

## Prevalence and Determinants of Depression among Type 2 Diabetic Patients in Tabuk City, Saudi Arabia

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### ABSTRACT

**Background:** Compared with patients with diabetes alone, patients with depression and diabetes have been shown to have poorer self-management and poor adherence to anti-diabetics, lipid-lowering and antihypertensive treatment.

**Objectives:** To investigate the prevalence and determinants of depression in patients with T2DM attending general hospitals, Tabuk, Saudi Arabia.

**Subjects and Methods:** A cross-sectional community based study was conducted in Tabuk city, Saudi Arabia. A representative random sample of diabetic type 2 Saudi patients aged 18 years or above who attended out patients clinics of the two main general hospitals, belonging to Ministry of health (King Khalid and King Fahd specialist hospitals) throughout the study period (20 July to 20 Aug, 2016) constituted the population for the study. Data collection questionnaire developed by the researchers composed of two parts; Personal characteristics and diabetes-related variables. The Arabic version of the Patient Health Questionnaire (PHQ-9) was utilized for diagnosis of depression.

**Results:** The study included 221 patients with a response rate of 61%. Approaching one-third of them (34.8%) aged between 50 and 59 years and 4.1% aged over 70 years. Males represent 51.6% of them. Obesity and extreme obesity were reported among 35.7% and 5.5% of the patients, respectively. Family history of depression was reported among 37 patients representing 16.7% of the respondents. Depression was reported among almost most of type 2 diabetic patients

(77.8%). It was mild among 32.1% of them, moderate among 25.8% whereas it was moderately severe or severe among 19.9% of them. Low income patients ( $\leq 5000$  SR/month), those with family history of depression, treated with insulin and having diabetic complication were more likely to be depressed than their counterparts.

**Conclusion:** Depression was prevalent among type 2 diabetic patients attended general hospitals in Tabuk city. Implementing screening program for diabetic patients regarding depression through trained family physicians especially for high risk groups as well as referral of those suffering from severe depression to psychiatrists as early as possible are recommended.

**Key Words:** Diabetes type 2, Depression, Patient Health Questionnaire, Insulin, Complications.

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### INTRODUCTION

The lifetime prevalence of major depression in adults is estimated to be 7 to 12 percent in men and 20 to 25 percent in women. The prevalence of depression in patients in primary care settings ranges from 5 to 10 percent. The rates are significantly higher in persons with certain medical conditions, including obesity, diabetes mellitus, cancer, and a history of myocardial infarction.<sup>1</sup>

The World Health Organization reported that 300 million people will suffer from diabetes by 2025.<sup>2</sup> In the Kingdom of Saudi Arabia; the number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. The overall prevalence of diabetes was 23.7%, with 26.2% being males and 21.5% females. The

calculated age-adjusted prevalence for Saudi population for the year 2000 was 21.9%. Diabetes mellitus is more prevalent among Saudis living in urban areas 25.5% compared to rural areas as 19.5%.<sup>3</sup>

Diabetes is a major contributor to the global burden of disease and a growing number of studies show links between depression and diabetes.<sup>4,7</sup> The rate of depression in people with diabetes is much higher than in the general population.<sup>8</sup> A meta-analysis including 20 controlled studies found that the risk of depression in the diabetic groups was two-fold higher than that in the non-diabetic comparison groups.<sup>9</sup> This relative risk of depression is greater than found in most other chronic diseases.<sup>10</sup> The risk of depression

increases in women with diabetes.<sup>8</sup> The prevalence of depression is higher in patients with diabetes who have long-term complications.<sup>11,12</sup>

Compared with patients with diabetes alone, patients with depression and diabetes have been shown to have poorer self-management and poor adherence to antidiabetic, lipid-lowering and antihypertensive treatment.<sup>13</sup> They are more likely to have higher cardiovascular risk factors like smoking, obesity, sedentary lifestyle, and uncontrolled hyperglycaemia.<sup>12</sup> Depression may be an important barrier to effective diabetes management. Patients with depression and diabetes are more likely to have higher macrovascular and microvascular complications<sup>9</sup> and higher mortality rates.<sup>14</sup>

