Original Article

Factors associated with high stress levels in adults with diabetes mellitus attending a tertiary diabetes care center, Chennai, Tamil Nadu, India

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ABSTRACT

Objective: We aimed to determine perceived stress levels among adults aged >20 years with type 2 diabetes mellitus (DM) in a tertiary care diabetes center, Chennai, Tamil Nadu, India, assess their association with sociodemographic and clinical characteristics and assess the possible risk factors for stress and coping strategies. **Methods:** A mixed-methods (triangulation design) study with quantitative methodology (survey) and qualitative methodology (interviews) was carried out. Stress levels were assessed among type 2 DM patients attending a diabetes clinic using a 5-point perceived stress scale-10. One-on-one interviews were carried out with 376 participants with DM having high/very high stress levels to understand the reasons for perceived stress and explore their coping mechanisms. **Results:** The prevalence of high/very high stress was 35% among DM patients. Age 30–40 years, working in professional jobs, and lack of physical activity were factors significantly associated with stress. The perceived major stress inducers were related to family, work, financial issues, and the disease itself. **Conclusions:** This study showed high levels of stress in more than one-third of DM patients. Potential solutions include regular, formal assessment of stress levels in the clinic, providing integrated counseling and psychological care for DM patients, and promoting physical activity.

Key words: Diabetes mellitus, India, perceived stress score, physical activity

Introduction

Diabetes mellitus (DM) is one of the most common noncommunicable diseases in the world. According to the International Diabetes Federation estimates, around 415 million people had DM in 2015 and this number is expected to rise to 642 million by 2040.[1] Around 75% of participants with DM live in low- and middle-income countries.[1] In financial terms also the global burden of DM is enormous, with an estimated annual expenditure in 2015 of USD$ 673 billion dollars, which constituted 12% of global health spending for that year.[1]

India with 69.1 million people is estimated to have the second-highest number of cases of DM in the world

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after China in 2015.[1] The prevalence of DM in India ranges from 5% to 17%, with higher levels found in the Southern part of the country.[2-4] DM continues to increase as a result of rapid cultural and social changes, which include aging populations, increasing urbanization, dietary changes, reduced physical activity, and unhealthy behaviors.[3,5] Historically, a disease of the affluent, recent epidemiological evidence indicates a rising DM incidence and prevalence in urban India's middle class and working poor.[6]

Individuals with chronic illnesses such as DM are reported to have comorbid unrecognized mental health disorders.[7] DM patients in India have one of the lowest levels of psychological well-being, based on the World Health Organization (WHO) Well-being Index, with 41% reported as having poor psychological well-being, especially among the lower-income group.[8] The International Diabetes Federation has also stressed the importance of integrating psychological care in the management of DM.[9] Stress may lead to deterioration of glycemic control through its effects on the neuroendocrine system, and it may impact indirectly because of a change in health-related behavior.[10,11] There is a general lack of understanding regarding the levels of stress, their associated characteristics, and the reasons for stress among DM patients.

The present study was carried out to determine perceived stress levels among adult participants (aged >20 years) with type 2 DM at Chennai, Tamil Nadu, India, to assess their association with sociodemographic and clinical characteristics, glycemic control, and comorbidities and assess the possible risk factors for stress and the possible coping strategies to manage stress.

Methods

Study design

This was a mixed methods study of triangulation design with a cross-sectional quantitative component (survey) and a descriptive qualitative component (interviews).

General setting

Chennai, along the coast of the Bay of Bengal, is the capital city of the state of Tamil Nadu. It is the biggest industrial and commercial center in South India, and a major cultural, economic, and educational center. It is the sixth largest city and the fourth most populous metropolitan area in the country with more than 8 million people. Large-scale studies have shown a higher prevalence of DM in South India, especially in urban pockets such as Chennai, when compared to the rest of the country.[3,4]

Study population and sample size

For the quantitative component of the study, the study population consisted of new or already registered patients with type 2 DM attending tertiary diabetes center in Chennai during a 4-month period from January to April 2016. DM patients who were waiting in the general outpatient hall were randomly selected and interviewed after getting informed consent, and on an average 5–10 participants were interviewed a day. Those with a known medically diagnosed psychiatric illness in the past (verified with medical records), with any form of cognitive impairment such as dementia or mental retardation, any female in the postpartum period, and participants unable to give consent were excluded from the study. For the qualitative component of the study, patients with DM recorded as having high levels of stress on the perceived stress scale (PSS) had one-on-one interviews.

