



Original Article

The Significance of Disease Knowledge as a Risk Factor for Depression and Anxiety in Diabetic Patients

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Background: Diabetes mellitus is a chronic disease that can lead to depression and anxiety disorders if it is not controlled and managed properly. This study aimed to estimate the prevalence of depression and anxiety disorders among diabetic patients and to determine whether patient knowledge is a risk factor.

Methods: The study included 220 patients with diabetes who attended the Diabetic Care Center. Socio-demographic data on the patients was collected. The Hospital Anxiety and Depression Scale questionnaire was used to assess patients' depression and anxiety levels. The Diabetes Knowledge Test 2 was used to assess the patients' knowledge of diabetes.

Results: From 220 patients with diabetes, anxiety was detected in 78.2%. From the recordings of these patients with diabetes, it was observed that 32.7%, 29.5%, and 15.9% suffered from mild, moderate, and severe anxiety, respectively. Depression was diagnosed in 170 patients (77.2%), with the majority showing a moderate degree (32.3%) of depression. Furthermore, 29.5% and 15.5% patients had recorded mild and severe degrees of depression, respectively. Patients' understanding of diabetes was inadequate in this study, with the majority of patients (70.5%) having a low level of overall diabetes knowledge. In terms of general knowledge of diabetes, 64.1% patients had a low knowledge level, whereas 74.5% patients had a low knowledge level related to insulin therapy.

Conclusion: The patients' diabetes knowledge is significantly correlated with their anxiety and depression symptoms. Patients with diabetes should be regularly screened for anxiety and depression symptoms. Our findings indicate that the educational diabetes program could be a useful intervention for reducing depression and anxiety.

Keywords: Anxiety, Depression, Diabetes mellitus, Hospital anxiety and depression scale, Knowledge

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INTRODUCTION

Diabetes mellitus (DM) is a growing global major health problem that can be fatal if not well controlled. Due to the region's rapid economic development, urbanization, and changes in dietary habits, the Middle East and North Africa are thought to have the greatest overall prevalence of diabetes [1]. Saudi Arabia Kingdom is not excluded from this worldwide epidemic and is considered as the most challenging health issue facing this country [2]. According to reports, 17.7% of Saudi Arabia's population has DM, which is the second highest second-highest prevalence in the area and ranks seventh globally [1]. DM is a metabolic status of different etiologies, distinguished by hyperglycemia, hyperglycemia which can be brought on by defects in with insulin production, insulin action, or both. It is also linked to disturbances in the metabolism of carbohydrates, proteins, and fats [3]. Being a chronic metabolic condition, diabetes requires meticulous lifestyle modifications that some diabetic patients may find hard and challenging to follow, which may have an impact on their psychology [4]. Depression is a prevailing, significant psychiatric disorder that, if not properly managed, can hinder a person's ability to function in a normal way and can even result in suicide [5]. During illness, diabetics patients are more likely to have psychological illnesses, particularly depressive symptoms that could ultimately result in suicidal ideation or suicide [6]. Co-morbid anxiety disorders are frequent in diabetes patients and include generalized anxiety condition, post-traumatic stress status, and panic disorder [7]. With the initial diagnosis of diabetes and with the first onset of diabetes complications, anxiety disorders increase among diabetic patients [8]. Diabetes and psychological illnesses, such as anxiety and depression, may be correlated in a bidirectional manner, with one condition raising the risk of the other [9].

There is a relationship between the prevalence of anxiety and depression in DM patients and worsening self-care, decreased medication adherence, increased healthcare costs, poor glycemic control, increased risk of diabetes micro- and macro-vascular problems, and worse quality of life [10-12]. Studies have shown that educating chronic patients helps them accepting the changes required to their way of life, as they must learn how to manage uncomfortable symptoms, pain, significant weakness, adjustments to and restrictions on their daily activities, side effects of their treatment, and others [13,14].

The procedure of developing the knowledge, skills, and abilities required for diabetic self-care is known as education for diabetes self-management. Diabetes education also improves the standard of treatment and health outcomes while reducing the risk of both immediate and long-term problems. To increase patient self-management, satisfac-

tion, and blood sugar control, all diabetic patients' understanding of their condition should be excellent [15,16]. This study can address the assumption that DM as a chronic disease is a potential risk factor of anxiety and depressive disorders which adversely affect patients' wellness, especially if the patients have no adequate knowledge about their illness. So, the study aimed to estimate the prevalence of depression and anxiety manifestations among diabetic patients. Furthermore, the study estimated the patients' knowledge level about their illness as a considerable risk factor of anxiety and depression.

