

Access this article online

Quick Response Code:



Website:
www.jehp.net

DOI:
10.4103/jehp.jehp_388_20

“Perceived stress” and its associated factors among diabetic patients receiving care from a rural tertiary health care center in South India

Gowshik M. Siddharthan, Mahendra M. Reddy¹, Bagepally N. Sunil¹

Abstract:

BACKGROUND: “Stress” acts as both etiological link and also as an outcome in the case of diabetes mellitus. There is a paucity of literature regarding stress levels and also factors associated with it among diabetic patients in India.

OBJECTIVE: To assess the perceived stress levels and their associated factors among diabetic inpatients in a rural tertiary health care center, South India.

MATERIALS AND METHODS: A facility-based cross-sectional analytical study was conducted among inpatient diabetics seeking care at a rural tertiary care center in Kolar district of Karnataka. A pre-tested semi-structured questionnaire was used to capture the sociodemographic, disease-related, treatment-related and behavior-related characteristics of the inpatients. The outcome of “perceived stress” was captured using a standard questionnaire of Cohen Perceived Stress Scale–10. Poisson regression was used for multivariable analysis, and the association was expressed as prevalence ratio with 95% confidence intervals (CI).

RESULTS: Out of the 247 study participants analysed, “perceived stress” was seen among 97 (39.3%) of the participants (95% CI: 33.3%–45.5%). Multivariable analysis showed that factors like younger age, lesser duration of diabetes, presence of any comorbidity, being underweight, having conflicts at work place/home in the last 1 month, and not having enough money for treatment had shown higher levels of “perceived stress.”

CONCLUSION: About two out of five inpatient diabetics seeking care from rural tertiary health centres had shown to have “perceived stress.” There is a need for the inclusion of stress management techniques in the diabetes education program at all levels of health-care systems.

Keywords:

Depression, health education, psychiatry, psychological morbidity, self-care

Introduction

Non-communicable diseases are on a constant rise, especially in Low- and Middle-Income Countries (LMICs) like India, compared to high-income countries.^[1] Globally, there are 463 million people with diabetes mellitus. In India, age-adjusted prevalence of diabetes among adults (20–79 years) was estimated to be 11.3%, which meant presence of 88 million diabetic individuals.^[2] Chronic

diseases such as diabetes and hypertension lead to higher healthcare costs due to loss of productivity from sickness absenteeism, and premature mortality of economically productive groups.^[3]

A cross-sectional study done among diabetics in 13 countries showed that about 41% of them had poor psychological well-being.^[4] Patients with diabetes experience stress in their life as there is a need for adherence to medications for several years and also due

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Siddharthan GM, Reddy MM, Sunil BN. “Perceived stress” and its associated factors among diabetic patients receiving care from a rural tertiary health care center in South India. *J Edu Health Promot* 2021;10:11.

Undergraduate Student,
Sri Devaraj Urs Medical
College, Sri Devaraj
Urs Academy of Higher
Education and Research,
Kolar, Karnataka,
India, ¹Department of
Community Medicine,
Sri Devaraj Urs Medical
College, Sri Devaraj
Urs Academy of Higher
Education and Research,
Kolar, Karnataka, India

Address for correspondence:

Dr. Mahendra M. Reddy,
Department of Community
Medicine, 2nd Floor,
Administrative Block,
Sri Devaraj Urs Medical
College, Sri Devaraj
Urs Academy of Higher
Education and Research,
Tamaka, Kolar - 563 103,
Karnataka, India.
E-mail: mahendrabmc@gmail.com

Received: 18-04-2020
Accepted: 04-09-2020
Published: 28-01-2021

to the requirement of lifestyle changes related to diet and physical activities.^[5-7] Stress has been established to be the etiological link as well as an outcome in diabetes mellitus.^[8-10]

Several studies have shown that stress can alter the metabolism of glucose and thus alter the glycemic status of the diabetic patients.^[11,12] Stress has not only shown to increase the risk of diabetes but also contributes to physical inactivity and difficulties in getting rid of habits like tobacco and alcohol use.^[13] Trials conducted in various parts of the world have proved improvements in the glycemic status among diabetics, through stress combating techniques like “mindfulness based stress reduction.”^[14-18]

There is a paucity of literature from rural India regarding the stress levels existing among the diabetic patients and also factors associated with such stress. An estimate of stress levels can help in setting priorities in mental health-related interventions, especially among persons with chronic diseases like diabetes mellitus. Moreover, identifying the factors that lead to stress among diabetes can help in planning preventive measures appropriate for various risk groups and at different levels of health care. This could also help in decreasing the burden of behaviour related problems like physical inactivity, tobacco, and alcohol use among individuals with diabetes as well as those at risk.

