Perceived Stress Level and its Associated Factors Among Patients with Type 2 Diabetes

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ABSTRACT: *Background:* Diabetes mellitus (DM) is a lifestyle-related disorder, it has been linked to an elevated risk of perceived stress (PS). Addressing the stress in DM management is crucial. Stress levels among DM patients and the factors that contribute to them have received very little attention in Bangladeshi literature. The aim of the study is to determine the level and associated factors of PS among type 2 DM patients. *Methods:* A cross-sectional study was carried out at Rajshahi Diabetic Association General Hospital in Rajshahi, Bangladesh from June 2023 and August 2023. A total of 250 patients with Type 2 DM were included in the study based on specific criteria using a purposive sampling technique. Each patient provided informed written consent. Demographic characteristics, family history, comorbidities, risk behaviors, and diabetes-related information were collected using a pretested data collection sheet. Bangla-validated perceived stress scale-10 (PSS-10) was used to determine the stress of the patients. *Results:* The mean age of the participants was 51.03±11.05 years. Among the patients, 7.2% were suffering from high PS. Among the patients with stress, 57.2% were female. Patients with age (≤55 years), residing in urban areas, suffering from dyslipidemia, and having HbA1c (>7%) significantly increase the odds of perceived stress by 1.963 (95% CI: 1.052-3.665), 2.252 (95% CI: 1.211-4.188), 1.927 (95% CI: 1.030-3.606), 2.798 (95% CI: 1.324-5.914) times, respectively. *Conclusion:* Remarkable DM patients were suffering from severe perceived stress. Age (≤55 years), urban residence, dyslipidemia, and uncontrolled diabetes were independent as risk factors for perceived stress. For patients at risk of PS, including stress reduction health education in diabetes management would be advantageous.

Keywords: Diabetes Mellitus, Perceived Stress, Perceived Stress Scale-10 (PSS-10), Bangladesh.

Article at a glance:

Study Purpose: To determine the perceived stress level and associated factors among patients with Type 2 diabetes mellitus (DM).

Key findings: 62% of participants experienced moderate perceived stress (PS), while 7.2% had high PS. Female patients, those aged <55 years, urban residents, and those with dyslipidemia or HbA1c >7% had significantly higher odds of experiencing perceived stress. Uncontrolled diabetes and dyslipidemia were associated with higher perceived stress levels.

Newer findings: This study is one of the few in Bangladesh to explore perceived stress in Type 2 DM patients and its association with factors like age, urban residence, and dyslipidemia. The study suggests that including stress reduction education in diabetes management could improve patient outcomes.

Abbreviations: DM-Diabetes Mellitus, PSS-10- Perceived Stress Scale-10, HbA1c- Glycated Hemoglobin, PS-Perceived Stress, CI-Confidence Interval

INRODUCTION

Diabetes is a chronic metabolic condition, approximately 422 million individuals globally are affected with diabetes, with the majority residing in low- and middle-income nations. Additionally, diabetes is directly responsible for causing 1.5 million deaths annually. The incidence and prevalence of diabetes have been consistently rising over the past few decades.[1] Various studies, including a comprehensive evaluation and analysis of multiple

