



## **Depression and Anxiety and Their Correlates in Patients with Diabetes Mellitus in Al-Jouf Region, Saudi Arabia**

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**Abstract:** Background : The aim of the study was to study the prevalence of depression and anxiety symptoms in patients with type one and two diabetes mellitus and their correlation with specific socio-demographic and clinical factors. Methods: 428 diabetic patients participated in the present cross-sectional study. Their demographic and clinical parameters were collected. The self-administered questionnaire HADS was used to determine level of depression and anxiety. Results: We found that 22.4% of the sample experienced significant depressive symptoms and 28.5% experienced significant anxiety symptoms. It was found that: Not practicing sports ( $p = 0.002$ ), smoking ( $p = 0.005$ ), having lower level of education ( $p = 0.006$ ) and insulin treatment ( $p = 0.013$ ) were significantly associated with depression. On the other hand, female gender ( $p = 0.017$ ), smoking ( $p = 0.007$ ) and being unmarried ( $p =$

0.036) were significantly associated with anxiety. Correlation showed that depression was significantly associated with BMI ( $p = 0.003$ ) and age of the patients ( $p = 0.004$ ). It was found that both anxiety and depression positively correlated significantly with duration of diabetes ( $p \leq 0.001$ ). Neither depression nor anxiety was associated with HBA1c levels or with mean blood pressure. **Conclusion:** Depression and anxiety symptoms were high among patients with type I and II diabetes mellitus. Depression was strongly related to age, lower level of education, smoking, not practicing sports, duration of diabetes, insulin treatment and BMI. Anxiety was strongly related to female gender, smoking, duration of diabetes and being unmarried.

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### 1. Introduction :

Worldwide and in Saudi Arabia in particular, diabetes mellitus (DM) is one of the most common chronic diseases. In the country, it is close to be an epidemic (IDF Diabetes Atlas - 7th edition, Alduraywish et al, 2015). This is due to high caloric intake, obesity and physical inactivity along with genetic predisposition (Alqurashi et al, 2011, Badran and Laher, 2012). Unfortunately, the disease prevalence is on the rise locally and worldwide (Gadsby. 2002; Passa. 2002; Lusignan et al., 2005; Al-Rubeaan et al., 2015). Regarding the International Diabetes Federation, 5 countries of the Gulf region have the highest prevalence rates of diabetes in the world (International Diabetes Federation, 2015). The prevalence of diabetes in the Kingdom of Saudi Arabia is 23.7% (Al-Nozha. 2004). Diabetes also resulted in the deaths of about 1,256 million in the world in 2008 with most of the deaths in developing countries (Kaur et al., 2013).

Unipolar depression represented 3rd leading cause of disability adjusted life years (DALYS) in 2004 and also unipolar depression is regarded to be the main cause of disease burden by 2030 (Kaur et al., 2013). Depression and diabetes are usually associated together (Anderson et al., 2001; Mezuk et al., 2008). Diabetic patients have two fold increases in depression and anxiety symptoms as the general population (Lustman et al., 2000; Ciechanowski et al., 2000; Furuya et al., 2010 and Gois et al., 2010). A study by Huang et al (2011), found that the prevalence and the incidence of anxiety in diabetic patients was significantly increased than the general population - with the higher prevalence related to female gender. Furthermore, depression associating DM affects 10 - 30% of diabetic patients (Li et al., 2008).

In Mexico, prevalence of depression in diabetic patients ranged from 46 - 63% (Garduno-Espinosa et al., 1998; Colunga-Rodriguez et al., 2008 and Castro-Ake et al., 2009). In Malaysia, the prevalence of depression was 11.5%, anxiety was 30.5%, and stress 12.5% in patients with type II DM (Kaur et al., 2013). In Nepal, 54% of the participants experienced depression (Mishra et al., 2015). In New Delhi, 18% of the sample reported

high level of depressive symptoms and more than quarter of diabetic women reported high level of anxiety symptoms (Weaver et al., 2015). In Morocco, the prevalence of depression in diabetic patients was 33.1% without gender difference and depression was found to be increased in unmarried vs. married patients (Bensbaa et al., 2014). In Palestine, prevalence of depression in diabetic patients reached 40.2% (Sweileh et al., 2014). In Arab Emirates, 12.5% of patients reported a high score on a measure that indicates mental health problems (Suliman et al., 2010).