Based on 80% power, a Type I error of 0.05, assuming a prevalence of stress among type 2 DM patients to be 13%.[12] An absolute precision of 3% and a nonresponse of 10%, a sample size of 400 participants with DM was calculated.

Data variables and collection

Phase 1: Quantitative data collection

Sociodemographic characteristics, anthropometric, clinical and biochemical parameters, and specified comorbidities were collected as exposure variables from the electronic patient record system maintained in the hospital. Current smoking was defined as one or more cigarettes smoked in the last month and current alcohol drinking as any alcohol taken at any time in the last month. Body mass index (BMI) was calculated using the formula, weight in kg/height in square meters. Blood test measurements were taken as the last recorded blood test in the patient case files: high serum cholesterol was defined as ≥200 mg/dl and uncontrolled DM as glycated hemoglobin (HbA1c) >7.0%.

The outcome variable (perceived stress) was obtained using a 10-item PSS.[13] Respondents were asked questions about their feeling and thoughts during the last month, and they were also asked to indicate how often they felt these thoughts on a 5-point scale that ranged from 0 (never) to 4 (very often) [Box 1]. Participants with DM were then categorized into the following stress score levels: very low (score 0–7), low (score 8–11); average (score 12–15), high (score 16–20), and very high (score 21 up to 40).

Phase 2: Qualitative data collection

Personal interviews were carried out on DM patients recorded as having high levels of stress (≥16 on the PSS) and willing to participate in the interviews to understand the possible risk factors for stress and explore their coping

Box 1: Perceived stress scale-10

Questionnaire items	Never	Almost never	Sometimes	Fairy often	Very often
In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
In the last month, how often have you felt confident about your ability To handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Adapted from Norris *et al*.[20] The questions in the PSS ask about feelings and thoughts during the last month. In each case, respondents are asked how often they felt a certain way. The PSS consists of multiple choice questions. Items include choice on a 5-point scale. Each item is rated for the past month on a 5-point Likert-type scale (0=never to 4=very often).The points corresponding to each level of the scale are marked with bold-faced brackets: [0], [1], [2], [3], or [4]. Items number 4, 5, 7, and 8 require reverse coding. To compute the total assessment score, sum all scale items. Total scores will range from 0 to 40, with higher scores indicating greater overall distress. Perceived stress scores are categorized based on the scores: Very low=0-7; low=8-11; average=12-15; high=16-20; very high=21-40. PSS: Perceived Stress Scale

mechanisms. For the purpose of the study, coping was defined as the process of spending conscious effort and energy to minimize or tolerate stress and stressors that occur in everyday life.[14] Before each interview, the study details were explained to the participants. The interviews were conducted by an investigator who is well trained in qualitative research in the local language (Tamil). Each interview took 10–20 min. The participants were informed of the purpose of the study, and only the participant and the researcher were present during the interview. An interview guide with broad open-ended questions was used to conduct the interviews.

Analysis and statistics

Quantitative

Data were double-entered and validated in EpiData (version 3.1, EpiData Association, Odense, Denmark) and analyzed in EpiData analysis version 2.2.2.183. The Items numbers 4, 5, 7, and 8 were coded reversely in the PSS before analysis was done. The Chi-square test was used to study the association between sociodemographic and clinical variables and high or very high levels of perceived stress. Prevalence ratios (PRs) and their 95% confidence intervals were calculated to establish the strength of their association. Variables (age, occupation, and physical activity) showing associations at $P \leq 0.2$ were then included in a multivariate regression model to calculate adjusted PRs. The level of significance was set at 5%.

Qualitative

The primary investigator noted down the proceedings of the interviews. Manual content analysis of the transcripts was done according to standardized guidance.[15,16] The participants' responses were validated by the principal investigator. These were reviewed by a second investigator to reduce subjective interpretation. The findings were reported using "Consolidated Criteria for Reporting Qualitative Research (COREQ)" guidelines.[17]

Ethics

Permission for the study was obtained from the Institutional Ethics Committee of the Madras Diabetes Research Foundation (MDRF), Chennai and the Union Ethics Advisory Group, the International Union against Tuberculosis and Lung Disease, Paris, France. Informed consent was obtained from eligible DM patients and those consenting were interviewed.

