

Sero-positivity and hematological markers of dengue fever in western Nepal

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ABSTRACT

Introduction: Dengue fever is increasingly emerging as a public health threat in Nepal, progressively spreading from the terai plains into the hilly regions. This study evaluated the prevalence of dengue sero-positivity and related hematological changes among suspected cases in western Nepal.

Methods: A prospective study was performed from June 2022 to May 2023, including 657 patients clinically suggestive of dengue. Diagnostic measures included rapid NS1 antigen tests and serological IgM/IgG assays, together with hematological parameters.

Results: Out of 657 suspected individuals, 70 (10.5%) were confirmed dengue-positive. Specifically, 34.2% tested positive for NS1 antigen (n = 24), 68.5% for IgM antibodies (n = 48), and 12.8% for IgG antibodies (n = 9). 60% of the infections were among inpatients, with the age group 20–29 years most affected (28.5%), followed by 40–49 years (20%). A surge in cases was observed in November (42.9%). Hematologically, 27.1% had platelet counts below 150000/mm³ and 25.7% showed leucopenia (< 4000/mm³).

Conclusion: Dengue sero-positivity among suspected cases in western Nepal was 10.5%, with recent infections (IgM positivity) predominating. The most affected age group was 20–29 years, and cases peaked in November. Thrombocytopenia and leucopenia were observed in over a quarter of confirmed cases, highlighting common hematological disturbances associated with dengue in this region.

Keywords: dengue fever, sero-positivity, NS1 antigen, IgM antibody, thrombocytopenia.

INTRODUCTION

Dengue is a virus spread by mosquitoes that is endemic to most tropical and subtropical regions of the world mostly found in urban and suburban areas.¹ Life-threatening symptoms like dengue shock syndrome (DSS) and dengue hemorrhagic fever (DHF) are caused by successive infection with distinct serotypes. The most typical clinical symptoms of dengue infection are plasma leakage, a rise in the likelihood of hemorrhagic tendencies, a continuous high-grade temperature (40°C) lasting two to seven days, and a total platelet count less than $100 \times 10^9/l$.² The definitive diagnosis of dengue virus (DENV) detection uses a variety of diagnostic techniques, including virus-specific serological testing, molecular detection, and virus isolation. The three markers that are most frequently employed in serological testing are

IgG for past infections, (non-structural protein) NS1-Ag and IgM for acute infections.³ Dengue fever (DF) is an emerging mosquito-borne viral disease and a global health issue mainly in Terai region which is expanding to Hilly region of Nepal.⁴ There is still a lack of statistics despite its increasing impact, which includes greater rates of illness and mortality. Hence, this study aims to establish sero-positivity rates among suspected dengue cases and emphasize associated hematological abnormalities.

METHODS

A prospective observational study was conducted in the Department of Microbiology at Devdaha Medical College and Research Institute from June 2022 to May 2023. A total of 657 whole blood samples were collected by applying standard procedures in K3-ethylenediaminetetraacetic acid and clot activator tubes for hematological and serological investigation respectively from clinically suspected patients and tested for

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complete blood cell count profile, dengue specific NS1 antigen and anti-dengue IgM & IgG antibodies. Hematological testing was done by using Advance ERBA Elite 3-part hematological analyzer, while serological testing for dengue-specific nonstructural antigen 1 (NS1) and anti-dengue IgM and anti-dengue IgG antibodies were done by using immune-chromatography rapid diagnostic kit as per manufacture instructions. The National guidelines for dengue testing has recommended rapid diagnostic test (NS1 antigen and anti-dengue IgM and IgG) for primary health care centers and district/provincial hospital.^{2,5,6}

Inclusion criteria: Patients with high fever with clinical symptoms suggestive of dengue infection

Exclusion criteria: Patients with fever with other known infectious etiology, patients of known chronic liver disease, and chronic kidney disease. Ethical approval was taken from the institutional review committee of Devdaha Medical College and Research Institute and verbal consent was taken from the patient prior the collection of the samples (IRC protocol approval number: 33/2022).

All data were analyzed by using Microsoft Excel according to frequency distribution and percentage.

RESULTS

Out of total 657 suspected patients, 70 (10.5%) were positive for dengue infection.

Table 1: Frequency of dengue fever positive cases.

Dengue positive	Number	Percentage
NS1 only	24	34.2%
IgM only	48	68.5%
IgG only	9	12.8%

Among 70 positive cases 24 (34.2%) were positive for NS1 antigen, 48 (68.5%) anti-dengue IgM antibody and 9 (12.8%) anti-dengue IgG antibody, as shown in Table 1.

Table 2: Departmental distribution of Dengue fever confirmed cases.

Department	IPD	OPD	Total
Frequency	42	28	70
Percentage	60	40	100

Indoor patients (60%) were highly infected as compared to outdoor patients (40%) as shown in Table 2.

Table 3: Gender distribution of Dengue fever confirmed cases.

Gender	Male	Female	Total
Frequency	38	32	70
Percentage	54.3	45.7	100

Male (54.3%) were significantly infected as compared to female (45.7%), as shown in Table 3.

Table 4: Age distribution of Dengue fever confirmed cases.

Age range	Frequency	Percentage
0-9	3	4.2
10-19	1	1.4
20-29	20	28.5
30-39	11	16
40-49	14	20
50-59	13	17.9
60 and above	8	12
Total	70	100

The highest frequency of positive cases was observed in age group 20-29 years (28.5%) followed by 40-49 years (20%). The least infected age group was 10-19 years (1.4%) followed by 0-9 years (4.2%), as shown in Table 4.

Most of the of positive cases were found in November (42.9%) while there was no case in January and February, as shown in Table 5.