Since the emergence of depression and anxiety and their maintenance is affected by cultural and societal factors (Lloyd et al., 2012), studies in different ethnic groups are important. The present cross-sectional study was approved by the Ethical Committees at the College of Medicine, Aljouf University, and Ministry of Health, Sakaka, Al-Jouf, Saudi Arabia and we aimed to study the prevalence of depression and anxiety in diabetic patients and to study their association with some socio-demographic characteristics and clinical parameters in a sample of Saudi diabetic patients from Al-Jouf region.

### 2. Methods:

#### Setting :

The present cross-sectional study was approved by the Ethical Committees at the College of Medicine, Aljouf University, and Ministry of Health, Sakaka, Al-Jouf, Saudi Arabia. Data were collected during February - May, 2016 at the diabetic centers of king Abdulaziz specialist hospital, Domat Al-Jandal General Hospital and Prince Muteb General Hospital in the northern Al-Jouf region in Saudi Arabia. The region has a 100,212 km<sup>2</sup> area and the number of population was 440,009 at the 2010 Census.

#### Participants:

All of the voluntarily willing patients were enrolled after signing an informed consent. Patients with gestational diabetes were excluded. Also, patients taking any psychiatric treatment were excluded from the study.

The patients were assured that their information will be anonymous and absolutely confidential. They comprised 428 patients with type I and type II diabetes.

#### Intervention

The socio-demographic characteristics and clinical parameters of the enrolled Saudi diabetic patients were obtained from the data collection form delivered to patients to be filled partly by the patient and partly by the attending physician. The form included items such as: age, job status, practicing sports, smoking habits, duration since first diagnosed with diabetes, type of treatment of diabetes, education level and marital status. Also, clinical parameters obtained included level of HbA1c, mean blood pressure and body mass index (BMI).

Glycated hemoglobin (HbA1c) was assessed using whole blood by affinity column using GLYCO-Tek method (Helena Laboratories). Mean arterial pressure that describes the average blood pressure was calculated as: Mean arterial pressure = diastolic pressure + 1/3 (systolic pressure - diastolic pressure) (Zheng et al., 2008). BMI was calculated from weight and height of patients. This index has been chosen and implemented for sample evaluation in regard to obesity (WHO, 1998).

Depression and anxiety were determined using the hospital anxiety and depression scale questionnaire (HADS) (Zigmond et al., 1983). The questionnaire was afforded in the local simple Arabic language that was validated before (El-Rofaie et al., 1987; and El-Rofaie et al., 1995). HADS questionnaire contains 14 items with answers in four grades. It consists of 7 questions regarding anxiety and 7 for depression. The answer results ranged from 0 to 3 and maximum sum was 21 for each scale. HADS detects the score of symptoms within the last 10 days. The questionnaire is designed to avoid false positive results in patients with somatic disorders (Hermann, 1997; and Michopolos et al., 2008). Scores of 11 or more on either subscale are considered as significant "case" of psychological illness and a score of 8-10 as borderline, while a score of 7 or less is considered normal (Bjelland et al., 2002; and Snaith, 2003). Among the 450 questionnaires distributed, 428 were valid for the study.

#### Statistical methods

Data presented as frequencies (n and %) and mean SD were processed using SPSS 20. Pearson Chi-Square and Fisher's exact tests were applied. One way ANOVA was also done to compare the means of some clinical parameters. Also, the association between parameters was investigated using Spearman correlation coefficient. The significance was set as  $p < 0.05$ .

