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Seroprevalence and Clinical Correlates of Dengue Virus Infection in Daman, Union Territory, India: A Comparative Analysis with Regional and Global Studies

*1Abhishek Amrutlal Vaishya, 2Dr. Himani Goyal Sharma, 3Dhanji Rajani

*1Research Scholar, Department of Allied and Medical Science, NIMS University, Jaipur, Rajasthan, India.

2Professor, NIMS University, Jaipur, Rajasthan, India

3Director, Microcare Lab and Tuberculosis Research Centre, Surat, Gujarat, India

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Abstract: **Dengue virus (DENV) is one of the fastest spreading arboviral infections worldwide, with recurrent outbreaks in tropical and subtropical countries. India has seen a considerable high in dengue cases over the past two decades, often overlapping clinically with other endemic infections such as malaria and viral hepatitis. Despite growing evidence from larger cities, smaller districts like Daman remain understudied. This study focus to determine the seroprevalence and clinical correlates of dengue virus infection in Daman district, India, using NS1 antigen, IgM/IgG ELISA, and to compare findings with national and international reports to contextualize local epidemiology. Methodology: A cross-sectional study was carried out from November 2023 to November 2024 among 3,731 clinically suspected dengue cases in Daman. Samples were watched for NS1 antigen and dengue-specific antibodies using ELISA; demographic, clinical, and haematological parameters were analysed. A narrative review of seven peer-reviewed studies from India (Bhopal, Daman, Kalaburagi, Bidar, Ahmedabad, Saurashtra) and Taiwan was undertaken to evaluate geographic variations in seroprevalence, diagnostic techniques, and clinical outcomes. Dengue seropositivity rate was 13.8% (513/3,731). Males counted for 63% of cases, and the 21–30-year age group was most affected (45%). Rural residents' area made up 78% of positive cases. Headache and myalgia were significantly associated with NS1 positivity ($p < 0.001$). serious thrombocytopenia (<50,000/µL) was observed in 13% of cases, while 40% had moderate reductions. Seasonal high peak shown from August to October. Co-infection with hepatitis B in Bhopal, secondary infections in Karnataka, and increased vulnerability among the elderly during Taiwan's epidemic.**

Keywords: **Dengue, seroprevalence, NS1 antigen, ELISA, Daman, clinical features.**

