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DEPRESSION, ANXIETY AND STRESS AMONG TYPE II DIABETIC PATIENTS IN AL-MADINAH, SAUDI ARABIA

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ABSTRACT

Diabetes mellitus is one of the highest global health emergencies of the 21st century, and the Kingdom of Saudi Arabia (KSA) has one of the highest prevalence rates of type 2 diabetes prevalence all over the world. Diabetes mellitus is a chronic disease that requires long-term medical attention to limit the development of its complications and manage them when they occur. Therefore, patients with diabetes have a greater risk of psychological problems, such as depression, stress, and anxiety, than people without diabetes. The study aims to estimate the prevalence and levels of depression, anxiety, and stress among type 2 diabetic patients and to identify the possible predictors of depression, anxiety, and stress among type 2 diabetic patients in Al-Madinah, Saudi Arabia. A cross-sectional design was conducted at primary healthcare centers affiliated with the Ministry of Health (MOH) in Al-Madinah City. This study observed that 3.3% of diabetes patients have depression from mild to moderate levels (2.5%, and 0.8%, respectively). The 34.4 diabetes patients had anxiety from mild to severe levels (17.6%, 11.6%, and 0.3%, respectively). 29.6% of diabetes patients had mild to extremely severe stress levels (10.6%, 19.8%, 3.8%, and 0.2%, respectively). These findings also suggest that the healthcare system must pay attention to the psychological aspects of diabetes and routinely request the screening and continual monitoring of DASS in diabetic patients.

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Introduction

Diabetes mellitus is one of the highest global health emergencies of the 21st century; as stated by the International Diabetes Federation (IDF) [1]. It is estimated that 463 million adults aged 20–79 exist with diabetes worldwide, and this will increase to 700 million in 2045 if no efforts are taken to overcome the situation [2]. The Kingdom of Saudi Arabia (KSA) has one of the highest prevalence rates of type 2 diabetes prevalence all over the world [1]; the prevalence of diabetes mellitus (DM) in adults was estimated as 25% [3]. Diabetes mellitus is a chronic disease that requires long-term medical attention to limit the development of its complications and manage them when they occur [4]. Therefore, patients with diabetes have a greater risk of psychological problems, such as depression, stress, and anxiety, than people without diabetes [5]. This could be attributed to the influence of stress on daily diabetic management, as well as alterations in diet, constant dependence on medication, short and long-term side effects, and the burden of costs [6, 7]. Psychologically disturbed diabetic patients are usually less likely to adapt to the added burden of the disease's self-care demands, less likely to adhere to their dietary regimen, less physically active, and less likely to comply with prescribed medications. And hence more liable to diabetic complications [8]. It has been documented that 10-30% of diabetic patients suffer from a major depressive disorder or sub-threshold depression [9, 10]. Diabetics are at a 24% increased risk of developing depression [11].

Despite numerous investigations, the underlying pathophysiology of the metabolic abnormalities related to the two diseases is poorly understood. A possible explanation could be due to the increased counter-regulatory hormone release involved in

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glucose homeostasis, alterations in the glucose transport function, and increased inflammatory activation triggered by depression [12]. The high prevalence of depression among diabetic patients is associated with poorer quality of life, impaired self-care activities, higher healthcare costs, a higher risk for developing diabetes complications, and increased mortality rates [13, 14]. Despite these known adverse effects, the high prevalence of depression in diabetes, and the fact that effective treatments are available, there is a considerable under-detection and subsequent under-treatment of these conditions. Less than half of the depressed patients with diabetes are recognized [15, 16].

Furthermore, studies suggested that diabetic patients are more prone to anxiety than healthy individuals [17, 18]. Stress among diabetics can result in an elevation of the blood glucose level and poor glycemic control due to its interaction with the endocrine system to influence nutritional behaviors, self-care-related activities, and physical activity [19]. The study aims to estimate the prevalence and levels of depression, anxiety, and stress among type 2 diabetic patients and to identify the possible predictors of depression, anxiety, and stress among type 2 diabetic patients.

