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Original Research Article

Observation of Hematocrit Level among Dengue Fever Patients in a Tertiary Care Hospital

Dr. Mst. Salina Akhtar[1*], Dr. Md. Mobinur Rahman[2], Dr. Mst. Sabina Akhter[3]

[1]Associate Professor and Head, Department of Physiology and Biochemistry, Sapporo Dental College and Hospital, Dhaka, Bangladesh
[2]Professor, Department of Medicine, Tairunnessa Memorial Medical College and Hospital
[3]Consultant, Department of Obstetrics and Gynecology, Dhaka Medical College Hospital

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***Corresponding author:** Dr. Mst. Salina Akhtar
Associate Professor and Head, Department of Physiology and Biochemistry, Sapporo Dental College and Hospital, Dhaka, Bangladesh

Abstract

Background: Dengue fever is a significant global health concern, particularly in tropical and subtropical regions, including Bangladesh. Hematocrit levels play a crucial role in monitoring plasma leakage and disease severity in Dengue patients. This study aims to observe the hematocrit levels and other hematological parameters among Dengue fever patients admitted to a tertiary care hospital. ***Methods:*** This cross-sectional observational study was conducted at Tairunnessa Memorial Medical College Hospital from March 2022 to August 2022. A total of 80 confirmed Dengue patients were included in the study. Daily hematocrit levels, hemoglobin levels, and white blood cell counts were recorded over a 10-day monitoring period. Data analysis included descriptive statistics to assess trends and variations in these hematological parameters. ***Result:*** The majority of participants (27.5%) belonged to the 18-27 years age group, with a nearly equal gender distribution (52.5% males, 47.5% females). Dengue fever with and without warning signs accounted for 93.75% of cases, while severe Dengue was observed in only 6-25% of cases. Fever was present in all patients, with headache (65%) and myalgia (47.5%) being the most common associated symptoms. The mean hematocrit level peaked on Day 3 (47.58±5.22%) before progressively declining, while hemoglobin levels followed a similar trend, peaking on Day 3 (16.02±1.92 g/dL) and reaching the lowest on Day 9 (12.82±1.42 g/dL). White blood cell counts declined until Day 4 (3333.52±24.11 per cu.mm) and then showed a gradual increase. Recovery was observed in 93.75% of cases, with a mortality rate of 1.25%. ***Conclusion:*** The study highlights the importance of monitoring hematocrit and other hematological parameters in Dengue fever patients for early detection of complications and effective management. While the majority of cases were Dengue fever with and without warning signs; the observed hematological trends underscore the need for vigilant monitoring to prevent severe outcomes. Further large-scale studies are warranted to strengthen clinical guidelines for Dengue management.

Keywords: Dengue fever, Dengue Hemorrhagic Fever, Hematocrit.

INTRODUCTION

Dengue, a vector-borne viral infection primarily transmitted by Aedes aegypti and Aedes albopictus mosquito, has emerged as a significant global health concern. The female Aedes mosquito becomes infected when it ingests blood from an individual during the acute febrile phase of Dengue fever. Over the past four decades, the incidence of Dengue has surged from nine countries in 1970 to over 128 countries today, making it the most rapidly spreading mosquito-borne viral disease [1,2]. This alarming spread is underscored by the estimated 390 million Dengue infections reported annually, highlighting its substantial global burden, particularly in tropical and subtropical regions [1,3]. The impact of Dengue on public health is profound, as evidenced by severe epidemics in countries like Sri Lanka, which reported 186,101 suspected cases in 2017 alone [4]. Epidemiology of the diseases is influenced by a complex interplay of urbanization, sanitation, environmental, and demographic factors, making its control a challenging public health endeavor [5,6]. Clinically, Dengue presents a spectrum of manifestations, ranging from mild undifferentiated fever to severe forms such as Dengue hemorrhagic fever (DHF) and Dengue shock syndrome (DSS). The disease is characterized by the sudden onset of symptoms like high fever, headache, anorexia, nausea, vomiting,

