RESEARCH ARTICLE

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Depression, anxiety, and stress among type-2 diabetic patients in Afghanistan: A cross-sectional survey study

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ABSTRACT

Background: Diabetic patients are prone to increased depression, anxiety, and stress. The main objective of this study was to assess the prevalence and associated factors of depression, anxiety, and stress among diabetic patients in Herat province of Afghanistan.

Methods: This cross-sectional study was conducted in 2024 among 353 adult diabetic patients in Herat province of Afghanistan. To assess depression, anxiety, and stress, the Persian version of the 21-item Depression Anxiety Stress Scale (DASS-21) was used. Data were analyzed by using descriptive statistics, Chi-square tests, and multiple regression analysis. A two-tailed p-value below 0.05 was considered statistically significant.

Results: Among the 353 diabetic patients, 95.2% were aged ⊡50 years, 61.8% were females, 62.0% were living in urban areas, 64.6% were illiterate, 75.1% had low economic status, and 62.9% were overweight/obese. Severe/extremely severe depression, anxiety, and stress were present in 73.9%, 84.1%, and 80.5% of the diabetic patients. The statistically significant predictors of depression were being female, having low economic status, and having had a bad event in the past month. The statistically significant predictors of anxiety were being female and having low economic status. The statistically significant predictors of stress were being female, being a widow/divorced, having low economic status, and having had a bad event in the past months. Being a female diabetic patient was a strong predictor for all three conditions of depression (adjusted odds ratio [AOR] = 11.01, p-value <0.001), anxiety (AOR = 4.53, p-value = 0.005), and stress (AOR = 6.77, p-value <0.001).

Conclusion: Depression and anxiety are highly prevalent among diabetic patients in Herat province of Afghanistan.

Introduction

Depression, anxiety, and stress are prevalent mental health issues that significantly impact individuals with diabetes. Research indicates that people with diabetes are at a higher risk of developing

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mental health disorders compared to the general population, largely due to the chronic nature of the disease, the complexity of self-management, and the burden of potential complications (1-2). The continuous need for blood glucose monitoring, dietary restrictions, and medication adherence can contribute to psychological distress, leading to decreased quality of life and poor disease management outcomes (3).

Studies have shown a bidirectional relationship between diabetes and mental health disorders. Depression and anxiety can negatively affect glycemic control by impairing self-care behaviors such as medication adherence, physical activity, and dietary management (4-5). Conversely, poorly managed diabetes can exacerbate psychological symptoms, creating a vicious cycle that complicates both mental health and diabetes management (6). Stress, in particular, can lead to hormonal changes that elevate blood glucose levels, further complicating diabetes control (7).

Limited research has examined mental health within Afghanistan, particularly since the rise of the Taliban government. A study (8) focusing on urban Afghan women reported a high prevalence of depression symptoms (80.4%) and mild to extremely severe anxiety (81.0%). Furthermore, a more recent large-scale cross-sectional study (9) found that across the Afghan population, the prevalence of depression was 72.05%, anxiety was 71.94%, and stress was 66.49%. These findings underscore a significant burden of depression, anxiety, and stress within Afghanistan.

The stigma associated with mental health issues, combined with the fear of being judged for not adequately managing diabetes, often prevents individuals from seeking psychological support (10). Additionally, inadequate mental health services and limited integration of psychological care within diabetes treatment programs contribute to the underdiagnosis and undertreatment of mental health disorders in diabetic patients (11). Therefore, addressing the mental health needs of individuals with diabetes is crucial for improving their overall well-being and enhancing disease management outcome (12).

In regions affected by prolonged conflict and political instability, such as Afghanistan, the burden of mental health disorders, including depression, anxiety, and stress, is particularly high. Afghanistan, situated in South Asia, has endured decades of conflict, political instability, and socioeconomic hardships, leading to a considerable prevalence of mental health issues among its population (13). Extended exposure to war-related trauma, displacement, poverty, and insufficient healthcare infrastructure has heightened the vulnerability of many Afghans to mental health conditions (13).

Among vulnerable populations, individuals with chronic illnesses, such as diabetes, are at an even greater risk of developing mental health disorders. Diabetes, a prevalent non-communicable disease in Afghanistan, is associated with increased psychological distress due to factors such as disease management challenges, financial constraints, and limited access to healthcare services 18). Studies have demonstrated that diabetic patients are more likely to experience depression, anxiety, and stress, which can further exacerbate their health outcomes (14-15). The bidirectional relationship between diabetes and mental health disorders underscores the need for comprehensive care approaches that integrate psychological support with routine diabetes management (16).

