e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(1); 1008-1010

Original Research Article

Autonomic Nervous System Function in Patients with Type 2 Diabetes Mellitus

Savita[1], Ashwini Kumar[2], Bipin Kumar[3], Rita Kumari[4]

[1]Tutor, Department of Physiology, Nalanda Medical College & Hospital, Patna, Bihar, India
[2]3rd Year Junior Resident, Department of Physiology, Nalanda Medical College & Hospital, Patna, Bihar,India
[3]Associate Professor, Department of PSM, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India
[4]Professor & HOD, Department of Physiology, Nalanda Medical College & Hospital, Patna, Bihar, India

Received: 28-11-2025 / Revised: 27-12-2025 / Accepted: 29-01-2026
Corresponding Author: Savita
Conflict of interest: Nil

Abstract:

Introduction: Diabetes mellitus is a longstanding chronic illness that predates the advent of Christ. The prevalence of diabetes mellitus has significantly risen in recent years, both in India and worldwide. Diabetes mellitus typically impacts the nervous system, resulting in three pathological conditions: retinopathy, nephropathy, and neuropathy. Despite often being asymptomatic, autonomic neuropathy is associated with an increased risk of death and other diabetes-related complications. Dysfunction of the autonomic nerve system is believed to indicate cardiovascular reflex impairment in other areas. The present study aimed to evaluate autonomic nerve system abnormalities in individuals with type II diabetes mellitus through the application of straightforward bedside autonomic function testing.

Methods: This study is a cross-sectional prospective examination conducted from March 2025 to November 2025. One hundred Type II diabetes patients, aged 25 to 45 years and free of any comorbidities or disorders, were enrolled. The total number of patients was classified into two groups based on the duration of diabetes: group A and group B. Assessments of the autonomic nervous system were performed on all patients.

Observations and Results: In T2DM patients, HRV analysis showed a significant decrease in time-domain parameters (SDNN and RMSSD), suggesting a decline in parasympathetic activity and overall HRV. Reduced HF power and an elevated LF/HF ratio were revealed by frequency-domain analysis, Indicating sympathetic predominance.

Conclusion: The findings of this investigation revealed anomalies in the active sympathetic and parasympathetic nervous systems in patients with diabetes. Considering the engagement of both elements of the autonomic nervous system and the manifestation of symptoms, it is likely that these diabetics have had autonomic dysfunction for a prolonged duration.

Keywords: Hyperglycemia, Autonomic Neuropathy, Heart Rate Variability, HbA1c, Diabetes mellitus.

DOI: 10.25258/ijcpr.18.1.166

Introduction

Hyperglycemia and insulin resistance are hallmarks of type 2 diabetes mellitus (T2DM), a chronic metabolic disease that can result in long-term microvascular and macrovascular problems. Among these, diabetic autonomic neuropathy is a dangerous yet frequently misdiagnosed illness that raises morbidity and death rates dramatically [1]. The most prevalent symptom is cardiovascular autonomic neuropathy (CAN), which is linked to orthostatic hypotension, exercise intolerance, resting tachycardia, and an elevated risk of sudden cardiac death [2]. Early detection can be facilitated by evaluating autonomic nervous system function utilising non-invasive techniques including heart rate variability (HRV) and traditional autonomic function testing. The purpose of this study was to assess autonomic nervous system function in T2DM patients and compare it to that of healthy controls [3].

Methods

Study Duration: The study was conducted over a period of 9 months.

Participants: A total of 115 participants were selected for this study.

The study was conducted in Nalanda medical college and hospital, Patna, Bihar. Healthy controls

and patients with T2DM (duration ≥5 years) were included in the study. Individuals having a history of smoking, type 1 diabetes, hypertension, ischaemic heart disease, renal failure, or drugs that interfere with autonomic function were not included. Standard cardiovascular autonomic tests, such as the heart rate response to standing, the resting heart rate, and the blood pressure response to standing, were used to evaluate autonomic function. A 5-minute resting ECG recording was used for heart rate variability analysis in order to derive time-domain (SDNN, RMSSD) and frequency-domain (LF, HF, LF/HF ratio) parameters.