abdominal pain, joint pain, and sometimes diarrhoea. Dengue fever starts with a sharp temperature rise and may be associated with severe headaches and body aches. Fever usually lasts for 3-7 days in the majority of the cases and usually goes to the critical phase after 3 to 4 days of onset of fever. Complications can escalate to DHF and DSS, marked by high fever, vascular permeability, and potential circulatory failure [7,8]. The transition from Dengue to severe Dengue is a critical phase, often accompanied by warning signs such as plasma leakage and hemoconcentration. The most dangerous complication, Dengue shock syndrome, is hypothesized to result from secondary viral infection leading to endothelial dysfunction and abrupt vascular permeability changes [9]. The standard diagnostic criteria for severe Dengue involve identifying signs of plasma leakage and shock, including hemodynamic compromise and impaired perfusion due to vascular leakage rather than blood loss [10]. Amidst this clinical backdrop, hematocrit (Hct.) measurement has emerged as an indispensable tool for monitoring plasma leakage and bleeding in Dengue patients. Hematocrit levels are crucial for detecting hemoconcentration, a key indicator of plasma leakage in Dengue patients. Studies have shown a significant correlation between hemoglobin measured by point-of-care testing and hematocrit measured by automated CBC, suggesting alternative methods for monitoring hematocrit levels in Dengue patients [11]. Understanding the dynamics of hematocrit levels in Dengue and severe Dengue patients could significantly contribute to the clinical management of the disease, aiding in the early detection and intervention strategies that are crucial for reducing morbidity and mortality associated with this rapidly spreading global health challenge.

MATERIALS & METHODS

This cross-sectional observational study was conducted for six months, from March 2022 to August 2022 at Tairunnessa Memorial Medical College Hospital, with the primary objective of examining hematocrit levels in confirmed Dengue patients. This study included a sample of 80 participants all of whom were confirmed Dengue fever positive diagnosed by clinical criteria and NS_1 antigen or IgM positivity as current Dengue infection. This study was designed for a detailed observation of daily hematocrit measurements of the patients, focusing on a monitoring period of 10 days starting from admission. Throughout this period, daily measurements of various blood parameters, including complete blood count, AST, ALT, and hematocrit levels, were systematically recorded for each participant. The resulting data were subsequently analyzed to calculate the Mean±SD for hematocrit levels, providing a distinctive understanding of the central tendency and variability in these values during the specified timeframe. Adherence to ethical guidelines, including obtaining informed consent from participants and securing approval from the relevant institutional review board, underscored the commitment to upholding research integrity and safeguarding participant rights throughout the study.

RESULTS

Table 1: Age distribution of the participants (N=80)

Age	Frequency	Percentage
18-27	22	27.50%
28-37	20	25%
38-47	18	22.50%
48-59	12	15%
60-69	8	10%

The age distribution of the study participants (N=80) revealed that the majority of cases were in the younger age groups. The highest proportion of participants (27.5%) were aged between 18-27 years, followed closely by 28-37 years (25%). The 38-47 age group comprised 22.5% of the study population, while the 48-59 age group accounted for 15%. The lowest representation was observed in the 60-69 age group, which made up only 10% of the participants.

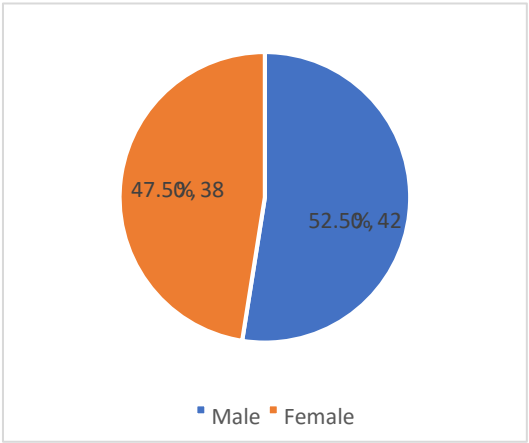

Figure 1: Gender distribution of the participants (N=80)

The gender distribution of the study participants (N=80) showed a nearly equal representation of both sexes, with a slight predominance of males. Males accounted for 52.5% (n=42) of the participants, while females constituted 47.5% (n=38).

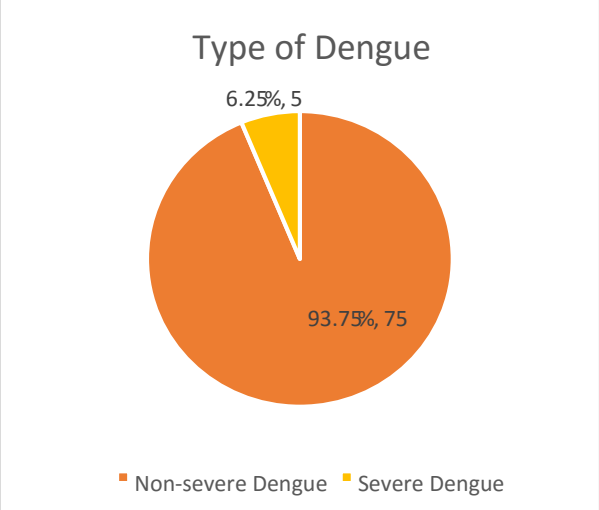

Figure 2: Distribution of Dengue severity among participants (N=80)

The distribution of Dengue severity among the participants (N=80) revealed that the vast majority of cases were classified as non-severe Dengue. Specifically, 93.75% (n=75) of the participants had non-severe Dengue, while only 6.25% (n=5) experienced severe Dengue.