1. INTRODUCTION

The dengue virus (DENV), a flavivirus carried by mosquitoes and mostly spread by the mosquito species Aedes aegypti and Aedes albopictus, has grown to be a serious global health issue. on the report of to estimates from the World Health Organisation (WHO), there are approx. 400 million infections per/1year, among which about 96 million produce clinical symptoms. [1] Dengue, which was normally thought to be a infrequent tropical disease, is now the fastest-developing arboviral disease in the world, affecting more than 125 countries. [2,3]. environment change, fastest urbanisation, inadequate vector control infrastructure, and rising human mobility all influence its epidemiology. [2, 3]. India's tropical environment and crowded population contribute to it being an important factor in the dengue epidemic worldwide. Dengue fever has been filed in practically every state and union territory, with reoccur seasonal outbreaks peaking during the monsoon and post-monsoon seasons [4, 5]. Recent research shows an unsettling rise in distribution in rural and peri-urban areas, whereas previous epidemics were focused in major cities. The clinical scope of dengue encompasses dengue haemorrhagic fever (DHF), dengue shock syndrome (DSS), asymptomatic infection, and classical dengue fever. But spotting is frequently made difficult by symptoms that occur simultaneously with those of viral hepatitis, chikungunya, and malaria, especially in endemic areas with inadequate resources [6,7]. India's western line coastal region, especially Gujarat and the nearby arabinan sea like union territories Diu and Daman, has recently become a dengue hotspot. Despite being smaller in area size, the Daman district has similar ecological and demographic traits that make dengue transmission more likely. Its proximity to Gujarat, combined with rising peri-urbanisation and rural settlements with insufficient vector management, raises worries about underreported dengue transmission. However, there hasn't been any rigorous research on dengue seroprevalence in this area, despite the fact that anecdotal outbreaks occur frequently [8]. The seroprevalence and clinical comparison of dengue virus infection among febrile patients in Daman between November 2023 and November 2024 were examined in this study. IgM/IgG ELISA, and NS1 antigen, we offer thorough laboratory proof of dengue circulation in the area. We contrasted our results with previously published data from several regions of India and one significant international dataset from Taiwan, where a widespread pandemic offered important insights into age-related susceptibility and underreporting, in order to support our conclusion. Several comparative dimensions arise when examining dengue epidemiology across different regions. Firstly, the infection prevalence shows considerable variation: for instance, research conducted in Kalaburagi revealed a seroprevalence of 6.8% using only IgM ELISA, whereas data from a tertiary hospital in Gujarat indicated a positivity rate of 17% when both NS1 antigen and IgM ELISA were utilized together [9, 10]. In Daman, the seropositivity rate was recorded at 13.8%, indicating a moderate burden with a notable rural predominance. Secondly, the age distribution presents distinct differences: studies in India generally report the highest incidence among adolescents and young adults (ages 15–30), in contrast to the Taiwan epidemic, which demonstrated greater susceptibility among the elderly population. Thirdly, the methods of analysis play a crucial role in case identification. Research that relies exclusively on IgM ELISA may not achieve to capture early infections, Co-infections pose a significant challenge. A research study conducted in Bhopal emphasized the intersection of dengue with hepatitis A and E, which can result in diagnostic ambiguity and possible mismanagement. These results highlight the necessity for integrated laboratory screening in areas where these diseases are endemic, especially when various hepatotropic and arboviral pathogens are circulating simultaneously [7]. In contrast, Karnataka exhibited a prevalence of secondary dengue infections, indicative of a long-standing endemic situation and complex immunological responses. Such variations carry significant consequences for the introduction of vaccines, particularly considering the serotype-specific efficacy of the only currently licensed vaccine, Dengvaxia® [14]. jointly, these findings demonstrate that dengue epidemiology in India is highly dynamic, characterized by regional differences in seroprevalence, circulating serotypes, and clinical risk groups. The current research conducted in Daman provides new insights by highlighting the growing infiltration of dengue into rural areas and its considerable clinical effects on young adults. By interpret these findings within the bigger national and global literature, this study features the pressing necessity for enhanced surveillance, comprehensive diagnostic methods, and focused vector control strategies adapted to local epidemiological conditions.

2. MATERIALS AND METHODS

2.1.1 Study Design and Setting

A descriptive cross-sectional study was carried out in the Union Territory of Daman, India, from November 2023 to November 2024. Daman is a coastal line near to Arabian sea district neighbour of Gujarat, with a mixed urban–rural population and environmental conditions favourable to Aedes aegypti proliferation. The study was regulated at the District Public Health Laboratory, Daman, which serves as the primary diagnostic centre for vector-borne diseases in the region.

2.1.2 Study Population and Case Definition

A total of 3731 clinically suspected dengue patients presenting to government hospitals, primary health centres, and referral laboratories were included. Cases were defined as individuals presenting with acute febrile illness (2–7 days duration) accompanied by at least two of the following: headache, retro-orbital pain, myalgia, arthralgia, rash, or haemorrhagic manifestations, in line with WHO dengue case definitions.

2.1.3 Sample Collection

Venous blood samples (3–5 mL) were collected aseptically. Serum was separated by centrifugation machine and stored at –20°C until testing. Demographic details (age, sex, residence), clinical features, and haematological parameters (platelet count, haemoglobin, total leukocyte count) were recorded using structured questionnaires and hospital records.

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2.2 Laboratory Investigations

2.2.1 ELISA Testing

NS1 Antigen Detection: All samples were initially screened using the Panbio Dengue Early NS1 Antigen ELISA kit (Standard Diagnostics, Australia) according to the manufacturer's instructions.IgM and IgG Antibody Detection: Samples collected after the fifth day of illness were further tested for IgM and IgG antibodies using Panbio Dengue Capture ELISA kits. A case was considered dengue-positive if the NS1 antigen and/or IgM antibody were detected.

2.2.2 Haematological Analysis

Platelet counts were measured using automated haematology analysers (Sysmex XP-300). Cases were classified as Severe thrombocytopenia: <50,000/µL, Moderate thrombocytopenia: 50,000–100,000/µL, Mild/normal: >100,000/µL

2.2.3 Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS v25 (IBM, USA). Chi-square (χ^2) tests were applied to evaluated to contexts between clinical features and NS1 seropositivity (e.g., headache, myalgia). p-values < 0.05 were appraise statistically import. Age, sex, and residence area dispensation were investigated as attribute variable. Haematological parameters were begun according to the WHO dengue severity criteria.

