

Community Based Screening for Depression in Diabetes Mellitus in Urban Areas of Thiruvallur District. A Cross Sectional-Analytical Study

Dr. G. Nirmal kumar^{1*}, Dr. Praveen Kumar², Dr. Buvnesh Kumar³, Dr. Gokul⁴

¹Department of Community Medicine, Saveetha Medical College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India.

²Assistant Professor, Department of Community Medicine, Saveetha Medical College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India.

³Professor, Department of Community Medicine, Saveetha Medical College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India.

⁴Senior Resident, Department of Community Medicine, Saveetha Medical College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India.

*Corresponding Author

Dr. G. Nirmal kumar,

Department of Community Medicine, Saveetha Medical College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India.

Email ID: nirmalworkaholics@gmail.com

Cite this paper as: Dr. G. Nirmal kumar, Dr. Praveen Kumar, Dr. Buvnesh Kumar, Dr. Gokul, (2025) Community Based Screening for Depression in Diabetes Mellitus in Urban Areas of Thiruvallur District. A Cross Sectional-Analytical Study. *Journal of Neonatal Surgery*, 14 (12s), 1026-1034.

ABSTRACT

Type 2 diabetes and depression are serious health issues in our society. Chronic diseases like diabetes may stress people and impact pathophysiologic systems and mood. This may cause despair and a poor T2DM prognosis. T2DM patients with depression are at risk for heart disease, stroke, and death. Depressive symptoms are not screened for, hence depression is underdiagnosed in diabetes patients despite its increased incidence and management burden. This research estimated the frequency of depression in T2DM patients in Thiruvallur District and examined its relationship to glycaemic management and other risk variables. This descriptive cross-sectional research included 271 T2DM patients from Urban Health Training Centre (UHTC), Thirumazhisai, our urban field practice region. The trial ran from July to August 2024. The nine-item "Patient Health Questionnaire-9" was used to screen for depression and monitor fasting and postprandial blood sugar levels. 46.5% of 271 T2DM patients were women and 53.5% were men. The average participation age was 55.12. 75.6 percent of research participants had FBS ≥ 125 mg/dl. Among the 69.3% with depression, 44% had mild, 14% moderate, 8% moderately severe, and 4% severe. Fasting blood glucose, family history, complications, diabetes duration, and exercise were substantially linked with depression. This research reveals that depression is common in T2DM patients and is linked to poor prognosis, as seen by poor FBS and PPBS and diabetes complications. Screening and counselling for depression in T2DM patients are necessary for optimal management and therapy.

Keywords: Psychosocial, Depression, Glycemic control, Diabetes mellitus, PHQ Questionnaire Screening.

1. INTRODUCTION

Chronic hyperglycemia and carbohydrate, lipid, and protein metabolism abnormalities due to insulin secretion and/or action deficit characterise diabetes mellitus. Type 1 and type 2 diabetes exist. About 5% of type 1 diabetes patients develop before maturity. Autoimmune pancreatic beta cell death causes severe insulinopenia and hyperglycemia. The majority of occurrences of type 2 diabetes mellitus (T2DM) occur in later adulthood. It mostly results from insulin resistance and beta-cell dysfunction. Retinal, renal, and peripheral nervous system problems might result from untreated T2DM, as can coronary artery disease. It is a major cause of death and illness in the US. With over 62 million diabetics in India, the illness is becoming an epidemic. Lancet found that half of 2014 diabetic adults reside in India, China, Indonesia, Brazil, and the US.

Major or mild depressive illness is a frequent mental condition that causes melancholy, lack of interest, low self-esteem, guilt, interrupted sleep, weariness, and poor attention. It might be hard to manage everyday tasks. Depression may lead to

suicide in extreme cases.⁵ Its ubiquity, misery, dysfunction, morbidity, and economic cost make it a public health issue. The worldwide burden of illness report puts the point prevalence of unipolar depressive episodes at 1.9% for men and 3.2% for women, and the one-year prevalence at 5.8% and 9.5%, respectively.⁶ One of the biggest population-based studies in South India reported 15.1% depression among 25,400 Chennai residents.⁷

Depression is a modifiable risk factor for the onset and prognosis of T2DM. The coexistence of diabetes and depression increases the likelihood of complications, comorbidities, patient distress, and related costs.⁸ Depression correlates with elevated levels of catecholamines, glucocorticoids, and growth hormone. This results in impaired glucose transport function and the release of inflammatory cytokines, both of which may contribute to insulin resistance and, eventually, serve as causative factors in the onset and consequences of diabetes mellitus.⁹ The disease load or diagnosis of T2DM may induce depressive symptoms in T2DM patients.¹⁰ Individuals with diabetes are almost twice as susceptible to anxiety and depression compared to the general population.^{11, 12}

