

# Analysis of the Dengue Infection, Occurrence and Hematological Profile of Dengue Patients in Dhaka City

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## Abstract

In the tropical and subtropical area, dengue virus is mostly found. To the determination of the occurrence of dengue viral infection and hematological profile of dengue infected peoples in the Dhaka city. A sum of 255 samples of blood from both sex and different age groups were collected in this research. Dengue nonstructural protein 1 (NS1) and complete blood count (CBC) test were performed for the study. During this study period, total 255 samples were tested. Among these, 67 samples were diagnosed as positive. Seroprevalence of dengue was 26.30%. Out of 67 positive dengue patients, 41 (61.2 %) were male and 26 (38.8 %) were female. Dengue infection was observed more in 21 to 30 years age group followed by above 40 years and 16 to 20 years but observed less in of 1st day to 5 years followed by 11-15 years, then 6-10 years and 31-40 years. It was seen that the >40 years of age group had the maximum unit of cases having low platelet count followed by 21-30 years and it was also seen that 21-30 years of age group had the maximum range of cases having low WBC count followed by above 40 years of age group. In our research, we showed thrombocytopenia (100000-150,000/ $\mu$ l) with leucopenia (White Blood Cells, WBC <5000/ $\mu$ l) in 8 (26.6%) cases and thrombocytopenia (100000-150,000/ $\mu$ l) without leucopenia in 9 (24.3%) cases but thrombocytopenia (<100000/ $\mu$ l) with leucopenia (White Blood Cells (WBC) <5000/ $\mu$ l) in 5 (16.7%) cases and thrombocytopenia (<100000/ $\mu$ l) without leucopenia in 6 (16.2%) cases. Among 67 positive cases, we found that (26.6%) had DF and (16.7%) had DHF according to WHO classification. For validating more reliability, this research needs further work.

**Keywords:** Dengue • Serology • WBC • Platelet count • CBC • Occurrence and Hematological Profile

## Introduction

In all over the world, dengue fever is considered as a serious public health challenge, with 2.5 billion people are in risk of infection and 25,000 deaths being reported annually [1]. The causative agent of Dengue fever (DF) is a virus called Dengue (DENV), mosquito-borne single- positive stranded (RNA) virus, it has four serotypes (DEN-1, DEN-2, DEN-3, and DEN-4). It belongs to the Flaviviridae family and referred as Arbovirus (arthropod-borne viruses) [2]. 3 structural proteins (C, prM and E) and 7 non-structural proteins (NS1, NS2A, NS2B, NS, NS4A, NS4B and NS5) are encoded by dengue. It causes a spectrum of illness ranging from asymptomatic to classical dengue fever (DF) and can be progressed to life threatening dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) [3,4]. Female bite of the *Aedes aegypti* mosquito is the main reason of transmitting to humans, which is infected by four serotypes of the virus. The incubation period of the virus is 3 to 15 days in humans with an average of 5 days following the transmission [5].

Dengue is now the most vital viral diseases which is mosquito borne. It appears with varied symptom etiology [6]. Dengue fever characterized by sudden onset of fever for 3-5 days with symptoms like intense headache, retro orbital pain, anorexia, myalgia, gastrointestinal disturbances and rash

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etc [7]. For an accurate diagnosis, specific laboratory tests are necessary. Serological, costly molecular methods (RT-PCR) and laborious virus isolation are performed to diagnose the specific dengue fever. For detecting dengue, the NS1 antigen (NS1 Ag) test is one of the most regular tests in clinical practice [8,9].

For viral translation, transcription, and replication, nonstructural proteins are involved. The NS1 protein antigen is involved in viral RNA replication among these proteins. Without forming part of the virion, NS1 is expressed on the surface of infected cells. Secreted NS1 serum level positively correlates with viral titers and are tremendous ways in dengue diagnosis [10]. For promoting the early diagnosis of dengue, thrombocytopenia and leukopenia serve as a predictive marker. The platelet count is the only accessory laboratory test which can support diagnosis of DHF or DSS [11]. In this research, we evaluated the incidence of infection of dengue and hematological profiling of dengue fever affected patients.

## Materials and Methods

### Study area

This analysis was done at department of Microbiology, of a renowned Diagnostic Centre in Dhaka district named Popular Diagnostic Centre, over a period of 4 months (April 2019 –August 2019). The research was approved by the ethical committee of the Diagnostic Centre. Total 255 outpatient samples were analyzed for these studies which were collected from dengue symptomatic patients of the Dhaka district.

### Sample collection

All the samples were aseptically collected in gel vacuities. Then the blood serum was properly separated by centrifugation at 1000 g for 5 min. All separated sera were tested immediately.