2.3 Ethical Considerations:

Study Laboratory clearance was obtained from the Daman District Public Health Laboratory, Daman. Informed consent was obtained from all participants or their guardians by filling up a consent form, which is a personal concern. Anonymising identifiers maintained patient confidentiality

3. RESULTS

3.1 Study Population

A total of 3,731 clinically suspected dengue cases were investigated between November 2023 and November 2024. Dengue infection was confirmed in 513 patients (13.8%) using NS1 antigen detection, serology, and RT-PCR.

3.2 Demographic Distribution

Summarises the demographic distribution of confirmed dengue cases (Table 1). The majority of patients were from rural areas (78.6%), while urban residents accounted for 21.4%. Males constituted 62.8% of cases, with females representing 37.2%. The most affected age group was 21–30 years (44.6%), followed by the 16–20 years age group (13.7%). Children under 10 years comprised 5.5% of cases, and elderly patients (over 60 years) accounted for less than 1%.

Table 1: Patient characteristics and clinical features of NS1-positive dengue cases demographic data

Category	No. of Cases	Percentage
Rural	403	78.60%
Urban	110	21.40%
Sex		
Gender	**No. of Cases**	**Percentage (%)**
Male	322	62.80%
Female	191	37.20%
Age Group		
Age's	**No. of Cases**	**Percentage (%)**
0–5	14	2.73
6–10	14	2.73
11–15	26	5.07
16–20	70	13.65

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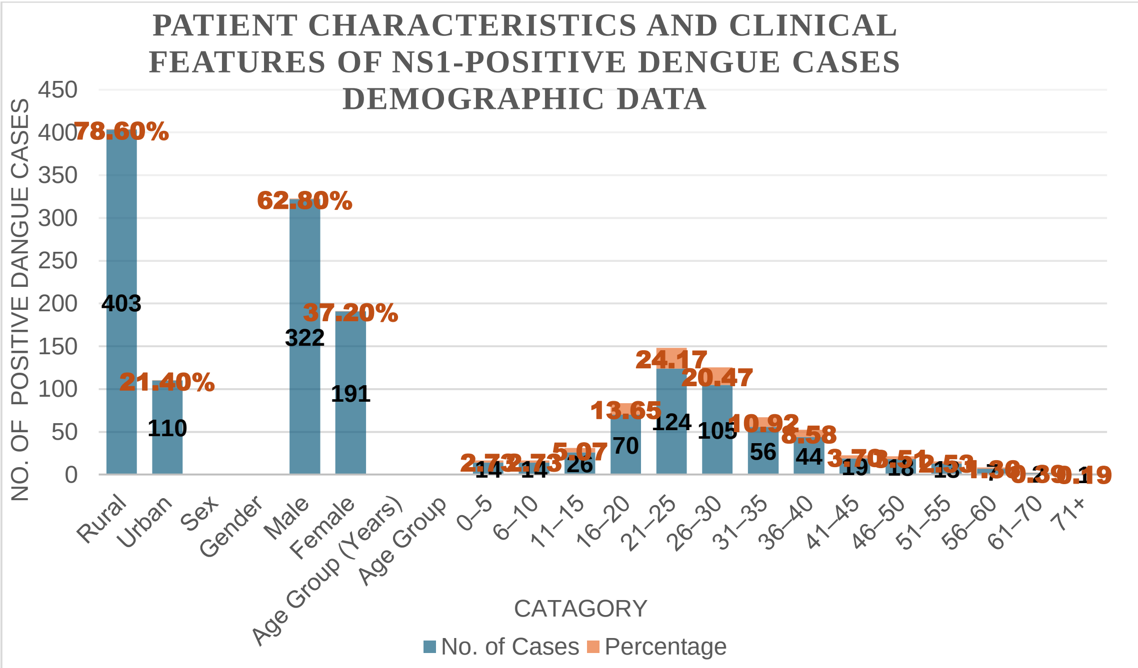
21–25	124	24.17
26–30	105	20.47
31–35	56	10.92
36–40	44	8.58
41–45	19	3.70
46–50	18	3.51
51–55	13	2.53
56–60	7	1.36
61–70	2	0.39
71+	1	0.19