Recent research shows that diabetics with depression have a high death rate.¹³ Diabetics and depressed people may have a 10 times increased risk of suicide, according to certain studies.^{14,15} This relationship may greatly affect T2DM prevention, treatment, and control. Depression early in life might raise type 2 diabetes risk because depressed people are more likely to smoke and be sedentary.¹⁶

This research was designed to investigate the correlation between depression and Type 2 Diabetes Mellitus (T2DM) patients in the urban field practice region of our hospital, with the following aims. 1. To ascertain the incidence of depression among patients with type 2 diabetes mellitus visiting urban health training centres in the Thirumazhisai region of Thiruvallur district. 2. To determine the correlation between depression, fasting blood sugar levels, and other risk factors in patients with Type 2 Diabetes Mellitus (T2DM).

METHODS

Study design

This is a community-based cross-sectional analytical study carried out in Thirumazhisai, an urban area of Thiruvallur District of Tamil Nadu.

Study area and population

The study was done among Type 2 diabetes mellitus patients attending the urban health training centre (UHTC), Thirumazhisai, which belongs to the urban field practice area of the Community Medicine Department, Saveetha Medical College, and the Hospital of Tamil Nadu.

Study period

The study was carried out between July 2024 and August 2024.

Sample size and sampling technique

Study by Anuhraha et al. found 22.8% depression prevalence. Thus, with a 95% confidence interval and 5% alpha error, the sample size was 271. Purposive sampling of UHTC T2DM patients according to inclusion and exclusion criteria was employed. Patients with T2DM for at least 6 months, FBS and PPBS data from the past 3 months, and age 18 or older were included. Patients lacking FBS and PPBS findings within three months, those without informed consent, and those with clinical evidence of any mental condition other than depression were excluded.

Ethical approval and informed consent

Ethical approval was obtained from Institutional ethical Committee, Saveetha Medical College and Hospital (Scientific review board No: 1039/03/2024/PG/SRB/SMCH). The study purpose and confidentiality were explained to each participant and the informed consent was obtained from all willing participant in the local language.

Data collection method

The data for this study was gathered using a pre-tested structured interview schedule that included socio-demographic information and clinical, psychosocial characteristics of the participants, such as comorbidities, diabetic complications, glycaemic status, types of exercise undertaken, and the presence of comorbid depression.

Clinical variables

Assessment of T2DM

The HbA1c readings of diabetics should indicate their glycaemic management. HbA1c is the 2- to 3-month glycaemic average.¹⁸ HbA1c readings over 8% are unsatisfactory for diabetes management, according to the Indian Council of Medical Research (ICMR).¹⁹ HbA1c is better at predicting chronic T2DM problems than fasting blood sugars, which only show the individual's current glycaemic levels.²⁰ Musenge et al. in Zambia showed that FBS may be used to measure glycaemic control without HbA1c.²¹ Our research employed FBS to measure glycaemic control instead of HbA1c since most patients did not

have this test.

Our investigation used medical data to acquire fasting and postprandial blood sugar readings over the last three months. The Indian Council of Medical Research (ICMR) recommends that fasting blood sugar readings exceeding 125 mg/dl be unacceptable for diabetes management.¹⁹ Thus, individuals were separated into those with FBS 70-125 mg/dl and those over 125. Postprandial blood sugar levels were separated into two groups: 200mg/dl and less. T2DM problems, such as Diabetic Retinopathy, Diabetic Nephropathy, Diabetic Neuropathy, and coronary artery disease, were checked in medical records.

Assessment of depression

Study participants were tested for depression using the Patient Health Questionnaire-9. A self-administered version of PRIME–MD diagnoses common mental diseases. The depression module rates each of the 9 DSM–IV criteria from 0 (not at all) to 3 (almost every day). Depression intensity is determined by giving scores of 0, 1, 2, and 3 to the answer categories of 0-not at all, 1-several days, 2-more than half the days, and 3-nearly every day. Nine-item PHQ-9 scores range from 0 to 27. Cut points for mild, moderate, moderately severe, and severe depression are 5, 10, 15, and 20.²² This depression severity test is accurate and trustworthy.²³