Every diabetic patient's fasting blood glucose and HbA1c readings were noted. Pearson correlation and the Student's t-test were used for statistical analysis. p-values less than 0.05 were regarded as statistically significant.

Results

When compared to healthy controls, patients with type 2 diabetes showed markedly reduced autonomic function. Diabetic individuals had significantly higher resting heart rates and significantly lower parasympathetic function tests.

In T2DM patients, HRV analysis showed a significant decrease in time-domain parameters (SDNN and RMSSD), suggesting a decline in parasympathetic activity and overall HRV. Reduced HF power and an elevated LF/HF ratio were revealed by frequency-domain analysis,

Indicating sympathetic predominance in table 2.

HbA1c levels and parasympathetic HRV indices showed a substantial negative connection, suggesting increased autonomic dysfunction with poor glycaemic control and prolonged diabetes duration.

Patients with type 2 diabetes have significantly lower SDNN, which suggests less total heart rate variability. Patients with type 2 diabetes have a much larger LF/HF ratio, which may indicate sympathetic predominance and autonomic instability.

HRV analysis showed a considerably larger LF/HF ratio and a significant decrease in SDNN and RMSSD in T2DM patients compared to controls ($p < 0.001$). These results show that patients with diabetes have less parasympathetic activity and more sympathetic dominance (Figures 1 and 2).

Table 1: Baseline Characteristics of Study Participants

Parameter	Controls (n = 58)	T2DM patients (n = 57)	p-value
Age (years)	50.4 ± 6.2	58.1 ± 5.2	
Male/Female	38 / 20	35 / 22	
Fasting blood glucose (mg/dL)	90.6 ± 8.2	174.8 ± 6.8	**<0.001**
HbA1c (%)	5.2 ± 0.8	9.2 ± 1.1	**<0.001**

Table 2: Comparison of HRV Parameters Between Controls and T2DM Patients

HRV parameter	Controls	T2DM patients	p-value
SDNN	50.8 ± 9.2	36.6 ± 8.0	<0.001
RMSSD	48.2 ± 8.4	22.4 ± 7.4	<0.001
LF	550 ± 120	650 ± 150	0.002
HF	510 ± 140	460 ± 110	<0.001
LF/HF ratio	1.22 ± 0.24	1.82 ± 0.44	<0.001

Discussion

The results of this study show that patients with type 2 diabetes have severe autonomic dysfunction, which mostly affects the parasympathetic cardiac control system. Even in asymptomatic individuals, early autonomic nervous system involvement is indicated by reduced HRV measurements and aberrant autonomic function tests. Autonomic neuropathy is exacerbated by oxidative stress, microvascular injury, and nerve ischaemia caused by chronic hyperglycemia [4]. Strict metabolic control is crucial, as evidenced by the link found between autonomic dysfunction and inadequate glycaemic control [5]. These results are in line with earlier research showing elevated sympathetic activity and decreased vagal tone in diabetic patients. In individuals with type 2 diabetes, early detection of autonomic dysfunction by HRV and easy bedside diagnostics may enable prompt management and lower cardiovascular risk [6].

Conclusion

Individuals with type 2 diabetes mellitus have severe autonomic nervous system dysfunction, which is typified by sympathetic predominance and decreased parasympathetic activity. In patients with type 2 diabetes, autonomic function assessment ought to be a crucial component of routine evaluation. Diabetic autonomic neuropathy and its related consequences may be avoided with early identification and ideal glycaemic management.