Platelet count <150000/mm³ was noted in 27.1% and leucopenia (count <4000/mm³) in 25.7% cases. Low red blood cell was observed in 12.9% cases and 10% of cases were associated with raised hematocrit, as shown in Table 6.

DISCUSSION

The increasing number of dengue cases in Nepal's western region reflects a global uptrend influenced by climate change, urban expansion, and insufficient mosquito control strategies. This research contributes to the growing body of evidence showing that dengue is no longer confined to the Terai plains but is gradually spreading into hilly and semi-urban areas. Although the recorded

Table 5: Dengue incidence rate in distinct months from June 2022 to May 2023.

Months	Year	Frequency	Percentage
June	2022	1	1.4
July	2022	4	5.7
August	2022	12	17.1
September	2022	4	5.7
October	2022	5	7.1
November	2022	30	42.9
December	2022	3	4.3
January	2023	0	0
February	2023	0	0
March	2023	3	4.3
April	2023	6	8.6
May	2023	2	2.9
Total		70	100

Table 6: Hematological parameters of dengue fever confirmed cases (N=70)

Hematological parameters	Frequency	Percentage
Platelets count		
Thrombocytopenia (<150000/mm ³)	19	27.1
Normal (>150000/mm ³)	51	72.9
Leucocyte count		
Leucopenia (<4000/mm ³)	18	25.7
Normal (>4000/mm ³)	52	74.3
Hemoglobin level		
Low (<14gm/dl)	11	15.7
Normal (>14gm/dl)	59	84.3
Red blood cell count		
Low (<4.5million/mm ³)	09	12.9
Normal (>4.5million/mm ³)	61	87.1
Hematocrit level		
Raised (>50%)	07	10
Normal (<50%)	63	90

sero-positivity rate of 10.5% is comparatively lower than that reported in studies carried out in Central Nepal,^{2,3} it still represents a notable public health concern, particularly when viewed in the context of expanding urban settlements and climate-induced ecological shifts that promote mosquito breeding in new areas.

The high prevalence of IgM antibodies (68.5%) indicates recent transmission and points toward an active outbreak, emphasizing the need for rapid vector control and monitoring. The relatively lower detection of NS1 antigen (34.2%) suggests that many individuals may have presented later

in the illness course, indicating potential delays in diagnosis and a lack of early health-seeking behavior. However, various studies revealed higher prevalence of NS1 antigens than IgM antibody.^{7,8,9}

A slightly higher proportion of infections was observed in males (54.3%) compared to females (45.7%), consistent with the findings of various studies.^{3,10} This gender difference may be linked to increased outdoor exposure among men or differing patterns in healthcare utilization, although more in-depth behavioral studies are needed to confirm these assumptions.

When examining age demographics, the 20–29-year age group emerged as the most affected (28.5%) which was supported by other previous findings.^{2,5,11} This age range includes a large portion of the working population, making them more exposed to transmission risks and heightening the socio-economic consequences due to absenteeism and reduced productivity. Conversely, the lower infection rates seen in children and adolescents may be a result of reduced exposure or under-diagnosis in these age groups.

Regarding hematological indicators, approximately 27.1% of cases exhibited thrombocytopenia and 25.7% showed leucopenia. These findings, although varying from other reports may be influenced by the timing of sample collection in relation to disease progression, as blood parameters often fluctuate throughout the course of dengue.^{7,12,13} Similarly 15.7% of the dengue fever confirmed patients were having anemia which is nearly in association with the results of other previous study.^{14,15} But the study performed in India showed the raised level of hemoglobin in dengue positive cases.¹⁶ The discrepancy can result from anemia being more common in Nepal.

A substantial number of cases were reported in November (42.9%), which aligns with the seasonal rise in mosquito populations following the monsoon. Similar finding was also found by various studies.^{17,18} This pattern highlights the importance of initiating preventive measures such as community clean-up drives, public awareness campaigns, and early mosquito control efforts well ahead of peak transmission months.

Notably, 60% of the infected individuals were hospitalized (indoor patients), indicating the overlooked danger of indoor mosquito breeding, especially by *Aedes aegypti*, which thrives in clean, stagnant water commonly found in domestic settings. This emphasizes the need for household-level interventions and tailored health messaging to address indoor transmission risks.

Overall, this study delivers essential baseline data for Lumbini Province and reveals existing gaps in early case recognition, health education, and vector control preparedness. These insights should guide health authorities to implement

continuous monitoring, establish sentinel sites, and promote community-based prevention strategies. Future investigations should aim to incorporate longitudinal data, vector surveillance indices, and viral genotyping to better inform public health responses and vaccine development strategies

Limitations and recommendations: This study relied on rapid tests (NS1, IgM, IgG) for dengue diagnosis. They are quick and convenient, but not always accurate. Their sensitivity varies with the stage of infection. To ensure more accurate detection and timely intervention, future research should incorporate advanced diagnostic techniques like RT-PCR and ELISA. These methods can confirm acute infections, and improve overall diagnostic precision.

CONCLUSION

The current data highlights the serious public health risk that dengue infections represent, since 10.5% of suspected cases test positive. The highest prevalence of recent infections is indicated by the preponderance of IgM antibodies (68.5%), and the most susceptible age group is those aged 20 to 30 (28.5%). The significant seasonal tendency indicated by the noteworthy clustering of cases in November (42.9%) is probably related to the post-monsoon mosquito multiplication. The presence of thrombocytopenia (27.1%) and leucopenia (25.7%) among confirmed cases signals the potential severity of clinical presentations. These results highlight the necessity of early diagnostic therapies, strong vector control plans, and focused awareness campaigns, particularly during high-risk months. The dengue burden can be considerably reduced with prompt surveillance and well-thought-out public health measures.

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