The Open Cardiovascular Medicine Journal
DOI: 10.2174/0118741924376137250808045625, 2025, 19, e18741924376137
ISSN: 1874-1924

RESEARCH ARTICLE **OPEN ACCESS**

Quality of Life and Occurrence of Metabolic Syndrome Among Type 2 Diabetes Patients in South India: A Pilot Study

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Abstract:

Introduction: Metabolic Syndrome (MetS), a prevalent contributing factor for cardiac complications in patients with diabetes mellitus (DM), adversely affects their quality of life (QoL). The objective of the study was to assess the QoL and the occurrence of MetS among patients with Type 2 DM.

Methods: The cross-sectional study included 191 inpatients aged 25-75 with Type 2 DM, diagnosed for over six months, and on diabetic medications. Patients with Type 1 DM, gestational DM, cognitive impairment, mental retardation, those on ventilator support, and outpatients were excluded. MetS and QoL were evaluated by the International Diabetes Federation (IDF) guidelines and the Audit of Diabetes Dependent Quality of Life Questionnaire (ADDQoL), respectively.

Results: Among the enrolled participants, 44.0% had MetS, with a greater impact observed in females. Type of treatment ($p=0.001$), physical activity ($p<0.00$), body mass index ($p<0.000$), alcohol intake ($p=0.007$), eating habits ($p=0.003$), frequency of exercise ($p<0.00$), smoking ($p=0.007$), waist circumference ($p<0.000$), and hypertension ($p<0.000$) were statistically predominant in those with DM and MetS. Both genders reported a comparable negative impact on QoL domains, with no statistically significant difference in the Average Weighted Impact Score between males and females ($p=0.644$).

Discussion: The high prevalence of MetS among hospitalized Type 2 DM patients highlights a significant yet often overlooked health burden. Its presence was significantly associated with various lifestyle and clinical risk factors. All QoL domains showed a decline, indicating that diabetes and its complications have a negative impact on quality of life.

Conclusion: In conclusion, MetS appears to be very common in patients with DM, and it negatively affects QoL.

Keywords: Cardiac Health, Diabetes Mellitus, Waist Circumference, International Diabetes Federation, Lifestyle Disease, Metabolic Syndrome.

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Cite as: Muhseena A, Swalih M, Varghese T, Chand S. Quality of Life and Occurrence of Metabolic Syndrome Among Type 2 Diabetes Patients in South India: A Pilot Study. Open Cardiovasc Med J, 2025; 19: e18741924376137.
http://dx.doi.org/10.2174/0118741924376137250808045625

Received: December 05, 2024
Revised: June 19, 2025
Accepted: June 30, 2025
Published: August 12, 2025

1. INTRODUCTION

Diabetes Mellitus (DM) is characterized by a marked elevation in blood glucose levels, resulting from a lack of, or resistance to, insulin. It affected approximately 415 million people worldwide as of 2015, and is expected to increase to 642 million by 2040 [1]. Data from the Diabetes Atlas, 10th edition, states that the prevalence of DM in India was 9.6% in 2021 and is thought to reach 10.9% by 2045 [2]. DM has a considerable effect on quality of life (QoL). Insulin resistance is documented as a risk factor for metabolic syndrome (MetS). MetS is a group of cardiac health indicators comprising raised fasting blood glucose (FBG), greater body mass index (BMI), hypertension, raised triglyceride (TG) levels, and decreased high-density lipoprotein cholesterol (HDL-C) levels [3]. Patients with Type 2 DM often have components of the MetS, which is linked with long-lasting complications like atherosclerotic cardiac disorders and death [4]. It has been suggested that a number of risks, like advanced age, greater BMI, and glycosylated hemoglobin level, elevated diastolic blood pressure (BP) and waist circumference, and alcohol intake, are predisposing factors for MetS in people with DM [5].