MATERIALS AND METHODS

1. Study design and setting

This study was conducted in the Diabetic Care Center at King Fahd Hospital, Al-Baha region, Kingdom of Saudi Arabia. The study was held from August 2022 till March 2023. Acceptance from the scientific research committee at King Fahd Hospital was obtained to collect data from the Diabetes Care Center. The present study protocol was reviewed and approved by the institutional review board of King Fahad Hospital, Al-Baha city, Saudi Arabia (KFH/IRB20112022/2). Informed consent was submitted by all subjects when they were enrolled.

2. Target population

The study included adult diabetic patients above 18 years of both genders attending the diabetes care center and not suffering from other co-morbid illnesses. The exclusion criteria was diabetic patients below 18 years, individuals who have other co-morbid illnesses, patients suffering from major psychiatric disorders, and patients who declined to participate in the study. Interviews with the diabetic patients were held for quantitative data collection after obtaining verbal consent from patients for agreement to share in the study. The participant's answers were kept private and confidential.

3. Instruments and tools

Socio-demographic data was collected, including age, gender, marital status, educational degree, and diabetes type. Clinical data were included in the questionnaire as the type of diabetes (type 1, type 2); the type of the medication they receive (oral therapy, insulin therapy, or both); compliance with treatment refers to the extent of conformity to the recommendations about day-to-day treatment by the healthcare provider with respect to the timing, dosage [17],

and frequency and herein the patients were classified as (compliant, to somewhat complaint and non-compliant); complication of the disease and is classified into (no complication, complication in one organ, complication in ≥ 2 organs); the regularity of follow-up visits (regular, non-regular). All questionnaires were completed by patients independently. The investigator assisted the patient to provide a response in any way influencing his or her response if they were illiterate or faced other challenges that prevented them from completing the questionnaire.

Hospital Anxiety and Depression Scale (HADS), which was developed by Zigmond and Snaith [18], was employed to evaluate patients' anxiety and depressive symptoms. Its goal is to give the physician a practical tool for recognizing and estimating anxiety and depression that is acceptable, reliable, valid, and easy to use. The scale serves a dimensional rather than a category purpose; it is best used to identify hospital patients who require additional psychiatric assessment and care rather than to diagnose psychiatric diseases. It is considered as a validated and standardized instrument with good sensitivity and specificity [19]. The HADS is a 14-item, 4-point Likert scale-based self-report rating measure (with a range of 0-3). Seven questions on this scale are used to assess depression and anxiety. The sum of the 14 items determines the final score, while the specific seven items (ranging from 0 to 21) determine the final score for each subscale. The HADS is available in English, and in Arabic. Arabic version that was validated by [20] was used. Scores of 7 or less on the anxiety and depression scales indicate non-cases. Mild cases are indicated by numbers 8 to 10, moderate cases by numbers 11 to 14, and severe cases by numbers 15 to 21.

For assessing patients' knowledge level about diabetes, Diabetes Knowledge Test 2 (DKT2) was applied. DKT2 has been shown to be an efficient and affordable way to estimate general diabetes and diabetes self-care knowledge. DKT2 is divided into two portions, each of which is scored separately. The first part, assessing the general knowledge, has 14 items. A further 9 items in part 2 entail questions regarding insulin therapy. Each part can be used independently [21,22]. But, we used both parts with a total score out of 23. Only a numerical score is provided by the DKT2, and there are no established categories for low, moderate, and high levels of knowledge. Consequently, we adopted the categories' definitions created by prior studies [23]. As follows: (1) Global DKT: 1-11, 12-18, and 19-23, respectively, for low, average, and high knowledge level, (2) General Knowledge Part: low 1-6, average 7-11, high 12-14, (3) Insulin Therapy Part: 1-4 is considered low, 5-7 is considered moderate, and 8-9 is considered high. The Arabic validated version of the questionnaire was used [24].