After reviewing the literature, few locally published studies from Saudi Arabia have been cited. However, none of them was carried out in Al-Madinah Region. In addition, some regional and international studies were found. In Western Region, KSA (2019), Alzahrani *et al.* carried out a cross-sectional study that included 450 adults with T2DM to estimate the prevalence and investigate determinants of depression, anxiety, and stress among patients with T2DM. The prevalence of depression was 33.8%, whereas anxiety and stress were 38.3% and 25.5%, respectively [20].

In Arar, Northern Saudi Arabia (2019), Mukrim *et al*. conducted a cross-sectional study to test the possible association between type II DM among those over 12 years and depression, anxiety, and stress. The prevalence rates of depression, anxiety, and stress were 37.4%, 45.6%, and 18.7%, respectively; female patients were more likely to have depressive symptoms. Depression and anxiety were significantly associated with the patient's age and lower educational level. Single status was significantly associated with depression [21].

In Qatar (2011), Bener *et al*. conducted a matched case-control study to compare depression, anxiety, and stress symptoms in diabetic patients (n=889) with those in a matched group of controls (n=889), Severe depression, anxiety, and stress scores were more reported in diabetic patients compared to healthy controls [22]. In Bahrain, a cross-sectional study was carried out to examine the association of co-morbid depression, anxiety, and stress disorders with type 2 diabetes.

A higher proportion of DM2 patients were found in the mild-moderate, and severe- extremely severe depression, chronic disease, and disease duration were significantly associated with the three disturbances. In contrast, employment status was associated with anxiety and depression [23]. In Iran, Ahangari *et al*. (2016) implemented a cross-sectional study to estimate the prevalence of depression, stress, and anxiety in type 2 diabetic patients and investigate their association with patients` demographic characteristics. The prevalence rate of depression, stress, and anxiety were 83.1%, 78.1%, and 96%, respectively. There was a significant positive correlation between depression, anxiety, stress, and the level of education. There was a significant association between diabetes complications and anxiety [24].

In Malaysia (2015), Tan *et al*. conducted a cross-sectional study. The prevalence of depression, anxiety, and stress were 26.6%, 40%, and 19.4%, respectively. Marital status and family history of depression were significantly associated with depression [25]. In Pakistan (2015), Rehman A and Kazmi SF have conducted a cross-sectional study to assess the prevalence of depression, anxiety, and stress in type II diabetic patients and compare patients with (n=120) those without complications (n=120).

Rates of depression, anxiety, and stress were 47.9%, 69.6%, and 62.9%, respectively, being significantly higher in patients with complications compared to those without complications [26]. In China (2016), Sun *et al*. conducted a cross-sectional community-based study to estimate the prevalence and define the determinants of depression and anxiety and assess their effect on glycemic control in 893 types 2 diabetic patients, the prevalence of depression was 56.1%, whereas that of anxiety was 43.6% [27]. In Greece (2009), Roupa *et al.* surveyed the existence of anxiety and depression symptoms in 310 type 2 diabetics with regard to sex and body mass index; women had a double risk of depression than men (41.4% versus 17.8 % [28].

Materials and Methods

A cross-sectional design was conducted at primary healthcare centers affiliated with the Ministry of Health (MOH) in Al-Madinah City of Saudi Arabia (KSA) (n=40). All type 2 diabetic patients attending the primary healthcare centers, MOH, in Al-Madinah city throughout data collection conduction (November- December 2020) are eligible to participate in the study. A stratified random sampling technique with equal allocation will be applied to select type 2 diabetic patients from 53 primary healthcare centers in this study. Data were collected by distributing a self-administered questionnaire composed of two parts; the first section addressed the sociodemographic data of each patient. The second part screened for depression, anxiety, and stress using the previously validated Arabic version of the Depression, Anxiety, and Stress Scale (DASS-21) questionnaire [29]. It consists of 21 items distributed on three scales for depression, anxiety, and stress, i.e., seven items each. Subjects are asked if they experienced a set of symptoms for each scale during the last week.

Statistical Analysis

All questionnaires were checked and entered Statistical Package for the Social Science (SPSS) version 20 software; it was used for descriptive and inferential analysis. The Scores for each scale of the DASS-21 are calculated by summing the scores

of the items, and the Mean of DASS is calculated. Individual scores were categorized into five groups and then transformed into a binominal variable. Univariate statistics such as frequencies and proportion percentages were derived for categorical variables, and Bivariate analyses (Pearson chi-square test) were used to measure the strength of association between the variables in the study. All tests were two-tailed, with significance defined as $p < 0.05$.