In view of the availability of scanty data on the stress levels existing among the diabetic patients in the rural area and at the same time, the potential for application of such information in public health, this study was undertaken to assess the perceived stress levels and factors associated with it among diabetic inpatients in a rural tertiary care setting.

Materials and Methods

A facility-based cross-sectional analytical study was conducted during August–September’ 2018 among diabetic in-patients in a tertiary health-care center in South India. This center is a medical college hospital situated in rural area catering to the majority of the population that are dependent on agriculture for their livelihood and belong to the lower socioeconomic class. The hospital has a 1000-bedded facility with access to 24 × 7 multi-specialty care with major diabetic in-patient admission to the Departments of General Medicine and General Surgery. All the patients with known history of diabetes of any duration and admitted under the Departments of Medicine and Surgery were included in the study. Diabetes patients with any history of psychiatric morbidity were excluded. All diabetics who were admitted to intensive care unit and those patients

who were critically ill and thus unable to respond to the questionnaire were also excluded from the study.

With a previous study reporting 22.1% of diabetics having stress,^[19] and considering absolute precision of 5%, the minimum sample size was calculated to be 265 (developed by Department of Biostatistics, Christian Medical College, Vellore, India).

Sociodemographic details, disease-related factors, treatment-related factors, personal and behavioral factors associated with stress were captured using a pre-tested semi-structured questionnaire (in context to the previous 1 month of the interview).

Cohen Perceived Stress Scale – 10 (PSS–10) was used to capture the perceived stress levels among diabetic patients. PSS-10 is one of the more popular tools for measuring psychological stress. It is a self-reported questionnaire that was designed to measure “the degree to which individuals appraise situations in their lives as stressful.”^[20] The PSS items are general in nature rather than focusing on specific events or experiences. PSS–10 was chosen over PSS–14 or PSS–4 due to its superior psychometric properties. A review of over 12 studies using PSS–10 has shown that both Cronbach’s alpha and Test-retest reliability were >0.7.^[21]

Prior to the study, ethical approval was obtained from the Institutional Ethics Committee (No. SDUMC/KLR/IEC/33/2018-19). All patients were interviewed at the time of their stay in the hospital. Interview was done by a single person who was well trained with the administration of PSS–10. Informed written consent was obtained from all the study participants before the start of the interview. Height was measured using stadiometer (accuracy of 0.1 centimeters) and weight using an electronic weighing scale (accuracy of 0.1 kg). Blood pressure (BP) was measured in the right arm after making the patients sit for 3 min with their back and arm supported. The second reading was repeated after 3 min only if BP recording was high ($\geq 140/90$ mmHg). Digital BP measuring apparatus was used to record BP (Omron BP Monitor, Model: HEM-8712).

Operational definitions

Good family care

Having support from any of the family member to take regular medications, undergo investigations, and continue with optimal physical activity and dietary practices.

Current tobacco use

Use of tobacco in any form at least once during the preceding 1 month of the interview.

Current alcohol use

Intake of alcohol (any quantity) at least once during the preceding 1 month of the interview.

Stress

All those who had a cumulative PSS-10 score of “20 and above” were considered as having “stress.” Since there is no given standard cut-off PSS scores and various studies using different cutoffs; we have chosen a more than or equal to 50% PSS score as the cut-off to define an individual having “stress.”

Normal blood pressure status

Systolic BP <140 mm Hg and Diastolic BP <90 mm Hg.

Normal glycemic status

Random Blood Sugar level <200 mg/dl.