Table 2: Distribution of clinical presentations among the participants (N=80)

Clinical Presentations	Frequency	Percentage
Fever	80	100.00%
Headache	52	65.00%
Myalgia	38	47.50%
Nausea	27	33.75%
Loss of Appetite	27	33.75%
Rash	6	7.50%
Abdominal Pain	5	6.25%
Bleeding	4	5.00%

The clinical presentations among the study participants (N=80) demonstrated fever as a universal symptom, present in 100% of cases. Headache was the second most common symptom, reported by 65% of participants, followed by myalgia, which affected 47.5% of cases. Nausea and loss of appetite were each observed in 33.75% of the participants. Less frequent symptoms included rash (7.5%), abdominal pain (6.25%), and bleeding manifestations, which were the least common, occurring in only 5% of the cases.

Table 3: Distribution of minimum platelet count among the participants (N=80)

Minimum Platelet Count	Frequency	Percentage
<20000	6	7.50%
20,000-50,000	26	32.50%
50,001-1,00,000	22	27.50%
>1,00,000	26	32.50%

The distribution of minimum platelet counts among the study participants (N=80) revealed significant variability. A considerable proportion of participants (32.5%) had platelet counts in the range of 20,000-50,000, while an equal percentage (32.5%) maintained platelet counts above 100,000. Additionally, 27.5% of participants had platelet counts between 50,001-100,000. Severe thrombocytopenia, characterized by platelet counts below 20,000, was observed in 7.5% of the cases.

Table 4: Distribution of mean hemoglobin level of participants on different days since admission (N=80)

Day	Mean±SD
Day 1	15.21±2.18
Day 2	15.85±1.72
Day 3	16.02±1.92
Day 4	15.09±2.08
Day 5	15.0±1.57
Day 6	14.34±1.77
Day 7	13.85±0.82
Day 8	13.2±2.24
Day 9	12.82±1.42
Day 10	13.5±2.05

The mean hemoglobin levels of the study participants (N=80) showed fluctuations over the 10-day monitoring period. On Day 1, the mean hemoglobin level was 15.21±2.18 g/dL, which slightly increased on Days 2 and 3, reaching 15.85±1.72 g/dL and 16.02±1.92 g/dL, respectively. However, from Day 4 onward, a gradual decline was observed, with levels dropping to 15.09±2.08 g/dL on Day 4 and further decreasing to 14.34±1.77 g/dL by Day 6. The lowest recorded mean hemoglobin level occurred on Day 9 at 12.82±1.42 g/dL, followed by a slight rise to 13.5±2.05 g/dL on Day 10.

Table 5: Distribution of mean hematocrit level of participants on different days since admission (N=80)

Day	Mean±SD
Day 1	44.51±4.24
Day 2	46.03±3.18
Day 3	47.58±5.22
Day 4	46.65±0.84
Day 5	43.15±4.41
Day 6	42.15±2.81
Day 7	41.08±5.28
Day 8	39.58±3.92
Day 9	38.44±2.14
Day 10	40.01±1.17

The mean hematocrit levels of the study participants (N=80) exhibited dynamic changes over the 10-day monitoring period. On Day 1, the mean hematocrit level was 44.51±4.24%, which increased over the next two days, reaching a peak of 47.58±5.22% on Day 3. A slight decline was observed on Day 4 (46.65±0.84%), followed by a more pronounced decrease from Day 5 onward. By Day 6, the mean hematocrit level had dropped to 42.15±2.81%, and this downward trend continued, reaching the lowest recorded level on Day 9 at 38.44±2.14%. On Day 10, a minor increase to 40.01±1.17% was noted.

Table 6: Distribution of mean White Blood Cell Count (per cu.mm) of participants on different days since admission (N=80)

Day	Mean±SD
Day 1	6943.28±13.29
Day 2	5425.17±25.18
Day 3	3720.82±11.82
Day 4	3333.52±24.11
Day 5	4489.18±7.85
Day 6	5115.94±15.11
Day 7	6240.65±13.92
Day 8	6883.25±21.18
Day 9	7518.61±18.56
Day 10	7983.74±23.19

The mean white blood cell (WBC) count of the study participants (N=80) showed a distinct pattern of decline followed by gradual recovery over the 10-day observation period. On Day 1, the mean WBC count was 6943.28±13.29 per cu.mm, which steadily declined to 5425.17±25.18 on Day 2 and further dropped to its lowest point on Day 4 at 3333.52±24.11 per cu.mm. Following this nadir, a gradual increase was observed from Day 5 (4489.18±7.85) onwards, with WBC counts progressively rising each day. By Day 7, the count had increased to 6240.65±13.92, eventually reaching 7983.74±23.19 per cu.mm by Day 10.

