al.<sup>2</sup> reported among the liver enzymes, SGOT was elevated in a larger proportion (47.42%) of patients when compared to alanine aminotransferase (SGPT) which was 30.92%. The previous study results as well as the current study findings suggest that the enhanced CRP level has some association with severe dengue and could probably be a useful biomarker to differentiate severe and non-severe dengue cases. Besides, CRP test is an inexpensive laboratory test compared to other diagnostic tests and may be beneficial in resource-limited settings of dengue endemic areas, especially during dengue outbreak.<sup>25</sup> There are few limitations to our study. Study conducted on the hematological and biochemical profile of dengue seropositive children often have a small sample size, which may limit the generalizability of the results, dengue is a disease that presents with varying degrees of severity and can affect different organ systems, which can lead to heterogeneity in the hematological and biochemical profile of infected children. There is currently no standardized protocol for the hematological and biochemical evaluation of dengue patients, which can lead to variability in the results obtained from different studies. The timing of sample collection is important in the evaluation of the hematological and biochemical profile of dengue patients, as the profile may vary depending on the stage of the disease. However, there may be variability in the timing of sample collection across different studies. Future research in this area should aim to address these limitations and provide more standardized and generalizable results.

## Conclusion

Based on the findings of this study, it can be concluded that dengue is a disease that affects all age groups, with the highest number of cases observed in children under 2 years of age. The disease is more common in male than female. Hematological parameters such as hemoglobin, hematocrit, and mean platelet volume were found to be affected in dengue patients, with a high percentage of patients being anemic and developing thrombocytopenia. Biochemical parameters such as SGPT and CRP were also found to be elevated in a high percentage of cases. Overall, this study provides important information about the demographic and clinical characteristics of dengue patients and highlights the need for effective management and treatment strategies to prevent complications and improve outcomes in affected individuals. Further studies are needed to validate these findings and explore potential risk factors and biomarkers for dengue infection.

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