Despite the increasing recognition of mental health disorders among diabetic patients globally, there has been limited research on this issue in Afghanistan. The present study aims to assess the prevalence of depression, anxiety, and stress among diabetic patients in Herat province, Afghanistan. Additionally, it seeks to identify the socio-demographic and clinical factors associated with these mental health indicators. Given the ongoing political and economic instability, understanding the psychological burden on diabetic patients is crucial for informing healthcare policies and interventions aimed at improving both mental and physical health outcomes in Afghanistan. So, the main objective of this study was to assess the prevalence and associated factors of depression, anxiety, and stress among diabetic patients in Herat province of Afghanistan.

Materials and Methods

Participants, Study Design, and Procedure

In 2024, a cross-sectional study was conducted in Herat province, Afghanistan, to assess depression, anxiety, and stress among diabetic patients. The study included 353 participants diagnosed with diabetes. Data collection was performed through face-to-face interviews conducted by trained data collectors using a structured questionnaire. Participants were recruited using cluster convenience sampling. Eligibility criteria required participants to (i) be residents of Afghanistan, (ii) be aged at least 18 years, (iii) have a confirmed diagnosis of diabetes, (iv) be able to understand either Dari or Pashto languages, and (v) provide either written or verbal informed consent.

The target sample size was determined using the formula $N = Z\alpha^2 P(1 - P)/d^2$, with $\alpha = 0.05$, $Z\alpha = 1.96$, and a margin of error (d) of 5%. The estimated proportion of individuals with depression, anxiety, and stress among diabetic patients was derived from existing literature. OpenEpi software (v3.01) was used for sample size calculation. Written informed consent was taken from all the study participants.

Instruments

The study utilized a structured questionnaire consisting of two sections: socio-demographic variables and mental health assessment. The socio-demographic section collected data on age (categorized as 18-49 years and 50-95 years), gender (male, female), marital status (single, married, widowed/divorced), residency (urban, rural), education level (illiterate, primary school, secondary school, high school, university), economic status (high income, middle income, low income), body mass index (BMI: underweight <18.5; normal weight 18.5-24.9; overweight 25-29.9; obesity >30), and the occurrence of a bad event in the past month (Yes, No).

To assess depression, anxiety, and stress, the Persian version of the 21-item Depression Anxiety Stress Scale (DASS-21) was used (17). This scale consists of three subdomains: depression, anxiety, and stress. Responses to items such as "I couldn't seem to experience any positive feeling at all" were recorded on a scale from 0 ("Did not apply to me at all") to 3 ("Applied to me very much or most of the time"). The total score for each subdomain was multiplied by two to align with the full 42-item version. Standard cut-off scores were used to classify severity levels: depression (0-9 normal, 10-13 mild, 14-20 moderate, >20 severe/extremely severe), anxiety (0-7 normal, 8-9 mild, 10-14 moderate, >14 severe/extremely severe), and stress (0-14 normal, 15-18 mild, 19-25 moderate, >25 severe/extremely severe). In the present study, Cronbach's alpha values for the depression, anxiety, and stress subscales were 0.850, 0.865, and 0.845, respectively.

Analysis

Data entry was performed using Microsoft Excel 2016, and statistical analyses were conducted using IBM SPSS version 26.0 for Windows. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize the data. Associations between categorical variables were examined using chi-square tests. Multiple regression analysis was performed to identify socio-demographic factors independently associated with depression, anxiety, and stress. A two-tailed p-value below 0.05 was considered statistically significant.

Results

The study included 353 diabetic patients, with the majority aged 50-95 years (59.2%) and 40.8% aged 18-49 years. More participants were female (61.8%) than male (38.2%). Most were married (83.3%), with smaller proportions being widowed/divorced (15.9%) or single (0.8%). Urban residents constituted 62.0% of the sample, while 38.0% were from rural areas. Educational attainment was generally low, with 64.6% being illiterate, followed by primary (17.8%), secondary (5.4%), high school (6.2%), and university education (5.9%). A majority reported low economic status (75.1%), with fewer participants in middle-income (21.8%) and high-income (3.1%) categories. In terms of BMI, most were overweight (43.6%), followed by normal weight (33.7%), obesity (19.3%), and underweight (3.4%). Additionally, 51.0% experienced a bad event in the past month, while 49.0% did not. [Table 1]

Table 1. General characteristics of the study participants.