#### 3. Results:

428 patients with type I and type II diabetes were studied from which 57% were men and 43% were women. 76.4% were married and 23.6% unmarried. 21% practiced some sort of sports and 79% didn't. Patients with duration of diabetes of more than 10 years were 45.8%, those with 5 - 10 years duration were 20.1%, those with from 1 - 5 years were 24.1%, and 10% of patients had <1 year disease duration. The patients treated with insulin constituted 51.6% and the remaining 48.4% were on non-insulin treatment. Regarding the educational level, 43.7% were educated to preparatory school level or lower, 25.5% to secondary school level and 30.8% had university education. The mean age of respondents was 52 ( $51.6 \pm 14.2$ ) and their HbA1c was 9 ( $8.5 \pm 1.97$ ). Their mean blood pressure was 100 ( $99.3 \pm 11.56$ ). Their BMI was 31 ( $30.5 \pm 6.35$ ). Furthermore, the mean depression and anxiety scores were 8 ( $7.9 \pm 3.79$ ) and 8 ( $7.99 \pm 4.27$ ), respectively. We found that 22.4% of the sample experienced significant depressive symptoms (caseness, score  $\geq 11$ ) and 28.5% experienced significant anxiety symptoms (score  $\geq 11$ ) (Table 1)

Pearson Chi-square analysis showed that only not practicing sports ( $p = 0.002$ ), smoking ( $p = 0.005$ ), having lower education ( $p = 0.006$ ) (fig. 1), and insulin treatment ( $p = 0.013$ ) were significantly associated with depression (Table 2).

On the other hand, female gender ( $p = 0.017$ ), smoking ( $p = 0.007$ ) and being unmarried ( $p = 0.036$ ) were significantly associated with anxiety (Table 3 and Figure 3).

It was found that both anxiety and depression correlated significantly with diabetes duration ( $p \leq 0.001$ ) (Figure 2 and Table 4). Depression was significantly associated with BMI ( $p = 0.003$ ) and age of the patients ( $p = 0.004$ ). Neither depression nor anxiety was related to HbA1c levels or mean blood pressure (Tables 5 and 6).

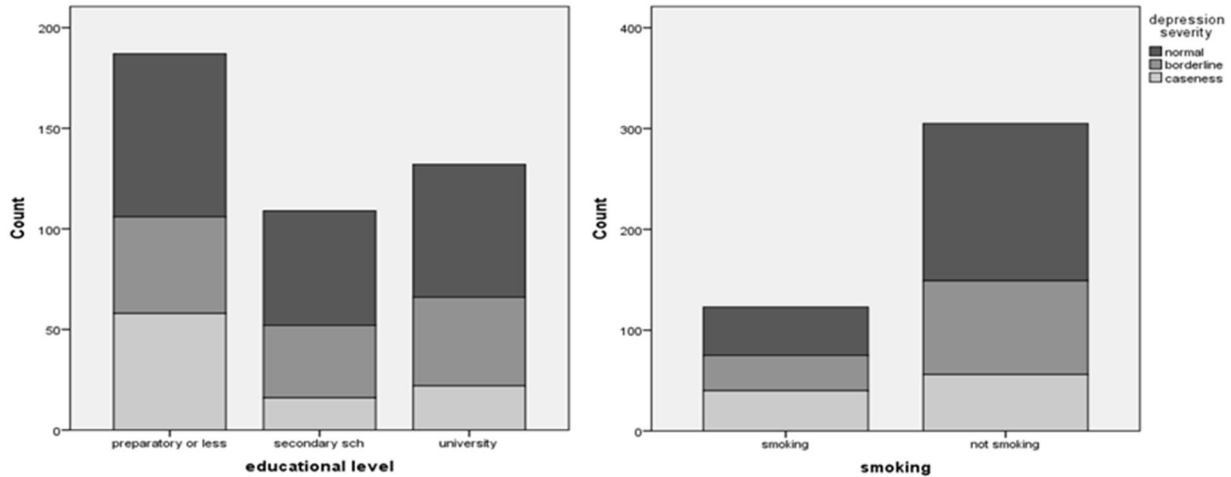


Figure 1: Association of the prevalence of depression with each of education level and smoking among the participating diabetic patients.

