International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Haematological Parameters, Biochemical Parameters and Inflammatory Markers in Diabetic and Non-Diabetic Patients Suffering from Dengue Fever: A Descriptive Analytical Study

Angelia R Mathew[1], Aruna Sajeevan[2], Dr. Joel John[3]

[1]Department of Physiology, Little Flower Institute of Medical Science and Research, Angamaly, Kerala, India

[2]Assistant Professor, Department of Physiology, Little Flower Medical Science and Research, Angamaly, Kerala, India

[3]Department of General Medicine, Little Flower Hospital and Research Centre, Angamaly, Kerala, India

Abstract: ***Background: The viral disease dengue fever is highly prevalent in tropical regions. Dengue causes characteristic hematological, biochemical and inflammatory markers abnormalities during acute infection. The presence of diabetes mellitus may modify these laboratory patterns through underlying metabolic and endothelial dysfunction. Objectives: To compare haematological, biochemical and inflammatory markers between dengue patients with and without diabetes mellitus and assess whether diabetes is associated with distinct laboratory abnormalities during dengue infection. Methods: This descriptive analytical study was conducted in the Department of General Medicine at Little flower Hospital and Research Centre Hospital, Angamaly, over a period of 10 months . A total of 50 confirmed dengue patients (25 diabetics and 25 non-diabetics) were included. Hematological indices (glycated haemoglobin (HBA1C), hemoglobin (Hb), total leucocyte count (TLC), lymphocyte count, neutrophil level, eosinophil level, monocyte count, platelet count), biochemical parameters (serum creatinine, blood urea, serum glutamic-oxaloacetic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), serum bilirubin, serum albumin) and Inflammatory markers (C-Reactive protein, erythrocyte sedimentation rate (ESR)) were measured at presentation. Diabetes mellitus was defined by previous diagnosis or HbA1c ≥ 6.5%. Statistical comparisons were made using the t-test with $p < 0.05$ considered significant. Results: Both groups exhibited comparable neutrophil counts, and overall platelet reduction. Severe thrombocytopenia was marginally more frequent among people with diabetes . Biochemical profiles showed more pronounced elevation of SGOT and SGPT levels in diabetic patients ($p < 0.05$), along with a mild trend toward higher serum creatinine and lower serum albumin levels. These differences indicate greater hepatic stress in the diabetic subgroup. CRP indicates statistically significant. Conclusion: Hematological abnormalities were similar in dengue patients irrespective of diabetes status except few, while in inflammatory indicates subtle variations especially in case of CRP, biochemical derangements particularly liver enzyme elevation were more prominent among people with diabetes. This suggests that diabetes may potentiate hepatic vulnerability during dengue infection, warranting closer biochemical monitoring in this comorbid population.***

Keywords: Haemoglobin (Hb), Diabetes Mellitus (DM), dengue virus (DENV)

1. Introduction

Dengue is a systemic febrile disease attributed to the mosquito – borne dengue virus (DENV). It is a minute (50nm) virus that belongs to the genus Flavivirus[1]. According to WHO, an estimated 2.5 billion individuals spanning over a hundred countries persist in a state of peril regarding dengue transmission , 50–100 million dengue outbreaks occur annually worldwide [2,3]. The majority of dengue infections are clinically silent; however, affected individuals may exhibit a heterogeneous spectrum of manifestations, ranging from self-limited febrile illness to life-threatening complications, including hemorrhagic phenomena, multi-organ involvement, and hypovolemic shock secondary to systemic vascular leak syndrome [4]. Dengue is identified via NAAT or NS1 in the acute phase and IgM assays, thereafter, necessitating confirmatory testing when diagnostic ambiguity persists [5].

Dengue virus infection is frequently associated with pronounced perturbations in both hematological and biochemical profiles, encompassing thrombocytopenia, leukopenia, hemoconcentration, and transaminase elevations. These laboratory derangements are integral to the pathophysiological landscape of dengue, representing the cumulative effects of plasma extravasation, endothelial barrier disruption, and orchestrated host immune responses [6]. In a clinical context, repeated laboratory assessments are crucial not only for establishing the diagnosis but also for predicting potential deterioration in the patient's condition [7].