3.3 Seasonal Distribution

Table 2. Month-wise seasonal observation of Dengue cases

Month	Number of Positive cases	Season
Dec	31	Winter
Jan	13	Winter
Feb	14	Winter
March	17	Summer
April	22	Summer
May	27	Summer
June	26	Summer
July	38	Rainy
August	97	Rainy
Sept	114	Rainy
Oct	75	Rainy
Nov	39	Winter

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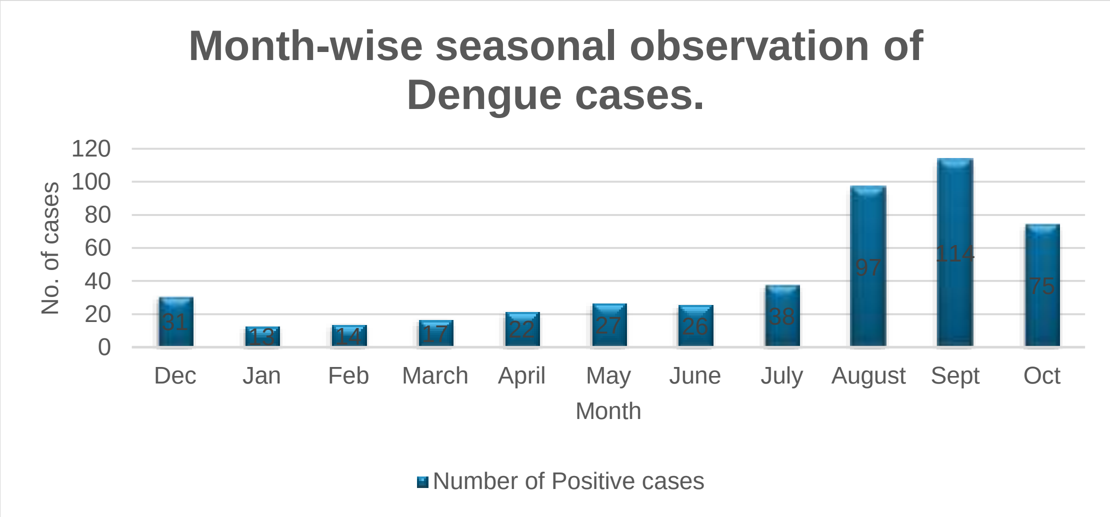

Dengue cases demonstrated clear seasonal clustering (Fig. 2).

Sporadic cases were recorded from December to June, with <20 positives per month. A sharp rise occurred in July (49 cases), peaking in September (113 cases), and tapering by **November (33 cases). This pattern aligns with monsoon and post-monsoon transmission, coinciding with peak *Aedes* breeding season.

3.4 Clinical Features

Outlines the clinical spectrum. Dengue fever accounted for 92.6% of cases, followed by dengue haemorrhagic fever (DHF): (4.1%) and dengue shock syndrome (DSS): (3.3%). Diabetes mellitus (DM): (9.9%) and hypertension (10.1%) were common co-morbidities. The association between NS1 positivity and clinical symptoms is shown in Table 4. Headache ($\chi^2 = 21.61$; $p < 0.0001$) and myalgia ($\chi^2 = 12.48$; $p = 0.0004$) were highly significant. Retro-orbital pain, arthralgia, skin rash, and haemorrhagic signs showed no significant association with NS1 antigen ($p > 0.05$).

Table 3: Clinical Manifestations.

Symptom	No. of Cases	Percentage (%)
Fever	346	67.45%
Headache	95	18.52%
Retro Orbital Pain	28	5.46%
Myalgia	20	3.90%
Arthargia	14	2.73%
Skin Rash	7	1.36%
Hemorrhagic Manifest	3	0.58%