Data were single entered using EpiData software version 3.1 (EpiData Association, Odense, Denmark). Data were analyzed using EpiData Analysis V.2.2.2.178. and Stata statistical software version 11 (StataCorp LP, College Station, TX, USA). Continuous data such as age were expressed using the mean (standard deviation [SD]). All the categorical data were expressed in counts (percentage). The association between perceived stress and socio-demographic details, disease-related factors, treatment-related factors, personal and behavioral factors was analyzed using bivariate logistic regression. The variables which were found to be significant in bivariate regression were included in the multivariable analysis. Poisson regression was used for multivariable analysis, and the association was expressed as Prevalence Ratio with 95% Confidence Interval (CI). A value of $P < 0.05$ was considered statistically significant in the multivariable analysis.

Results

During the period of study a total of 264 in-patient diabetics who met the inclusion criteria and gave written consent for participation were interviewed. Of the total 264 diabetics, 17 had missing information and thus were excluded from the final analysis. Thus, a total of 247 in-patient diabetics were analyzed and all the results are reported for $n = 247$. Of the 247 study participants, mean (SD) age was 55.4 (13.3) years and 166 (67.2%) were males. The detailed sociodemographic characteristics are shown in Table 1.

Of the 247 study participants, 104 (52.1%) had at least one comorbidity, and about half of the study participants (38.1%) had diabetes for at least 5 years. Abnormal BP readings were noted in 21.5%, whereas 56.7% of them had abnormal random blood sugar levels. The detailed disease, treatment, personal, and behavioral characteristics are shown in Table 2.

Perceived stress was seen among 97 (39.3%) of the participants (95% CI: 33.3%–45.5%). Multivariable

Table 1: Sociodemographic characteristics of inpatient diabetics seeking care in a rural tertiary care center in South India (n=247)

Sociodemographic characteristic	Frequency, n (%)
Age (years)	
≤40	28 (11.4)
41-59	117 (47.3)
≥60	102 (41.3)
Gender	
Male	166 (67.2)
Female	81 (32.8)
Years of schooling	
No formal education	19 (7.7)
1-7	87 (35.2)
8-10	102 (41.3)
>10	39 (15.8)
Occupation	
Unemployed (includes homemaker)	86 (34.8)
Employed	161 (65.2)
Marital status	
Currently married	217 (87.8)
Others [#]	30 (12.2)
Socioeconomic status [*]	
Class I	21 (8.5)
Class II	51 (20.7)
Class III	69 (27.9)
Class IV	84 (34.0)
Class V	22 (8.9)
Family type	
Nuclear	142 (57.5)
Joint	105 (42.5)

^{*}Modified B G Prasad classification for January 2018, [#]Include unmarried/widowed/separated/divorced

analysis showed that people aged ≤40 years, duration of diabetes being ≤1 year or a duration between 6 and 10 years, presence of any comorbidity, being underweight, having conflicts at workplace/home in the previous 1 month, and not having enough money for treatment had higher perceived stress after adjusting for all other variables in the model [Table 3].

Discussion

The current study highlights the fact that perceived stress is higher among the in-patient diabetics seeking care from a rural tertiary care center (39%). Age ≤40 years, lesser duration of diabetes (≤10 years), presence of any comorbidity, being underweight, having conflicts at the workplace/home and not having enough money for treatment were found to be independently associated with having high perceived stress.

A study done in 17 high-income countries and LMICs which including India, reported 9.8% of diabetics to be under permanent stress (assessed using two semi-structured questions).^[22] A study conducted in Mangalore, Karnataka, among type 2 diabetic patients

Table 2: Disease, treatment, personal, and behavioral-related characteristics of in-patient diabetics seeking care in a rural tertiary care center in south India (n=247)