Despite numerous investigations, the underlying pathophysiology of the metabolic abnormalities are poorly understood. A possible role play the increases counter-regulatory hormone release involved in glucose homeostasis, alterations in the glucose transport function and increased inflammatory activation triggered by depression.<sup>10</sup> Psychiatric disorders could affect patients' quality of life. Such effects may be due to alterations in diet, constant dependence on medication, short and long-term side effects and the burden of costs.<sup>15</sup>

Previous studies have shown individuals who are insulin-resistant may have higher serotonin concentrations and may be more prone to depression and even suicide.<sup>9</sup>

While depression may contribute to poor diabetes-related outcomes, diabetes and its complications may also contribute to poor depression outcomes.<sup>10,13,16</sup>

In the absence of systematic screening, family physicians miss at least 50% of cases of major depression. The 9-item Patient Health Questionnaire (PHQ-9) is a potentially valuable tool for diagnosis and management of depression.<sup>17</sup> The PHQ-9 has been recommended for depression screening in primary care.<sup>18</sup>

This study aimed to investigate the prevalence and determinants of depression in patients with T2DM attending general hospitals, Tabuk, Saudi Arabia.

## SUBJECTS AND METHODS

A cross-sectional community based study was conducted in Tabuk city, Saudi Arabia. In Tabukcity, there are two main general hospitals, belonging to Ministry of health (King Khalid and King Fahd specialist hospitals) where the study was conducted. All diabetic type 2 Saudi patients aged 18 years or above who attended out patients clinics of the involved hospitals throughout the study period (20 July to 20 Aug, 2016) constituted the target population for the study.

Assuming that the prevalence of major depressive disorder among type 2 diabetic patients was 6.2%;<sup>19</sup>

According to the formula of sample size calculation:

$$N = \frac{T^2 \times P(1-P)}{M^2}$$

Where N = required sample size. T = confidence level at 95% (standard value of 1.96), P = estimated prevalence of disease in the project area and M = margin of error at 5% (standard value of 0.05). The sample size was a minimum of 362 patients. The sample size was almost equally distributed over the two hospitals (King Khalid hospital and King Fahd specialist hospital). An average of two week was spent in each hospital to randomly select patients.

Data collection questionnaire developed by the researchers composed of two parts; Personal characteristics: Age, sex, education, employment, marital status, number of children, presence of co-morbidity (e.g., hypertension, heart disease, bronchial asthma, renal disease, etc.), smoking and family history of depression and diabetes-related variables: duration of disease, insulin treatment, compliance with therapy, presence of complications. In addition to data collected from patient's file (number of follow-up visits over the last year, last fasting blood glucose level, last HBA1c, weight and height). Fasting blood sugar level (mg/dl) will be assessed for diabetic patients. The level of control of diabetes as indicated by fasting blood sugar control was determined according to Campbell and Braithwaite,<sup>20</sup> as follows: Good (<126 mg/dl), borderline (126-180 mg/dl) and poor (>180 mg/dl).

Glycosylated hemoglobin (HBA1c) Levels above 9% was considered as poor control, and levels above 12% will be considered as very poor control.<sup>21</sup> Body mass index (BMI) was calculated by dividing the weight in kg by the square of the length in meter. Participants were categorized, based on their BMI values into four subgroups; normal (BMI from 18.5 to 24.9 kg/m<sup>2</sup>), overweight (BMI from 25 to 29.9 kg/m<sup>2</sup>), Obese (BMI from 30 to 39.9 kg/m<sup>2</sup>), and extremely obese (BMI ≥ 40 kg/m<sup>2</sup>).