4. Statistical analysis

Statistical Package for the Social Sciences version 26 (IBM Co.) was used to analyze the data. Numbers and percentages are used to represent descriptive statistics. A 95% confidence interval and a p-value cut-off point of 0.05 were used to evaluate statistical significance. For categorical variables, a chi-square test was performed, and for continuous variables, a Spearman's rho test was used. Cross tabulation was employed to examine the relationship between categorical variables. By applying these statistical techniques, we gained valuable insights into the relationships between variables in our study and were able to draw meaningful conclusions from our data.

RESULTS

1. Patients' socio-demographics and prevalence of anxiety and/or depression

This study enrolled a total of 220 diabetic patients. Of them, 74.5% were women and 25.5% were men. The mean age was 41.9 (15.6) years. In total, 65.9% were married and 52.7% had educational qualification at university level. Of the total, 65.9% had diabetes type 2 and 40.9% were on insulin therapy. The characteristics of subjects are shown in Table 1 stratified by the occurrence of anxiety or depression disorders. A total of 172 patients (78.2%) had an anxiety score of ≥ 8 , mainly mild degree of anxiety (32.7%). Depression was recorded in 170 individuals (77.2%), and mainly moderate degree (32.35%). Patients with type 2 diabetes group was found to have a higher prevalence rates of depression than patients suffering from type 1 diabetes. The prevalence of 'mild', 'moderate', and 'severe' scores of anxiety and depression, by type of diabetes is shown in Table 2. There is no significant correlation between anxiety and depression scores and other variables including age, gender, educational level, complications, or compliance with treatment.

2. Diabetes knowledge level as recorded by DKT2 scores

The majority of the patients (70.5%) have a low level of global diabetes knowledge level which included both parts (general and insulin therapy knowledge) and (25.0%) had average knowledge. While, only (4.5%) had high knowledge level scores by DKT2 with the mean score of 8.18 (5.86). Regarding the part of general knowledge (64.1%), had low knowledge level and the mean score was 5.06 (4.02). For the insulin therapy, part (74.5%) had low knowledge level and the mean score was 3.1 ± 2.08 (Fig. 1). As shown in Table 3, no

Table 1. Socio-demographic data characteristics stratified by anxiety and/or depression total score