Comorbidities such as diabetes mellitus significantly influence the trajectory of laboratory abnormalities in dengue infection. Diabetes is characterized by chronic low-grade inflammation, endothelial dysfunction, and microvascular impairment, factors that have the potential to amplify or alter the typical hematological and biochemical responses to the disease[8] .Numerous observational research reveals that diabetic dengue patient shows more profound thrombocytopenia or delayed platelet recovery compared to non-diabetics . Chen CY et al.[9] described significantly lower platelet counts in people with diabetes early during the infection course. Similarly, Singh R et al.[10] found greater perturbations in inflammatory indices and hematological parameters in diabetic dengue patients. It emphasizes, consideration of diabetes status in the clinical assessment and management of dengue is emphasized, as the inflammatory response is exacerbated by metabolic dysregulation, necessitating vigilant monitoring and targeted intervention.

Biochemical markers, such as transaminases, renal function tests, complement hematological indices by providing valuable insight into organ involvement and the severity of dengue. Raised liver enzymes, for instance, often correlate with more severe disease and hepatic injury [11]. Hyperglycemia may potentiate dengue virus replication and cellular metabolic stress, thereby aggravate organ dysfunction and contribute to more severe hepatic, renal, and metabolic derangements [12] .

Acknowledging recent clinical evidence, the current study provides a descriptive analysis of the selected inflammatory biomarkers, haematological and biochemical parameters between dengue patients with and without diabetes mellitus. Notably, this research intends to examine whether diabetes is associated with distinct laboratory abnormalities during dengue infection, which could enable precise risk assessment and guide tailored monitoring strategies in patients with this multimorbidity.

2. Materials and Methods

This study was performed in the department of general medicine at Little Flower Hospital and Research Centre, Angamaly, Ernakulam. This study was designed as a hospital-based descriptive analytical study aimed at evaluating haematological, biochemical and inflammatory alterations in dengue patients with and without diabetes mellitus. The data collection extended over a period of 10 months.

Patients aged 15 years and over presented serologically confirmed as dengue positive (by Dengue NS1 Ag/ Dengue IgM) were recruited after obtaining informed consent from patients and guardians. Both formerly diagnosed diabetics and newly detected cases (HbA1c≥ 6.5%) were included in diabetes group . Individuals with haemopoietic disorders, autoimmune diseases , pregnant women , liver diseases ,alcoholic patients, who underwent chemotherapy or taking drugs causing thrombocytopenia were omitted .Those declining consent were also excluded. The study consists of 50 dengue patients with 25 diabetes mellitus and 25 without diabetes were chosen through purposive sampling techniques.

By using IBM, SPSS [statistical package for social science] version 22 software, data were compiled and analyzed. Descriptive statistics will be used to assess the baseline parameters. All quantitative variables are prosecuted as mean +/- SD. All quantitative variables will be presented as frequency and percentages. Kolmogorov Smirnov test will be used to assess the normality of the data. t test or Mann-Whitney was performed for group comparisons between diabetics and non-diabetics. A p-value <0.05 was considered statistically significant.

3. Data Collection

The study protocol reviewed and approved by the scientific and ethical committee (EC/25/2024), informed consent was obtained from each participant who is eligible and admitted in the department of general medicine before enrollment. The patient will be selected as per inclusion and exclusion criteria. Data will be collected using structured proforma, either by direct interviews with patients or bystanders or data will be collected from the investigation reports in patient chart. Patients diagnosed with dengue fever are divided into two subgroups, that is patient who are with diabetes and patients who did not have diabetes.

The inflammatory markers, haematological and biochemical parameters detailed in the proforma were evaluated and charted at the time of admission and during the course of hospital stay. In haematological indices both lower and upper limit was taken for investigation, biochemical parameters like SGOT, SGPT, blood urea, serum bilirubin maximum and serum albumin base value is taken for analysis. Inflammatory markers like CRP and ESR peak values were evaluated.