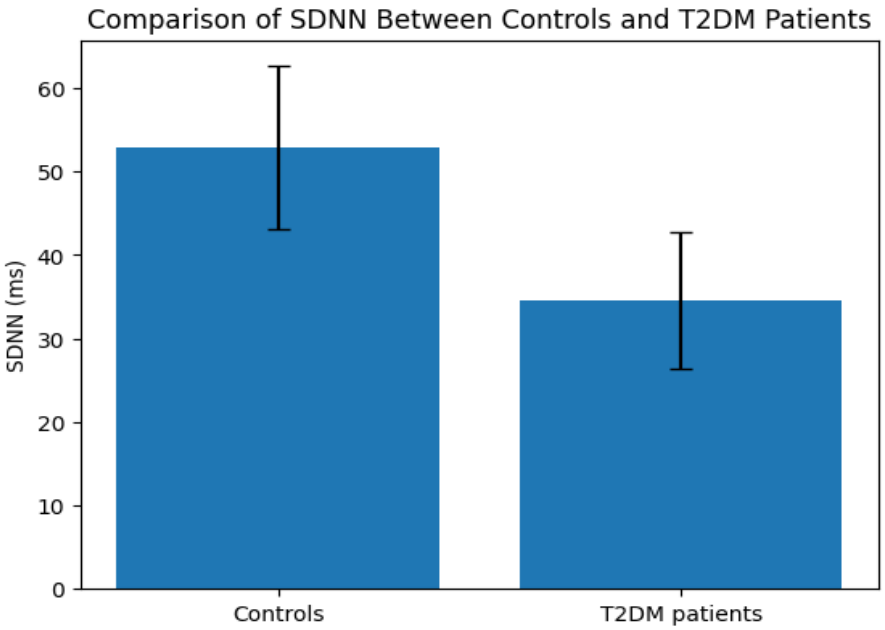

Figure 1: Comparison of SDNN between controls and T2DM patients

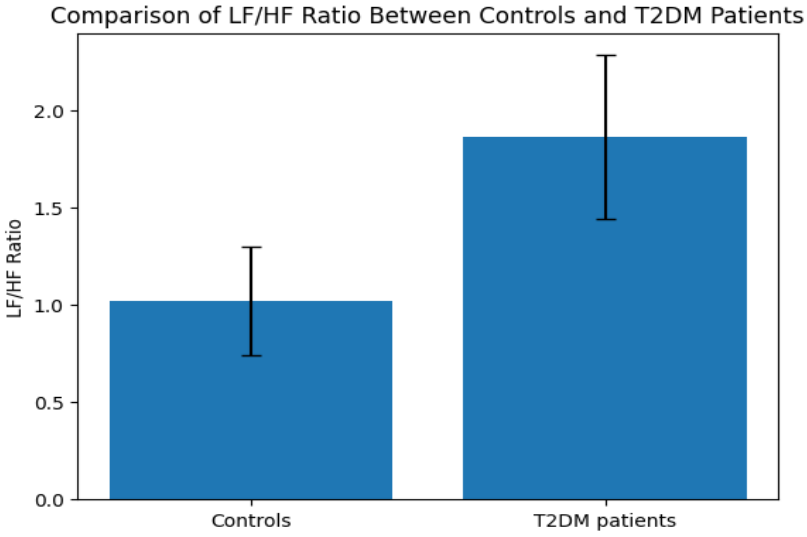

Figure 2: Comparison of LF/HF ratio between controls and T2DM patients

References

1. Sucharita S, Bantwal G, Idiculla J, Ayyar V, Vaz M. Autonomic nervous system function in type 2 diabetes using conventional clinical autonomic tests, heart rate and blood pressure variability measures. 2025;15(3).
2. Motataianu A, Barcutean L, Bajko Z, Stoian A, Maier S, Voidazan S, et al. Autonomic and Somatic Nerve Functions in Type 2 Diabetes Mellitus Patients: Electrophysiological Aspects. 2021;1–13.
3. Haskell W, Liao D. Prospective Investigation of Autonomic Nervous System Function and the Development of Type 2 Diabetes. 2003;2190–5.
4. Birajdar SV, Chavan SS, Munde SA, Bende YP. A Study of autonomic nervous system dysfunction among patient with diabetes mellitus: a cross-sectional study. 2017; 4(2): 406–11.
5. Dr. Prafullata Bhakare DSRP. Study of Autonomic Function Tests in Type II Diabetes Mellitus. 2025;6(4).
6. Dr. Rajula Tyagi, Dr. Sunil Tyagi, Dr. Anamika Chakraborty Samant DDV. A Comparative study of Autonomic Function Tests in Type 2 Diabetics and Healthy Controls. 2024;(3):710–4.