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studies, as well as national survey reports, have demonstrated a significant rise in the incidence of diabetes among adults in Bangladesh. The prevalence has increased from approximately 5% in 2001 to almost 14% in 2017.[2-5] Recent data suggests that in Bangladesh, 13,136,300 adults lived with diabetes in 2024 with a reported prevalence of 12.5% in adults.[6] The prevalence of DM is rising due to rapid cultural and social transformations, such as aging populations, urbanization, improved socioeconomic status, changes in dietary patterns and irregular eating habits, increased consumption of processed food, reduced physical activity, and unhealthy behaviors.[7–10] The prevalence of diabetes rises in parallel with healthcare expenditures, exerting pressure on the economy .[11, 12] Based on productivity-adjusted life years (PALY), Bangladesh is losing US$97.4 billion, or US$16,987 per person, in GDP. Each person with diabetes loses US$ 323 (BDT 25,473) a year on medical care.[13] Increased pocket expenditure and declines in antihyperglycemic drug adherence and nonadherence resulted in a rise in diabetes-related comorbidities and associated expenses.[14] It is important to properly control Type 2 diabetes to lower healthcare costs, avoid complications, and improve people's physical and mental health.[15,16] Sticking to the medications, making changes to your lifestyle, and getting enough exercise are all important parts of managing diabetes properly. These things have been linked to stress, which can make it harder to stick to the treatment plan.[17, 18] The impact of stress on glycemic control in patients with Type 2 diabetes is significant, although often overlooked. Multiple studies have demonstrated that stress can modify glucose metabolism, hence affecting the glycemic condition of individuals with diabetes. Hormonal release in reaction to stress might lead to an increase in blood sugar levels.[19] Trials undertaken worldwide have demonstrated that stress-combating approaches such as "mindfulness-based stress reduction" have led to changes in the glycemic status of individuals with diabetes.[20–24]

There is a scarcity of research from Bangladesh about the stress levels experienced by diabetic patients and the factors related to this stress. In a study conducted by Jahan N *et al.*, it was found that 10% of diabetic patients experience severe stress.[25] Furthermore, stress was found to be more common among females and younger individuals. Research conducted in India found that almost 40% of diabetes patients admitted to rural tertiary health centers exhibited symptoms of "perceived stress".[17] The study found that younger individuals had a shorter duration of diabetes, had comorbidities, were underweight, experienced disputes at work or home in the past month, lacked sufficient funds for treatment exhibited higher levels of perceived stress.[17,26] Understanding stress levels can be valuable for prioritizing mental health interventions, particularly for individuals with chronic conditions such as diabetes mellitus. In addition, understanding the causes of stress in diabetes can assist in developing targeted preventive strategies for different risk groups and healthcare settings. This could also assist in reducing the prevalence of behavior-related issues such as physical inactivity, tobacco, and alcohol use among individuals with diabetes and those who are at risk .[17] Given the information provided, this study aimed to investigate the perceived stress levels and related factors in patients with type 2 diabetes mellitus.

METHOD

Study design and setting

This cross-sectional study was conducted at the Rajshahi Diabetic Association General Hospital in Rajshahi, Bangladesh, from June 2023 to August 2023. The hospital was selected as the study setting because it serves as a major healthcare provider for patients with diabetes in the region. By focusing on this hospital, the study was able to concentrate on a population that is both accessible and relevant to the research objectives, ensuring more accurate and context-specific findings. The hospital's established infrastructure and the presence of specialized care for Type 2 diabetes mellitus were key factors in choosing it as the study site. A total of 250 patients diagnosed with Type 2 diabetes mellitus and seeking treatment at this hospital during the study period were enrolled based on inclusion and exclusion criteria. A purposive sampling technique was employed to select participants who met the study's requirements. Patients who did not cooperate, had severe physical or mental illness, cognitive impairment, or were diagnosed with depression were excluded from the study. Written informed consent was obtained from each patient once the study's goals and objectives were thoroughly explained. Data collection was performed through face-to-face interviews using a pre-tested, semi-structured data collection sheet. Information on socio-demographic characteristics,

family history, comorbidities, risk behaviors, and diabetes-related details was gathered.

A total of 250 patients suffering from Type 2 diabetes mellitus and seeking treatment from the aforementioned hospital during the study period, were enrolled in this study based on inclusion and exclusion criteria following a purposive sampling technique. Patients who did not cooperate, had severe physical or mental illness or cognitive impairment, or were diagnosed with depression were not included in the study. Written informed consent was obtained from each patient once the study's goals and objectives were explained. The data collection was conducted through face-to-face interviews using a pretested semi-structured data collection sheet. A detail of socio-demographic characteristics, family history, comorbidities, risk behaviors, and diabetes-related information was taken.