Results and Discussion

A total of 602 diabetic patients who visited primary healthcare centers completed the questionnaire, female patients represent 65.1% of participants, 38.0% of participants are between 45-54 years old, almost 37.5% of the participants had secondary education and 60.5% were unemployed **(Table 1)**. The result showed that 82.9% of participants have co-morbidities of diabetes, while only 66.3% have regular follow-ups in primary healthcare centers. Most patients received only oral hypoglycemic (65.8%), whereas 22.3%% received both oral and insulin **(Table 2)**.

Table 1. Sociodemographic data of participants

Variable	categories	N(%)
Gender	Male	210 (34.9%)
	Female	392 (65.1%)
Age	Less than 44	33(5.7%)
	45-54	229(38.0%)
	55-64	182(30.0%)
	65-74	77(12.8%)
	75-84	58(9.6%)
	>85	23(3.8%)
Education	Primary	93(15.4%)
	elementary	81(13.5%)
	secondary	226(37.5%)
	university	152(25.2%)
	High	10(1.7%)
	No education	40(6.6%)
Social status	single	37(6.1%)
	married	435(72.3%)
	Divorced	33(5.5%)
	Widow/er	97(16.1%)
job	employed	133(22.1%)
	unemployed	364(60.5%)
	retired	105(17.4%)

Table 2. Clinical characteristics of participants

Variable	Categories	N(%)
Diabetes complication	yes	499(82.9%)
	No	103(17.1%)
Smoking History	smoker	70(11.6%)
	Non-smoker	418(69.4%)
	x-smoker	114(18.9%)
Type of treatment	Lifestyle and Diet	57(9.5%)
	Oral hypoglycemic	396(65.8%)
	Oral+insluin	134(22.3%)
	Insulin only	15(2.5%)
Family History of psychological illness	Yes	96(15.9%)
	no	506(84.1%)
DM duration	Less than 4 years	78(13%)

	5-10years	316(52.5%)
	11-15years	149(24.8%)
	16-19years	45(7.5%)
	20 years and more	14(2.3%)
Follow-up in clinic	Yes	399(66.3%)
	no	203(33.7%)

The prevalence of stress, anxiety, and depression was 30.2%, 35%, and 4%, respectively, as shown in **Table 3**. 70.4% of diabetes patients have no stress, 17.6% have mild stress, 11.6% have moderate stress, and 0.3% have severe stress. 65.6% of diabetes patients have no anxiety, 10.6% have mild anxiety, 19.8% have moderate anxiety, and 3.8% have severe anxiety. 96.7% of diabetes patients having no depression, 2.5% have mild depression, and 0.8% have severe depression.

Table 3. Stress, anxiety, and depression prevalence by categorical

	Stress	**Anxiety**	**Depression**
Normal	424(70.4%)	395(65.6%)	582(96.7%)
Mild	106(17.6%)	64(10.6%)	15(2.5%)
Moderate	70(11.6%)	119(19.8%)	5(0.8%)
Severe	2(0.3%)	23(3.8%)	0
Extremely severe	0	1(0.2%)	0

Table 4 shows the difference between the DASS status and clinical or sociodemographic variable. There was no significant difference between gender and between job status and depression, while there was a significant difference between stress, anxiety, and job status; it demonstrated that (57.5%) of anxiety patients are unemployed and (28.1%) of stress patients are retired. Results showed that the education level is significantly different, (30.3%) of stress patients and (26.6%) of anxiety patients are primary school level, while (25.0%) of depression patients are at the elementary school level.