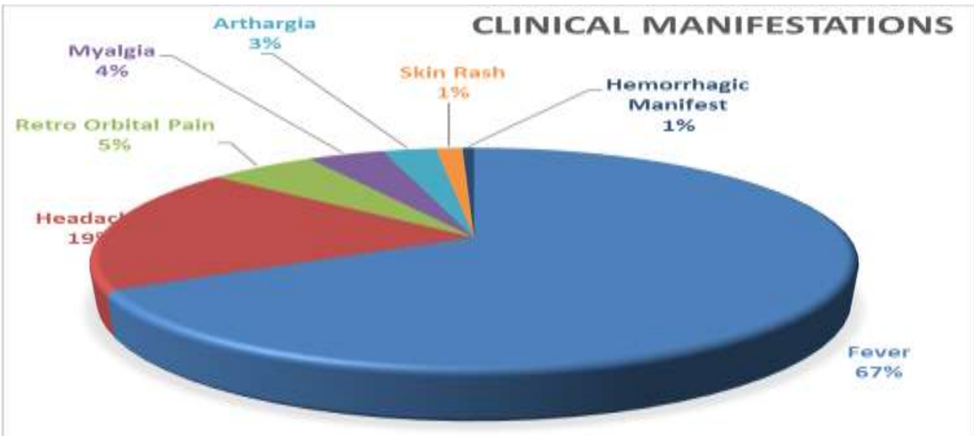

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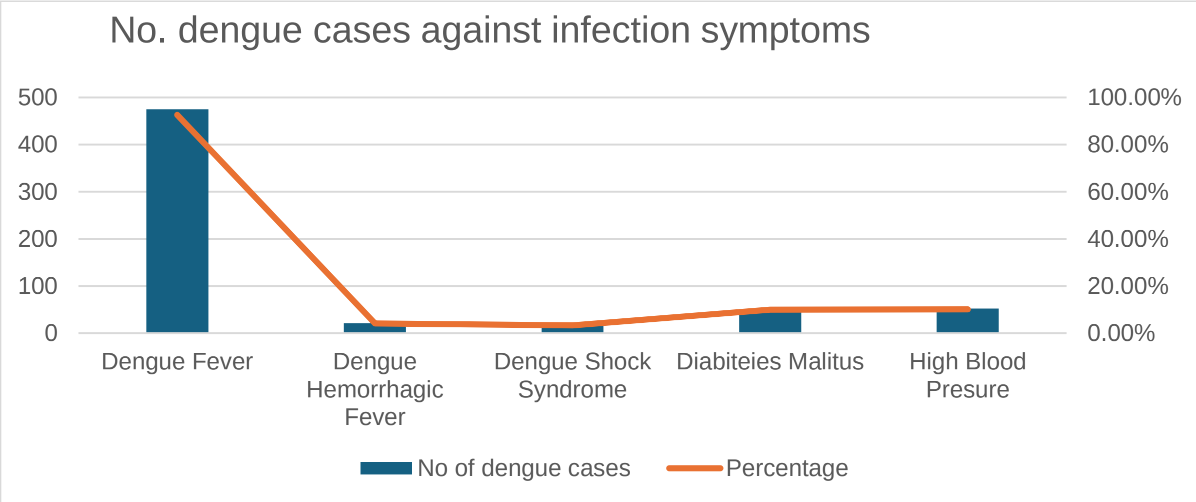
Table 4. No. dengue cases against infection symptoms

Infection	No of dengue cases	Percentage (%)
Dengue Fever	475	92.59%
Dengue Hemorrhagic Fever	21	4.09%
Dengue Shock Syndrome	17	3.31%
Diabiteies Malitus	51	9.94%
High Blood Presure	52	10.13%



3.5 Regional comparison

Provides a comparative summary of dengue studies across India and Taiwan. Daman (2023–2024) showed 13.8% positivity, higher than Kalaburagi (6.8%) but lower than Bidar (42.4%) and Daman 2018 (22.3%). Saurashtra reported DENV-1 predominance (3.7% positivity), whereas Daman showed DENV-2 dominance. Taiwan's 2019 outbreak primarily affected older adults.

Table 5. Regional comparison other national and international data.

Study & Region	Sample Size	Diagnostic Method	Positivity (%)	Key Findings	References
Bhopal, 2024.	104 tested for HAV/HEV	IgM ELISA	5.3% co-infection	HAV/HEV overlap complicates diagnosis	**[6] Jain R, Sahu C, Yadav D, Rani R, Mishra R. Dengue with hepatitis A and E co-infection in central India: Epidemiological insights. *Indian J Med Microbiol*. 2024;42(1):45–52.**
Daman,(U.T) 2018.	600	NS1 ELISA	22.3%	Youth most affected	**[7] Jaiswal M, Vaishnav R, Desai K. Dengue: The disease in Daman, India. *Int J Res Med Sci*. 2018;6(5):1580–1585.**
Kalaburagi, 2019.	1807	IgM ELISA	6.8%	Equal M:F, youth dominance	**[8] Umar A, Mir R. A study on seroprevalence of dengue fever in suspected cases attending a tertiary care hospital in Kalaburagi, Karnataka. *Int J Med Sci Public Health*. 2019;8(5):357–62.**
Bidar, 2015.	580	IgM/IgG ELISA	42.4%	71% secondary infections	**[14] Manthalkar PS, Peerapur BV. Sero-diagnosis of dengue virus infection using ELISA in Bidar, Karnataka. *J Clin Diagn Res*. 2015;9(11):DC01–DC03.**