Characteristics	Frequency, n (%)
Age group	
18–49 years	144 (40.8)
50–95 years	209 (59.2)
Gender	
Male	135 (38.2)
Female	218 (61.8)
Marital status	
Single	3 (0.8)
Married	294 (83.3)
Widow/divorced	56 (15.9)
Residency	
Urban	219 (62.0)
Rural	134 (38.0)
Education	
Illiterate	228 (64.6)
Primary school	63 (17.8)
Secondary school	19 (5.4)
High school	22 (6.2)
University	21 (5.9)
Economic status	
High-income	11 (3.1)
Middle-income	77 (21.8)
Low-income	265 (75.1)
BMI	
Underweight	12 (3.4)
Normal weight	119 (33.7)
Overweight	154 (43.6)
Obesity	68 (19.3)
Bad event occurring in the past month	
Yes	180 (51.0)
No	173 (49.0)
Total	**353 (100.0)**

The severity of depression, anxiety, and stress among participants showed high levels of psychological distress. For depression, 73.9% of participants reported severe or extremely severe symptoms, while 15.9% had moderate symptoms, and only 10.2% had normal or mild levels. Regarding anxiety, 84.1% of participants experienced severe or extremely severe anxiety, with 9.9% experiencing moderate anxiety, and 5.9% reporting normal or mild anxiety. For stress, 80.5% of participants had severe or extremely severe stress, while 10.5% experienced moderate stress, and 9.0% reported normal or mild levels. [Table 2]

Table 2. The prevalence of depression, anxiety, and stress among the study participants.

Variable/Severity	Frequency, n (%)
Depression	
Normal/Mild	36 (10.2)
Moderate	56 (15.9)
Severe/Extremely severe	261 (73.9)
Anxiety	
Normal/Mild	21 (5.9)
Moderate	35 (9.9)
Severe/Extremely severe	297 (84.1)
Stress	
Normal/Mild	32 (9.0)
Moderate	37 (10.5)
Severe/Extremely severe	284 (80.5)

The association between depression and socio-demographic characteristics revealed several significant relationships. Gender was strongly associated with depression, with a higher prevalence among females (96.3%) compared to males (79.3%) (p-value = < 0.001). Economic status also showed a significant association, as depression was more prevalent among low-income participants (94.3%) compared to middle-income (75.3%) and high-income groups (81.8%) (p-value = < 0.001). Additionally, experiencing a bad event in the past month was linked to higher depression rates (95.0% vs. 84.4%, p-value = < 0.001). No significant associations were found with age group, marital status, residency, education, or BMI. [Table 3]

The association between anxiety and socio-demographic characteristics revealed a few notable trends. Gender was significantly associated with anxiety, as a higher percentage of females (97.2%) reported anxiety compared to males (88.9%) (p-value = 0.001). Economic status also showed a significant relationship, with anxiety more prevalent among low-income participants (96.2%) compared to middle-income (87.0%) and high-income (90.9%) groups (p-value = 0.010). No significant associations were found with age group, marital status, residency, education, BMI, or experiencing a bad event in the past month, suggesting that these factors were not strongly linked to anxiety in the study sample. [Table 4]

Table 3. Association of depression with socio-demographic characteristics of the study participants