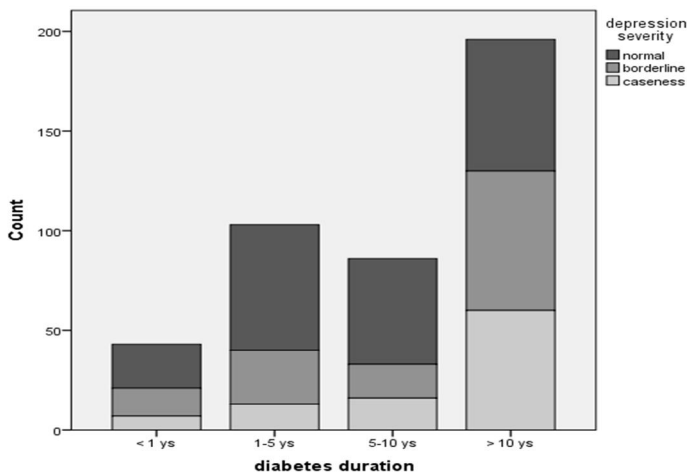


Figure 2: Association of the prevalence of depression with duration of diabetes among the participating diabetic patients

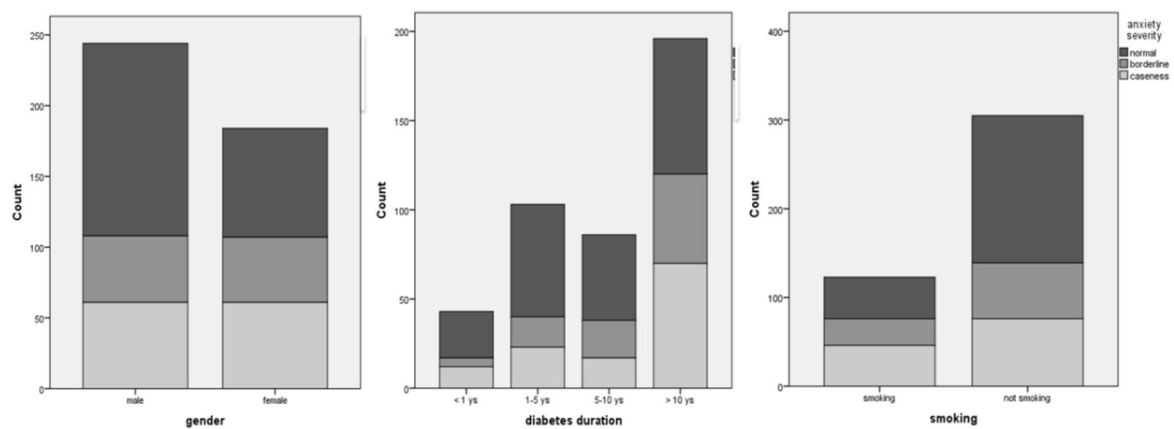


Figure 3: Association of the prevalence of anxiety with each of disease duration, gender and smoking among the participating diabetic patients.

**Table 1:** Socio-demographic and clinical characteristics of the participating diabetic patients (n = 428). Data shown are mean  $\pm$  SD and frequencies (n and %).