4. Results

4.1 Haematological parameters Assessment in diabetic and non-diabetic dengue patients

The descriptive statistics which assess haematological parameters which are HBA1C, Hb, Total Leucocyte Count, Lymphocyte, Neutrophil, Eosinophil, Monocyte, Platelet count assessment in diabetic and non-diabetic dengue patients is given in Table 1.

Table 1: Haematological parameters in dengue patients

Parameter	Group							
	Diabetes				Non-diabetes			
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum
HBA1C	7.09	0.84	6.5	9.7	5.22	0.36	4.5	5.6
HB	12.8	2.5	7.3	19.2	12.3	1.6	8.9	15
TLC	7.24	7.49	1.91	31.83	4.86	3.68	1.61	15.42
Lymphocyte	37	20	7	76	43	21	5	77
Neutrophil	62	18	18	90	51	21	20	91
Eosinophil	2	2	0	11	2	2	0	7
Monocyte	8	3	1	12	7	3	2	15
Platelet	71	53	10	191	118	48	32	213

4.2 Biochemical parameters Assessment in diabetic and non-diabetic dengue patients

The descriptive statistics which assess biochemical parameters which are Serum Creatinine, Blood Urea, SGOT, SGPT, Serum Bilirubin and Serum Albumin assessment in diabetic and non-diabetic dengue patients is given in Table 2.

Table 2: Biochemical parameters in dengue patients

Parameters	Group							
	Diabetes				Non-diabetes			
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum
Serum Creatinine	1.97	0.33	1.1	2.6	0.97	0.23	0.7	1.74
Blood Urea	34	30	11	164	24	10	13	55
SGOT	125	39	71	225	71	68	22	360
SGPT	112	50	54	225	64	64	14	299
Serum Bilirubin	3.37	12.64	0.4	64	0.75	0.59	0.27	3.34
Serum Albumin	3.3	0.3	2.8	4.2	3.6	0.8	0.6	5

4.3 Inflammatory markers Assessment in diabetic and non-diabetic dengue patients

The descriptive statistics which assess Inflammatory markers which are CRP, ESR assessment in diabetes and non-diabetes dengue patients is given in Table 3.

Table 3: Inflammatory markers in dengue patients

	Group							
	Diabetes				Non-diabetes			
Parameters	Mean	Standard Deviation	Minimum	Maximum	Mean	Standard Deviation	Minimum	Maximum
CRP	18.31	14.89	6.00	70.19	6.17	1.21	2.5	8.2
ESR	27	25	3.00	120	24	12	10	50

4.4 Comparison of haematological parameters

Table 4 presents the comparison of key hematological indices between diabetic and non-diabetic dengue patients. Total leukocyte counts , Hb, lymphocytes, eosinophil , neutrophil counts were mainly within the normal range in both groups, though was slightly more frequent among diabetics. Platelet counts showed a uniform decline in both groups , with people with diabetes demonstrating marginally lower mean values, though the difference was statistically significant ($p > 0.05$). Neutrophil values did differ meaningfully, showing significance in both populations. The HBA1C is significantly high in diabetic dengue patients.

Table 4: Comparison of the haematological parameters between Diabetic and non-diabetic patients suffering from Dengue fever

Parameter	Group	Post-test Mean	S.D.	Difference in mean	t	*p-value*
HBA1C	Diabetic	7.09	0.84	1.87	10.26	*$p < 0.001$*
	Non-diabetic	5.22	0.35			
HB	Diabetic	12.76	2.48	0.47	0.80	*$p = 0.427$*
	Non-diabetic	12.29	1.58			
TLC	Diabetic	7.24	7.48	2.38	1.42	*$p= .159$*
	Non – diabetic	4.85	3.68			
Lymphocytes	Diabetic	36.64	19.61	-6.64	-1.16	*$p=.249$*
	Non-diabetic	43.28	20.62			
Neutrophil	Diabetic	62.00	18.37	11.40	2.03	*$p<0.05$*
	Non-diabetic	50.60	21.21			
Eosinophil	Diabetic	2.24	1.78	0.48	0.79	*$p=.433$*
	Non-diabetic	1.76	3.17			
Monocyte	Diabetic	7.60	3.07	0.72	0.81	*$p=.419$*
	Non-diabetic	6.88	53.2			
Platelet	Diabetic	70.52	53.21	-47.40	-3.32	*$p < 0.05$*
	Non-diabetic	117.92	47.56			