Study characteristic	n (%)
Duration of diabetes (years)	
≤1	70 (28.3)
1-≤5	83 (33.6)
6-≤10	51 (20.7)
>10	43 (17.4)
Treatment for diabetes	
OHA's alone	88 (35.6)
OHA's + insulin	135 (54.7)
Insulin alone	24 (9.7)
Associated comorbidity*	
None	143 (57.9)
One	67 (27.1)
Two	26 (10.5)
>Two	11 (4.5)
BMI#	
Under-weight	13 (5.3)
Normal	57 (23.1)
Overweight	36 (14.5)
Obese	141 (57.1)
Glycemic status [§]	
Normal	107 (43.3)
Abnormal	140 (56.7)
BP status [†]	
Normal	194 (78.5)
Abnormal	53 (21.5)
Tobacco use	
Yes	30 (12.2)
No	217 (87.8)
Alcohol use	
Yes	21 (8.5)
No	226 (91.5)
Good family care	
Present	214 (86.6)
Absent	33 (13.4)
Conflicts at work place/home	
Present	86 (34.8)
Absent	161 (65.2)
Disturbed sleep	
Present	118 (47.8)
Absent	129 (52.2)
Have enough money for treatment	
Yes	78 (31.6)
No	169 (68.4)

*Includes hypercholesterolemia/heartdisease/asthma/hypothyroid/hyperthyroid, #BMI classification for Asian population, [§]Random blood sugar <200 mg/dl is normal, [†]Abnormal BP → systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg. OHA=Oral hypoglycemic agents, BMI=Body mass index, BP=Blood pressure

showed 22.1% of diabetics had stress (assessed using PSS-10).^[19] Studies done outside India in various countries such as China, Malaysia, Croatia, and Japan have shown varying levels of stress among diabetics ranging from 7% to 15.2% (using different scales of assessment).^[23-25]

A recent study from a tertiary care center in Chennai reported a prevalence of 35% (using the PSS-10 scale), which was almost similar to our study.^[26] The similarity may be attributed to almost similar settings, use of the same questionnaire with almost the same cutoff and also being closely contemporary in the timeline of the study (done in 2016). The differences in the findings as compared to other studies may be attributed to the fact that the current study was done in rural tertiary care setting with different background of patient pool and also the use of different tools for measuring stress levels other than PSS-10. The difference in the findings in studies which used the same questionnaire can also be attributed to the usage of different cutoffs in scores to define stress. Such differences in findings also call for studies to be taken up at the regional level so that the actual burden estimates could be revealed and hence, the need for such studies cannot be overemphasized.

The Chennai study which is similar to this study has shown higher levels of stress among younger age group as compared to the elderly. The study, however, did not show any difference across gender, although it revealed that people who were employed had a higher burden of stress.^[26] The younger age group usually tend to have difficulty in being adherent to the prescribed treatment and also the notion of taking medications for life-long may potentially alleviate their stress levels as compared to the elderly. This could also be the reason for the association between lesser disease duration and higher stress levels as there are lesser coping mechanisms at the initial phase of the disease. Studies from other countries showed that females were at a higher risk of having stress compared to males.^[24,25,27] The difference in the findings could be due to the different set of roles played by the female gender in India and also due the variability in the study age group (current study having a mean age of about 55 years). Furthermore, the sample size in the current study may not be able to detect the existing difference. The same reason could also be operational in our study for not being able to reveal a statistically significant difference in terms of education, occupation, and marital status categories, although there are differences across the subgroups in these categories.

The Chennai study^[26] showed that the presence of comorbidity among diabetics is associated with stress, which was similar to our study. Because of co-morbid status, the patients are at increased risk of taking multiple medications, and the associated costs which could have a bearing on the overall perceived stress levels.

Various studies have shown the interplay between stress and body mass index (BMI) among all sections of the population, including the diabetics. Studies show a positive correlation between stress and BMI.^[28,29] A recent study

Table 3: Association of sociodemographic and disease-related characteristics with perceived stress among in-patient diabetics seeking care in a rural tertiary care centre in South India (n=247)