Results

Quantitative

A total of 406 participants with DM were recruited and interviewed, but 36 were excluded due to some clinical information missing from the electronic data file. Patients with DM who were included in the study (The sociodemographic and clinical characteristics of the 367 participants) are shown in Table 1. Nearly half of the patients were aged 60 years and above, there were a higher proportion of males, 80% had been educated to secondary school level or above, 40% were unemployed/retired, and the majority was married. The majority of the participants had never smoked or drank alcohol and nearly two-thirds engaged in moderate exercise. Over 80% had normal cholesterol levels, over 50% had HbA1c

Table 1: Sociodemographic and clinical characteristics of patients with diabetes mellitus attending a diabetes specialty hospital, Chennai, India: January to April 2016

Characteristics	*n* (%)
Total	370 (100)
Age group in years	
30-40	13 (3.5)
41-50	64 (17.3)
51-60	121 (32.7)
61 and above	172 (46.5)
Gender	
Male	214 (57.8)
Female	156 (42.2)
Education	
None	10 (2.7)
Primary school	62 (16.9)
Secondary school	126 (34.3)
Undergraduate	128 (34.9)
Postgraduate	31 (8.4)
No record	13 (2.7)
Occupation	
Professional/corporation	33 (8.9)
Medium business	100 (27.0)
Skilled manual labor	20 (5.4)
Household and domestic	62 (16.8)
Unemployed/retired	147 (39.7)
Other	4 (1.1)
No record	4 (1.1)
Marital status	
Single	2 (0.5)
Married	341 (92.2)
Widower	24 (6.5)
Missing data	3 (0.8)
Smoking status	
Current smoker	18 (4.9)
Ex-smoker	30 (8.1)
Never smoked	319 (86.2)
Missing data	3 (0.8)
Alcohol	
Current alcohol drinker	52 (14.1)
Ex-drinker	15 (4.1)
Never	300 (81.1)
Missing data	3 (0.7)
Physical activity	
Moderate	233 (63.0)
None	134 (36.2)
Missing data	3 (0.8)
Body mass index (kg/m2)	
<18.5	6 (1.6)
18.5-22.9	42 (11.4)
23-25	78 (21.1)
>25	240 (64.9)
Missing data	4 (1.1)
Serum cholesterol mg/dl	
≥200	46 (12.4)
<200	314 (84.9)
No data	10 (2.7)
Glycated hemoglobin (%)	
≤7.0	160 (43.2)
>7	208 (56.2)
No data	2 (0.5)
Complications	
Yes	253 (68.4)
No	117 (31.6)
Duration of diabetes (years)	
<5	71 (19.2)
5-10	68 (18.4)
>10	227 (61.4)
No data	4 (1.1)

concentrations >7.0%, over 60% had >25 BMI, and had more than 10 years of diabetes.

The distribution of perceived stress scores in the 367 participants with DM is shown in Figure 1. The scores ranged from 1 to 25. There were 118 participants (32%) with high scores and 11 (3%) with very high scores. Sociodemographic and clinical characteristics in association with high or very high stress scores are shown in Table 2. On univariate analysis, the factors significantly associated with high/very high stress were age 30–40 years, having a professional work, and lack of physical activity. After multivariate regression, age 30–40 years, working in a professional job, and lack of physical activity were still found to be significantly associated with high/very high stress.

Qualitative

A total of 14 patients with DM were interviewed: Nine were males, and the mean age was 56 ± 14 years. Table 3 shows the major themes and reasons for stress and the coping strategies adopted during times of stress. Under perceived reasons for stress, the major themes were family-related (conflicts within the family, family members not obeying instructions, and too many responsibilities); job-related (nature of the work and working hours); financial (lack of monetary resources and not being able to make ends meet), and disease-related (chronicity of the illnesses). Four dominant ways of coping emerged: seeking support from family members and friends, various techniques of relaxation, physical activity, and recreation.