Biochemical parameters are summarized in Table 5. Both groups exhibited augmented transaminase levels , a hallmark of dengue -associated hepatic injury .mean SGOT and SGPT levels were significantly higher among diabetic patients (SGOT : 124.88 vs.70.60 U/L ;SGPT : 111.56 vs 64.04 U/L, $p<0.05$). serum creatinine values were mildly raised in both with $p <0.001$.Blood urea and serum bilirubin had subtle variations but not differ significantly. The result indicates elevated liver enzymes in people with diabetes may contribute to liver metabolic and inflammatory stress .

Table 5: Comparison biochemical parameters between Diabetic and non-diabetic patients suffering from Dengue fever

Parameter	Group	Post-test Mean	S.D.	Difference in mean	t	*p-value*
Serum creatinine	Diabetic	1.97	0.33	1.00	12.30	$p<0.001$
	Non -diabetic	0.96	0.23			
Blood urea	Diabetic	33.60	29.80	9.24	1.47	$p = 0.147$
	Non-diabetic	24.36	9.76			
SGOT	Diabetic	124.88	39.44	54.28	3.47	$p<0.05$
	Non-diabetic	70.60	67.52			
SGPT	Diabetic	111.56	50.13	47.52	2.92	$p<0.05$
	Non-diabetic	64.04	63.99			
Serum bilirubin	Diabetic	3.36	12.64	2.61	1.03	$p=0.307$
	Non-diabetic	0.75	0.58			
Serum albumin	Diabetic	3.34	0.29	-0.29	-1.76	$p<0.05$
	Non-diabetic	3.64	0.78			

Table 6: Comparison of Inflammatory markers between Diabetic and non-diabetic patients suffering from Dengue fever

Parameter	Group	Post-test Mean	S.D.	Difference in mean	t	*p-value*
CRP	Diabetic	18.30	14.89	12.13	4.06	$p<0.001$
	Non-diabetic	6.17	1.20			
ESR	Diabetic	26.72	24.83	2.36	0.43	$p=0.66$
	Non-diabetic	24.36	11.51			

The above table interprets the comparison of inflammatory markers between diabetic and non- diabetic dengue patients. The parameter CRP ($p < 0.001$) shows significant difference between diabetic and non -diabetic dengue patients. There is no significant difference in ESR.

5. Discussion

The hematological abnormalities identified in our dengue cohort closely reflected patterns documented in previous research. Thrombocytopenia was globally observed in both diabetic and non-diabetic groups and was attributed to dengue-related marrow suppression and peripheral platelet destruction. Mean platelet counts marginally lower among people with diabetes, thrombocytopenia is significant in both subgroups . The trends observed in our study were found to be concordant with those reported by Chen CY et al.9, reported a steep decline in platelet counts among diabetics. Comparable trends has been documented that diabetes does not independently influence the depth of cytopenia, but platelet recovery might be associated with metabolic stress and endothelial dysfunction. Neutrophil variation is significant .Recent studies show that dengue virus activates neutrophils ,leading to release of myeloperoxidase and the formation of neutrophil extracellular traps; these were shown to enhance vascular permeability and mediate dengue-associated cardiac impairment, contributing to severe dengue. Neutrophils are recruited during early dengue virus infection, and they release soluble molecules such as olfactomedin 4 and soluble urokinase plasminogen activator receptors into the circulation; these may be useful biomarkers to predict disease progression in dengue. Given that neutrophils may mediate severe dengue, attenuating the neutrophil response can be an attractive pathway to ameliorate disease severity.