2. RESULTS

Socio-demographic characteristics of the study population

The study included 271 people. Clinical features of study patients are shown in Table 1. This study included 30–80-year-olds. The average participant age was 55.12 ± 11.928 years. Males made up 53.5% and females 46.5%. Education: 59 (21.8%) are graduates, 27 (10%) have completed upper secondary, 17 (6.3%) have completed high school, 59 (21.8%) have completed middle school, 50 (18.5%) have completed elementary school, and 59 (21.8%) are illiterate. There were 223 (82.3%) married, 15 (5.5%) single, and 33 (12.2%) widowed. 165 (60.9%) lived in rural areas, while 106 (39.1%) lived in cities. Class I (38.4%) and Class II (33.2%) socioeconomic status dominated the research population. The people lived in pucca 174 (64.2%), semi-pucca 86 (31.7%), and kutchha 11 (4%).

Table 1: Sociodemographic details of the study participants (N=271)

Variables	Frequency (%)
Gender	
Male	145(53.5)
Female	126(46.5)
Age	
≥55	157(57.9)
<55	114(42.1)
Marital status	
Married	223(82.3)
Single	15(5.5)
Widowed	33(12.2)
Educational Status	
Graduate	59(21.8)
Higher secondary	27(10)
High school	17(6.3)
Middle school	59(21.8)
Primary school	50(18.5)

No formal education	59(21.8)
Residence	
Rural	165(60.9)
Urban	106(39.1)
Socioeconomic status	
Upper Class	104(38.4)
Upper Middle Class	90(33.2)
Middle Class	56(20.7)
Lower Middle	15(5.5)
Lower Class	6(2.2)
Type of House	
Pucca	174(64.2)
Semi Pucca	86(31.7)
Kutcha	11(4.1)

Clinical and psychosocial characteristics of the study participants.

According to Table 2, 205 (75%) of the patients exhibit fasting blood glucose levels above 126 mg/dl, whereas 168 (62%) have postprandial blood glucose levels over 200 mg/dl. 235 individuals (86.7%) are now receiving regular medication. A majority of the research participants, 197 (72.7%), were afflicted with other comorbidities, while 204 (75.3%) had problems related to diabetes. Our research indicates that 168 (62%) of the individuals engaged in mild-intensity workouts, whereas 103 (38%) participated in moderate-intensity exercises.

Table -2- Clinical and psychosocial characteristics of study participants (N=271).

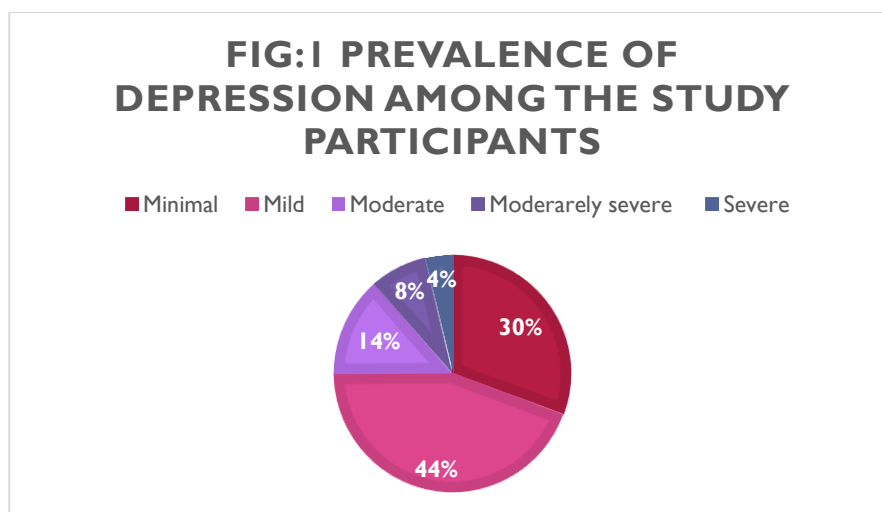
Variables	Frequency (%)
Fasting blood glucose	
≥126	205(75.6)
<126	66(24.4)
Post prandial blood glucose	
≥200	168(62.8)
<200	103(38)
Family history of diabetes	
Yes	119(43.9)
No	152(56.1)

Currently under regular medication	
Yes	235(86.7)
No	36(13.3)
Type of exercise	
Mild intensity	168(62)
Moderate intensity	103(38)
Co morbidities	
Yes	197(72.7)
No	74(27.3)
Complications of Diabetes	
Yes	204(75.3)
No	67(24.7)

*P value<0.05, statistically significant at 95% confidence interval.