Study Characteristics	Total (n=247), n	Stress present (n=97), n (%)	PR (95% CI)	Adjusted PR (95% CI)
Age (years)				
≤40	28	15 (53.6)	1.6 (1.0-2.4)*	1.8 (1.1-2.9)**
41-59	117	47 (40.2)	1.2 (0.8-1.7)	1.4 (1.0-1.9)
≥60	102	35 (34.3)	1	1
Gender				
Male	166	68 (40.1)	1.1 (0.8-1.6)	-
Female	81	29 (35.8)	1	-
Years of schooling				
No formal education	19	04 (21.1)	1	-
1-7	87	34 (39.1)	1.9 (0.8-4.6)	-
8-10	102	49 (48.0)	2.3 (0.9-5.6)	-
>10	39	10 (25.6)	1.2 (0.4-3.4)	-
Occupation				
Unemployed (includes homemaker)	86	31 (36.5)	1	-
Employed	161	66 (40.1)	1.1 (0.8-1.6)	-
Marital status				
Currently married	217	87 (40.1)	1	-
Others [#]	30	10 (33.3)	1.2 (0.7-2.1)	-
Socioeconomic status[§]				
Class I	21	08 (38.1)	1.7 (0.7-4.3)	-
Class II	51	19 (37.3)	1.6 (0.7-3.8)	-
Class III	69	27 (39.1)	1.7 (0.8-3.9)	-
Class IV	84	38 (45.2)	2.0 (0.9-4.5)	-
Class V	22	05 (22.7)	1	-
Family type				
Nuclear	142	61 (43.0)	1.3 (0.9-1.7)	-
Joint	105	36 (34.3)	1	-
Duration of diabetes (years)				
≤1	70	36 (51.4)	2.2 (1.2-4.0)*	2.1 (1.2-3.9)**
1-≤5	83	28 (33.7)	1.5 (0.8-2.7)	1.5 (0.8-2.8)
6-≤10	51	23 (45.1)	1.9 (1.0-3.6)*	2.2 (1.2-3.9)**
>10	43	10 (23.3)	1	1
Treatment for diabetes				
OHAs alone	88	37 (42.1)	1	-
OHAs + insulin	135	51 (37.8)	1.1 (0.6-2.0)	-
Insulin alone	24	09 (37.5)	1.0 (0.6-1.8)	-
Associated comorbidity[†]				
Present	104	49 (47.1)	1.4 (1.0-1.9)*	1.8 (1.3-2.5)**
Absent	143	48 (33.6)	1	1
BMI[‡]				
Under-weight	13	10 (76.9)	2.4 (1.5-4.0)*	2.9 (1.8-4.8)**
Normal	57	18 (31.6)	1	1
Overweight	36	14 (38.9)	1.2 (0.7-2.2)	1.1 (0.7-1.9)
Obese	141	55 (39.0)	1.2 (0.8-1.9)	1.4 (0.9-2.1)
Glycemic status[§]				
Normal	107	44 (41.2)	1	-
Abnormal	140	53 (37.9)	0.9 (0.7-1.3)	-
BP^{**}				
Normal	194	78 (40.2)	1	-
Abnormal	53	19 (35.9)	0.9 (0.6-1.3)	-
Current tobacco user				
Yes	30	13 (43.3)	1.1 (0.7-1.7)	-

Contd...

Table 3: Contd...

Study Characteristics	Total (n=247), n	Stress present (n=97), n (%)	PR (95% CI)	Adjusted PR (95% CI)
No	217	84 (38.7)	1	
Current alcohol user				
Yes	21	8 (38.1)	1.0 (0.6-1.7)	-
No	226	89 (39.4)	1	
Good family care				
Present	214	84 (39.3)	1	-
Absent	33	13 (39.4)	1.0 (0.6-1.6)	
Conflicts at work place/home				
Present	86	43 (50.0)	1.5 (1.1-2.0)*	1.3 (1.0-1.8)**
Absent	161	54 (33.5)	1	1
Disturbed sleep				
Present	118	49 (41.5)	1.1 (0.8-1.5)	-
Absent	129	48 (37.2)	1	
Have enough money for treatment				
Yes	78	21 (28.0)	1	1
No	169	76 (44.2)	1.6 (1.1-2.4)*	1.6 (1.1-2.3)**

* $P < 0.05$ in bivariate analysis, ** $P < 0.05$ in multivariate analysis, [§]Modified B G Prasad classification for January 2018, [#]Include unmarried/widowed/separated/divorced, [†]Includes hypercholesterolemia/heartdisease/asthma/hypothyroid/hyperthyroid, [‡]BMI classification for the Asian population, [§]Random blood sugar < 200 mg/dl is normal, ^{**}Abnormal BP \rightarrow systolic BP ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg. PR=Prevalence ratio, CI=Confidence interval, OHA=Oral hypoglycemic agents, BMI=Body mass index

done among university students showed a U-shaped relationship between the BMI and emotional states, i.e., obese and underweight students recorded higher rates of emotional problems compared with normal and overweight students.^[30] The study showed a significant increase in levels of perceived stress in underweight category with no such increase in overweight or obese as compared to those with normal BMI. Still, the interplay between diabetes, stress, and BMI needs an in-depth understanding from the genetic, social and disease management level. Further research is required to opine on these findings.