Table 7: Distribution of hospital outcomes among the participants (N=80)

Outcome	Frequency	Percentage
Recovered	75	93.75%
Delayed recovery	4	5%
Death	1	1.25%

The outcome of the patients showed that 93.75% had completed recovery, while 5% (n=4) had delayed recovery. Unfortunately, 1 patient (1.25%) had expired in our study.

DISCUSSION

In examining the key findings of this study, several noteworthy insights emerge regarding the clinical and hematological aspects of confirmed Dengue patients. The age distribution of our study cohort revealed a notable concentration in the 18-27 years age group (27.5%), aligning with the trends observed in similar studies that indicate a higher susceptibility to Dengue in young adults [12]. Nearly equal gender distribution in our cohort, with males comprising 52.5% and females 47.5%, is consistent with the general pattern observed in Dengue studies, reflecting the indiscriminate nature of Dengue transmission among different genders [13]. The prevalence of non-severe Dengue in the majority of our participants (93.75%) aligns with the typical distribution observed globally, emphasizing the predominant occurrence of milder forms of the disease [13]. The spectrum of clinical presentations, including the universal presence of fever (100%) and varying frequencies of symptoms such as headache (65%) and myalgia (47.5%), mirrors the diverse symptomatology commonly associated with Dengue infections [1,14]. Examining hematological parameters, our study indicates a progressive decrease in mean hemoglobin levels after peaking on Day 3 (16.02±1.92 g/dL), with the lowest level observed on Day 9 (12.82±1.42 g/dL). This pattern aligns with studies suggesting that hemoglobin levels fluctuate due to plasma leakage and disease progression [15,16]. Conversely, the observed fluctuations in mean hematocrit levels, with a peak on Day 3 (47.58±5.22%) followed by a decline, indicate the dynamic fluid shifts characteristic of Dengue infections, warranting further investigation into the factors influencing these variations [17]. White blood cell counts displayed a distinctive temporal pattern, characterized by an initial decrease until Day 4 (3333.52±24.11 per cu.mm) followed by a subsequent increase. This dynamic fluctuation aligns with existing literature suggesting that monitoring WBC counts can provide insights into the immune response and potential complications during Dengue infections [18]. Considering the hospital outcomes, the substantial majority of participants (93.75%) experienced stable improvement, consistent with the general prognosis of Dengue cases. However, the observation of mortality in a small subset (1.25%) underscores the importance of ongoing efforts to enhance clinical management and intervention strategies for severe cases, emphasizing the need for continuous improvement in Dengue care practices [19]. Comparing our findings with existing literature, this study contributes nuanced insights into the clinical and hematological dynamics of Dengue infections, aligning with broader trends observed globally. The age distribution, gender prevalence, and spectrum of clinical presentations resonate with established patterns, affirming the consistency of these characteristics across diverse populations. The observed variations in hematological parameters and hospital outcomes provide valuable additions to the existing body of knowledge, emphasizing the need for further exploration of these dynamics in larger, multicentric studies to enhance our understanding of Dengue pathophysiology. Overall, these findings collectively contribute to the broader discourse on Dengue research and underscore the importance of ongoing efforts to refine diagnostic and management strategies in addressing the complex challenges posed by this globally significant infectious disease.

Limitations of The Study

- The study was conducted in a single hospital.
- The sample size was smaller.

So, the results may not represent the whole community.

CONCLUSION

In conclusion, this study evaluates the Hct. Levels among patients with dengue fever. Normal Hct levels in adult healthy male people ranges from 39%-49% and in adult healthy female persons ranges from 35%-45%. A significant rise in Hct level (greater than 20%) in patients of dengue fever indicates plasma leakage that may lead to dengue shock syndrome. Significant fall of Hct. occurs in dengue hemorrhagic fever, which is also life-threatening. Aside from hematological features, including hemoconcentration, leukopenia, and thrombocytopenia are also important for

diagnosis and case management in dengue. In case of raised Hct. levels due to plasma leakage, Hct. should be corrected by judicious use of intravenous fluid, especially colloid. In the case of dengue hemorrhagic fever, decreased hematocrit should be managed by blood transfusion. This study contributes to the broader discourse on dengue research, emphasizing the need for continuous efforts to refine diagnostic and management strategies for better outcomes in dengue patients. Further investigations, particularly in larger, multi-centric studies, are warranted to advance our knowledge and enhance our ability to address the global burden of this significant infectious disease.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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