### Serological Profiling Including Determination of Ns-1 Ag

Serological profiling of Dengue was done by SD BIOSENSOR Dengue (Dengue NS-1) kit which is originated in South Korea for detecting NS-1 Ag. Added 3 drops (about 100 µl) of specimen into the sample well with the disposable droppers. Test results were interpreted at 15-20 minutes. If the patient is affected by dengue virus, a purple color moves across the result window in the center of the test device.

### Pathological profiling including complete blood count (CBC)

CBC test of all patients' sample was estimated on a fully automated blood cell counter of Siemens, which originated in Germany.

### Statistical analysis

Statistical analysis was performed in Microsoft Excel using Welch's t-test for studying the significance of differences.

## Results

During this research, total 255 samples of blood were examined for dengue viral infection. Among these 67 samples were diagnosed as positive dengue. So the seroprevalence rate was 26.30% (Table 1). Out of 67 dengue patients 41 (61.2 %) were male and 26 (38.8 %) were female which is shown in Figure 1.

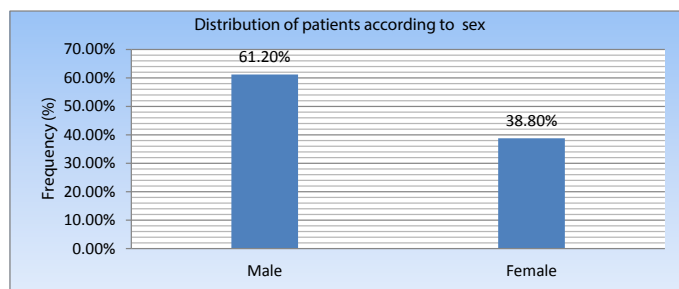
In this analysis infection of dengue was observed more among age group of 21 to 30 years followed by above 40 and 16 to 20 years observed less in age of 1<sup>st</sup> day to 5 years followed by 11-15 years, then 6-10 years and 31-40 years which is shown in Figure 2.

In Table 2, it was seen that >40 years of age group had the maximum unit of cases having low platelet count followed by 21-30 years but the 21-30 years of age group also has the maximum area of cases having high platelet count followed by 16-20 years.

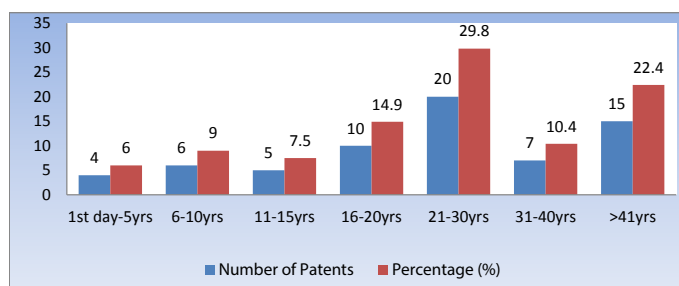
In Table 3, it was seen that 21-30years of age group has maximum range of cases having low WBC count followed by above 40years group of age. But 21-30years of age group also has maximum cases having high WBC count

**Table 1.** Sero prevalence of dengue infection in Bangladesh.

Total no of patients	Dengue positive patients	Percentage (%)
255	67	26.30%



**Figure 1.** Distribution of patients according to sex.



**Figure 2.** Distribution of patients according to age.

**Table 2.** Frequency of dengue infection according to a platelet cell and age.

Age	Platelet Count/µl				Total
	<50000	50000-100000	100001-150000	>150000	
	N (%)	N (%)	N (%)	N (%)	N (%)
1 <sup>st</sup> day – 5yrs	0(0.0)	0(0.0)	0(0.0)	4(100)	4(6)
6 – 10yrs	0(0.0)	1(16.7)	0(0.0)	5(83.3)	6(8.9)
11 – 15yrs	0(0.0)	0(0.0)	1(20)	4(80)	5(7.5)
16 – 20yrs	0(0.0)	2(20)	1(10)	7(70)	10(14.9)
21 – 30yrs	0(0.0)	3(15)	6(30)	11(55)	20(29.8)
31 – 40yrs	0(0.0)	1(14.4)	3(42.8)	3(42.8)	7(10.5)
>41yrs	0(0.0)	4(26.7)	6(8.95)	5(33.3)	15(22.4)
Total	0(0.0)	11(16.4)	17(25.4)	39(58.2)	67(100)

followed by above 40years of age group and then 16-20 years group of age.

In our analysis, we focused thrombocytopenia (100000-150,000/µl) with leucopenia (White Blood Cells (WBC) <5000/µl) in 8(26.6%) cases and without leucopenia in 9(24.3%) cases and thrombocytopenia (<100000/µl) with leucopenia (White Blood Cells (WBC) <5000/µl) in 5 (16.7%) cases without leucopenia in 6 (16.2%) cases. The total result is shown in Table 4.