The most apparent group consequences in this study were associated with the biochemical profile, particularly in areas related to hepatic enzymes . Significantly increased SGOT and SGLT concentrations were observed in diabetic patients, suggesting heightened hepatic perturbation. Lee IK et al13. also emphasized that persistent inflammation and pre-existing oxidative stress in diabetics impair hepatocellular resilience , making it more prone to dengue-induced injury. In diabetics, transaminase elevations were disproportionately higher, a phenomenon Munish K attributed to synergistic effects of metabolic dysregulation and viral cytopathy14.

In this investigation, we found that dengue patients had slightly lower serum albumin and higher serum creatinine, while serum bilirubin and blood urea shoed only showed subtle changes. Previous studies suggest that diabetic microvascular compromise and hyperglycemia-driven osmotic changes could collectively increase renal vulnerability in systemic infections . Singh R et al10 found that diabetic patients exhibited a disproportionately high incidence of biochemical perturbations, observable even in the absence of overt organ failure, underscoring the latent compromise in their physiological reserve.

Among the measured inflammatory mediators, one demonstrated significantly elevated levels in patients with coexisting dengue and diabetes relative to those with dengue alone, highlighting the potential modulatory effect of diabetes on the host inflammatory response. Inflammatory marker CRP showed statistically significant ($p <0.001$), There was no notable difference in ESR. Previous studies also showed rise in CRP concentration .they emphasizes that increased levels of CRP and Endocan trigger endothelial dysfunction which may be because of the biological mechanism that leads to the severity of dengue fever in diabetic subjects, by increasing the intrinsic permeability of the endothelial surface resulting with dengue complications in the diabetic population.

Combine all the report it depicts that, the haematological parameters of dengue expect neutrophils, platelets showed mild changes others remained almost similar irrespective of diabetes, biochemical profile – especially hepatic enzymes elevated in diabetes than non-diabetic, inflammatory marker particularly CRP indicates increased trend. These observations denote plausible interplay between chronic

metabolic disease and dengue induced organ stress, emphasizing the value of close monitoring of inflammatory and biochemical markers in diabetic dengue patients.

6. Conclusion

The present study demonstrated that haematological abnormalities such as thrombocytopenia, neutrophilia and HBA1C changes occurred with comparable frequency in both diabetic and non-diabetic dengue patients. However, biochemical alterations, particularly hepatic enzyme elevation, were more pronounced among individuals with diabetes mellitus, along with inflammatory marker elevation can be seen in CRP. These findings suggest that diabetes does not markedly alter the haematological trajectory of dengue and ESR but may exacerbate hepatic and CRP stress during infection . Routine biochemical monitoring, especially of liver function, inflammatory marker that is CRP may therefore be of greater clinical relevance in diabetic dengue patients to facilitate early detection of evolving organ dysfunction. It is necessary to manage diabetes in patients to improve outcomes and effectively prevent the spread of dengue infection through a comprehensive national eradication campaign implemented by government authorities

References

[1] Prattay KMR, Sarkar MR, Shafiullah AZM, Islam MS, Raihan SZ, Sharmin N. A retrospective study on the socio-demographic factors and clinical parameters of dengue disease and their effects on the clinical course and recovery of the patients in a tertiary care hospital of Bangladesh. PLoS Negl TropDis. 2022 Apr 4;16(4):e0010297. doi: 10.1371/journal.pntd.0010297. PMID: 35377886.

[2] Farias KJS, Machado PRL, de Almeida Ju´nior RF, Lopes da Fonseca BA. Brefeldin A and Cytochalasin B reduce dengue virus replication in cell cultures but do not protect mice against viral challenge. Access Microbiol. 2019; 1: e000041. https://doi.org/10.1099/acmi.0.000041 PMID:32974532.