Apart from managing symptoms of DM, the comprehensive assessment and improvement of QoL are important [6]. QoL is multifaceted and includes social, psychological, and physical well-being. The long-lasting nature of illness, the difficulty of day-to-day care, and the existence of complications all have a substantial impact on the QoL. It is crucial to identify the variables affecting QoL among DM patients, especially in those who also have MetS, in order to optimize treatment and improve outcomes [7]. Therefore, determining MetS and its contributing components helps achieve optimal adherence to treatment and a healthy lifestyle. Additionally, QoL may improve, and increased public awareness and health education initiatives may prevent more comorbidities.

There is currently little research on MetS and its occurrence among DM patients in South India. With this paucity of data, we planned to assess QoL and the occurrence of MetS among people in South India diagnosed with Type 2 DM.

2. MATERIALS AND METHODS

2.1. Study Design

This was a cross-sectional study at the General Medicine Department of Yenepoya Medical College Hospital, Mangalore, India.

2.1.1. Study Population

A total of 215 patients were assessed for eligibility in this pilot study. Of these, 191 patients met the inclusion criteria and were enrolled in the study. The enrolled DM patients included 116 males (60.7%) and 75 females (39.3%). An informed consent form was obtained, and the process was carried out in different wards. Privacy was provided for patients to decide whether to participate; they also had the right to discontinue their participation at any time.

2.1.2. Inclusion and Exclusion Criteria

In-patients (IP) of age between 25-75 years diagnosed with Type 2 DM for >6 months and prescribed hypoglycemic medications were included. Patients diagnosed with other types of DM, cognitive impairment, mental retardation, or not willing to participate, and outpatients were excluded.

2.1.3. Ethical Issues

The local Scientific Review Board (YPCRC/SRB/RP/UG_125/2023) and Yenepoya Ethics Committee (YEC-1/2023/376) approved this study.

2.1.4. Data Collection

Structured interviews were conducted to collect data on various demographic parameters and risk factors, including physical activity levels, smoking habits, and alcohol consumption. The medication history interview was conducted to gather information on pre-existing conditions, medication use, and past diagnoses relevant to Metabolic Syndrome (MetS). Laboratory parameters were extracted from the patients' medical records. MetS was defined according to the International Diabetes Federation (IDF) guidelines Table **1**. Quality of Life (QoL) was assessed using the Audit of Diabetes-Dependent Quality of Life (ADDQoL) questionnaire.

Table 1. Diagnostic criteria for Metabolic Syndrome (MetS) according to the International Diabetes Federation (IDF) [8, 9].

1. Central besity	**Waist circumference ≥94cm and 80cm for men and women, respectively.**
With any two of the criteria listed below:	
2. High-density lipoprotein cholesterol	Less than 1.0 and 1.3mmol/L for males and females, respectively (or on medication for dyslipidemia)
3. Triglycerides	More than 1.7 mmol/L, (or on medication for dyslipidemia)
4. Blood pressure	Systolic BP ≥130 or diastolic BP ≥85 mmHg, or medications for hypertension.
5. Fasting blood glucose (FBS)	FBS >5.6 mmol/L, or previously diagnosed Type 2 diabetes.

2.2. Assessment of MetS

2.2.1. Audit of Diabetes Dependent Quality of Life Questionnaire (ADDQoL) [10]

The ADDQoL assesses the influence of DMon on several aspects of life through specific domains, including physical health, emotional well-being, and social interactions. It evaluates how DM affects daily activities, work, treatment management, diet, sleep, sexual function, and overall QoL, helping to understand the broader psychosocial consequences of living with the condition. ADDQoL scoring involves rating each domain on two scales: importance (0 to +3) and impact (−3 to +1). A score of zero represents ‘not important’ and a score of +3 represents ‘extremely important’ for the importance scale. A score of -3 means ‘extremely negative impact’, zero means no impact, and the value +1 indicates a ‘positive

impact'. The weighted score of each domain was calculated by multiplying the importance score by the impact score, which ranged from -9 (very negative impact, with high importance) to +3 (positive impact, with high importance). The total score of each patient was calculated by summing the weighted scores of all 19 domains. This total score represents an overall assessment of how DM impacts a person's QoL. The average weighted impact (AWI) score is calculated by dividing the sum of the weighted scores for each patient by the total number of patients. This provides the mean weighted impact score across all participants in the study, with a more negative score indicating a greater negative impact of diabetes mellitus (DM) on the QoL of the patients. A license agreement was obtained to use the ADDQoL-19 Questionnaire.