Many studies have shown the association between glycemic status and stress levels in diabetics and also stress as a pathway in the abnormal glycemic status, including the development of diabetes.^[23,31] In this study, there was no association between poor glycemic status and poor BP status in implicating high stress. However, the finding that almost half of the diabetic patients (about 57%) having uncontrolled or abnormal blood sugar levels, and about 21.5% of them having higher BP, is a matter of concern. This could be the reason for their inpatient status and poor adherence to treatment regimen or decreased health-care seeking practices. Interventions need to be planned to ensure maintenance of the glycemic and BP status within acceptable limits among diabetic patients with a focus of care within the ambit of primary health-care setup.

In a qualitative study done among diabetic patients in Delhi, India, about one in two respondents reported that family conflict was the major source of stress in their lives.^[32] The Mangalore study also showed that family support among diabetics played an important role in determining their stress levels.^[19] Similarly, a Malaysian

study highlights that “life events” adversely affecting the balance in work, family, and leisure time activity, could act as a significant stressor among diabetics.^[24] The current study reports similar finding with, “presence of conflicts either at workplace or at home” showing independent association with perceived stress. Experiencing frequent conflicts at workplace or at home can build up stress levels and can further increase the existing stress level in any individual. The diseased status may add to the stress, making the symptoms of stress to be consistent over a period of time. This highlights the role of family and also the need for improvement of the work environment.^[33]

The financial burden can be a cause of stress in itself. This study tried to find out whether the financial position led the patients to compromise their disease treatment and thus, acted as a stressor. In the study done in Delhi, all the diabetic patients reported financial instability or economic insecurity as one among the top stressors that made them remain under “stress always”.^[32] The current study findings are in concordance with the previous study findings, showing stress level being twice among those people who do not have enough money to afford their treatment compared to those who can afford.

This study shows that social aspects could be one of the major stressors among diabetic patients seeking care from a rural tertiary care center. Qualitative studies which reflect the experiences of such people seeking care at primary health-care settings may be required to gain an in-depth knowledge of stressors.

This study has a few strengths. First, we have used the PSS-10 questionnaire, which has a very high reliability in assessing stress compared to other questionnaires.

This study tried to assess the factors related to stress in all the important domains, namely, the factors related to socio-demography, disease, treatment, as well as personal and behavioral factors. A single doctor well trained and fluent in the local language administered the questionnaire, thus providing more credibility in the outcomes assessed. Furthermore, the use of the Prevalence Ratio for reporting association is likely to give more precise estimates compared to the reporting of Odds ratio.^[34] The study is not without limitations. Although, the study covered a sizeable sample for the study, still the sample may not be adequate to capture the association between all the variables under study. The study failed to capture the family history of any psychological morbidity among the study participants which is considered to be a proven risk factor for stress. As the study was done in a single health care facility, the generalizability of results should be done with caution.

This study has a few implications. The study highlights the high prevalence of stress among diabetic in-patients and thus, calls for the inclusion of stress management techniques in diabetes education program at this health-care level. Stress management is the need of the hour at both individual and group level. Although the efficacy of them is proven elsewhere, it needs a relook in LMICs like India.^[12] The regular follow-up care should include the assessment of stress using standard tools like PSS-10, which could guide the treating physicians in their management decisions of these patients. The study also shows the importance of family and workplace environment that could have an impact in causing stress. Management of work-related stress among these patients is very important as it can impact the disease progression and treatment adherence. Thus, involving family members as a part of diabetes management may be the need of the hour. Yoga therapy is a proven strategy for stress reduction and is known to help in achieving optimal glucose and BP levels.^[35] As the primary healthcare in India is now integrated with alternative systems of medicine for the management of chronic diseases, this could be the way forward.