<b>Demographic characteristics</b>	<b>Mean <math>\pm</math> SD</b>	<b>n (%)</b>
Age: Years	51.6 $\pm$ 14.2	
Gender: Male/female		244/184 (57/43)
Practicing sports: Yes/No		90/338 (21/79)
Smoking: Yes/No		123/305 (28.7/71.3)
Diabetes duration: Years		
<1		43 (10)
1-5		103 (24.1)
5-10		86 (20.1)
>10		196 (45.8)
Diabetic treatment: Non-insulin/Insulin		207/221 (48.4/51.6)
Marital status: Single/Married		101/327 (23.6/76.4)
Education level:		
Preparatory or less		187 (43.7)
Secondary school		109 (25.5)
University		132 (30.8)
HbA1c	8.52 $\pm$ 1.97	
Mean Blood Pressure	99.3 $\pm$ 11.56	
BMI	30.53 $\pm$ 6.35	
Depression Score	7.93 $\pm$ 3.79	
Anxiety Score	7.99 $\pm$ 4.27	
Depression Severity:		
Normal ( $\leq 7$ )		204 (47.7)
Borderline (8 - 10)		128 (29.9)
Caseness ( $\geq 11$ )		96 (22.4)
Anxiety Severity:		
Normal ( $\geq 7$ )		213 (49.8)
Borderline (8 - 10)		93 (21.7)
Caseness ( $\geq 11$ )		122 (28.5)

**Table 2:** Socio-demographic and clinical characteristics of participants by depression severity. Data shown are n and p value. NS = non-significant.

<b>Variable</b>	<b>Depression Severity</b>			<b>P value</b>
	<b>normal</b>	<b>borderline</b>	<b>Caseness</b>	
Gender: Male/female	125/79	62/66	57/39	NS
Practicing sports: Yes/No	57/147	22/106	11/85	0.002
Smoking: Yes/No	48/156	35/93	40/56	0.005
Marital status: Single/Married	39/165	32/96	30/66	0.063
Education Level:				0.006
Preparatory or less	81	48	58	
Secondary school	57	36	16	
University	66	44	22	
Treatment: Non-insulin/Insulin	109/95	64/64	34/62	0.013

Table 3: Association between different socio-demographic and clinical characteristics of participants and anxiety severity. Data shown are n and p value.

Variable	Anxiety severity			P value
	normal	borderline	Caseness	
Gender: Male/female	136/77	47/46	61/61	0.017
Practicing sports: Yes/No	54/159	18/75	18/104	NS
Smoking: Yes/No	47/166	30/63	46/76	0.007
Marital status: Single/Married	43/170	19/74	39/83	0.036
Education level:				
Preparatory or less	88	44	55	NS
Secondary school	60	21	28	
University	65	28	39	
Treatment: Non-insulin/Insulin	104/109	40/53	63/59	NS

Table 4: Spearman' correlation coefficient (2-tailed) for the association between each of depression and anxiety severity and diabetes disease duration. Data shown are r (p value).

	Diabetes duration
Depression severity (n = 428)	0.231 (0.000)
Anxiety severity (n = 428)	0.184 (0.000)

Table 5: Association between different socio-demographic and clinical characteristics of diabetic participants and depression (one way ANOVA):

	df	F	P value
Age	2	5.703	0.004
Hb1Ac	2	0.517	0.596
Mean BP	2	0.896	0.409
BMI	2	5.952	0.003

Table 6: Association between different socio-demographic and clinical characteristics of diabetic participants and anxiety (one way ANOVA):

	df	F	P value
Age	2	0.884	0.414
Hb1Ac	2	1.890	0.152
Mean BP	2	2.564	0.078
BMI	2	2.898	0.056

#### 4. Discussion:

Anxiety and depression are common psychiatric disorders and they often affect people with chronic and debilitating illnesses such as DM (Gavard et al., 1993; and Ali et al., 2006). Our study showed that the prevalence of depression reached 22.4% and that of anxiety was 28.5%. Other studies had found higher depression rates among diabetic patients (Khwaja et al., 2010; Tovilla-Zarate et al., 2012; and De Groot et al., 2007). Other studies in Saudi Arabia found that the prevalence of depression to be 37% for type 1 and 37.9% for type 2 diabetes in one study in Riyadh and 49.6% for type 2 diabetes in another study (Gemeay et al., 2015; El Mahalli, 2015). Furthermore, a study done in Qatar using another instrument (DASS 21) found more than half of the patients had depression, anxiety and stress symptoms (Bener et al., 2011). However, a number of studies found lower prevalence of depression than ours

such as a 15.8% in rural America (Bell et al., 2005), 12.5% at Emirates (Sulaiman et al., 2010), and 10.2% at Germany (Kruse et al., 2003).