Table 4. Association of predictor variable and DASS

Predicting variables	**Stress symptoms**		**Anxiety symptoms**		**Depression symptoms**	
	yes	no	yes	no	yes	no
Gender						
Male	71(39.9%)	139(32.8%)	73(35.3%)	137(34.7%)	6(30.0%)	204(35.1%)
Female	107(60.1%)	285(67.2%)	134(64.7%)	258(65.3%)	14(70.0%)	378(64.9%)
	Chi-square test, P=0.11		**Chi-square test, P=0.92**		**Chi-square test, P=0.81**	
Age						
Less than 44	1(3.0%)	32(97.0%)	3(9.1%)	30(90.9%)	0	33(100%)
45-54	48(21.0%)	181(79.0%)	56(24.5%)	173(75.5%)	11(4.8%)	218(95.2%)
55-64	48(26.4%)	134(73.6%)	51(28.0%)	131(72.0%)	6(3.3%)	176(96.7%)
65-74	27(35.1%)	50(64.9%)	38(49.4%)	39(50.6%)	2(2.6%)	75(97.4%)
75-84	38(65.5%)	20(34.5%)	37(63.8%)	21(36.2%)	0	58(100%)
>85	16(69.6%)	7(30.4%)	22(95.7%)	1(4.3%)	1(4.3%)	22(95.7%)
	Fisher test, P=0.00		**Fisher test, P=0.00**		Fisher test, P=0.42	
Job						
Employee	30(16.9%)	103(24.3%)	36(17.4%)	97(24.6%)	5(25.0%)	128(22.0%)
No job	98(55.1%)	266(62.7%)	119(57.5%)	245(62.0%)	12(60.0%)	352(60.5%)
Retired	50(28.1%)	55(13.0%)	52(25.1%)	53(13.4%)	3(15.0%)	102(17.5%)
	Chi-square test, P=0.00		**Chi-square test, P=0.001**		Chi-square test, P=0.92	
Education level						
No formal education	22(12.4%)	18(4.2%)	21(10.1%)	19(4.8%)	5(25.0%)	35(6.0%)
primary school	54(30.3%)	39(9.2%)	55(26.6%)	38(9.6%)	3(15.0%)	90(15.5%)
Elementary school	38(21.3%)	43(10.1%)	53(25.6%)	28(7.1%)	5(25.0%)	76(13.1%)

Secondary school	33(18.5%)	193(45.5%)	46(22.2%)	180(45.6%)	3(15.0%)	223(38.3%)
University and high	31(17.4%)	131(30.9%)	32(15.5%)	130(32.9%)	4(20.0%)	158(27.1%)
	Chi-square test, P=0.00		**Chi-square test, P=0.00**		**Fisher test.P=0.006**	
Follow-up in clinic						
regular	83(46.6%)	316(74.5%)	109(52.7%)	290(73.4%)	14(70.0%)	385(66.2%)
irregular	95(53.4%)	108(25.5%)	98(47.3%)	105(26.6%)	6(30.0%)	197(33.8%)
	Chi-square test, P=0.00		**Chi-square test, P=0.00**		Chi-square test, P=0.72	
DM duration						
10 yrs and less	107(60.1%)	287(67.7%)	129(62.3%)	265(67.1%)	13(65.0%)	381(65.5%)
11yrs and more	71(39.9%)	137(32.3%)	78(37.7%)	130(32.9%)	7(35.0%)	201(34.5%)
	Chi-square test, P=0.074		Chi-square test, P=0.24		Chi-square test, P=0.96	
Family Hx						
yes	**41(23.0%)**	55(13.0%)	41(19.8%)	55(13.9%)	**14(70.0%)**	82(14.1%)
no	137(77.0%)	369(87.0%)	166(8.2%)	340(86.1%)	6(30.0%)	500(85.9%)
	Chi-square test, P=0.002		Chi-square test, P=0.61		**0Fisher test.P=0.00**	
DM com						
yes	**163(91.6%)**	336(79.2%)	**193(93.2%)**	306(77.5%)	19(95.0%)	480(82.5%)
no	15(8.4%)	88(20.8%)	14(6.8%)	89(22.5%)	1(5.0%)	102(17.5%)
	Chi-square test, P=0.00		**Chi-square test, P=0.00**		Fisher test.P=0.22	
Type of treatment						
Insulin only	2(13.3%)	13(86.7%)	2(13.3%)	13(86.7%)	0	15(100%)
Oral only	78(19.7%)	318(80.3%)	87(22.0%)	309(78.0%)	9(2.3%)	387(97.7%)
Oral+insulin	82(61.2%)	52(38.8%)	86(64.2%)	48(35.8%)	10(7.5%)	124(92.5%)
Lifestyle	16(28.1%)	41(71.9%)	32(56.1%)	25(43.9%)	1(1.8%)	56(98.2%)
	Fisher test, P=0.00		**Fisher test, P=0.00**		Fisher test, P=0.11	

The first objective of this study was to assess the prevalence of stress, anxiety, and depression in patients with type 2 diabetes mellitus. This study observed that 3.3% of diabetes patients have depression from mild to moderate levels (2.5%, and 0.8%, respectively). The 34.4 diabetes patients had anxiety from mild to severe levels (17.6%, 11.6%, and 0.3%, respectively). 29.6% of diabetes patients had mild to extremely severe stress levels (10.6%, 19.8%, 3.8%, and 0.2%, respectively).