## Discussion

For diagnosing dengue infection, Dengue NS1 antigen testing is a direct rapid test method. The cost of this method is lower than other methods like PCR. For achieving early, conclusive, and serotype-specific diagnosis, this is an excellent testing method. It is used to get the result rapidly in less than five days after the onset of fever [12].

During this research time, total 255 samples were examined. Among these, 67 samples found positive. Seroprevalence of Dengue was 26.30%. Similar type of findings was found in the analysis of [13] which corroborates our study.

Many studies have reported a higher prevalence of dengue viral infection among males than females [14,15]. In our research, out of 67 dengue patients, 41 (61.2%) were male, 26 (38.8%) were female. [16] also reported similar observation in their study, out of total positive dengue cases, 62.63% were males and 37.37% females.

In our research, most dengue infected patients were from age group 21 to 30years (29.8%) followed by above 40 (22.4%) years and 16 to 20 years (14.9%) of age. Maximum dengue cases in the age group 21 to 40 years were observed in [17].

Out of all dengue cases, thrombocytopenia (<1,00,000/mm<sup>3</sup>) was found in 11 cases. The WHO diagnostic criterion for DHF is Thrombocytopenia: <1 lakh/mm<sup>3</sup>. In this study, above 40 years of age group has the maximum amount of cases having low platelet count followed by 21-30 years but 21-30 years of age group has also the maximum unit of cases having high platelet count followed by 16-20 years. Almost similar results were found in the research of [18] Among the 67 cases, 8 cases had a lower total WBC count, were less than 3000 /µl, 10 cases were less than 4000 /µl, 11 cases were less than 5000/µl and the total WBC count of 29 cases was ranging from 2000-5000/µl. Rest of the results had more than 5000/µl.

The total count of leucocyte count less than 2.6 × 10<sup>9</sup>/L, count of platelet less than 100 × 10<sup>9</sup>/L at day 2.5 is highly suggestive to a child which is progressing towards DHF [19]. These findings were almost similar to our research. WHO characterizes dengue fever in 2011, leukopenia, WBC < 5000/µl, thrombocytopenia (100000-150,000/µl) while dengue hemorrhagic fever is mainly characterized by thrombocytopenia (<100,000/µl) [20]. In our research, we reported thrombocytopenia (100000-150,000/µl) with leucopenia (WBC) <5000/µl) in 8 (26.6%) cases and without leucopenia in 9 (24.3%) cases. Similarly thrombocytopenia (<100000/µl) with leucopenia

**Table 3.** Frequency of dengue infection according to a White blood cell and Age.

Age	WBC Count/ $\mu$ l					Total N (%)
	<2000	2000–3000	3001–4000	4001 –5000	>5000	
	N (%)	N (%)	N (%)	N (%)	N (%)	
1 <sup>st</sup> day – 5yrs	0(0.0)	0(0.0)	1(25)	0(0.0)	3(75)	4(6)
6 – 10yrs	0(0.0)	0(0.0)	0(0.0)	2(33.3)	4(66.7)	6(8.9)
11 – 15yrs	0(0.0)	0(0.0)	1(20.0)	2(40.0)	2(40.0)	5(7.5)
16 – 20yrs	0(0.0)	1(10.0)	1(10.0)	1(10.0)	7(70.0)	10(14.9)
21 – 30yrs	0(0.0)	3(15.0)	3(15.0)	3(15.0)	11(55.0)	20(29.8)
31 – 40yrs	0(0.0)	1(14.3)	1(14.3)	2(28.6)	3(42.8)	7(10.5)
>41yrs	0(0.0)	3(20.0)	3(20.0)	1(6.7)	8(53.3)	15(22.4)
<b>Total</b>	0(0.0)	8(11.9)	10(14.9)	11(16.4)	38(56.8)	67(100)

**Table 4.** Frequency of dengue infection according to WBC and Platelet.

WBC	Platelet count/ $\mu$ l						Total	
	<100000		100000 – 150000		>150000		N	%
	N	%	N	%	N	%		
<5000	5	16.7	8	26.6	17	56.7	30	44.8
>5000	6	16.2	9	24.3	22	59.5	37	55.2
<b>Total</b>	<b>11</b>	<b>16.4</b>	<b>17</b>	<b>25.4</b>	<b>39</b>	<b>58.2</b>	<b>67</b>	<b>100</b>

(WBC) < 5000/ $\mu$ l) in 5 (16.7%) cases and without leucopeniain 6 (16.2%) cases.

## Conclusion

According to the classification of WHO, we saw that (26.6%) had DF, (16.7%) had DHF among 67 dengue positive cases. All the samples were aseptically collected from dengue symptomatic patients in the Dhaka region and tests were done in the Popular Diagnostic Centre in Dhaka, Bangladesh between April, 2019 and August, 2019. Seroprevalence rates of dengue viral infection were 26.30%, which is not a satisfactory thing. The accurate early and efficient diagnosis of the disease is very significant for the cure and vaccine research. We cannot diagnose Dengue infection just basing on clinical presentation. For supporting Epidemiological Surveillance Programs, efficient laboratory diagnosis is an important tool. As dengue has become one of the most important and major issue in public health in Bangladesh, it is very much important to analyze the exact dengue prevalence. So, more and more research is necessary to better understand the dengue infection prevalence in Bangladesh.