2.3. Sample Size

This estimation was not carried out due to a lack of prevalence data and because this is only a pilot study.

2.4. Data Analysis

The data were organized and analyzed using the International Business Machines Statistical Package for the Social Sciences (IBM SPSS) Statistics for Windows, version 22 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation for normally distributed data. The non-parametric variables were expressed as median (interquartile range). Categorical variables were reported as percentages and frequencies. The chi-square (χ^2) test was used to assess frequencies. For normally distributed variables, the difference between the groups was determined by an independent sample t-test. The Mann-Whitney U test was used for non-normally distributed variables. A two-sided $p<0.05$ was considered statistically significant, while a $p=0.001$ was taken as highly significant.

3. RESULTS

A total of 191 patients with DM were studied; 116 males (60.7%) and 75 females (39.3%). The mean age was 53.7±11.3 years. The mean age was 53.7±10.8 for males and 53.6±11.1 for females. For most people with DM (41.9%), the duration of diagnosis was between two and five years, while for 17.8%, it was >10 years; 37.7% of the patients with DM who were on insulin treatment were also taking an oral hypoglycemic agent (Table **2**). The study results confirm that social habits, such as smoking ($p < 0.001$), alcohol intake ($p < 0.001$), and the use of habit-forming substances ($p < 0.001$), have a significant impact on males. In this study, the use of smokeless tobacco products (such as gutkha, khaini, and betel quid with tobacco), as well as other substances, including cannabis (marijuana), cocaine, and heroin, was considered as habit-forming substance use.

Table 2. Socio-demographic characteristics of the study population by gender.

Parameters		Male n (%)	Female n (%)	*P*
Age (Years)	20-30	2(1.0)	2(1.0)	0.097
	31-40	10(5.2)	12(6.2)	
	41-50	32(16.7)	18(9.4)	
	51-60	36(18.8)	20(10.4)	
	61-70	33(17.2)	15(7.8)	
	71-80	3(1.5)	8(4.1)	
Marital Status	Married	112(58.6)	75(39.2)	0.104
	Unmarried	4(2.1)	0(0)	
Residence	Rural	60(31.4)	35(18.3)	0.548
	Urban	56(29.3)	40(21.2)	
Smoking	Non-smoker	44(23.0)	75(39.2)	<0.001*
	Current smoker	19(9.9)	0	
	Past smoker	53(27.7)	0	
Alcohol Intake	Non	81(42.3)	75(39.2)	<0.001*
	Current	5(2.6)	0	
	Past	30(15.7)	0	
Physical Activity	Yes	49(25.6)	29(15.16)	0.624
	No	67(35)	46(24)	
Habit-forming Substances Use	Yes	77(40)	0	<0.001*
	No	39(20.3)	75(39.2)	
Family History of DM	Yes	38(19.8)	28(14.6)	0.739
	No	78(40.7)	47(24.5)	
Duration of Diagnosis (Years)	0-1	11(5.7)	6(3.1)	0.739
	2-5	51(26.7)	29(15.2)	
	6-10	33(17.2)	27(14.1)	
	>10	21(10.1)	13(6.7)	

Parameters		Male n (%)	Female n (%)	P
Diet Pattern	Veg	33(17.2)	14(7.3)	0.125
	Both veg and non-veg	83(43.4)	61(31.9)	
Frequency of Exercise	Regular	15(7.8)	11(5.7)	0.500
	Occasional	37(19.4)	18(9.4)	
	No exercise	64(33.4)	46(24)	

Abbreviations: Veg: Vegetarian; DM: diabetes mellitus; physical activity: person doing physical exercise for at least 30 min in at least 5 days in a week, alcohol use: person ever drank alcohol; Habit-forming substances use: The use of smokeless tobacco products (such as gutkha, khaini, and betel quid with tobacco), as well as other substances including cannabis (marijuana), cocaine, and heroin, was considered as habit forming substance use; smoking status: person involved in smoking regularly.*Represents statistically significant at p<0.05.