In the western Region of Saudi Arabia, the prevalence of depression was 33.8%, whereas those of anxiety and stress were 38.3%, and 25.5%, respectively [1]. In the North region of Saudi Arabia, 22.4% of diabetic patients experienced significant depressive symptoms, and 28.5% experienced significant anxiety symptoms [30]. In Taif, the prevalence of anxiety among people with diabetes was 45.45% [31]. Many studies showed the prevalence of depression among diabetic patients to be within the range of 8.5%– 27.3%. Our study showed that depression was 3.3% which is not consistent with other studies. The cause may be related to different data collection tools or cultural factors.

Similar to two studies of diabetic patients in Saudi Arabia [31, 32] that examined anxiety compared to other mental health problems, anxiety was the most common form of psychological distress. The other objective is to study the predicting factor of DASS among diabetic patients. The result showed that stress, anxiety, and depression are more prevalent in females (60.1%. 64.7%, and 70.0%, respectively), but it is not significantly associated with other studies [24, 25] find that a female diabetic is a predicting factor for psychological symptom. Additionally, anxiety and stress are more prevalent in unemployed diabetic patients (55.1% and 57.5%, respectively), which is consistent with the study done in Bahrain [23] that concludes employment status is strongly associated with psychological symptoms.

Similar to other studies [14, 21, 24], the result of proving that age and educational level were significantly related to the DASS status of diabetics patients. We found that the family history of psychological disease had a statistically significant relationship with stress and anxiety. However, there was no relationship with depression, while another study [25] found a significant association between anxiety, stress, and depression.

Studies done in Pakistan [26] have shown a positive association between diabetes complications and DASS; our study only proves it for stress and anxiety. Meanwhile, the result approves that if patients not regularly visiting primary healthcare centers will express stress and Anxiety symptoms, it showed that 53.4 % of stress-symptomatic patients were not regularly visiting primary healthcare centers.

We found that type of diabetes treatment can affect the patient's psychological status; anxiety and stress are presented in 61.2% and 64.2% of patients using oral hypoglycemia and insulin; the cause may relate to newly introduced insulin as treatment. Another study done in Saudi Arabia [30] found an association between insulin use and depression. Other studies [25, 33] did

not find any association between various social and clinical factors, such as marital status, smoking status, and duration of DM, which were predicted to be associated with DASS status. However, our study failed to prove such an association.

Conclusion

The present study showed that the prevalence reached approximately 35% for anxiety, 30.2% for stress, and 4% for depression among diabetic patients. Diabetic patients are often constantly challenged to control their blood glucose and prevent co-morbidities. These findings also suggest that the healthcare system must pay attention to the psychological aspects of diabetes and routinely request the screening and continual monitoring of DASS in diabetic patients. Especially for the vulnerable group, i.e., females, family history of psychological disease, newly introduced insulin, and presence of complications.