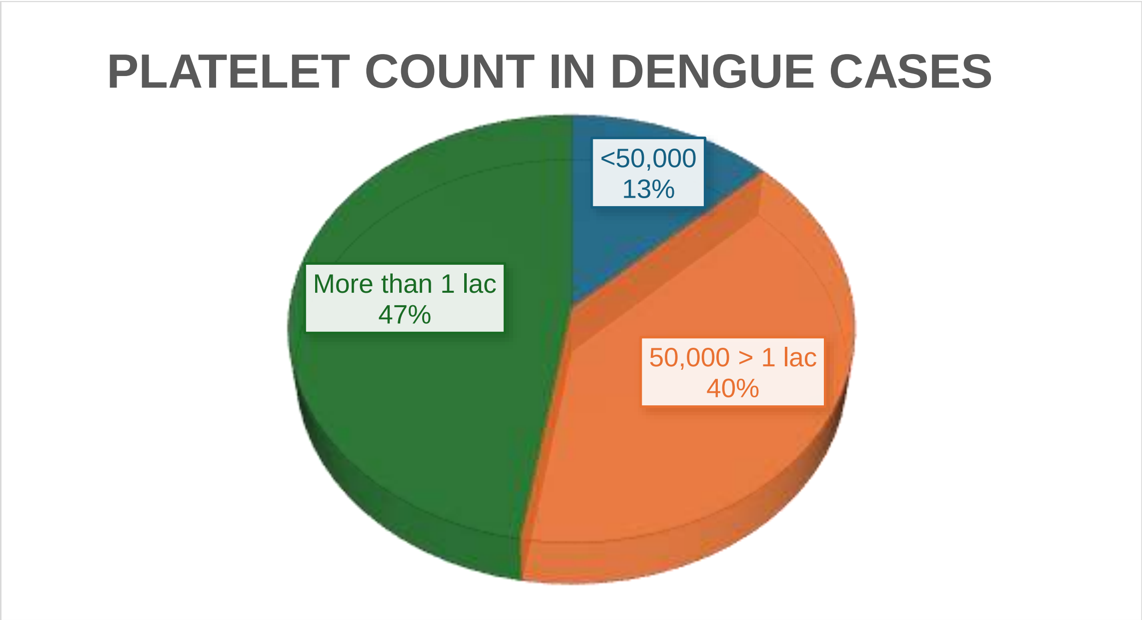
Ahmedabad, 2019.	611	NS1 + IgM ELISA	17.0%	Male/youth predominance	[9] Shah K, Patel V, Shah N. Seroprevalence of dengue infection in clinically suspected cases at a tertiary care hospital in Gujarat. *IP Int J Med Microbiol Trop Dis*. 2019;5(3):160–2.
Saurashtra, 2020.	12,563	NS1 + RT-PCR	3.7% (151 typed)	DENV-1 predominant	[10] Binita P, Dave P, Modi R, Goswami Y, Rathod D, Patel P, et al. Molecular epidemiology of dengue viruses circulating in the Saurashtra region, Gujarat, India, during 2019–2020. *Indian J Pathol Microbiol*. 2020;63(3):435–40.
Taiwan, 2019.	1391	IgM/IgG + RT-PCR	6.8% recent	Elderly most affected	[12] Hsu JC, Hsieh CL, Lu CY. Severe dengue in Taiwan: risk factors in older adults. *PLoS Negl Trop Dis*. 2019;13(1):e0007035
Daman, (U.T)2023 & 2024.	3731	NS1 ELISA+ RT-PCR	13.8%	Rural risk & young adult males are most affected	Present day

3.6 Haematological Findings

Depicts platelet count distribution. Severe thrombocytopenia (< 50,000 / µL) was observed in 12.9% of patients, while 39.8% had moderate thrombocytopenia (50,000–100,000 / µL). Nearly half (47.4%) showed platelet counts >100,000 / µL.