Similarly, the analysis of clinical characteristics revealed that males used oral antidiabetic medications and insulin more frequently, whereas the combination of both was more common among females (Table **3**). The BMI parameters, dietary modification, and parameters related to the regular follow-up were non-significant.

The prevalence of MetS was 44.0% according to IDF criteria [8, 9], and the impact was greater on females (74.7%) compared to males (24.1%). There was no significant difference in the average age between DM patients with and without MetS (54.0 ± 10.5 *vs*. 53.4 ± 11.8 years; p = 0.71). This research detected a statistically significant difference in body weight and BMI between the group with MetS and the non-MetS group (p<0.01). The several variables in this study, especially treatment type (p = 0.001), physical activity ($p < 0.000$), BMI ($p < 0.000$), alcohol intake (p = 0.007), eating habits (p = 0.003), frequency of exercise, and smoking status (p = 0.007), were statistically significant in those with MetS. When evaluating each MetS component separately, an increased plasma glucose level was detected in 95.3% of the participants. Waist circumference (98.8%) and hypertension (80.9%) were identified as the commonly shared risk factors for MetS (Table **4**). The study's findings strongly indicate that there were statistically significant variances in waist circumference (p<0.000) and hypertension (p<0.000) between patients with Type 2 DM who had MetS and those who did not have it. Greater waist circumference (p<0.000), higher TG levels (p<0.000), and lower HDL-C (p=0.11) levels were significantly predominant in females compared with males.

The average weighted impact (AWI) score of QoL was summarized using the median and interquartile range (IQR), as the data were not normally distributed (Shapiro-Wilk test, $p < 0.05$). The median score was –1.60 (IQR: –2.05 to –1.21), indicating a substantial negative impact of DM on the participants' QoL assessed by the ADDQoL-19 questionnaire. In this study, both genders reported comparable negative impacts on their QoL, as measured by the ADDQoL. In the employment domain of the ADDQoL, males reported a significantly more negative impact on QoL compared with females (p=0.0047). There was no statistically significant difference in the AWI score between males and females with DM(p=0.644). The negative values observed across all domains of QoL indicate that DM has a detrimental effect on various aspects of QoL. Table **5** presents the comparison of different ADDQoL domains between genders.

Table 3. Clinical characteristics of the study population by gender.

Parameters		Male N (%)	Female N (%)	P
BMI	Under weight	9(4.7)	3(1.5)	0.227
	Normal weight	56(29.2)	33(17.2)	
	Over weight	38(19.8)	23(12)	
	Obese	13(6.7)	16(8.3)	
Treatment	Oral agent	50(26.15)	20(10.4)	0.004*
	Insulin	33(17.5)	16(8.6)	
	Both	33(17.2)	39(20.3)	
Diet modification	No	22(11.5)	20(10.4)	0.282
	Yes	94(49.0)	55(28.7)	
Follow-up	Regular	86(44.9)	51(26.6)	0.358
	Irregular	30(15.6)	24(12.5)	

Abbreviations: BMI: Body Mass Index;
Notes: *Represents statistically significant at p<0.05; Diet modification is the process of changing eating habits to improve health or manage specific conditions, such as reducing sugar intake.

Table 4. Gender-based assessment of risk factors for metabolic syndrome (MetS). Results are expressed as n (%).