[3] Ferede G, Tiruneh M, Abate E, Wondimeneh Y, Gadisa E, Howe R, Aseffa A, Tessema B. A study of clinical, hematological, and biochemical profiles of patients with dengue viral infections in Northwest Ethiopia: implications for patient management. BMC Infect Dis. 2018 Dec 4;18(1):616. doi: 10.1186/s12879-018-3557-z. PMID: 30514223; PMCID: PMC6278031.

[4] WHO. dengue and severe dengue. Fact sheet N 117 [cited 2018]. available from: http://www.searo.who.int/thailand/factsheets/fs0008/en/.

[5] Laboratory testing for dengue virus: interim guidance, April 2025. Geneva: World Health Organization; 2025. https://doi.org/10.2471/B09394

[6] Martina BE, Koraka P, Osterhaus AD. Dengue virus pathogenesis: an integrated view. Clin Microbiol Rev. 2009 Oct;22(4):564-81. doi: 10.1128/CMR.00035-09. PMID: 19822889; PMCID: PMC2772360.

[7] Hossain MJ, Das M, Shahjahan M, Islam MW, Towhid ST. Clinical and Hematological Manifestation of Dengue Patients in 2022 Outbreak: A Tertiary Care Hospital-Based Cross-Sectional Study. Health Sci Rep. 2025 Jan 17;8(1): e70356. doi: 10.1002/hsr2.70356. PMID: 39831075; PMCID: PMC11739715.

[8] Yang DR, Wang MY, Zhang CL, Wang Y. Endothelial dysfunction in vascular complications of diabetes: a comprehensive review of mechanisms and implications. Front Endocrinol (Lausanne). 2024 Apr 5; 15: 1359255. doi: 10.3389/fendo.2024.1359255. PMID: 38645427; PMCID: PMC11026568

[9] Chen CY, Lee MY, Lin KD, Hsu WH, Lee YJ, Hsiao PJ, Shin SJ. Diabetes mellitus increases severity of thrombocytopenia in dengue-infected patients. Int J Mol Sci. 2015 Feb 10;16(2):3820-30. doi: 10.3390/ijms16023820. PMID: 25674854; PMCID: PMC4346928.

[10] Singh R, Goyal S, Aggarwal N, Mehta S, Kumari P, Singh V, Chopra H, Emran TB. Study on dengue severity in diabetic and non-diabetic population of tertiary care hospital by assessing inflammatory indicators. Ann Med Surg (Lond). 2022 Sep 16; 82: 104710. doi: 10.1016/j.amsu.2022.104710. PMID: 36268329; PMCID: PMC9577853.

[11] Samanta J, Sharma V. Dengue and its effects on liver. World J Clin Cases. 2015 Feb 16;3(2):125-31. doi: 10.12998/wjcc.v3.i2.125. PMID: 25685758; PMCID: PMC4317605.

[12] Shen TJ, Chen CL, Tsai TT, Jhan MK, Bai CH, Yen YC, Tsai CW, Tseng PC, Yu CY, Lin CF. Hyperglycemia exacerbates dengue virus infection by facilitating poly(A)-binding protein-mediated viral translation. JCI Insight. 2022 Nov 8;7(21): e142805. doi: 10.1172/jci.insight.142805. Erratum in: JCI Insight. 2023 Jan 24;8(2):e168446. doi: 10.1172/jci.insight.168446. PMID: 36125898; PMCID: PMC9675471.

[13] Lee IK, Hsieh CJ, Lee CT, Liu JW. Diabetic patients suffering dengue are at risk for development of dengue shock syndrome/severe dengue: Emphasizing the impacts of co-existing comorbidity(ies) and glycemic control on dengue severity. J Microbiol Immunol Infect. 2020 Feb;53(1):69-78. doi: 10.1016/j.jmii.2017.12.005. Epub 2018 Jan 31. PMID: 30146413.

[14] Munish K, Singhal G, Gupta A. Correlation between diabetics and non-diabetics recovery in hospitalized dengue positive patients. Int J Life Sci Biotechnol Pharma Res. 2024;13(7):260.