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References

1. IDF Diabetes Atlas, Tenth Edition [Internet]. [cited 2021 Nov 12]. Available from: https://diabetesatlas.org/
2. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Res Clin Pract. 2019;157:107843. Available from: https://pubmed.ncbi.nlm.nih.gov/31518657/
3. Abuyassin B, Laher I. Diabetes epidemic sweeping the Arab world. World J Diabetes. 2016;7(8):165-74. Available from:/pmc/articles/PMC4835661/
4. Narayan KV, Boyle JP, Thompson TJ, Sorensen SW, Williamson DF. Lifetime risk for diabetes mellitus in the United States. Jama. 2003;290(14):1884-90. Available from: https://jamanetwork.com/journals/jama/fullarticle/197439
5. Katon W, Lin EH, Kroenke K. The association of depression and anxiety with medical symptom burden in patients with chronic medical illness. Gen Hosp Psychiatry. 2007;29(2):147-55. Available from: https://journals.sagepub.com/doi/10.1177/0145721707304079?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub++0pubmed
6. Penckofer S, Ferrans CE, Velsor-Friedrich B, Savoy S. The psychological impact of living with diabetes: women's day-to-day experiences. Diabetes Educ. 2007;33(4):680-90.
7. Aditama L, Athiyah U, Utami W, Qomaruddin M. Effect of comprehensive medication management on patient empowerment 'type II diabetes mellitus patients in primary care'. J Adv Pharm Educ Res. 2021;11(3):42-7.
8. Li C, Liu JC, Xiao X, Chen X, Yue S, Yu H, et al. Psychological distress and type 2 diabetes mellitus: a 4-year policemen cohort study in China. BMJ Open. 2017;7(1):e014235. Available from: https://bmjopen.bmj.com/content/7/1/e014235
9. Berge LI, Riise T. Comorbidity between Type 2 Diabetes and Depression in the Adult Population: Directions of the Association and Its Possible Pathophysiological Mechanisms. Int J Endocrinol. 2015;2015:164760. Available from: /pmc/articles/PMC4589629/
10. Lin EH, Von Korff M, Alonso J, Angermeyer MC, Anthony J, Bromet E, et al. Mental disorders among persons with diabetes--results from the World Mental Health Surveys. J Psychosom Res. 2008;65(6):571-80. Available from: /pmc/articles/PMC3672403/
11. Nouwen A, Winkley K, Twisk J, Lloyd CE, Peyrot M, Ismail K, et al. Type 2 diabetes mellitus as a risk factor for the onset of depression: a systematic review and meta-analysis. Diabetologia. 2010;53(12):2480-6. Available from: /pmc/articles/PMC2974923/
12. Rustad JK, Musselman DL, Nemeroff CB. The relationship of depression and diabetes: pathophysiological and treatment implications. Psychoneuroendocrinology. 2011;36(9):1276-86.
13. Hamer M, Stamatakis E, Kivimäki M, Kengne AP, Batty GD. Psychological distress, glycated hemoglobin, and mortality in adults with and without diabetes. Psychosom Med. 2010;72(9):882-6. Available from: https://journals.lww.com/psychosomaticmedicine/Fulltext/2010/11000/Psychological_Distress,_Glycated_Hemoglobin,_and.9.aspx
14. Ahmed IB, Binnwejim MS, Alnahas TM, Raes AA, Basamad MA, Alqurashi AE, et al. Level of diabetic patients' knowledge of diabetes mellitus, its complications and management. Arch Pharm Pract. 2019;10(4):80-6.
15. Maric A, Molnar D, Premosa T, Novak S, Vidovic J, Kiric MM. Depression and quality of life in patients with type 2 diabetes mellitus. InEndocrine Abstracts 2017 May 3 (Vol. 49). Bioscientifica. Available from: https://www.endocrine-abstracts.org/ea/0049/ea0049ep491