MetS parameter		Male (n=116) n (%)	Female (n=75) n (%)	*p-value*
FBG	Present	108(93.1)	74(98.7)	0.076
	Absent	8(6.9)	1(1.3)	
Low HDL-C	Present	12(10.3)	18(24.0)	0.011*
	Absent	104(89.6)	57(76.0)	
Raised serum TG	Present	4(3.4)	13(17.3)	0.001*
	Absent	112(96.5)	62(82.7)	
Hypertension	Present	40 (34.5)	19 (25.3)	0.181
	absent	76 (65.5)	56 (74.7)	
Increased Waist Circumference	Present	69 (59.5)	13 (17.3)	0.001*
	Absent	47 (40.5)	62 (82.7)	
Metabolic Syndrome	Present	28 (24.1)	56 (74.7)	<0.001*
	Absent	88 (75.9)	19 (25.3)	

Abbreviations: FBG: Fasting Blood Glucose; TG: Triglycerides; HDL-C: High-Density Lipoprotein Cholesterol; BP: Blood Pressure; WC: Waist Circumference; DM: Diabetes Mellitus; MetS: Metabolic Syndrome *Represents statistically significant at p<0.05

Table 5. Different domains of ADDQoL by gender.

Domain of ADDQoL	Male Median (IQR)	Female Median (IQR)	U Statistic	P
Leisure	0.00 (1.00)	0.00 (1.00)	4093.0	0.4550
Employment	-2.00 (1.00)	-1.00 (1.00)	3352.0	0.0047*
Journey (ability to travel without limitations)	-2.00 (1.00)	-2.00 (2.00)	3750.5	0.0852
Enjoyment of holidays	-2.00 (2.00)	-2.00 (2.00)	720.5	0.8528
Physical activity	-2.00 (0.75)	-2.00 (1.00)	3657.5	0.0685
Family life	-2.00 (2.00)	-2.00 (1.00)	1725.0	0.6162
Friendship	-2.00 (2.00)	-2.00 (1.00)	1725.0	0.6162
Personal relationship	-1.00 (2.00)	-1.00 (2.00)	4404.5	0.8774
Sex life	-2.00 (2.00)	-1.00 (2.00)	3874.5	0.1858
Physical appearance	-1.00 (2.00)	-1.00 (2.00)	4047.5	0.2550
Self confidence	-2.00 (2.00)	-1.00 (2.00)	1250.5	0.8777
Motivation	-2.00 (1.00)	-2.00 (1.00)	4182.5	0.6388
People’s reaction	-2.00 (1.00)	-2.00 (2.00)	4181.5	0.6395
Future	-2.00 (2.00)	-1.00 (2.00)	3928.0	0.2409
Finance	-2.00 (2.00)	-2.00 (2.00)	4363.0	0.9719
Living condition	-2.00 (1.50)	-2.00 (1.00)	4548.5	0.5828
Dependence	-2.00 (2.00)	-1.00 (2.00)	4460.5	0.7570
Freedom to eat	-2.00 (2.00)	-2.00 (1.25)	4617.5	0.4551
Difficulty enjoying favorite drinks	-2.00 (2.00)	-2.00 (1.25)	4317.5	0.9288
Average weighed score	-1.60 (0.80)	-1.59 (0.90)	4523.0	0.644

3.1. Journey (Travel Freedom)

This domain evaluates how diabetes impacts a person’s ability to travel or take trips, and the importance of this aspect to their overall quality of life.

3.1.1. Enjoyment of Holidays

This domain assesses how diabetes affects a person's ability to enjoy or participate in vacations, travel, or leisure trips.

3.1.2. Difficulty Enjoying Favorite Drinks (Drink Restrictions)

This domain measures the extent to which diabetes limits the individual’s ability to consume their preferred beverages, including alcoholic or sugary drinks. The Mann-Whitney U test was used to compare Quality of Life (QoL) scores between genders.