The Arabic version of the Patient Health Questionnaire (PHQ-9): This questionnaire is composed of 9 statements. The PHQ-9 is a multipurpose instrument for screening, diagnosing, monitoring and measuring the severity of depression. The PHQ-9 incorporates DSM-IV depression diagnostic criteria with other leading major depressive symptoms into a brief self-report tool. The tool rates the frequency of the symptoms which factors into the scoring severity index. The PHQ-9 is brief and useful in clinical practice. The PHQ-9 is completed by the patient in minutes and is rapidly scored by the clinician. The PHQ-9 can also be administered repeatedly, which can reflect improvement or worsening of depression in response to treatment.<sup>22</sup> Liuet al.<sup>23</sup> reported that the PHQ-9 had a good internal consistency ( $\alpha = .80$ ) and test-retest reliability (intra-class correlation coefficient = 0.87). The PHQ-9 is significantly correlated with the external validators such as the 17-item of Hamilton Rating Scale and the Short Form of the Quality of Life Enjoyment and Satisfaction Questionnaire ( $P < 0.001$ ). A PHQ-9 score of 10 or higher had a sensitivity of 0.86 and a specificity of 0.94 for recognizing major depressive disorders. The PHQ-9 has 9 questions with a score ranging from 0 to 3 for each setting to consider initiating treatment with antidepressants.<sup>24</sup> Table 1 describes the provisional diagnoses for scoring classes.

Table 1: PHR-p classification

PHQ-9 score	Provisional diagnosis
• 0-4	None
• 5-9	Mild depression
• 10-14	Moderate depression
• 15-19	Moderately severe depression
• 20-27	Severe depression

Prior to data collection, the investigators informed all potential participants regarding the objectives of the study. They were assured that no harm is ever expected to occur if they decide to

participate in the study. All diabetic subjects who obtained scores >10 were referred to a psychiatrist to establish the final diagnosis and to start management accordingly.

Statistical Package for Social Sciences (SPSS) software version 21.0 was used for computerized data entry and analysis. Descriptive statistics (number, percentage for categorical variables and mean, standard deviation and range for continuous variables) and analytic statistics using Chi Square tests ( $\chi^2$ ) to test for the association and/or the difference between two categorical variables were applied. P-value equal or less than 0.05 was considered statistically significant.

## RESULTS

The study included 221 patients with a response rate of 61%. Table 2 summarizes their socio-demographic characteristics. Approaching one-third of them (34.8%) aged between 50 and 59 years and 4.1% aged over 70 years. Males represent 51.6% of them. Majority of the participants (77.4%) were married. Most of them (72.8%) had at least four children. About half of them (45.3%) were house wives whereas 22.6% were governmental employees. The income of 60.6% of them was below SR/month. Current smoking was reported among 24.4% of the participants whereas 9.5% were ex-smokers.

**Table 2: Socio-demographic characteristics of the participants**

	Frequency (N=221)	Percentage
<b>Age in years</b>		
30-39	45	20.4
40-49	56	25.3
50-59	77	34.8
60-69	34	15.4
≥70	9	4.1
<b>Gender</b>		
Male	114	51.6
Female	107	48.4
<b>Marital status</b>		
Single	11	5.0
Married	171	77.4
Divorced	15	6.8
Widowed	24	10.8
<b>Number of children</b>		
None	13	5.9
1	11	5.0
2	15	6.8
3	21	9.5
≥4	161	72.8
<b>Job</b>		
Governmental employee	50	22.6
Private sector employee	19	8.6
Business	18	8.1
House wife	100	45.3
Retired	34	15.4
<b>Income in Saudi Riyals/month</b>		
≤5000	134	60.6
5001-10000	47	21.3
>10000	40	18.1
<b>Smoking history</b>		
Current smoker	54	24.4
Non-smoker	146	66.1
Ex-smoker	21	9.5