Characteristic	Anxiety					Depression				
	No	Yes	Total	X ²	p-value ^{a)}	No	Yes	Total	X ²	p-value ^{a)}
Age (yr)				3.289	0.349				6.739	0.081
18-30	17 (35.4)	59 (34.3)	76 (34.5)			19 (38.0)	57 (33.5)	76 (34.5)		
31-45	13 (27.1)	29 (16.9)	42 (19.1)			13 (26.0)	29 (17.1)	42 (19.1)		
46-55	9 (18.8)	47 (27.3)	56 (25.5)			6 (12.0)	50 (29.4)	56 (25.5)		
> 55	9 (18.8)	37 (21.5)	46 (20.9)			12 (24.0)	34 (20.0)	46 (20.9)		
Total	48	172	220			50	170	220		
Gender				0.007	0.935				0.072	0.788
Man	12 (25.0)	44 (25.6)	56 (25.5)			12 (24.0)	44 (25.9)	56 (25.5)		
Woman	36 (75.0)	128 (74.4)	164 (74.5)			38 (76.0)	126 (74.1)	164 (74.5)		
Total	48	172	220			50	170	220		
Marital status				1.149	0.765				4.179	0.243
Married	31 (64.6)	114 (66.3)	145 (65.9)			29 (58.0)	116 (68.2)	145 (65.9)		
Single	11 (22.9)	41 (23.8)	52 (23.6)			13 (26.0)	39 (22.9)	52 (23.6)		
Divorced	0 (0.0)	2 (1.2)	2 (0.9)			0 (0.0)	2 (1.2)	2 (0.9)		
Widow	6 (12.5)	15 (8.7)	21 (9.5)			8 (16.0)	13 (7.6)	21 (9.5)		
Total	48	172	220			50	170	220		
Education				2.707	0.608				1.707	0.789
Primary	5 (10.4)	20 (11.6)	25 (11.4)			6 (12.0)	19 (11.2)	25 (11.4)		
Secondary	2 (4.2)	2 (1.2)	4 (1.8)			0 (0.0)	4 (2.4)	4 (1.8)		
High	10 (20.8)	33 (19.2)	43 (19.5)			11 (22.0)	32 (18.8)	43 (19.5)		
University	26 (54.2)	90 (52.3)	116 (52.7)			27 (54.0)	89 (52.4)	116 (52.7)		
Uneducated	5 (10.4)	27 (15.7)	32 (14.5)			6 (12.0)	26 (15.3)	32 (14.5)		
Total	48	172	220			50	170	220		
Type of diabetes mellitus				0.824	0.364				5.571	0.018
Type 1	19 (39.6)	56 (32.6)	75 (34.1)			24 (48.0)	51 (30.0)	75 (34.1)		
Type 2	29 (60.4)	116 (67.4)	145 (65.9)			26 (52.0)	119 (70.0)	145 (65.9)		
Total	48	172	220			50	170	220		
Medication				0.723	0.697				1.667	0.434
Oral	17 (35.4)	50 (29.1)	67 (30.5)			18 (36.0)	49 (28.8)	67 (30.5)		
Insulin	18 (37.5)	72 (41.9)	90 (40.9)			21 (42.0)	69 (40.6)	90 (40.9)		
Oral and insulin	13 (27.1)	50 (29.1)	63 (28.6)			11 (22.0)	52 (30.6)	63 (28.6)		
Total	48	172	220			50	170	220		
Compliance with treatment ^{b)}				0.502	0.778				1.356	0.508
Compliant	28 (58.3)	107 (62.2)	135 (61.4)			28 (56.0)	107 (62.9)	135 (61.4)		
To somewhat	17 (35.4)	52 (30.2)	69 (31.4)			19 (38.0)	50 (29.4)	69 (31.4)		
Non-compliant	3 (6.3)	13 (7.6)	16 (7.3)			3 (6.0)	13 (7.6)	16 (7.3)		
Total	48	172	220			50	170	220		
Complication				0.064	0.969				0.174	0.917
No complication	24 (50.0)	87 (50.6)	111 (50.5)			24 (48.0)	87 (51.2)	111 (50.5)		
Complication in one organ	20 (41.7)	69 (40.1)	89 (40.5)			21 (42.0)	68 (40.0)	89 (40.5)		
Complication in two or more organ	4 (8.3)	16 (9.3)	20 (9.1)			5 (10.0)	15 (8.8)	20 (9.1)		
Total	48	172	220			50	170	220		
Follow-up				1.727	0.189				1.086	0.297
Regular	42 (87.5)	136 (79.1)	178 (80.9)			43 (86.0)	135 (79.4)	178 (80.9)		
Non-regular	6 (12.5)	36 (20.9)	42 (19.1)			7 (14.0)	35 (20.6)	42 (19.1)		
Total	48	172	220			50	170	220		

Values are presented as number (%) or number only.

Definition of anxiety and/or depression status: hospital anxiety scale-anxiety ≥ 8 and/or hospital depression scale-depression score ≥ 8 . X² = chi-square test.

^{a)}No significant differences observed on chi-square analysis except between depression and type 2 diabetes ($p < 0.05$).

^{b)}Compliance to treatment: compliant means is strictly adherent to treatment regarding dose, time and frequency; to some what compliant means is adherent to the dose, time and frequency in about more that 80%; non-complaint means to not adherent to the treatment regarding dose, time and frequency.

Table 2. Correlation between diabetes type and anxiety and/or depression score

	Anxiety				X ²	p-value	Depression				X ²	p-value
	Mild	Moderate	Severe	Total			Mild	Moderate	Severe	Total		
Type of diabetes mellitus					0.561	0.961					0.121	0.042 ^{a)}
Type 1	21 (37.50)	21 (37.50)	14 (25.00)	56 (100)			20 (39.22)	22 (43.14)	9 (17.65)	51 (100)		
Type 2	51 (43.97)	44 (37.93)	21 (18.10)	116 (100)			45 (37.82)	49 (41.18)	25 (21.01)	119 (100)		
Total	72 (41.86)	65 (37.79)	35 (20.35)	172 (100)			65 (38.24)	71 (41.76)	34 (20.00)	170 (100)		

Values are presented as number (%).

X²: chi-square test.

^{a)}Significant correlation between depression status and type 2 diabetes.