Discussion

This study showed that 35% of DM patients seen in a tertiary diabetes care clinic in Chennai, Tamil Nadu, India report high to very high stress level. Being aged 30–40 years, working in professional jobs, and lack of physical activity were found to be significantly associated with stress in the study. These findings on the quantitative analysis were further confirmed through the one-to-one interviews where family conflict, workplace issues, financial concerns, and disease-related issues were noted to also contribute to high stress levels.

Table 2: Stratification of diabetes mellitus patients with stress based on various parameters

Characteristic	Number	*n* (%) with high/very high stress score	PR (95% CI)	*P*	aPR (95% CI)	*P*
Total	367	129 (35)				
Age group (years)						
30-40	13	9 (69)	2.5 (1.6-3.8)	0.002	2.9 (1.8-6.3)	0.01
41-50	64	26 (41)	1.4 (0.9-2.1)	0.06	1.6 (0.9-2.5)	0.1
51-60	121	46 (38)	1.3 (0.9-1.9)	0.07	1.5 (0.9-2.0)	0.15
61 and above	171	48 (28)	Reference		Reference	
Gender						
Male	156	51 (33)	Reference	0.46		
Female	214	78 (36)	1.1 (0.8-1.5)			
Occupation						
Professional	33	17 (52)	1.8 (1.2-2.8)	0.008	2.2 (1.1-3.4)	0.04
Medium business	100	31 (31)	1.1 (0.8-1.6)	0.60	1.0 (0.5-1.9)	0.93
Skilled manual labor	20	11 (55)	2.0 (1.2-3.2)	0.01	1.8 (0.9-2.9)	0.08
Household/domestic	62	27 (44)	1.6 (1.1-2.3)	0.03	1.6 (0.8-2.5)	0.16
Unemployed/retired	147	41 (28)	Reference		Reference	
Marital status						
Married	341	123 (36)	2.2 (0.9-5.3)	0.054		
Widower	24	4 (17)	Reference			
Smoking status						
Current smoker	18	11 (61)	1.3 (0.9-1.9)	0.3		
Ex-smoker	30	13 (43)	0.9 (0.61.4)	0.6		
Never smoked	319	153 (48)	Reference			
Alcohol use						
Current alcohol drinker	52	23 (44)	0.9 (0.7-1.3)	0.5		
Ex-drinker	15	7 (47)	1.0 (0.5-1.6)	0.9		
Never	300	147 (49)	Reference			
Physical activity						
Moderate	233	73 (31)	Reference		Reference	
None	134	56 (42)	1.4 (1.1-1.8)	0.04	1.7 (1.1-2.4)	0.03
BMI (kg/m^2)						
<18.5	6	3 (50)	Reference			
18.5-22.9	42	12 (27)	0.6 (0.3-1.4)	0.23		
23-25	78	24 (31)	0.8 (0.4-1.9)	0.63		
>25	239	89 (37)	0.6 (0.3-1.5)	0.30		
Serum cholesterol (mg/dl)						
≥200	46	11 (25)	Reference			
<200	314	112 (36)	1.5 (0.9-2.6)	0.11		
Glycated hemoglobin (%)						
≤7.0	158	53 (34)	Reference			
>7.0	208	76 (37)	1.1 (0.8-1.4)	0.55		
Complications						
Yes	115	35 (30)	1.2 (0.9-1.7)	0.21		
No	252	94 (37)	Reference			
Duration of diabetes (years)						
<5	71	31 (44)	Reference			
5-10	68	25 (37)	0.8 (0.6-1.3)	0.41		
>10	227	72 (32)	0.7 (0.5-1.0)	0.06		

PR: Prevalence ratio, aPR: Adjusted prevalence ratio, BMI: Body mass index, CI: Confidence interval

Earlier studies have shown the prevalence of stress among participants with DM to range from 12% to 23% although these studies have used different scales to measure stress levels.[12,18,19] These findings suggest that stress is a critical issue among participants with DM, and one that deserves to be identified and managed as part of comprehensive care.