**Table 3: Medical characteristics of the participants**

	Frequency (N=221)	Percentage
<b>BMI (kg/m<sup>2</sup>)</b>		
Underweight	4	1.8
Normal	34	15.4
Overweight	92	41.6
Obese	79	35.7
Extremely obese	12	5.5
<b>Family history of depression</b>		
Yes	37	16.7
No	184	83.3
<b>History of other chronic diseases</b>		
Yes	94	42.5
No	127	57.5
<b>Number of daily drugs taken</b>		
One	23	10.4
Two	74	33.5
Three	67	30.3
Four and more	57	25.8
<b>Insulin therapy</b>		
Yes	112	50.7
No	109	49.3
<b>Compliance with diabetic therapy</b>		
Yes, perfect	105	47.5
Yes, to some extent	94	42.5
No	22	10.0
<b>Diabetic complications</b>		
Yes	52	23.5
No	169	76.5
<b>Number of follow-up visits/year</b>		
One	17	7.7
Two	86	38.9
Three	85	38.5
More than three	33	14.9
<b>Fasting blood glucose (mg/dl)</b>		
Good (<126)	66	29.9
Borderline (126-180)	114	51.5
Poor (>180)	41	18.6
<b>HbA1c %</b>		
Controlled (<9%)	162	73.3
Poor controlled (9-12%)	58	26.2
Very poor controlled (>12%)	1	0.5

Obesity and extreme obesity were reported among 35.7% and 5.5% of the patients, respectively. Family history of depression was reported among 37 patients representing 16.7% of the respondents. Less than half of the participants (42.5%) had history of chronic disease other than DM. Almost one-fourth of those (25.8%) reported taking at least 4 drugs on daily basis for their medical problems. About one-half of the type 2 diabetic patients (50.7%) reported insulin therapy. Approximately half of the

patients (47.5%) claimed that they are perfectly compliant with diabetic therapy whereas only 22 patients representing 10% of the participants reported that they are not compliant with diabetic therapy. Diabetic complications were reported among 23.5% of type 2 diabetic patients. Follow-up visits exceeded 3 per year among 14.9% of patients. Fasting blood glucose level was poor among more 18.6% of the participants whereas it was borderline among 51.5% of them. According to glycated hemoglobin,

diabetes was poorly controlled among 26.2% of patients and very poorly controlled among 0.5% of them. Table 3

As shown in figure 1, depression was reported among almost most of type 2 diabetic patients (77.8%). It was mild among 32.1% of them, moderate among 25.8% whereas it was moderately severe or severe among 19.9% of them.

Moderately severe/severe depression was more reported among patients whose monthly income was 5000 SR or less than those whose monthly income exceeded 10000 SR (22.4% versus 15%). The differences were statistically significant,  $p=0.014$ . Also, depression was reported among majority of patients who reported family history of depression (91.9%) compared to 75% of those without family history of depression. Moderately severe and severe depression was reported among 29.7% of patients with family history of depression compared to 17.9% of those without family

history of depression. The difference was statistically significant,  $p=0.016$ .

Majority of diabetic patients on insulin therapy (84.8%) compared to 70.6% of those without insulin therapy were depressed. Moderately severe or severe depression was reported among 21.4% of patients on insulin therapy compared to 18.3% of those without insulin therapy. The difference was statistically significant,  $p=0.048$ . Majority of patients with diabetic complications (94.2%) compared to 72.8% of those without complications were depressed. In addition, moderately severe or severe depression was reported among 26.9% of complicated patients compared to only 17.8% of not complicated. The difference was statistically significant,  $p=0.007$ . Depression and/or its severity were not significantly associated with other studied factors as shown in table 4.