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## Conflicts of Interest

Authors announce that no competing interest exists.

## References

1. Mustafa MS, Bansal AS and Rastogi V. "Flightless Aedesmosquitoes in dengue control." *MJAFI* 67 (2011): 192.
2. Rodenhuis-Zybert IA, Wilschut J and Smit JM. "Dengue virus life cycle: viral and host factors modulating infectivity, Cellular and molecular life sciences." 67 (2010): 2773-2786.

3. Ahammad SF. "Clinico-demographic profile of dengue fever in a south indian tertiary care teaching hospital." *World J Pharmacy and Pharmaceutical Sci* 5 (2016): 1602-1609.
4. Uddin MA. "Exploring socio-economic impact of dengue fever in Dhaka city: a statistical modeling approach." *Eur J Med Health Sci* 2 (2020): 125-133.
5. Oishi K, Saito M, Mapua CA and Natividad FF. "Dengue illness: clinical features and pathogenesis." *J Infection Chemotherapy* 13 (2007): 125-133.
6. Bhawe S, Rajput C and Bhawe S. "Clinical profile and outcome of dengue and dengue hemorrhagic fever in paediatric age group with special reference to who guidelines 2012 on fluid management of dengue fever." *Int J Advanced Res* 3 (2015): 196- 201.
7. Park K. "Epidemiology of Communicable Diseases" Dengue syndrome. Park's textbook of Preventive and Social Medicine. 20<sup>th</sup> edition, Jabalpur, India: M/s Bhanarsidas Bhanot (2009): 218-222.
8. Paula SO and Fonseca BA. "Dengue: a review of the laboratory tests a clinician must know to achieve a correct diagnosis." *Braz J Inf Dis* 8 (2004): 390-398.
9. Shazeed-UI-Karim. "Dengue and recent mosquito-borne viral fever outbreak in Bangladesh: concern, causes, and control." *Am J Pure Appl Sci* 1(2019): 44-48.
10. Rocha Queiroz Lima M Da, Nogueira RMR, Schatzmayr HG and Filippis AMB de et al. "A new approach to dengue fatal cases diagnosis: NS1 antigen captor in tissues." *PLoS Neglected Tropical Diseases* 5 (2011): 1147.
11. Sindhanai V, Banoo S, Rajkumar N and Sureshchander VC. "Evaluation of correlation between dengue serological markers & Platelet count." *Sch J App Med Sci* 4 (2016): 618-622.
12. Chan HBY, How CH, and Ng CWM. "Definitive tests for dengue fever: when and which should I use?." *Singapore Med J* 58 (2017): 632.
13. Madan SP, Bhatawadekar S and Lahiri K. "Clinico-demographic profile and seroprevalence of dengue at a tertiary care hospital- study from Maharashtra." *Int J Health Sci Res* 8 (2018): 43-48.
14. Parameswarappa Jyothi and Basavraj C Metri, "Correlation of serological

- markers and platelet count in the diagnosis of Dengue virus infection." *Adv Biomed Res* 4 (2015).
15. SmitaSood. "A Hospital Based Serosurveillance Study of Dengue Infection in Jaipur (Rajasthan), India." *J Clin Diagnostic Res* 7 (2013): 1917-1920.
  16. Mahesh Kumar, Sharma R, Parihar G and Sharma M. "Seroprevalence of Dengue in Central Rajasthan: A Study at a Tertiary Care Hospital." *Int J Curr Microbiol App Sci* 4 (2015): 933-940.
  17. Chetan A, Ajeet S, Narotam S and Manish DS et al. "Characterization of Dengue Virus by Molecular and Serological Methods in Clinical Isolates and its Association with Disease Monitoring". *International J Res Analytical Reviews (IJRAR)* 5 (2018): 560-566.
  18. Manal MAS and Khaleed SA. "Evaluation of some hematological and serological changes in dengue patients of Lahj-Yemen." *Electronic J University of Aden for Basic & Applied Sci* 1 (2020): 25-29.
  19. Kularatnam GAM, Jasinghe EA, Gunasena S, and Samaranayake D et al. "Evaluation of Biochemical Changes in Dengue Fever and Dengue Haemorrhagic Fever". 17<sup>th</sup> Annual Scientific Congress of the Sri Lanka College of Paediatricians (2014): 26-29.
  20. World Health Organization (WHO), "Comprehensive guideline for prevention and control of dengue and dengue hemorrhagic fever" (2011).

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