Physical activity is known to promote feelings of well-being and reduce stress.[20] Several plausible mechanisms for how physical inactivity affects mental well-being have been proposed with the effects probably mediated through increased release of β-endorphins and brain neurotransmitters (e.g., serotonin, dopamine, and norepinephrine).[21] In our study, it was apparent that participants who indicated no physical activity were at risk of high levels of stress. This is in line with other studies showing positive associations between lack of physical activity and poor mental well-being such as stress, depression, and anxiety.[12,21-23] Physical activity

Table 3: Major reasons for stress that emerged from the qualitative study and possible solutions

Perceived reasons for stress	Coping strategies adopted	Possible solutions
Family related	Seeking support	Role of family caregiver
Family conflicts	Support from family	Role of a counselor
Family members/children not obeying instructions	Support from friends	Relaxation techniques as part of counseling
Too many responsibilities	Relaxation	Promote physical activity
Job related	Close your eyes	or recreation
Nature of work	Deep breathing	Create enabling environment
Work hours	Take rest/sleep	
Financial reasons	Pray	
Lack of monetary resources	Meditate	
Not able to make ends meet	Be alone	
Disease (DM) related	Physical activity/recreation	
Chronicity of the problem	Go out	
	Watch TV	
	Engage in work	
	Play with children	
	Listen to songs	

DM: Diabetes mellitus

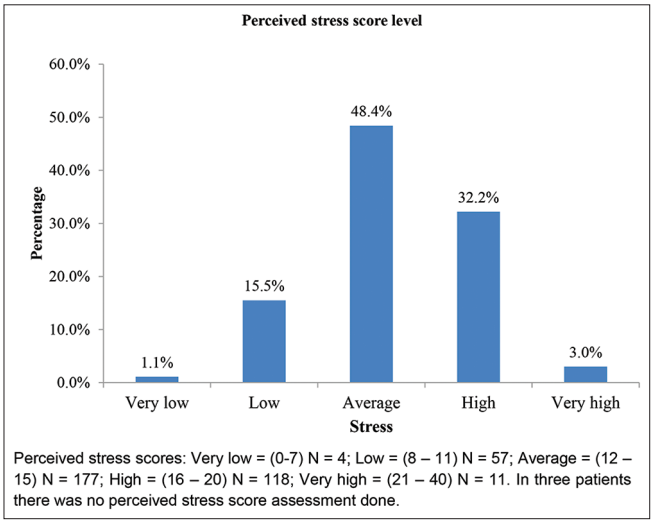

Figure 1: Perceived stress levels of persons with diabetes mellitus attending a diabetes specialty hospital, Chennai, Tamil Nadu, India: January to April 2016

and recreation were also reported as a coping strategy by patients with DM having stress.

In our study, participants engaged in professional jobs or business were found to have higher stress levels, similar to what has been found in other studies.[18,24,25] These findings were also verified through the one-on-one interviews during which job-related factors were recognized and acknowledged as one of the major reasons for stress.

Stress due to the disease itself, i.e., DM, was reported by some participants. This was found to be common, and providers generally recognized that patients were concerned about the chronic and potentially long-term complications of the disease and that these issues interfered with their self-management efforts.[8]

This study has several programmatic implications for a tertiary care clinic looking after patients with DM. First, given the prevalence of stress in the study population, all patients who attend the clinic should be formally and regularly assessed, maybe once a year, using simple instruments such as the perceived stress score system. This could help to identify those with high stress levels who need further attention. Second, special counseling services should be offered to those with high levels of stress, and these services could include advice about regular physical activity, teaching methods of relaxation, and further engaging the help of family and/or friends. Third, aggressive management of risk factors for cardiovascular or cerebrovascular disease would be of benefit to the whole clinic population, and one of these would be more attention given to help DM patients lose weight and engage in more exercise which may result in reducing disease-related comorbidity and mortality.[26,27]

The strengths of this study are that it is a mixed method methodology and the adherence to COREQ and Strengthening the Reporting of Observational Studies in Epidemiology guidelines in reporting of the study results.[17,28] There are, however, a few limitations. First, this being a cross-sectional design, causal pathways underlying the reported associations cannot be ascertained. Second, being a clinic-based study, referral bias could have affected the results. Finally, there was no control group, so we do not know whether the prevalence of stress levels is similar in the general population.

Conclusions

Nearly, one-third of the participants with DM seen at a tertiary diabetes clinic in Southern India had high stress levels. This underscores the need for psychological care

and counseling at diabetes centers and people with diabetes in general.

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Conflicts of interest

There are no conflicts of interest.

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