Sampling

Purposive sampling was chosen for this study rather than probability sampling because it allowed for targeted selection of participants who were directly relevant to the research objectives. Given the specific nature of the study—focused on Type 2 diabetes patients receiving treatment in a particular hospital—the purposive sampling technique enabled the researchers to select participants who best met the study's inclusion criteria, ensuring that the data collected was both relevant and of high quality. This approach was particularly useful in reaching individuals with specific characteristics, such as those with Type 2 diabetes, who were receiving care at the Rajshahi Diabetic Association General Hospital.

Assessment of perceived stress

Bangla-validated Perceived stress scale-10 was used to determine the stress of the patients. The scores on the PSS can range from 0 to 40, with higher scores indicating higher levels of perceived stress. Stress levels can be categorized based on a scoring system. Scores between 0-13 indicate low stress, while scores between 14-26 suggest moderate stress. On the other hand, scores between 27-40 are indicative of high/severe perceived stress 27. In this study, low stress was considered as no stress, and moderate and severe stress was considered as the presence of stress. Ethical approval of the study was taken from the Institutional Animal, Medical Ethics, Biosafety, and Biosecurity Committee (IAMEBBC) [Ref: 415(27)/320/IAMEBBC/I BSc.

Statistical analysis

The statistical analysis was done using the Statistical Package for Social Science (SPSS), Version 23. Continuous data were summarized using means and standard deviations. Categorical data were presented by frequency (percentage). The data's normal distribution was assessed using the Shapiro-Wilk test. To determine the association between categorical variables, chi-square tests or Fisher's exact tests were done. Risk factors for perceived stress in Diabetes Mellitus were determined by Univariate and multivariate logistic regression. A P-value <0.05 was considered to indicate statistical significance.

RESULTS

The mean age of the participants was 51.03±11.05 years with the majority of them from the 30-55 years age group. The male-female proportion was almost equal. The majority of the patients were from rural areas and married. About 46.8% of the patients were housewives, followed by service (24.0%) and business (15.6%). Last month's family expenditure of more than four-fifths of the patients was ≤20000 taka (Table 1).

Table 1: Distribution of the study participants according to Socio-demographic characteristics (N=250)

Socio-demographic characteristics		Frequency	Percentage
Age (years)	30-55	168	67.2
	56-80	82	32.8
	Mean ±SD	51.03±11.05	
	Median (Range)	52 (31-78)	
Gender	Male	123	49.2
	Female	127	50.8
Residence	Rural	130	52.0
	Urban	120	48.0

Marital status	Married	249	99.6
	Unmarried	1	0.4
Occupation	Service	60	24.0
	Business	39	15.6
	Labor	3	1.2
	Housewife	117	46.8
	farmer	15	6.0
	Unemployed	16	6.4
Education	Illiterate	2	0.8
	Class 1-5	38	15.2
	Class 6-12	168	67.2
	Graduate Plus	42	16.8
Last month's expenditure (taka)	≤20000	203	81.2
	>20000	47	18.8

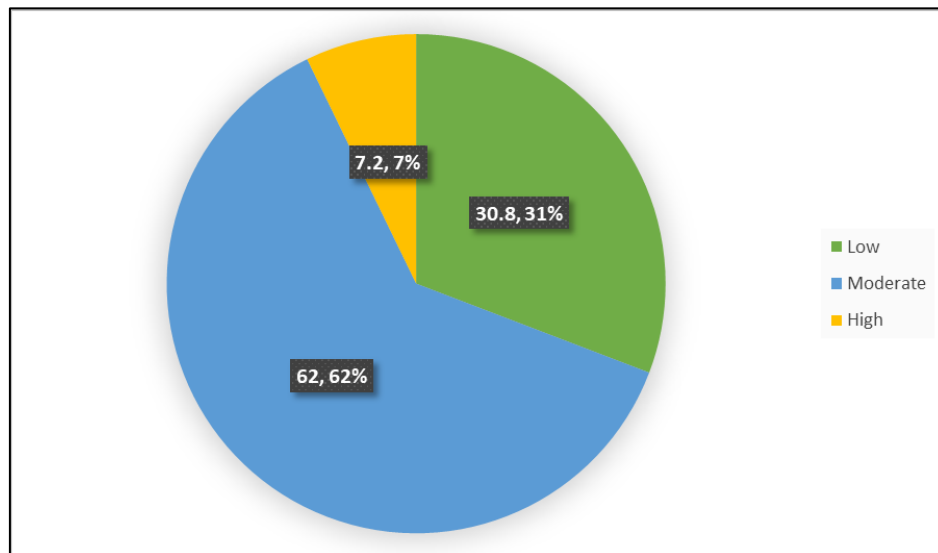N.B.: Data were presented as Mean ±SD, Median (range), frequency, Percentage