4. DISCUSSION

MetS and DM, especially Type 2 DM, are closely associated because they share similar pathophysiological mechanisms and a number of risk factors [11]. One of the main characteristics of MetS and Type 2 DM is insulin resistance. Elevated plasma glucose levels result from insulin resistance, leading to diabetic complications and poor QoL [12]. The present study aimed to identify the occurrence rate of MetS and its associated risks with respect to QoL. The results revealed that the prevalence of MetS in Type 2 DM was 44.0%. This prevalence rate was in accordance with the findings reported by James M. *et al*. in Dakshina Kannada, Mangalore, India, which was 42.28% according to IDF criteria [13]. Another observational study conducted in South India at Dr. Panikar's DM Care Center observed that the overall occurrence of MetS among the study participants was 65.4% based on World Health Organization (WHO) criteria, and 69.8% using the IDF criteria. The study also reported a steady rise in the prevalence of MetS over three time periods: Group I (2004–2008), Group II (2009–2013), and Group III (2014–2019) [14].

In the present study, nearly three-quarters of the female participants presented with a cluster of conditions related to MetS. Women have a greater frequency of MetS during the menopausal age. This is because hormonal fluctuations during menopause play a significant role, leading to increased visceral fat, particularly upper body fat deposition and abdominal adiposity [15]. These factors are important determinants in the development of MetS in females. In this study, more females with MetS reported not exercising regularly compared to males with MetS; however, this difference was not statistically significant ($p = 0.586$). Patients with MetS had a high BMI and were not exercising regularly. One reason why physical activity can effectively manage MetS is that it lowers systemic oxidative stress by dilating blood vessels and increasing nitric oxide levels, thereby contributing to a significant reduction in cardiometabolic risk factors. Exercise has been shown to be beneficial in preventing obesity, heart disease, and MetS [16, 17]. Another study from India reported a significantly higher prevalence of MetS among female patients (58%) compared to males ($p = 0.001$) [18]. The study also found a significant association between MetS and higher BMI, with a greater prevalence observed in patients with elevated BMI compared to those with normal BMI. The results of this investigation also indicated a trend toward increased prevalence of MetS among elderly individuals, although the difference was not statistically significant.

Similar findings were reported by Xiao *et al*. [19], who observed a significant age-related increase in MetS prevalence ($p < 0.001$). In their study conducted among rural residents of Nantong, China, MetS was found in <15% of individuals below 30 years, 22% in the 30-39 age group, and >50% in those aged 60-69 years. Additionally, the study identified rice wine consumption and regular physical activity as protective factors against the development of MetS.

The present study found an association ($p<0.01$) between body weight and the presence of MetS. Among the overweight individuals, 41% did not have MetS. In the obese category, only 10.6% were free from MetS. Similar results were obtained from a study conducted in the urban region of Mumbai, the industrial capital of western India, which reported a strong correlation between MetS and obesity, with a statistically higher prevalence in males [20]. The prevalence of higher BMI (≥25 kg/m^2) in the study was reported to be as high as 79.01%. South Asians are more prone to central obesity than overall obesity, and this is associated with dyslipidemia and elevated blood pressure, essential elements of MetS diagnosis [21]. This might contribute to its high occurrence in patients with DM. According to a study by Sharma *et al*. [22], a higher incidence of cardiac risks is correlated with the presence of MetS in the Indian population. Those with DM had a higher prevalence of obesity, hypertension, and waist circumference. This outcome was aligned with previously published data on the Indian population. According to the study by Mattoo *et al*., BMI was significantly associated with the prevalence of MetS, and females had a higher prevalence of MetS among the Indian population residing in and around the Punjab [23]. Another study by Simon *et al*. reported that low HDL-C levels and high LDL-C were significantly ($p < 0.05$) more common in individuals with MetS compared with their healthy counterparts in the South Indian population [24].