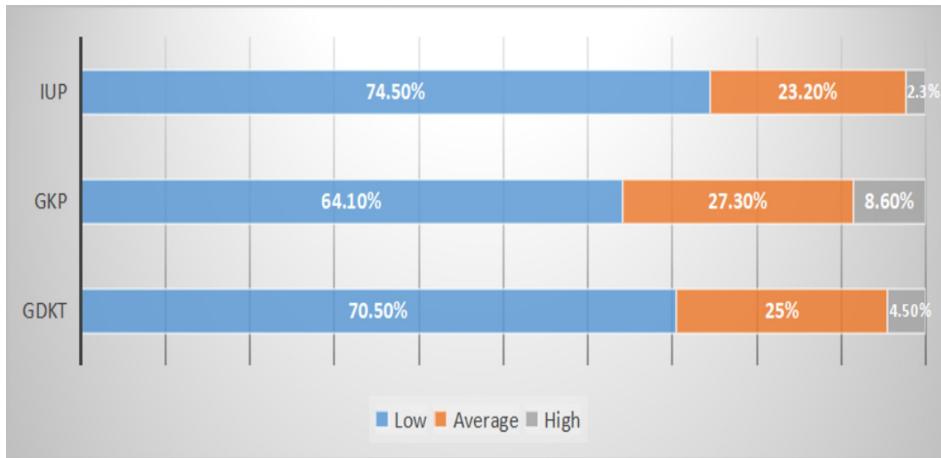


Fig. 1. Percentage of diabetes knowledge level according to the scores of Diabetic Knowledge Test. IUP: Insulin Use Practice, GKP: General Knowledge Part, GDKT: Global Diabetic Knowledge Test.

significant correlation between socio-demographic characteristics and knowledge level except a significant correlation ($p < 0.05$) was noticed between the occurrence of complications and the patients' knowledge level.

3. Patients' knowledge about diabetes and subjects' anxiety and depression

All questionnaire questions of the DKT were assessed and it was shown that the level of patient knowledge and their experience with anxiety and depression are significantly correlated regarding part 1 of general knowledge and part 2 about insulin therapy. Patients' anxiety and depressive symptoms and the patients' level of diabetes knowledge, which includes general, global, and insulin therapy knowledge, were significantly correlated (Table 4).

DISCUSSION

DM is the most chronic prevalent disease in Saudi Arabia and is considered as the most challenging health problem facing this country [25]. It demands lifelong management, which can enhance and have an impact on the patient's life in various ways, particularly regarding the psychological burden and quality of life [26,27]. Our findings demonstrat-

ed that 78.2% of diabetic patients had anxiety and 77.2% had depression. Patients with depression were significantly more in diabetic type 2 patients. This is consistent with previous studies recording 80% depression cases [28] and 54% depression manifestations among type 2 diabetic patients [29]. The high prevalence of anxiety and depression among diabetic patients could be explained by one biological theory postulating that changes in blood glucose levels may have an impact on the central nervous system, which regulates mood and cognition [30]. Moreover, the high level of inflammatory markers in diabetic patients could contribute to depressive manifestations [31].

Another striking theory is that diabetes is not like other chronic diseases where the major management is mainly the role of the medical team, but it depends mainly on the patients and their families. This burden is presented by precise daily monitoring of blood glucose levels and adjusting the insulin dose [32]. Patients have to take rapid actions in cases of hypo/hyperglycemia [2]. So, it is crucial for patients to be well educated about their illness and how to manage it to be more confident and thus decreasing the liability for anxiety and depression.

The study findings have shown that there is a low level of knowledge about diabetes among patients for both DKT2 parts (general knowledge and insulin therapy). This finding is consistent with that of Zowgar et al. [23] which demon-

Table 3. Socio-demographic data characteristics stratified by Diabetes Knowledge Test 2 scores