Characteristic	Categories	Depression		p-value
		Absent, n (%)	Present, n (%)	
Age group	18–49 years	15 (10.4)	129 (89.6)	0.910
	50–95 years	21 (10.0)	188 (90.0)	
Gender	Male	28 (20.7)	107 (79.3)	<0.001
	Female	8 (3.7)	210 (96.3)	
Marital status	Single	1 (33.3)	2 (66.7)	0.188
	Married	32 (10.9)	262 (89.1)	
	Widow/divorced	3 (5.4)	53 (94.6)	
Residency	Urban	23 (10.5)	196 (89.5)	0.809
	Rural	13 (9.7)	121 (90.3)	
Education	Illiterate	26 (11.4)	202 (88.6)	0.279
	Primary school	4 (6.3)	59 (93.7)	
	Secondary school	0 (0.0)	19 (100.0)	
	High school	4 (18.2)	18 (81.8)	
	University	2 (9.5)	19 (90.5)	
Economic status	High-income	2 (18.2)	9 (81.8)	<0.001
	Middle-income	19 (24.7)	58 (75.3)	
	Low-income	15 (5.7)	250 (94.3)	
BMI	Underweight	1 (8.3)	11 (81.7)	0.343
	Normal weight	17 (14.3)	102 (85.7)	
	Overweight	12 (7.8)	142 (92.2)	
	Obesity	6 (8.8)	62 (91.2)	
Bad event occurring in the past month	Yes	9 (5.0)	171 (95.0)	<0.001
	No	27 (15.6)	146 (84.4)	
Total		**36 (10.2)**	**317 (89.8)**	

Table 4. Association of anxiety with the socio-demographic characteristics of the study participants.

Characteristic	Categories	Anxiety		p-value
		Absent, n (%)	Present, n (%)	
Age group	18–49 years	7 (4.9)	137 (95.1)	0.473
	50–95 years	14 (6.7)	195 (93.3)	
Gender	Male	15 (11.1)	120 (88.9)	0.001
	Female	6 (2.8)	212 (97.2)	
Marital status	Single	1 (33.3)	2 (66.7)	0.052
	Married	19 (6.5)	275 (93.5)	
	Widow/divorced	1 (1.8)	55 (98.2)	
Residency	Urban	14 (6.4)	205 (93.6)	0.652
	Rural	7 (5.2)	127 (94.8)	
Education	Illiterate	15 (6.6)	213 (93.4)	0.802
	Primary school	4 (6.3)	59 (93.7)	
	Secondary school	1 (5.3)	18 (94.7)	
	High school	0 (0.0)	22 (100.0)	
	University	1 (4.8)	20 (95.2)	
Economic status	High-income	1 (9.1)	10 (90.9)	0.010
	Middle-income	10 (13.0)	67 (87.0)	
	Low-income	10 (3.8)	255 (96.2)	
BMI	Underweight	0 (0.0)	12 (100.0)	0.110
	Normal weight	12 (10.1)	107 (89.9)	
	Overweight	7 (4.5)	147 (95.5)	
	Obesity	2 (2.9)	66 (97.1)	
Bad event occurring in the past month	Yes	7 (3.9)	173 (96.1)	0.095
	No	14 (8.1)	159 (91.9)	
Total		**21 (5.9)**	**332 (94.1)**	

The association between stress and socio-demographic characteristics revealed several significant factors. Gender showed a strong association with stress, with a higher percentage of females (96.8%) experiencing stress compared to males (81.5%) (p-value < 0.001). Marital status also had a significant relationship, as married participants (89.8%) were more likely to experience stress than single (66.7%) or widowed/divorced individuals (98.2%) (p-value 0.045). Economic status was significantly linked to stress, with low-income participants (94.3%) reporting higher stress compared to middle-income (84.4%) and high-income (54.5%) groups (p-value < 0.001). Additionally, experiencing a bad event in the past month was associated with higher stress levels, as those who experienced a bad event (95.0%) were more likely to report stress compared to those who did not (86.7%) (p-value 0.007). No significant associations were found with age group, residency, education, or BMI. [Table 5]

Table 5. Association of stress with socio-demographic characteristics of the study participants.

Characteristic	Categories	Stress		p-value
		Absent, n (%)	Present, n (%)	
Age group	18–49 years	8 (5.6)	136 (94.4)	0.057
	50–95 years	24 (11.5)	185 (88.5)	
Gender	Male	25 (18.5)	110 (81.5)	**<0.001**
	Female	7 (3.2)	211 (96.8)	
Marital status	Single	1 (33.3)	2 (66.7)	**0.045**
	Married	30 (10.2)	264 (89.8)	
	Widow/divorced	1 (1.8)	55 (98.2)	
Residency	Urban	22 (10.0)	197 (90.0)	0.412
	Rural	10 (7.5)	124 (92.5)	
Education	Illiterate	25 (11.0)	203 (89.0)	0.392
	Primary school	5 (7.9)	58 (92.1)	
	Secondary school	1 (5.3)	18 (94.7)	
	High school	0 (0.0)	22 (100.0)	
	University	1 (4.8)	20 (95.2)	
Economic status	High-income	5 (45.5)	6 (54.5)	**<0.001**
	Middle-income	12 (15.6)	65 (84.4)	
	Low-income	15 (5.7)	250 (94.3)	
BMI	Underweight	0 (0.0)	12 (100.0)	0.382
	Normal weight	14 (11.8)	105 (88.2)	
	Overweight	11 (7.1)	143 (92.9)	
	Obesity	7 (10.3)	61 (89.7)	
Bad event occurring in the past month	Yes	9 (5.0)	171 (95.0)	**0.007**
	No	23 (13.3)	150 (86.7)	
Total		**32 (9.0)**	**321 (91.0)**	