Figure 1: Perceived in diabetic patients based on Perceived Stress Scale (PSS)

Among the patients, 62.0% of the patient were suffering from moderate PS and 7.2% were suffering from high PS. Only 30.8% were suffering from low PS, which in the study was considered as having no stress (Figure 1). Female, patients aged ≤55 years and urban patients were significantly suffering from stress. Whereas no such association was observed between marital status, occupation, education and stress (Table 2).

Table 2: Association of socio-demographic characteristics with stress (N=250)

Socio-demographic characteristics		Stress (n=173) N (%)	No Stress (n=77) N (%)	p-value
Age (years)	≤55	125 (72.3)	43 (55.8)	[a] 0.011
	>55	48 (27.7)	34 (44.2)	
Gender	Male	74 (42.8)	49 (63.6)	[a] 0.002
	Female	99 (57.2)	28 (36.4)	

Residence	Rural	81 (46.8)	49 (63.6)	[a] 0.014
	Urban	92 (53.2)	28 (36.4)	
Marital status	Married	172 (99.4)	77 (100.0)	[b] >0.99
	Unmarried	1 (0.6)	0 (0.0)	
Occupation	Service	41 (23.7)	19 (24.7)	[a] 0.097
	Business	24 (13.9)	15 (19.5)	
	Labor	3 (1.7)	0 (0.0)	
	Housewife	88 (50.9)	29 (37.7)	
	farmer	10 (5.8)	5 (6.5)	
	Unemployed	7 (4.0)	9 (11.7)	
Education	illiterate	1 (0.6)	1 (1.3)	[a] 0.815
	Class 1-5	28 (16.2)	10 (13.0)	
	Class 6-12	114 (65.9)	54 (70.1)	
	Graduate Plus	30 (17.3)	12 (15.6)	
Last month expenditure (taka)	≤20000	144 (83.2)	59 (76.6)	[a] 0.217
	>20000	29 (16.8)	18 (23.4)	

Patients with dyslipidemia and patients having HbA1c (>7%) were significantly suffering from stress. Of patients suffering from stress, 74% had a family history of diabetes mellitus, and 56.1% were being treated with both oral medication and insulin (Table 3).

Table 3: Association of comorbidity, diabetes, treatment, and behavioral-related characteristics with stress (N=250)

Characteristics		Stress (n=173) N (%)	No Stress (n=77) N (%)	p-value
Body mass index	Non-obese	156 (90.2)	71 (92.2)	0.607
	Obese	17 (9.8)	6 (7.8)	
Smoking habit	Yes	20 (11.6)	4 (5.2)	0.115
	No	153 (88.4)	73 (94.8)	
Hypertension	Yes	99 (57.2)	39 (50.6)	0.334
	No	74 (42.8)	38 (49.4)	
Dyslipidemia	Yes	129 (74.6)	45 (58.4)	0.011
	No	44 (25.4)	32 (41.6)	
Family history of Diabetes Mellitus	Yes	128 (74.0)	48 (62.3)	0.062
	No	45 (26.0)	29 (37.7)	
Duration of suffering from Diabetes Mellitus (years)	≤15	157 (90.8)	65 (84.4)	0.143
	>15	16 (9.2)	12 (15.6)	
Anti-diabetic treatment	Both oral medication and insulin	97 (56.1)	33 (42.9)	0.054
	Others (oral medication, or insulin, or lifestyle modification)	76 (43.9)	44 (57.1)	
HbA1c	>7%	152 (87.9)	52 (67.5)	<0.001
	≤7%	21 (12.1)	25 (32.5)	