Characteristics	Global diabetes score	p-value	General knowledge score	p-value	Insulin use score	p-value
Age (yr)	8.18 ± 5.86	0.49	5.06 ± 4.02	0.517	3.11 ± 2.08	0.718
Gender, n (man/woman)	8.18 ± 5.86	0.439	5.06 ± 4.02	0.747	3.11 ± 2.08	0.843
Marital status						
Married	8.17 ± 5.72	0.86	5.08 ± 3.92	0.976	3.08 ± 2.03	0.732
Single	8.06 ± 6.38		4.96 ± 4.34		3.10 ± 2.23	
Divorced	4.00 ± 1.41		2.50 ± 2.12		1.50 ± 0.71	
Widow	8.95 ± 5.83		5.43 ± 4.08		3.52 ± 2.14	
Educational level		0.811		0.874		0.868
Primary	7.32 ± 5.75		4.40 ± 3.97		2.92 ± 1.98	
Secondary	9.75 ± 7.89		6.25 ± 4.79		3.50 ± 3.11	
High	8.56 ± 5.81		5.23 ± 3.98		3.33 ± 2.10	
University	8.16 ± 5.94		5.14 ± 4.13		3.02 ± 2.02	
Uneducated	8.22 ± 5.79		4.94 ± 3.76		3.28 ± 2.30	
Type of diabetes mellitus		0.168				0.735
Type 1	7.63 ± 5.85		4.60 ± 4.07		3.03 ± 1.98	
Type 2	8.46 ± 5.87		5.30 ± 3.98	0.294	3.16 ± 2.14	
Type of medication		0.182		0.181		0.196
Oral	8.94 ± 6.26		5.63 ± 4.31		3.31 ± 2.17	
Insulin	8.26 ± 6.05		5.07 ± 4.14		3.19 ± 2.14	
Oral and insulin	7.25 ± 5.06		4.46 ± 3.44		2.79 ± 1.89	
Compliance with treatment		0.539				0.547
Compliant	8.18 ± 5.93		5.07 ± 3.96	0.501	3.11 ± 2.17	
To somewhat	7.35 ± 5.76		4.42 ± 4.07		2.93 ± 1.97	
Non-compliant	11.75 ± 4.49		7.81 ± 3.17	3.94	3.94 ± 1.65	
Follow-up		0.526		0.881		0.523
Regular	8.25 ± 5.99		5.16 ± 4.06		3.09 ± 2.15	
Irregular or no	7.88 ± 5.31		4.67 ± 3.83		3.21 ± 1.80	
Complications		0.049 ^{a)}		0.035 ^{a)}		0.03 ^{a)}
No complications	9.02 ± 5.84		5.65 ± 4.11		3.37 ± 2.00	
Complication in one organ	7.25 ± 5.70		4.40 ± 3.77		2.84 ± 2.13	
Complication in two or more organs	7.65 ± 6.27		4.75 ± 4.28		2.90 ± 2.25	

Values are presented as mean±standard deviation.

^{a)}Correlation is significant at the 0.05 level (2-tailed).

Table 4. Correlation between the patients' knowledge level about diabetes and anxiety and depression status

	Spearman's rho	Anxiety	Depression	GDKT	GKP	IUP
Anxiety	Correlation coefficient	1	0.695 ^{a)}	-0.225 ^{a)}	-0.222 ^{a)}	-0.204 ^{a)}
	Sig. (2-tailed)		0.000	0.001	0.001	0.002
Depression	Correlation coefficient		1	-0.225 ^{a)}	-0.235 ^{a)}	-0.176 ^{a)}
	Sig. (2-tailed)			0.001	0.000	0.009
GDKT	Correlation coefficient			1	0.975 ^{a)}	0.925 ^{a)}
	Sig. (2-tailed)				0.000	0.000
GKP	Correlation coefficient				1	0.823 ^{a)}
	Sig. (2-tailed)					0.000
IUP	Correlation coefficient					1
	Sig. (2-tailed)					

Sig.: significance, GDKT: Global Diabetic Knowledge Test, GKP: General Knowledge Part, IUP: Insulin Use Practice.

^{a)}Correlation is significant at the 0.01 level (2-tailed).

strated poor patients' knowledge regarding diabetes in their study that was conducted in Makkah city, Kingdom of Saudi Arabia. The major result of this study was the significant relationship between the patients' knowledge level about their

illness and the occurrence of anxiety or depression. Lower illness knowledge was correlated significantly with a higher score. The demographics, clinical characteristics, complications, and care of diabetes patients were the focus of previ-

ous studies that looked at the correlation between anxiety and/or depression scores [29]. To our best of knowledge, there were no prior studies correlating a patient's knowledge level with their likelihood of experiencing anxiety or depression. Disease knowledge proved to be a noteworthy risk factor that was previously disregarded and that can be appreciated. Accordingly, we hypothesized that in diabetic patients, anxiety and depression are mainly determined by the patient's insight of the overwhelming chronic disease and the perspective of fronting this problematic condition.