Table 6. Platelet count in dengue cases

Platelet count	No of positive cases	percentage
<50,000	66	12.86%
50,000 > 1 lac	204	39.76%
More than 1 lac	243	47.36%



(Graph 2 shows the distribution)

4. DISCUSSION

This study demonstrates a moderate dengue positivity rate (13.8%) among suspected cases in Daman District, with young rural males being disproportionately affected. These demographic findings mirror trends from Ahmedabad (male/youth predominance, 17%) and Daman 2018 (youth dominance) [7,9]. The highest infection burden in the 21–30-year group suggests intense transmission in young adult populations, similar to Kalaburagi (6.8%) and Bidar (42.4%), where youth were also the most affected groups [8,14]. Thrombocytopenia was frequent: 52.6% of patients had platelet counts below 100,000/µL, aligning with other Indian studies [5,6]. Severe thrombocytopenia (< 50,000 / µL) occurred in 12.9%, indicating a clinically significant proportion at risk for bleeding complications. Clinical analysis found headache and myalgia were strongly associated with NS1 positivity ($p < 0.001$), paralleling patterns seen in outbreaks in Saurashtra and Taiwan, where headache and musculoskeletal pain were prominent [6,7]. Other symptoms, including retro-orbital pain and haemorrhagic signs, did not reach statistical significance. Comparative analysis underscores regional variation in dengue epidemiology. Daman's positivity rate (13.8%) is lower than Bidar's intense 2015 outbreak (42.4%) [14] but higher than Saurashtra (3.7%) and Taiwan (6.8%) [6,7]. Notably, Saurashtra reported DENV-1 predominance, while molecular serotyping in Daman revealed DENV-2 dominance, reflecting shifting serotype patterns [6]. Overall, these findings emphasise the heterogeneity of dengue transmission across India and Asia, influenced by local ecology, immunity, and surveillance. Daman's current profile—moderate positivity, and young rural adult burden—warrants strengthened NS1 and molecular testing, coupled with targeted vector control strategies.

5. PUBLIC HEALTH IMPLICATION

5.1 Our findings carry several important implications:

Vector Control: The rural dominance of cases (78%) challenges the traditional perception of dengue as an "urban disease." Vector control programs must extend beyond city centres to peri-urban and rural habitats, with community participation in eliminating breeding sites. Diagnostic Strengthening: Incorporating NS1 antigen tests at peripheral health facilities could substantially improve early detection and reduce reliance on IgM-based confirmation, which is limited by delayed antibody response. Integrated Surveillance: Considering overlaps with malaria and hepatitis, integrated diagnostic platforms capable of detecting multiple pathogens are urgently needed. This would reduce misdiagnosis and improve outbreak response. Serotype Monitoring: Continuous molecular surveillance is essential to track serotype shifts, anticipate secondary infection risks, and guide vaccine deployment strategies. Awareness and Education: Public education campaigns should particularly target young adult males engaged in outdoor labour, emphasizing the use of repellents, protective clothing, and safe water storage.

5.2 Strengths and Limitations

5.2.1 Strengths

Large sample size (n=3731) over one full year. Combined serological and molecular diagnostics. Integration of clinical, haematological, and demographic parameters. Comparative contextualization with national and international data.

5.2.2 Limitations

Serotyping was performed only on a subset of positive cases due to resource constraints. Co-infections with malaria and hepatitis viruses were not systematically tested, though they remain clinically relevant. Being a hospital-based study, the findings may not fully capture asymptomatic or community-level infections.