The results of the present study found that alcohol consumers and smokers are more prone to MetS than non-smokers and non-alcohol drinkers. The increased prevalence of MetS among smokers could be attributed to the fact that the nicotine and other toxins from the smoke can cause the body to absorb toxic substances that can cause inflammation, insulin resistance, and an increase in visceral fat, which are the crucial aspects in the progression of MetS [25]. Excessive alcohol intake has been associated with increased visceral fat accumulation, insulin resistance, and unfavorable body fat distribution, all of which contribute to the development of MetS [26]. Additionally, smoking has been independently associated with a higher risk of developing Type 2 DM, as well as adverse lipid profiles, characterized by increased triglycerides, reduced HDL-C, and insulin resistance, all of which are core components of MetS [27]. Diabetes mellitus (DM) adversely affects patients' quality of life (QoL), impacting both their professional and personal lives. In this study, all QoL domains showed negative mean values, indicating that DM had a detrimental effect across various aspects of life. More than 80% of the participants stated that their QoL would be better if they did not have DM. Similar results were reported in a study conducted in Poland, where individuals with Type 1 and Type 2 DM noted that diabetic complications restricted their eating and drinking habits and also affected their sexual health. Pharmacist involvement and the provision of pharmaceutical care were found to help mitigate these issues and improve QoL [28]. In the present study, both genders reported a comparable negative impact on their

QoL, as measured by the ADDQoL.

The employment domain of the ADDQoL revealed a significantly greater negative impact on QoL among male participants compared with females. There was no statistically significant difference in the Average Weighted Impact Score between males and females with DM(p=0.644). No statistically significant differences were observed in the weighted impact scores of the remaining ADDQoL domains among patients in the present study. The results of the study by Bąk *et al*. [29] suggest that various sociodemographic, social, and clinical factors, including eating and drinking habits, significantly influence QoL in patients with DM. The study also highlighted the adverse impact of MetS on aspects of work life and sexual functioning, particularly among Polish men.

The study has some limitations, including a relatively small sample size and restriction to a single hospital center in South India. Therefore, its findings cannot be applied to general settings. To validate the findings, large-scale multicenter studies are needed.

CONCLUSION

The occurrence of MetS among patients with DM was 44.0% of the enrolled participants, based on IDF criteria. The majority of patients reported poor QoL across various aspects of their health. Compared to males, female gender, advanced age, illiteracy, high BMI, being overweight, a positive family history, and lack of physical activity were key contributing factors that predisposed hyperglycemic patients to develop MetS, thereby leading to poorer QoL. The study also showed that patients with DM experienced significantly reduced QoL in domains, such as social interactions, physical and mental health, and dietary autonomy. Additionally, the presence of MetS further contributed to the decline in QoL among patients with DM. These findings suggest that comprehensive diabetes management should aim not only for glycemic and metabolic control but also for improvement in QoL. While certain risk factors, such as gender, family history, and age, are non-modifiable, individualized care plans that include lifestyle modifications, psychosocial support, employment assistance, and educational interventions are essential to improving the overall health and QoL of individuals with DM.

LIST OF ABBREVIATIONS

DM	=	Diabetes Mellitus
T2DM	=	Type 2 Diabetes Mellitus
MetS	=	Metabolic Syndrome
QoL	=	Quality of Life
IDF	=	International Diabetes Federation
BMI	=	Body Mass Index
WC	=	Waist Circumference
AWI Score	=	Average Weighted Impact Score
ADDQoL	=	Audit of Diabetes-Dependent Quality of Life Questionnaire

AUTHORS' CONTRIBUTIONS

The authors confirm their contributions to the paper as follows:T.P.V.: Study conception and design; A.M.: Data collection; M.S.: Analysis and interpretation of results; S.C.: Draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The local Scientific Review Board (YPCRC/SRB/RP/UG_125/2023) and Yenepoya Ethics Committee (YEC-1/2023/376) approved this study.

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Participants were randomly selected after obtaining written informed consent from the volunteers; the participants' related data were blinded.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

Materials supporting the findings are available from the corresponding author on reasonable request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

The authors would like to thank Health Psychology Research Ltd., 188 High Street, Egham, Surrey TW20 9ED ("HPR") for providing them permission to use their tool to carry out this research work.

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