Conclusion

About two in five in-patient diabetics seeking inpatient care at the rural tertiary health center had shown to have “perceived stress.” Younger age, lesser duration of diabetes, presence of comorbidity, being underweight, and also social factors like having conflicts at the workplace/home and not having enough money for treatment were found to be independently associated with perceived stress. Scaling up of counseling and other services to alleviate stress at all levels of the health-care system is the need of the hour.

Acknowledgment

We would like to thank Dr. Ananta Bhattacharyya, Associate Professor in the Department of Community Medicine, Sri Devaraj Urs Medical College and Director, Media and Communication Centre, Sri Devaraj Urs Academy of Higher Education and Research for help in language edit of the manuscript. The authors would also like to thank all the study participants for their participation and giving their valuable time for the study.

Financial support and sponsorship

This project was supported by the Indian Council of Medical Research–Short Term Studentship (ICMR–STS) 2018 program (Reference ID: 2018-06806).

Conflicts of interest

There are no conflicts of interest.

References

1. Mendis S, Davis S, Norrving B. Organizational update: The world health organization global status report on noncommunicable diseases 2014; one more landmark step in the combat against stroke and vascular disease. *Stroke* 2015;46:e121-2.
2. International Diabetes Federation. International Diabetes Federation Diabetes Atlas. 8th ed. Brussels, Belgium: International Diabetes Federation; 2017. p. 106.
3. World Economic Forum, Harvard School of Public Health. The Global Economic Burden of Non-communicable Diseases. Geneva, Switzerland: World Economic Forum; 2011. p. 45.
4. Peyrot M, Rubin RR, Lauritzen T, Snoek FJ, Matthews DR, Skovlund SE. Psychosocial problems and barriers to improved diabetes management: Results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med* 2005;22:1379-85.
5. Burkhart PV, Sabaté E. Adherence to long-term therapies: Evidence for action. *J Nurs Scholarsh* 2003;35:207.
6. Pellmar TC, Brandt EN Jr., Baird MA. Health and behavior: The interplay of biological, behavioral, and social influences: Summary of an Institute of Medicine report. *Am J Health Promot* 2002;16:206-19.
7. Tol A, Mohebbi B, Sadeghi R. Evaluation of dietary habits and related factors among type 2 diabetic patients: An innovative study in Iran. *J Educ Health Promot* 2014;3:4.
8. Falco G, Pirro PS, Castellano E, Anfossi M, Borretta G, Gianotti L. The Relationship between Stress and Diabetes Mellitus. *J Neurol Psychol* April 2015;3:7.
9. Surwit RS, Schneider MS. Role of stress in the etiology and treatment of diabetes mellitus. *Psychosom Med* 1993;55:380-93.
10. Lloyd C, Smith J, Weinger K. Stress and diabetes: A review of the links. *Diabetes Spectr* 2005;18:121-7.
11. Viner R, McGrath M, Trudinger P. Family stress and metabolic control in diabetes. *Arch Dis Child* 1996;74:418-21.
12. Surwit RS, van Tilburg MA, Zucker N, McCaskill CC, Parekh P, Feinglos MN, *et al.* Stress management improves long-term glycemic control in type 2 diabetes. *Diabetes Care* 2002;25:30-4.
13. Rod NH, Grønbaek M, Schnohr P, Prescott E, Kristensen TS. Perceived stress as a risk factor for changes in health behaviour and cardiac risk profile: A longitudinal study. *J Intern Med* 2009;266:467-75.
14. Whitebird RR, Kreitzer MJ, O'Connor PJ. Mindfulness-Based Stress Reduction and Diabetes. *Diabetes Spectr* 2009;22:226-30.
15. van Son J, Nyklíček I, Pop VJ, Pouwer F. Testing the effectiveness