On Univariate analysis, age (≤55 years) significantly increases the odds of perceived stress by 2.059 (95% CI: 1.177-3.603) times (p-value: 0.011), and being female increases the odds of perceived stress by 2.341 (95% CI: 1.346-4.072) times (p-value: 0.003). Residing in the urban area was found to increase the chance of perceived stress with odds of 1.988 (95% CI: 1.144-3.452) (p-value: 0.015). Patients with

dyslipidemia were found to increase the chance of perceived stress with odds of 2.085 (95% CI: 1.182-3.679) (p-value: 0.011). HbA1c increases the odds of perceived stress by 3.480 (95% CI: 1.798-6.733) times (p-value: <0.001) (Table 4).

Table 4: Univariate logistic regression of risk factors for stress in Diabetes Mellitus patients

Risk factors	Odds ratio (OR)	95% confidence interval	p-value
Age (≤55 years)	2.059	1.177-3.603	0.011
Gender (female)	2.341	1.346-4.072	0.003
Residence (Urban)	1.988	1.144-3.452	0.015
Family history of Diabetes mellitus	1.719	0.969-3.047	0.064
Dyslipidemia	2.085	1.182-3.679	0.011
Treatment (Both oral medication and insulin)	1.702	0.990-2.926	0.055
HbA1c (>7%)	3.480	1.798-6.733	<0.001

On multivariate analysis, age (≤55 years) significantly increases the odds of perceived stress by 1.963 (95% CI: 1.052-3.665) times (p-value: 0.034). Residing in urban areas was found to increase the chance of perceived stress with odds of 2.252 (95% CI: 1.211-4.188) (p-value: 0.010). Patients with dyslipidemia were found to increase the chance of perceived stress with odds of 1.927(95% CI: 1.030-3.606) (p-value: 0.040). HbA1c (>7%) increases the odds of perceived stress by 2.798 (95% CI: 1.324-5.914) times (p value:0.007) (Table 5).

Table 5: Multivariate logistic regression of risk factors for stress in Diabetes Mellitus patients

Risk factors	Adjusted Odds ratio (AOR)	95% confidence interval	p-value
Age (≤55 years)	1.963	1.052-3.665	0.034
Gender (female)	1.453	0.784-2.695	0.236
Residence (Urban)	2.252	1.211-4.188	0.010
Family history of Diabetes mellitus	1.358	0.717-2.574	0.348
Dyslipidemia	1.927	1.030-3.606	0.040
Treatment (Both oral medication and insulin)	1.215	0.647-2.281	0.544
HbA1c (>7%)	2.798	1.324-5.914	0.007

DISCUSSION

Diabetes is linked to an increased risk of feeling depressed, anxious, and stressed due to its debilitating nature and complications. As a lifestyle disorder, psychological and behavioral elements such as stress are crucial for its management. Stress not only impacts glycemic control via biological pathways, but it also promotes harmful behavior .[28] In the present study, 30.8% had no perceived stress. Patients aged ≤55 years, living in urban areas, with dyslipidemia and uncontrolled diabetes mellitus experienced considerably higher levels of perceived stress.

This study revealed that 62.0% of the patients experienced moderate perceived stress, whereas 7.2% experienced high perceived stress. A separate study carried out in Bangladesh revealed that 10% of patients were experiencing severe stress.[25] A study conducted in India found that over one-third of individuals with diabetes experienced significant levels of stress.[26, 27] Research conducted in multiple countries, including China, Malaysia, Croatia, and Japan, has revealed diverse levels of stress in individuals with diabetes, ranging from 7% to 15.2%, as measured by different evaluation measures.[29–31] A study conducted in 17 high-income nations and low- and middle-income countries (LMICs) found that 9.8% of individuals with diabetes experience permanent stress.[32] The incidence of stress varies significantly throughout nations and even within them. This difference can be attributed to factors such as diverse study populations, the utilization of different assessment techniques, and even the application of varying cut-off levels within the same scales.[33]

Multiple studies have identified many characteristics as risk factors for feeling stress in people with diabetes. A study conducted in Chennai; India revealed that the younger age group experienced elevated levels of stress in comparison to the elderly.[26] The majority of participants in our study were aged ≤55 years, with a mean age of 51.03±11.05 years.