Prevalence of depression

According to the PHQ-9 scoring criteria, an individual with a score of ≥ 5 is classified as experiencing depression. Depression, indicated by a PHQ score of ≥ 5 , was seen in 69.32% of the subjects. Of the total, 44.28% exhibited mild depression, indicated by a PHQ score of 5 to 9; 13.65% shown moderate depression, with a PHQ score of 11 to 14; 7.7% had moderately severe depression, reflected by a PHQ score of 15 to 19; and 3.69% suffered from severe depression, defined by a PHQ score of 20 or higher. Figure 1 illustrates the distribution of depression severity, according to the PHQ-9, among the study participants.



Association between the risk factors and depression in study population

This 271-person research found no significant connection between depression prevalence and gender, age, marital status, postprandial blood glucose, housing type, or co-morbidities. Participants with a family history of diabetes had a substantially lower prevalence of depression (PR: 0.83, 95% CI: 0.49–1.40, $p=0.032$), and rural patients were more likely to be depressed than urban patients (PR: 1.16, 95% CI: 0.69–1.96, $p=0.04$). Patients with fasting blood sugar $> 125\text{mg/dl}$ were more depressed (PR: 2.266 CI: 1.192–4.309, $P=0.00$). Mild-intensity exercise was associated with more depression than moderate-intensity

exercise (PR: 1.34, 95% CI: 0.79–2.28, $p=0.001$). Depression was substantially greater in individuals with complications of diabetes (PR: 1.20, 95% CI: 0.62-2.30, $p=0.03$) and longer duration of T2DM (>8 years). p -value < 0.05 is significant.

Table 3- Association between THE risk factors and depression in the study population (N=271)

*Others- Single and Widowed

<u>Variables</u>	<u>Co variables</u>	<u>Depression status (n)</u> <u>Yes</u>	<u>Depression (n)</u> <u>No</u>	<u>Prevalence Ratio (PR)</u>	<u>P- Value</u>
Gender	Female	94(74.6)	32(25.4)	1.15(0.68 - 1.95)	0.072
	Male	94(64.8)	51(35.2)		
Age	≥ 55	107(68.2)	50(31.8)	0.96 (0.57 - 1.62)	0.56
	< 55	81(71.1)	33(28.9)		
Residence	Rural	121(73.3)	44(26.7)	1.16 (0.69 - 1.96)	0.04
	Urban	67(63.2)	39(36.8)		
Marital status	*Others	34(60.7)	22(39.3)	1.18 (0.64 - 2.18)	0.09
	Married	154(71.6)	61(28.4)		
Fasting blood glucose level	≥ 125 mg/dl	141(68.8)	64(31.2)	2.266 (1.192 - 4.309)	0.00
	< 125 mg/dl	17(30.36)	39(69.64)		
Post prandial blood glucose level	≥ 200 mg/dl	119(70.8)	49(29.2)	1.06 (0.62 - 1.79)	0.46
	< 200 mg/dl	69(67)	34(33)		
Type of House	Pucca	118(67.8)	56(32.2)	0.94 (0.54 - 1.62)	0.40
	Semi pucca and kutchha	70(72.2)	27(27.8)		
Family History of Diabetes	No	114(75)	38(25)	0.83 (0.49 - 1.40)	0.02
	Yes	74(62.2)	45(37.8)		
Currently under Regular medications	No	23(63.9)	13(36.1)	1.10 (0.53 - 2.29)	0.42
	Yes	165(70.2)	70(29.8)		
Known complications	No	135(66.2)	69(33.8)	1.20 (0.62 - 2.30)	0.03
	yes	53(79.1)	14(20.9)		

Type of Exercise	Mild intensity	129(76.8)	39(23.2)	1.34 (0.79 - 2.28)	0.00
	Moderate intensity	59(57.3)	44(42.7)		
Co morbidities	No	49(66.2)	25(33.8)	1.07 (0.60 - 1.89)	0.52
	Yes	139(70.6)	58(29.4)		
Duration of T2DM	<u>>8</u>	83(77.6)	24(22.4)	1.21 (0.70 - 2.11)	0.00
	<8	105(64)	59(36)		