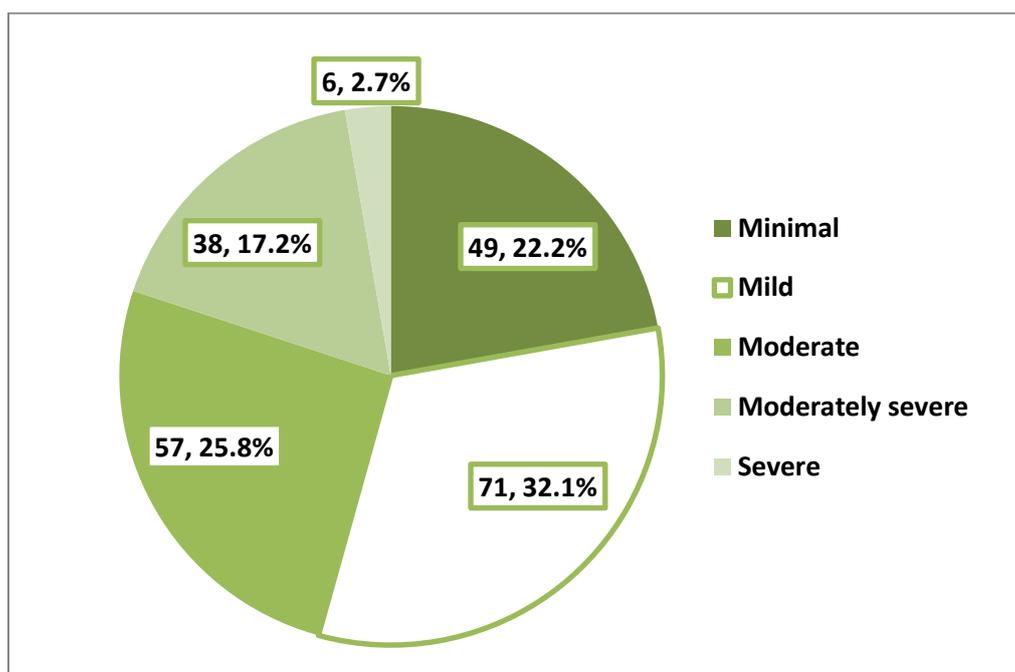


Figure 1: Depression among type 2 diabetic patients, Tabuk city

Table 4: Association between diabetic patient's age and depression severity.

Age (years)	Depression				$\chi^2$ (p-value)
	No	Mild	Moderate	Moderately severe/Severe	
	N=49 N (%)	N=71 N (%)	N=57 N (%)	N=44 N (%)	
<b>Age (years)</b>					
30-39 (n=45)	12 (26.7)	18 (40.0)	9 (20.0)	6 (13.3)	10.23 (0.596)
40-49 (=56)	11 (19.6)	19 (33.9)	13 (23.2)	13 (23.2)	
50-59 (n=77)	18 (23.4)	19 (24.7)	20 (26.0)	20 (26.0)	
60-69 (n=34)	7 (20.6)	12 (35.3)	11 (32.4)	4 (11.8)	
≥70 (n=9)	1 (11.1)	3 (33.3)	4 (44.4)	1 (11.1)	
<b>Gender</b>					
Male (n=114)	30 (26.3)	41 (36.0)	26 (22.8)	17 (14.9)	6.67 (0.083)
Female (n=107)	19 (17.8)	30 (28.0)	31 (29.0)	27 (25.2)	
<b>Marital status</b>					
Single (n=11)	6 (54.5)	2 (18.2)	2 (18.2)	1 (9.1)	11.04 (0.273)
Married (n=171)	37 (21.6)	57 (33.3)	43 (25.1)	34 (19.9)	
Divorced (n=15)	3 (20.0)	4 (26.7)	3 (20.0)	5 (33.3)	
Widowed (n=24)	3 (12.5)	8 (33.3)	9 (37.5)	4 (16.7)	