- of a mindfulness-based intervention to reduce emotional distress in outpatients with diabetes (DiaMind): Design of a randomized controlled trial. *BMC Public Health* 2011;11:131.
16. Niazi AK, Niazi SK. Mindfulness-based stress reduction: A non-pharmacological approach for chronic illnesses. *N Am J Med Sci* 2011;3:20-3.
 17. Carlson LE. Mindfulness-based interventions for physical conditions: A narrative review evaluating levels of evidence. *ISRN Psychiatry* 2012;2012:651583.
 18. van Son J, Nyklíček I, Pop VJ, Blonk MC, Erdtsieck RJ, Spooren PF, *et al.* The effects of a mindfulness-based intervention on emotional distress, quality of life, and HbA (1c) in outpatients with diabetes (DiaMind): A randomized controlled trial. *Diabetes Care* 2013;36:823-30.
 19. Bhandary B, Rao S, Sanal TS. The effect of perceived stress and family functioning on people with type 2 diabetes mellitus. *J Clin Diagn Res* 2013;7:2929-31.
 20. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24:385-96.
 21. Lee EH. Review of the psychometric evidence of the perceived stress scale. *Asian Nurs Res (Korean Soc Nurs Sci)* 2012;6:121-7.
 22. Rosengren A, Teo K, Rangarajan S, Kabali C, Khumalo I, Kutty VR, *et al.* Psychosocial factors and obesity in 17 high-, middle- and low-income countries: The Prospective Urban Rural Epidemiologic study. *Int J Obes (Lond)* 2015;39:1217-23.
 23. Bralić Lang V, Bergman Marković B, Vrdoljak D. The association of lifestyle and stress with poor glycemic control in patients with diabetes mellitus type 2: A Croatian nationwide primary care cross-sectional study. *Croat Med J* 2015;56:357-65.
 24. Kaur G, Tee GH, Ariaratnam S, Krishnapillai AS, China K. Depression, anxiety and stress symptoms among diabetics in Malaysia: A cross sectional study in an urban primary care setting. *BMC Fam Pract* 2013;14:69.
 25. Zhao FF, Suhonen R, Katajisto J, Leino-Kilpi H. The association of diabetes-related self-care activities with perceived stress, anxiety, and fatigue: A cross-sectional study. *Patient Prefer Adherence* 2018;12:1677-86.
 26. Sendhilkumar M, Tripathy JP, Harries AD, Dongre AR, Deepa M, Vidyulatha A, *et al.* Factors associated with high stress levels in adults with diabetes mellitus attending a tertiary diabetes care center, Chennai, Tamil Nadu, India. *Indian J Endocrinol Metab* 2017;21:56-63.
 27. Hara Y, Hisatomi M, Ito H, Nakao M, Tsuboi K, Ishihara Y. Effects of gender, age, family support, and treatment on perceived stress and coping of patients with type 2 diabetes mellitus. *Biopsychosoc Med* 2014;8:16.
 28. Harding JL, Backholer K, Williams ED, Peeters A, Cameron AJ, Hare MJ, *et al.* Psychosocial stress is positively associated with body mass index gain over 5 years: Evidence from the longitudinal AusDiab study. *Obesity (Silver Spring)* 2014;22:277-86.
 29. Yamamoto K, Okazaki A, Ohmori S. The relationship between psychosocial stress, age, BMI, CRP, lifestyle, and the metabolic syndrome in apparently healthy subjects. *J Physiol Anthropol* 2011;30:15-22.
 30. Abdel Sadek HA, Abu-Nazel MW, Shata ZN, Abd El-Fatah NK. The relationship between the BMI and the emotional status of Alexandria University students, Egypt. *J Egypt Public Health Assoc* 2016;91:101-8.
 31. Vasanth R, Ganesh A, Shanker R. Impact of stress on type 2 diabetes mellitus management. *Psychiatr Danub* 2017;29:416-21.
 32. Mendenhall E, Shivashankar R, Tandon N, Ali MK, Narayan KM, Prabhakaran D. Stress and diabetes in socioeconomic context: A qualitative study of urban Indians. *Soc Sci Med* 2012;75:2522-9.
 33. Rad GS, Bakht LA, Feizi A, Mohebi S. Importance of social support in diabetes care. *J Educ Health Promot* 2013;2:62.
 34. Thompson ML, Myers JE, Kriebel D. Prevalence odds ratio or prevalence ratio in the analysis of cross sectional data: What is to be done? *Occup Environ Med* 1998;55:272-7.
 35. Sengupta P. Health impacts of yoga and pranayama: A state-of-the-art review. *Int J Prev Med* 2012;3:444-58.