Our study revealed that those aged 55 years or younger have a much higher likelihood of experiencing perceived stress, which increases the odds by 1.963 times. This finding aligns with the results reported by Sendhilkumar *et al.*, Nevertheless, this study revealed that females experienced a higher level of stress, as reported by Jahan N *et al*. [25] However, this disparity in stress levels did not indicate that being female was a risk factor, which aligns with the findings reported by Siddharthan *et al.*,[17] In addition to the fact that younger people typically struggle to follow treatment plans, the idea of taking drugs for the rest of their lives may make them feel more stressed than older people.[17] Urban life is often complex, and those residing in urban regions have a higher level of stress compared to those in rural areas.[34] Life events that influence the balance between job, family, and leisure activities can cause severe stress for those with diabetes.[30] Siddharthan *et al.*, found that the presence of disputes, whether in the office or at home, is independently linked to perceived stress.[17] Nevertheless, our study focused on residential regions and revealed that living in urban areas was associated with a 2.252-fold increase in the likelihood of perceiving stress.

Multiple studies have demonstrated a relationship between glycemic status and stress levels in individuals with diabetes, as well as stress serving as a mechanism for abnormal glycemic status, including the onset of diabetes.[29,35] In this study, approximately 80% of the diabetic participants experienced uncontrolled diabetes. Uncontrolled diabetes raises the likelihood of perceived stress by 2.798 times (95% CI: 1.324-5.914), and perceived stress significantly raises the chance of uncontrolled diabetes mellitus by 3.48 times (95% CI: 1.80–6.73). Poor compliance with the treatment regimen or reduced healthcare-seeking behavior, in combination with perceived stress, may have produced this bidirectional link between diabetes and stress. The financial load may have also caused stress. The majority of the study participants had an income of less than twenty thousand takas, and a significant proportion of patients were being treated with both oral medication and insulin, which requires a substantial amount of money. The patients compromised illness management, due to their financial condition, resulted in uncontrolled diabetes and increased stress. Siddharthan *et al.*, and Mendenhall *et al.*.[17, 35] identified financial instability, or economic insecurity, as a significant stressor in their studies. Having additional medical conditions with diabetes can lead to a higher likelihood of needing to take several medications, which in turn can result in increased costs and heightened levels of perceived stress. Studies have reported that the presence of comorbidity among diabetics is associated with stress.[17,26] This study revealed a substantial association between dyslipidemia and a higher risk of perceived stress, with odds of 1.927 (95% CI: 1.030–3.606). However, we observed no causal connection between perceived stress and high blood pressure or obesity. Together with antidiabetic drugs and lifestyle changes, stress management may help manage diabetes. Trials conducted worldwide have shown that stress-reduction strategies such as "mindfulness-based stress reduction" improve diabetes glycemic status.[20–24] At this level of healthcare, we also have to include stress management strategies in the diabetes education program to ensure improved health outcomes for type 2 diabetes patients who are at risk of stress.

CONCLUSION

About seventy in a hundred diabetes patients were suffering from stress and seven of them from severe stress. A significant number of diabetic patients, particularly women, were experiencing high levels of stress. Stress exacerbates uncontrolled diabetes and vice versa. Mostly middle-aged patients residing in urban areas and suffering from uncontrolled diabetes mellitus with dyslipidemia are at risk of suffering from perceived stress. Integrating stress reduction health education into the management of diabetes patients who are at risk of experiencing perceived stress would be advantageous from a Bangladeshi standpoint.

Limitation

The study involved a small sample size of patients in a tertiary care hospital, which might not be sufficient to establish the relationship between all the factors being examined and might not be

representative of the community scenario. Conflicts at work or home in the previous month are regarded as a known risk factor for stress. However, the study neglected to record the family history of any psychological illness among the participants. As this study mostly uses observational data, it is difficult to prove a clear causal relationship.

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