<b>Number of children</b>					
None (n=13)	7 (53.8)	3 (23.1)	2 (15.4)	1 (7.7)	
1 (n=11)	4 (36.4)	3 (27.3)	1 (9.1)	3 (27.3)	19.06
2 (n=15)	3 (20.0)	3 (13.3)	5 (33.3)	5 (33.3)	(0.087)
3 (n=21)	3 (14.3)	8 (38.1)	3 (14.3)	7 (33.3)	
≥4 (n=161)	32 (19.9)	55 (34.2)	46 (28.6)	28 (17.4)	
<b>Job</b>					
Employee (n=50)	10 (20.0)	21 (42.0)	11 (22.0)	8 (16.0)	
Private employee (n=19)	4 (21.1)	5 (26.3)	6 (31.6)	4 (21.1)	7.83
Business (n=18)	4 (22.2)	6 (33.3)	6 (33.3)	2 (11.1)	(0.789)
House wife (n=100)	21 (21.0)	27 (27.0)	27 (27.0)	25 (25.0)	
Retired (n=34)	10 (29.4)	12 (35.3)	7 (20.6)	5 (14.7)	
<b>Income</b>					
≤5000 (n=134)	35 (26.1)	32 (23.9)	37 (27.6)	30 (22.4)	16.02
5001-10000 (n=47)	7 (14.9)	25 (53.2)	7 (14.9)	8 (17.0)	(0.014)
>10000 (n=40)	7 (17.5)	14 (35.0)	13 (32.5)	5 (15.0)	
<b>Smoking history</b>					
Current smoker (n=54)	12 (22.2)	22 (40.7)	13 (24.1)	7 (13.0)	4.94
Non-smoker (n=146)	33 (22.6)	41 (28.1)	38 (26.0)	34 (23.3)	(0.552)
Ex-smoker (n=21)	4 (19.0)	8 (38.1)	6 (28.6)	3 (14.3)	
<b>BMI</b>					
Underweight (n=4)	0 (0.0)	3 (75.0)	0 (0.0)	1 (25.0)	
Normal (n=34)	9 (25.6)	9 (26.5)	10 (29.4)	6 (17.6)	11.79
Overweight (n=92)	24 (26.1)	27 (29.3)	25 (27.2)	16 (17.4)	(0.463)
Obese (n=79)	12 (15.2)	30 (38.0)	18 (22.8)	19 (24.1)	
Extremely obese (n=12)	4 (33.3)	2 (16.7)	4 (33.3)	2 (16.7)	
<b>Family history of depression</b>					
Yes (n=37)	3 (8.1)	12 (32.4)	11 (29.7)	11 (29.7)	5.77
No (n=184)	46 (25.0)	59 (32.1)	46 (25.0)	33 (17.9)	(0.016)
<b>History of other chronic diseases</b>					
Yes (n=94)	18 (19.1)	28 (29.8)	28 (29.8)	20 (21.3)	2.12
No (n=127)	31 (24.4)	43 (33.9)	29 (22.8)	24 (18.9)	(0.548)
<b>Number of daily drugs taken</b>					
One (n=23)	7 (30.4)	7 (30.4)	4 (17.4)	5 (21.7)	
Two (n=74)	16 (21.6)	23 (31.1)	18 (24.3)	17 (23.0)	7.00
Three (n=67)	13 (19.4)	27 (40.3)	15 (22.4)	12 (17.9)	(0.637)
Four and more (n=57)	13 (22.8)	14 (24.6)	20 (35.1)	10 (17.5)	
<b>Insulin therapy</b>					
Yes (n=112)	17 (15.2)	36 (32.1)	35 (31.3)	24 (21.4)	7.90
No (n=109)	32 (29.4)	35 (32.1)	22 (20.2)	20 (18.3)	(0.048)
<b>Compliance with diabetic therapy</b>					
Yes, perfect (n=105)	31 (29.5)	29 (27.6)	26 (24.8)	19 (18.1)	8.67
Yes, to some extent (n=94)	16 (17.0)	34 (36.2)	26 (27.7)	18 (19.1)	(0.193)
No (n=22)	2 (9.1)	8 (36.4)	5 (22.7)	7 (31.8)	
<b>Diabetic complications</b>					
Yes (n=52)	3 (5.8)	17 (32.7)	18 (34.6)	14 (26.9)	11.99
No (n=169)	46 (27.2)	54 (32.0)	39 (23.1)	30 (17.8)	(0.007)
<b>Number of follow-up visits/year</b>					
One (n=17)	7 (41.2)	4 (23.5)	3 (17.6)	3 (17.6)	
Two (n=86)	20 (23.3)	25 (29.1)	24 (27.9)	17 (19.8)	6.77
Three (n=85)	15 (17.6)	33 (38.8)	20 (23.5)	17 (20.0)	(0.661)
More than three (n=33)	7 (21.2)	9 (27.3)	10 (30.3)	7 (21.2)	
<b>Fasting blood glucose (mg/dl)</b>					
Good (n=66)	9 (13.6)	23 (34.8)	18 (27.3)	16 (24.2)	5.00
Borderline (n=114)	29 (25.4)	36 (31.6)	30 (26.3)	19 (16.7)	(0.544)
Poor (>180) (n=41)	11 (26.8)	12 (29.3)	9 (22.0)	9 (22.0)	
<b>HbA1c %</b>					
<9% (n=162)	37 (22.8)	54 (33.3)	39 (24.1)	32 (19.8)	1.10
>9% (n=59)	12 (20.3)	17 (28.8)	18 (30.6)	12 (20.3)	(0.777)