Multiple logistic regression analysis was performed to see which variables predicted depression, anxiety, and stress. The multiple logistic regression analysis of depression, anxiety, and stress in relation to socio-demographic characteristics in Afghanistan revealed several significant findings. Gender was a strong predictor for all three conditions, with females being at significantly higher risk for depression (AOR = 11.01, p-value < 0.001), anxiety (AOR = 4.53, p-value = 0.005), and stress (AOR = 6.77, p-value < 0.001) compared to males. Economic status was also a significant factor, with middle-income individuals having a higher likelihood of experiencing depression (AOR = 5.29, p-value < 0.001) and anxiety (AOR = 3.34, p-value = 0.012) compared to low-income individuals. Traumatic events had a significant association with all three conditions: those who experienced a traumatic event had lower odds of depression (AOR = 0.32, p-value = 0.012) and stress (AOR = 0.37, p-value = 0.020), but the association with anxiety was not statistically significant (p-value = 0.248). Other variables, such as age group, residency, and BMI did not show significant associations with depression, anxiety, or stress in this analysis. [Table 6]

Table 6. Multiple logistic regression analysis of depression, anxiety and stress among the study participants' sociodemographic characteristics in Afghanistan.

Variable	Depression AOR [95% CI]	p-value	Anxiety AOR [95% CI]	p-value	Stress AOR [95% CI]	p-value
Age group						
18–49 years	1.92 [0.83 – 4.44]	0.126	1.01 [0.37 – 2.76]	0.987	0.69 [0.28 – 1.67]	0.409
50–95 years	Reference		Reference		Reference	
Gender						
Male	11.01 [4.06 – 29.81]	**<0.001**	4.53 [1.58 – 12.96]	**0.005**	6.77 [2.73 – 16.78]	**<0.001**
Female	Reference		Reference		Reference	
Economic status						
High-income	4.58 [0.75 – 27.98]	0.099	3.04 [0.33 – 28.45]	0.329		
Middle-income	5.29 [2.36 – 11.87]	**<0.001**	3.34 [1.30 – 8.58]	**0.012**		
Low-income	Reference		Reference			
Residency						
Urban	1.42 [0.62 – 3.22]	0.41	1.49 [0.56 – 3.96]	0.424	1.99 [0.87 – 4.54]	0.104
Rural	Reference		Reference		Reference	
BMI						
Underweight	0.31 [0.03 – 3.52]	0.346				
Normal weight	0.65 [0.20 – 2.11]	0.472				
Overweight	0.53 [0.16 – 1.76]	0.301				
Obesity	Reference					
Traumatic event						
Yes	0.32 [0.14 – 0.78]	**0.012**	0.57 [0.21 – 1.49]	0.248	0.37 [0.16 – 0.86]	**0.020**
No	Reference		Reference		Reference	

Discussion

This cross-sectional study was conducted among 353 type 2 diabetes mellitus patients in Herat province of Afghanistan. In this study, three-quarters (75.1%) of the patients were from families with low socio-economic status. More than half (62.9%) of the study participants were either overweight or obese. Severe/extremely severe depression, anxiety, and stress were present in 73.9%, 84.1%, and 80.5% of the diabetic patients. The main predictors of depression were being female, having low economic status, and having had a bad event in the past month. The main predictors of anxiety were being female and having low economic status. The main predictors of stress were being female, being a widow/divorced, having low economic status, and having had a bad event in the past months. Being a female diabetic patient was a strong predictor for all three conditions of depression, anxiety, and stress.