3. DISCUSSION

Despite the implementation of National and State initiatives to raise awareness and screen for Non-Communicable Diseases such as diabetes, screening for depression in diabetic patients is not conducted. Patients with Type 2 Diabetes Mellitus are often oblivious to the influence of their mental health on the prognosis and outcome of their condition. The research conducted among T2DM patients at the UHTC in Thirumazhisai indicates a significant prevalence of depression in this population. This research revealed that the prevalence of depression among individuals with Type 2 Diabetes Mellitus (T2DM) was 69.32%. These findings were analogous to several other investigations done in other locations. The incidence of depression among T2DM patients in the UK and USA ranges from 30% to 83%.^{24, 25} A research conducted by Thour et al. in Chandigarh revealed a prevalence of 41%. Seventeen Research conducted by Madhu et al at a tertiary care hospital in Southern India revealed a prevalence rate of 49%.²⁶ In both investigations, depression correlated with inadequate glycaemic management. This research indicates that sadness exhibits no gender bias. This was inconsistent with the research conducted by Sahota et al., which indicated that women were twice as likely to experience depression compared to men.²⁷ Depression prevalence was shown to be elevated among jobless and uneducated individuals. The cause may have been instability and reliance on family members for subsistence and survival.

Our investigation identified a statistically significant correlation between fasting blood sugar levels and the degree of depression. Elevated FBS levels were seen in persons with depression compared to those without depression. This may have resulted in diabetic problems, which were again linked to rising FBS levels. Comparable results were noted in research conducted by Bajaj et al. in Uttar Pradesh.²⁸ Approximately 43.5% of the research participants reported moderate difficulty in performing daily activities according to the PHQ-9 assessment. This may have resulted in inadequate drug adherence, subsequently leading to unfavourable illness outcomes. Comparable results were noted in research conducted by Habtewold et al. in Ethiopia.²⁹ Diabetic problems were significantly correlated with the intensity of depression. Comparable results were noted in research conducted by Joseph et al. in Mangalore. Thirty Elevated depression severity was correlated with fasting blood glucose levels. Elevated depression severity in individuals with T2DM may result in worse Fasting Blood Sugar levels, potentially leading to diabetes complications and heightened morbidity associated with the condition. The most often reported consequence of diabetes is diabetic neuropathy. A similar conclusion was seen in the research conducted by Thour et al. in Chandigarh. Seventeen. A drawback of this research was the unavailability of glycated haemoglobin levels (HbA1C) for the diabetic patients, since the majority who visited our Health Centre had not undergone HbA1C testing.

4. CONCLUSION

The biochemical mechanism between T2DM and depression is unknown. Depression is common in T2DM patients (69.32%), according to our research. Increasing depression severity is linked to decreasing glycaemic management, as measured by fasting blood sugar. This led to diabetes issues. This research shows that people with T2DM and depression are more likely to have poor glycaemic control, which may lead to diabetes complications and morbidity. Exercise at moderate intensity protects against depression. Periodic and rigorous health education and awareness campaigns must inform all healthcare workers about the bidirectional association between Type 2 diabetes and depression. To prevent glycaemic worsening, co-morbid depression and T2DM patients might get counselling, medication, or psychiatrist referrals. Doing so reduces diabetes complications and improves prognosis.