The prevalence of anxiety was more than that of depression and this was comparable to the findings present in current literature in which anxiety was frequently higher than depression (Khwaja et al., 2010; Tovilla-Zarate et al., 2012; Tann et al., 2007; and Collins et al., 2007).

Our results showed that gender was significantly related to anxiety symptoms with 33% of women having anxiety compared to 25% of men. Similarly, many studies showed that women were more prone to anxiety symptoms (Anderson et al., 2001; Katon et al., 2004; and Huang et al (2011). Being unmarried was significantly associated with anxiety. It is well known that being married is related to less liability to develop psychiatric disorders including depression and anxiety

(St John et al., 2009; Afifi et al., 2006; and Stutzer et al., 2006).

It was found that depression was significantly related to the age of the patients and with lower educational level. This was in accordance with the findings of a study on Mexican Americans that found that depressed diabetic patients to be of older age and to have lower education (Kendzor et al., 2014). Lower education may affect income and be a source of stress leading to diabetes and making it a chronic disease (Kendzor et al., 2014) and consequently lead to depression.

There was no relation between depression or anxiety and the glycemic control index HbA1c. This is in consistency with a study in a Japanese hospital comprising 3305 participants that failed to reveal a relation between depression and HbA1c (Tsujii et al., 2012). Furthermore, a study showed that changes in depressive symptoms were not related to changes in HbA1c or glucose levels in either type I or type II diabetic patients (Georgiades et al., 2007). One explanation for these results is that glycemic control may be affected by other confounding factors that have an influence on mental health function (Hasan et al., 2015). Regarding anxiety and HbA1c, a study by Ruddock et al (2010), found a weak correlation only between anxiety and HbA1c. A study in Malaysia, found that the anxiety symptoms was not significantly related to glycemic control (Hasan et al., 2015).

There was significant relation between depression and anxiety and diabetes duration. This was in accordance with other studies that found a relation with duration of diabetes (Khuwaja et al., 2010; Almawi et al., 2008). Increased duration of diabetes leads to increased diabetic complications and consequently leads to increased psychological disorders (Tovilla-Zarate et al., 2012). Depression was significantly related to BMI and was significantly related to not practicing sports. This is similar to a study on Mexican Americans (Kendzor et al., 2014) and with a study done in Palestine (Sweileh et al., 2014). Gortmaker et al (1993), suggested that obesity is usually accompanied by low self esteem leading to social and psychological problems and obesity is the main factor leading to occurrence of type II diabetes mellitus (WHO, 2004; Lefebvre et al., 2004; and Liu et al., 2010). However, no significant relation was found between anxiety and BMI and according to Garipey et al (2010), a moderate degree level of evidence is present for a positive relation between anxiety and obesity.

Regarding significant relation between insulin treatment and depression, this was in agreement with a number of studies that found that insulin treatment was related to depressive symptoms (Rezvanfar et al., 2009; Noh et al., 2005; and Katon et al., 2004).