## DISCUSSION

It has been documented that the existence of depression among patients with diabetes is associated with adverse diabetic complications.<sup>25</sup> Therefore, this study was carried out to explore the possible association between diabetes and depression and type 2 diabetes and its determinants in Tabuk, Saudi Arabia.

The prevalence of depression among type 2 diabetic patients in the present study was 77.8%, it was mild among 32.1% of them and moderately severe or severe among 19.9%. In another study carried out in Jeddah (2005), it was 48%.<sup>26</sup> In Riyadh, AL-Baik et al (2013) reported a prevalence of 45.8%.<sup>27</sup> In Makkah (2010), the prevalence was 41.9%.<sup>28</sup> In the Qatif area, a prevalence of 14.5% for depression among diabetic has been reported.<sup>29</sup>

Internationally, Raval et al. (2010) in North India reported a prevalence of 41% of clinically significant depression.<sup>30</sup> In Iran (2007) Khamseh et al. reported a major depression prevalence of 71.8% among patients with diabetes (both types; type 1 and type 2).<sup>31</sup>

This difference in prevalence rates of depression among diabetic patients between different studies either local or international could be explained by the fact that some studies included only major depression according to Diagnostic and Statistical Manual of Mental Disorders, IV (DSM VI) criteria while others, like the present study included depression as one category, in addition to different tools used for diagnosis of depression and different patients' background criteria.

In agreement with others,<sup>28,32</sup> the present study confirmed a significant relationship between family history of depression and developing depression among diabetic patients.

In the current survey, presence of diabetic complications was a significant predictor for depression. Earlier studies confirmed this finding.<sup>28,31-34</sup> Moreover, it has been reported that having more than two diabetic complications increased odds ratio of having depression by almost three times.<sup>34</sup> Additionally, Lustman et al<sup>35</sup> reported that longer depression period increased the risk of developing diabetic retinopathy as a result of long periods of poor glycaemic control. Also, in a meta-analysis published by De Groot et al,<sup>10</sup> a significant association between diabetic complications (retinopathy, neuropathy, nephropathy, sexual dysfunction and macrovascular complications) and depression was confirmed.

The present study showed a higher significant rate of depression among those treated with insulin. Al-Mouaalamy in Saudi Arabia has reported a significant increase in depression rate among patients treated with insulin.<sup>23,26</sup> In addition, Peyrot and Ruben<sup>34</sup> documented that risk to develop depression increased by forty percent among diabetics type 2 who were using insulin. This finding can be explained by the fact that uncontrolled and/or complicated patients were usually using insulin.

In agreement with others,<sup>36</sup> we did not find an association between gender and depression among diabetics. However, other studies reported that female patients were more prone to depression than male patients.<sup>37-40</sup>

Uncontrolled diabetes, as indicated by levels of fasting blood sugar and glycosylated haemoglobin percentage, was not significantly associated with depression in the present study. Other studies reported that uncontrolled diabetes would increase the risk of having depression.<sup>32-34</sup> However other studies<sup>10</sup> did not observe significant differences in average HbA1C by depression status.

Limitations to the current study included the cross-sectional nature of the study design which did not prove causality, carrying out the study in one city in the kingdom that makes it difficult to generalize the findings to other areas as well as the use of self-report questionnaires, as literature documented that rate of depression is higher in self-report questionnaires than psychiatric interview.<sup>41</sup>

In conclusion, depression was prevalent among type 2 diabetic patients attended general hospitals in Tabuk city. We recommended implementing screening program for diabetic patients regarding depression through trained family physicians especially for high risk groups as well as referral of those suffering from severe depression to psychiatrists as early as possible.

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