REFERENCES

- [1] Sharad P. Practical Management of Diabetes. Chapter 1. 2nd edition. India: Jaypee Brothers Medical Publishers; 2002: 16.
- [2] Krentz AJ, Bailey CJ. Type 2 Diabetes in Practice. Chapter 1. India: Panther Publishers; 2001:1.
- [3] Kaveeshwar S. The current state of diabetes mellitus in India. *Australas Med J.* 2014;7(1):45–8.
- [4] NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *Lancet.* 2016;387(10027):1513–30.
- [5] World Health Organization Regional office for Europe. Depression: definition. Available at: <http://www.euro.who.int/en/health-topics/non-communicable-diseases/pages/news/news/2012/10/depression-in-europe/depression-definition>. Accessed on 19 December 2016.
- [6] Grover S, Dutt A, Avasthi A. An overview of Indian research in depression. *Indian J Psychiatry.* 2010;52(7):178-88.
- [7] Poongothai S, Pradeepa R, Ganesan A, Mohan V. Prevalence of Depression in a Large Urban South Indian Population - The Chennai Urban Rural Epidemiology Study (Cures-70). *PLoS ONE.* 2009;4(9):7185.
- [8] Khuwaja AK, Lalani S, Dhanani R, Azam IS, Rafique G, White F. Anxiety and depression among outpatients with type 2 diabetes: A multi-centre study of prevalence and associated factors. *Diabetol Metabol Syndr.* 2010;2(1):72.
- [9] Das R, Singh O, Thakurta RG, Khandakar M, Ali S, Mallick A, et al. Prevalence of depression in patients with type II diabetes mellitus and its impact on quality of life. *Indian J Psychol Med.* 2013;35(3):284-9.
- [10] Talbot F, Nouwen A. A review of the relationship between depression and diabetes in adults: is there a link? *Diabetes Care.* 2000;23(10):1556–62.
- [11] Nichols L, Barton PL, Glazner J, McCollum M. Diabetes, minor depression and health care utilization and expenditures: a retrospective database study. *Cost Eff Resour Alloc.* 2007;5(1):4.
- [12] Bouwman V, Adriaanse MC, Van der Riet E, Snoek FJ, Dekker JM, Nijpels G. Depression, anxiety and glucose metabolism in the general Dutch population: the new Hoorn study. *PLoS One.* 2010;5(4):9971.
- [13] Zhang X. Depressive Symptoms and Mortality among Persons with and without Diabetes. *Am J Epidemiol.* 2005;161(7):652–60.
- [14] Katon WJ. The Comorbidity of Diabetes Mellitus and Depression. *Am J Med.* 2008;121(11):8–15.
- [15] Goldston DB, Kovacs M, Ho VY, Parrone PL, Stiffler L. Suicidal ideation and suicide attempts among youth with insulin-dependent diabetes mellitus. *J Am Acad Child Adolesc Psychiatry.* 1994;33(2):240-6.
- [16] Goldston DB, Kelley AE, Reboussin DM, Daniel SS, Smith JA, Schwartz RP, et al. Suicidal ideation and behavior and noncompliance with the medical regimen among diabetic adolescents. *J Am Acad Child Adolesc Psychiatry.* 1997;36(11):1528-36.
- [17] Liang CC, Tsan KW, Ma SM, Chow SF, Wu CC. The Relationship between Fasting Glucose and HbA1c among Customers of Health Examination Services. *Formos J Endocrin Metab.* 2010;1(3):1-5.
- [18] Indian Council of Medical Research. Guidelines for Management of Type 2 Diabetes Mellitus. Available at: http://icmr.nic.in/guidelines_diabetes/section4.pdf. Accessed on 25 December 2016.
- [19] Bonora E, Tuomilehto J. The Pros and Cons of Diagnosing Diabetes with A1C. *Diabetes Care.* 2011;34(2):184-90.
- [20] Musenge EM, Manankov A, Michelo C, Mudenda B. Relationship between glycated hemoglobin and fasting plasma glucose among diabetic out-patients at the University Teaching Hospital, Lusaka, Zambia. *Tanzan J Health Res.* 2016;18(3):1-9.
- [21] Instruction Manual. Instructions for Patient Health Questionnaire (PHQ) and GAD-7 Measures. Available at: <https://phqscreeners.pfizer.edrupal-gardens.com/sites/g/files/g10016261/f/201412/instructions.pdf>. Accessed on 12 February 2017.
- [22] Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606–13.
- [23] Li C, Ford ES, Strine TW, Mokdad AH. Prevalence of depression among U.S. adults with diabetes: findings from the 2006 behavioral risk factor surveillance system. *Diabetes Care.* 2008;31(1):105- 7.
- [24] Kendrick T, Dowrick C, McBride A, Howe A, Clarke P, Maisey S, et al. Management of depression in UK general practice in relation to scores on depression severity questionnaires: analysis of medical record data.

BMJ. 2009;338:750.

- [25] Madhu M, Abish A, Anu K, Jophin RI, Kiran AM, Vijayakumar K. Predictors of depression among patients with diabetes mellitus in Southern India. *Asian J Psychiatr*. 2013;6(4):313–7.
 - [26] Sahota PKC, Knowler WC, Looker HC. Depression, Diabetes, and Glycemic Control in an American Indian Community. *J Clin Psychiatry*. 2008;69(5):800-9.
 - [27] Bajaj S, Agarwal SK, Varma A, Singh VK. Singh. Association of depression and its relation with complications in newly diagnosed type 2 diabetes. *Indian J Endocrinol Metab*. 2012;16(5):759-63.
 - [28] Dejenie HT, Radie YT, Sharew NT. Prevalence of Depression among Type 2 Diabetic Outpatients in Black Lion General Specialized Hospital, Addis Ababa, Ethiopia. *Depress Res Treat*. 2015;(2015):184902.
 - [29] Joseph N, Unnikrishnan B, Raghavendra Babu YP, Kotian MS, Nelliyanil M. Proportion of depression and its determinants among type 2 diabetes mellitus patients in various tertiary care hospitals in Mangalore city of South India. *Indian J Endocrinol Metab*. 2013;17(4):681-8.
-