In 2018, a cross-sectional study was conducted to study the prevalence and predictors of depression, anxiety, and stress among 450 adult type 2 diabetes mellitus (T2DM) patients in Western regions of Saudi Arabia. The prevalence of depression, anxiety, and stress was 33.8%, 38.3%, and 25.5%, respectively. The main predictors of psychological distress in the study were decreased age, female gender, the presence of comorbidities, increased duration since T2DM diagnosis, and increased serum level of hemoglobin A1c (18).

In 2013–2015, a large study among 3170 T2DM patients was conducted in 15 countries of the world. The main objective of the study was to assess the prevalence and associated factors of anxiety disorders among T2DM patients. The overall prevalence of anxiety disorders was 18%. An increased prevalence of anxiety disorders was observed in Ukraine (72.7%), Saudi Arabia (52.2%), and Argentina (37.6%), while a decreased prevalence in Bangladesh (0.0%) and India (0.5%). The main factors associated with increased anxiety disorder were female gender, the presence of diabetic complications, and increased HbA1c levels in the study participants (19).

In 2022, a study was conducted in West Bengal state of India to determine the prevalence and associated factors of depression and anxiety among 152 diabetic patients. The prevalence of depression

was 39.5%, while anxiety was 36.2%. The main factors associated with depression were low income, urban residence, being unmarried, on insulin therapy, presence of retinopathy, and having ischemic heart disease. Meanwhile, the main associated factors of anxiety among diabetic patients were being married, literate, and having diabetic complications such as neuropathy, retinopathy, and ischemic heart disease (20).

In 2020, a multicentric cross-sectional study was conducted in five hospitals in Fayoum, Egypt, to assess the prevalence and associated factors of anxiety and depression among 679 diabetic patients. Among these patients, 34.2% had depression and 38% had anxiety. The main factors with increased prevalence of depression among diabetic patients were age >50 years, anxiety, and the presence of neuropathy, sexual dysfunction, and coma or spasm. Meanwhile, the only factor associated with increased anxiety among diabetic patients was the presence of depression (21).

In our study, the prevalence of anxiety, depression, and stress was much higher than in the above-mentioned studies. The main reasons behind this increase could be increased poverty, not allowing females to study or do jobs in Afghanistan, increased illiteracy rate, decreased health education regarding diabetes, and decreased availability of better diagnostics and treatment facilities for the common people, especially females.

This study had a few limitations. First, data for this study was collected from Herat province only, one of the 34 provinces of Afghanistan. So, we cannot generalize our results to the diabetic patients of the entire Afghanistan. Second, we collected data through face-to-face interviews. Therefore, there are more chances of recall bias. Third, we did not include many important associated factors, such as the presence of comorbidities of diabetes mellitus, duration of the T2DM, complications of T2DM, and HbA1c levels of the study participants. Fourth, it was a cross-sectional study. So, we could not draw long-term conclusions from the results of this study.

Conclusion and recommendation

Depression and anxiety are highly prevalent among diabetic patients in Herat province of Afghanistan. Factors associated with depression were being female, having low economic status, and having had a bad event in the past month. The main predictors of anxiety were being female and having low economic status. The main predictors of stress were being female, being a widow/divorced, having low economic status, and having had a bad event in the past months. It is highly recommended that all diabetic patients who seek medical contact should be screened for depression, anxiety, and stress, especially those with predisposing factors. There is an intense need for more studies, especially prospective cohort studies, to be conducted in all 34 provinces of Afghanistan (both rural and urban areas) to find out the real burden and risk factors of depression, anxiety, and stress among the Afghan population.

Declarations

Ethical approval and consent to participate

The present study was granted ethical approval by the Ethical Committee of the Afghanistan Center for Epidemiological Studies, under reference number #23.1.052. Prior to participant involvement, the study's objectives were comprehensively explained. Informed consent was obtained from all participants before their participation, and they were made aware of their right to withdraw from the study at any stage. All procedures adhered strictly to relevant ethical standards and regulatory guidelines.

Conflict of interest

The authors assert that there are no conflicts of interest to disclose.

Author contributions
- MNN designed the study.
- MNN contributed to the data collection of this study.
- MN analyzed the data.
- AQM, MR, NR, and MN prepared the draft of the manuscript.
- MNN critically reviewed, rewrote, edited, and finalized the manuscript.
- All authors reviewed the manuscript.

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