However, the study has certain limitations. The cross-sectional design of the research makes it difficult to determine a cause-and-effect relationship between the variables. This study is conducted in one region only in Saudi Arabia and so a limited number of participants were included that limits the generalization of the study results. Furthermore, because the patients were not followed-up, it is impossible to make predictions on how the individuals' anxiety and depression symptoms will develop in the future in relation to other variables. Prospectively monitoring these individuals would be useful to determine the progression of the symptoms and the final outcome.

CONCLUSION

Anxiety and depression are prevalent among diabetic patients, especially young women with type 2 diabetes. In this study, we noted that the level of diabetic patients' disease knowledge is a significant risk factor of anxiety and/or depression. According to this study, a risk factor for anxiety and/or depression in diabetic patients is their level of disease knowledge. Screening diabetic patients for anxiety and depression manifestations is crucial to provide the necessary therapy and support. Besides, increasing the patients' knowledge by an educational diabetes self-management program, that enhances the knowledge, talents, and skills required for self-care of diabetes, will support patients and decrease the scores of anxiety and depression.

NOTES

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- **Authors' contributions:** N.E. has shared in conceptualization of the study, implementation and writing. H.A. and M.S. have shared in the implementation and the writing of the manuscript. A.A. has shared in data collection. A.A., H.A., R.W., and W.A. have shared in the study design, data collection and writing manuscript. R.A. made the data analysis and shared in writing the manuscript. All authors read and approved the final manuscript.
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REFERENCES

1. International Diabetes Federation. IDF diabetes atlas reports [Internet]. IDF; 2022 [cited 2023 May 15]. Available from: <https://diabetesatlas.org/atlas-reports/>
2. AlDawish MA, Robert AA, Braham R, Al Hayek AA, Al Saeed A, Ahmed RA, et al. Diabetes mellitus in Saudi Arabia: A review of the recent literature. *Curr Diabetes Rev* 2016;12(4):359-68.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2010;33(Suppl 1):S62-9.
4. Kalra S, Sridhar GR, Balhara YP, Sahay RK, Bantwal G, Baruah MP, et al. National recommendations: Psychosocial management of diabetes in India. *Indian J Endocrinol Metab* 2013; 17(3):376-95.
5. Poznyak V. World Health Organization guidelines for the treatment of substance use disorders and comorbid conditions. *Rev Int Investig Addicciones* 2018;4(1):1-3.
6. Poulsen K, Pachana N. Depression and anxiety in older and middle-aged adults with diabetes. *Aust Psychol* 2012;47(2):90-7.
7. Katon W. Depression and diabetes: Unhealthy bedfellows. *Depress Anxiety* 2010;27(4):323-6.
8. Doupis J, Veves A. Antioxidants, diabetes, and endothelial dysfunction. *US Endocrinology* 2007;(2):61-5.
9. Pan A, Lucas M, Sun Q, van Dam RM, Franco OH, Manson JE, et al. Bidirectional association between depression and type 2 diabetes mellitus in women. *Arch Intern Med* 2010;170(21):1884-91.
10. Grey M, Whittemore R, Tamborlane W. Depression in type 1 diabetes in children: Natural history and correlates. *J Psychosom Res* 2002;53(4):907-11.
11. Stewart SM, Rao U, Emslie GJ, Klein D, White PC. Depressive symptoms predict hospitalization for adolescents with type 1