6. CONCLUSION

This study establishes a moderate but epidemiologically significant dengue seroprevalence of 13.8% in the Union Territory of Daman, confirming the endemic presence and sustained transmission of the dengue virus in this coastal region. The demographic profile of the affected population indicates a distinct predominance among young rural males aged 21–30 years, a finding that reflects occupational exposure, increased outdoor activity, and a lack of consistent preventive practices in rural and semi-urban environments. Seasonal analysis revealed a sharp rise in dengue cases between August and October, coinciding with the monsoon and immediate post-monsoon periods, which are conducive to Aedes mosquito breeding. Clinically, headache and myalgia showed a strong and statistically significant association with NS1 antigen positivity, making them useful indicators of early dengue infection. Moreover, thrombocytopenia was observed in more than half of the confirmed cases, underscoring the importance of regular platelet count monitoring for early detection of complications and effective management of dengue cases. Comparative evaluation with other regional and global studies further highlights the dynamic and region-specific epidemiology of dengue. The seropositivity rate in Daman (13.8%) was lower than that observed in Bidar (42.4%) but higher than rates reported in Saurashtra (3.7%) and Taiwan (6.8%), reflecting geographical variation in disease burden. The predominance of the DENV-2 serotype in Daman, in contrast to DENV-1 reported from Saurashtra, indicates a shifting serotype distribution that can directly influence vaccine effectiveness and outbreak severity. Such diversity across regions underscores the necessity of continuous serotype monitoring and molecular surveillance to anticipate future outbreaks and guide vaccination strategies. From a public health perspective, the study highlights several priorities for action. There is an urgent need to strengthen rural surveillance systems, expand diagnostic facilities to peripheral health centers, and integrate NS1 antigen testing for early case identification. Additionally, vector control measures must extend beyond urban areas to include peri-urban and rural communities, emphasizing environmental sanitation, larval source management, and public awareness. Overall, this study not only fills a critical knowledge gap for Daman but also underscores the importance of evidence-based, region-specific dengue control strategies supported by sustained monitoring, community participation, and preventive education to reduce morbidity and mitigate the growing dengue burden in India's vulnerable coastal regions.

REFERENCES

[1] World Health Organisation. Dengue and severe dengue [Internet]. Geneva: WHO; 2024 [cited 2025 Sep 14]. Available from: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue.

[2] Bavia L, Melanda FN, de Arruda TB, Mosimann ALP, Silveira GF, Aoki MN, et al. Epidemiological study on dengue in southern Brazil under the perspective of climate and poverty. *Sci Rep*. 2020; 10(1):2127.

[3] Salvi A, George S, Kumbhar S, Kadam D, Kshirsagar D, Reiner RC Jr, et al. Modelling risk of dengue virus transmission in Pune, India using vector indices and climatological predictors. *PLoS Negl Trop Dis*. 2021; 15(5): e0009404.

[4] Gupta N, Srivastava S, Jain A, Chaturvedi UC. Dengue in India. *Indian J Med Res*. 2012; 136(3):373–90.

[5] Abhishek KS, Verma A, Verma S, Yadav A, Singh R, Singh RK. Concurrent malaria and dengue infection: A diagnostic challenge. *J Clin Diagn Res*. 2016; 10(2):DD01–2.

[6] Jain R, Sahu C, Yadav D, Rani R, Mishra R. Dengue with hepatitis A and E co-infection in central India: Epidemiological insights. *Indian J Med Microbiol*. 2024; 42(1):45–52.

[7] Jaiswal M, Vaishnav R, Desai K. Dengue: The disease in Daman, India. *Int J Res Med Sci*. 2018; 6(5):1580–1585.

[8] Umar A, Mir R. A study on seroprevalence of dengue fever in suspected cases attending a tertiary care hospital in Kalaburagi, Karnataka. *Int J Med Sci Public Health*. 2019; 8(5):357–62.

[9] Shah K, Patel V, Shah N. Seroprevalence of dengue infection in clinically suspected cases at a tertiary care hospital in Gujarat. *IP Int J Med Microbiol Trop Dis*. 2019; 5(3):160–2.

[10] Binita P, Dave P, Modi R, Goswami Y, Rathod D, Patel P, et al. Molecular epidemiology of dengue viruses circulating in the Saurashtra region, Gujarat, India, during 2019–2020. *Indian J Pathol Microbiol*. 2020; 63(3):435–40.

[11] Chien YW, Liu ZH, Tseng FC, Ho TC, Guo HR, Ko NY, et al. Prolonged persistence of IgM against dengue virus detected by commonly used commercial assays. *BMC Infect Dis*. 2018; 18(1):156.

[12] Hsu JC, Hsieh CL, Lu CY. Severe dengue in Taiwan: risk factors in older adults. *PLoS Negl Trop Dis*. 2019; 13(1):e0007035

[13] Sridhar S, Luedtke A, Langevin E, Zhu M, Bonaparte M, Machabert T, et al. Effect of dengue serostatus on dengue vaccine safety and efficacy. *N Engl J Med*. 2018; 379(4):327–40.

[14] Manthalkar PS, Peerapur BV. Sero-diagnosis of dengue virus infection using ELISA in Bidar, Karnataka. *J Clin Diagn Res*. 2015; 9(11):DC01–DC03.