16. Andreoulakis E, Hyphantis T, Kandylis D, Iacovides A. Depression in diabetes mellitus: a comprehensive review. Hippokratia. 2012;16(3):205-14. Available from: /pmc/articles/PMC3738724/
17. Zamani-Alavijeh F, Araban M, Koohestani HR, Karimy M. The effectiveness of stress management training on blood glucose control in patients with type 2 diabetes. Diabetol Metab Syndr. 2018;10(1):1-9. Available from: https://dmsjournal.biomedcentral.com/articles/10.1186/s13098-018-0342-5
18. Yesuf SA. Depression, Anxiety and Stress among Non-communicable Disease Patients: Diabetes Mellitus and Hypertension as Paradigmatic Illnesses. Int J Sci Basic Appl Res. 2020;51(2):69-87. Available from: https://gssrr.org/index.php/JournalOfBasicAndApplied/article/view/10912
19. Esmaeili Z, Esmaeili L, Dabbashi F. Effectiveness of stress inoculation training on psychological well-being in women with diabetes mellitus type 2. Int J Educ Psychol Res. 2016;2(2):88. Available from: https://www.researchgate.net/publication/298807421_Effectiveness_of_stress_inoc ulation_training_on_psychological_well- being_in_women_with_diabetes_mellitus_type_2
20. Alzahrani A, Alghamdi A, Alqarni T, Alshareef R, Alzahrani A. Prevalence and predictors of depression, anxiety, and stress symptoms among patients with type II diabetes attending primary healthcare centers in the western region of Saudi Arabia: a cross-sectional study. Int J Ment Health Syst. 2019;13(1):1-7. Available from: https://ijmhs.biomedcentral.com/articles/10.1186/s13033-019-0307-6
21. Mukrim ME, Alshammari NM, Alshammari WM, Alshammari MS, Alshammari YN, Alshammari AS, et al. Prevalence of depression, anxiety, and stress among diabetes mellitus patients in Arar, Northern Saudi Arabia. IJMDC. 2019;229-33.
22. Bener A, OAA Al-Hamaq A, E Dafeeah E. High prevalence of depression, anxiety and stress symptoms among diabetes mellitus patients. Open Psychiatr J. 2011;5(1):5-12.
23. Almawi W, Tamim H, Al-Sayed N, Arekat MR, Al-Khateeb GM, Baqer A, et al. Association of comorbid depression, anxiety, and stress disorders with Type 2 diabetes in Bahrain, a country with a very high prevalence of Type 2 diabetes. J Endocrinol Invest. 2008;31(11):1020-4. Available from: https://pubmed.ncbi.nlm.nih.gov/19169060/
24. Ahangari H, Moasheri B, Norouzi E, Shayesteh M. The prevalence of stress, anxiety and depression in patients with type 2 diabetes and their association with demographic factors. Health Educ Health Promot. 2016;4(3):13-22.
25. Tan KC, Chan GC, Eric H, Maria AI, Norliza MJ, Oun BH, et al. Depression, anxiety and stress among patients with diabetes in primary care: A cross-sectional study. Malays Fam Physician. 2015;10(2):9-21. Available from: /pmc/articles/PMC4826577/
26. Rehman A, Kazmi SF. Prevalence and level of depression, anxiety and stress among patients with type-2 diabetes mellitus. Ann Pak Inst Med Sci. 2015;11(2):81-6.
27. Sun N, Lou P, Shang Y, Zhang P, Wang J, Chang G, et al. Prevalence and determinants of depressive and anxiety symptoms in adults with type 2 diabetes in China: a cross-sectional study. BMJ Open. 2016;6(8):e012540. Available from: /pmc/articles/PMC5013513/
28. Roupa Z, Koulouri A, Sotiropoulou P, Makrinika E, Marneras X, Lahana I, et al. Anxiety and depression in patients with type 2 diabetes mellitus, depending on sex and body mass index. Health Sci J. 2009;3(1):32-40. Available from: https://pure.unic.ac.cy/en/publications/anxiety-and-depression-in- patients-with-type-2-diabetes-mellitus-
29. Moussa MT, Lovibond P, Laube R, Megahead HA. Psychometric properties of an arabic version of the depression anxiety stress scales (DASS). Res Soc Work Pract. 2017;27(3):375-86. Available from: https://journals.sagepub.com/doi/abs/10.1177/1049731516662916
30. Alduraywish A, Fattah DA, Abd-Eltawab A, Al-Ruwili M, Alhassan A, Alnafe N, et al. Depression and anxiety and their correlates in patients with diabetes mellitus in Al-Jouf Region, Saudi Arabia. Clin Med Diagn. 2017;7(2):48-56.
31. Alharithy MK, Abdalgader OR, Alobaylan MM, Alsugair ZO, Alswat KA. Anxiety prevalence in type 2 diabetes patients in Taif Saudi Arabia. Anxiety. 2019;8(2):88-92.
32. Al-Mohaimeed AA. Prevalence and factors associated with anxiety and depression among type 2 diabetes in Qassim: A descriptive cross-sectional study. J Taibah Univ Med Sci. 2017;12(5):430-6.
33. Fisekovic Kremic MB. Factors associated with depression, anxiety and stress among patients with diabetes mellitus in primary health care: Many questions, few answers. Malays Fam Physician. 2020;15(3):54-61. Available from: https://pubmed.ncbi.nlm.nih.gov/33329863/