- diabetes mellitus. *Pediatrics* 2005;115(5):1315-9.
12. Egede LE, Ellis C. Diabetes and depression: Global perspectives. *Diabetes Res Clin Pract* 2010;87(3):302-12.
 13. Bogner HR, Morales KH, de Vries HF, Cappola AR. Integrated management of type 2 diabetes mellitus and depression treatment to improve medication adherence: A randomized controlled trial. *Ann Fam Med* 2012;10(1):15-22.
 14. Johnson JA, Al Sayah F, Wozniak L, Rees S, Soprovich A, Qiu W, et al. Collaborative care versus screening and follow-up for patients with diabetes and depressive symptoms: Results of a primary care-based comparative effectiveness trial. *Diabetes Care* 2014;37(12):3220-6.
 15. Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, Hess Fischl A, et al. Diabetes self-management education and support in type 2 diabetes: A joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *Diabetes Care* 2015;38(7):1372-82.
 16. American Diabetes Association. 1. Promoting health and reducing disparities in populations. *Diabetes Care* 2017;40(Suppl 1):S6-10.
 17. Cramer JA, Roy A, Burrell A, Fairchild CJ, Fuldeore MJ, Ollendorf DA, et al. Medication compliance and persistence: Terminology and definitions. *Value Health* 2008;11(1):44-7.
 18. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67(6):361-70.
 19. Herrmann C. International experiences with the hospital anxiety and depression scale - a review of validation data and clinical results. *J Psychosom Res* 1997;42(1):17-41.
 20. Terkawi AS, Tsang S, AlKahtani GJ, Al-Mousa SH, Al Musaed S, AlZoraigi US, et al. Development and validation of Arabic version of the hospital anxiety and depression scale. *Saudi J Anaesth* 2017;11(Suppl 1):S11-8.
 21. Fitzgerald JT, Funnell MM, Hess GE, Barr PA, Anderson RM, Hiss RG, et al. The reliability and validity of a brief diabetes knowledge test. *Diabetes Care* 1998;21(5):706-10.
 22. Fitzgerald JT, Funnell MM, Anderson RM, Nwankwo R, Stansfield RB, Piatt GA. Validation of the revised brief diabetes knowledge test (DKT2). *Diabetes Educ* 2016;42(2):178-87.
 23. Zowgar AM, Siddiqui MI, Alattas KM. Level of diabetes knowledge among adult patients with diabetes using diabetes knowledge test. *Saudi Med J* 2018;39(2):161-8.
 24. Alhaiti AH, Alotaibi AR, Jones LK, DaCosta C, Lenon GB. Psychometric evaluation of the revised Michigan diabetes knowledge test (V.2016) in Arabic: Translation and validation. *J Diabetes Res* 2016;2016:9643714.
 25. Alhawaish AK. Economic costs of diabetes in Saudi Arabia. *J Family Community Med* 2013;20(1):1-7.
 26. Delamater AM, de Wit M, McDarby V, Malik J, Acerini CL; International Society for Pediatric and Adolescent Diabetes. ISPAD clinical practice consensus guidelines 2014. Psychological care of children and adolescents with type 1 diabetes. *Pediatr Diabetes* 2014;15(Suppl 20):232-44.
 27. AlBuhairan F, Nasim M, Al Otaibi A, Shaheen NA, Al Jaser S, Al Alwan I. Health related quality of life and family impact of type 1 diabetes among adolescents in Saudi Arabia. *Diabetes Res Clin Pract* 2016;114:173-9.
 28. Alaqeel A, Almijmaj M, Almushaigeh A, Aldakheel Y, Almesned R, Al Ahmadi H. High rate of depression among Saudi children with type 1 diabetes. *Int J Environ Res Public Health* 2021;18(21):11714.
 29. Al Qusaibi B, Mosli H, Kattan W, Fadel H, Alariefy A, Almalki B, et al. Depression among patients with type 2 diabetes mellitus at King Abdulaziz University Hospital (KAUH): A cross-sectional study. *Cureus* 2022;14(6):e25990.
 30. Lyoo IK, Yoon SJ, Musen G, Simonson DC, Weinger K, Bolo N, et al. Altered prefrontal glutamate-glutamine-gamma-aminobutyric acid levels and relation to low cognitive performance and depressive symptoms in type 1 diabetes mellitus. *Arch Gen Psychiatry* 2009;66(8):878-87.
 31. Herder C, Schmitt A, Budden F, Reimer A, Kulzer B, Roden M, et al. Association between pro- and anti-inflammatory cytokines and depressive symptoms in patients with diabetes-potential differences by diabetes type and depression scores. *Transl Psychiatry* 2018;7(11):1.
 32. Reynolds KA, Helgeson VS. Children with diabetes compared to peers: Depressed? Distressed? A meta-analytic review. *Ann Behav Med* 2011;42(1):29-41.