Our study showed significant relation between depression and anxiety and smoking. Anxiety is often associ-

ated with smoking (Collins et al., 2009) and nicotine dependence (Castro et al., 2008; Breslau et al., 1991). Accordingly, some studies showed a high prevalence of anxiety symptoms among diabetic smokers than non-smokers (Spangler et al., 2001; and Lloyd et al., 2000). Also, symptoms of anxiety and depression have been strongly related to risky health behaviors such as smoking, alcohol intake and low physical activity (Collins et al., 2009; Strine et al., 2008; and Khuwaja et al., 2010). This may have led to the significant association between depression and anxiety and smoking in our study. Our study showed no relation between depression or anxiety and mean blood pressure. Similarly, a study of 110 African-American patients with diabetes reported no association of depression with blood pressure, over a 3-year period (Gary et al., 2005). Another study found no relation between depression and systolic blood pressure in diabetic patients (Heckbert et al., 2010).

Our study is the first study that study anxiety and depression in diabetic patients in Al-Jouf region of Saudi Arabia. However, there are limitations in our study. Firstly, it is a cross-sectional study that doesn't allow for cause and effect relationship to be extracted. Secondly, HADS questionnaire is a screening instrument and is not designed of specific psychiatric disorders. Also, there was a possibility for a recall bias by the participants and this was overcome by limiting the recall period to 7 days before the filling of the questionnaire. The information regarding age, type of treatment, and duration of diabetes was matched against the medical records where applicable. As part of the complete management plan and care for diabetic patients, we advise that the screening for depression and anxiety should be done regularly for diabetic patients and vulnerable subjects should have special attention and appropriate intervention leading to better overall outcome.

#### Conclusions:

Our study illustrates that the prevalence of depression was 22.4% and that of anxiety reached 28.5%. Depression was significantly associated with not practicing sports, smoking, lower educational level, insulin treatment, BMI and age of the patients. Depression also significantly correlated with diabetes duration.

Anxiety was significantly associated with female gender, smoking and being unmarried. Anxiety also significantly correlated with diabetes duration. Our results may help primary care physicians and direct their attention towards a high risk group of patients with diabetes mellitus for screening of depression and anxiety.

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**Author contributions**

All authors made a substantial contribution to the conception and design for analysis and interpretation of data, drafting the article and revising it critically for important scientific content and final agreement about the version to be published.

**Declaration of conflicting interests**

The authors declare that there is no conflict of interests.

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**References:**

- [1]. Afifi TO, Cox BJ, Enns MW. Mental health profiles among married, never-married, and separated/divorced mothers in a nationally representative sample. *Soc Psychiatry Psychiatr Epidemiol.* 2006; 41:122–129.
- [2]. Alduraywish AA, AlAnazi FM, Alharbi MA, Al-rasheed FM, and Alaithan LT. Correlation among the glycemic control and lipogram indices with chronic complications in Saudi diabetic patients: Al-Jouf Status. *AUMJ.* 2015; 2(3): 9 - 24.
- [3]. Ali S, Stone MA, Peters JL, Davies MJ, Khunti K. The prevalence of co-morbid depression in adults with Type 2 diabetes: a systematic review and meta-analysis. *Diabet Med.* 2006; 23(11):1165- 1173
- [4]. Almawi W, Tamim H, Al-Sayed N, Arekat MR, Al-Khateeb GM, Baqer A, Tutanji HCK: 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; 31:1020–1024.
- [5]. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harhi SS, Arafah MR, Khalil MZ, et al. Diabetes mellitus in Saudi Arabia. *Saudi Med J.* 2004; 25:1603-10.
- [6]. Alqurashi KA, Aljabri KS, and Bokhari SA. Prevalence of diabetes mellitus in a Saudi community. *Ann Saudi Med.* 2011; 31(1):19-23.
- [7]. Al-Rubeaan K, Al-Manaa HA, Khoja TA, Ahmad NA, Al-Sharqawi AH, Siddiqui K, Al-naqeb D, Aburishah KH, Youssef AM, Al-Batel A, Alotaibi MS, Al-Gamdi AA. Epidemiology of abnormal glucose metabolism in a country facing its epidemic: SAUDI-DM study: SAUDI-DM. *J Diabetes.* 2015; 7(5):622-32.
- [8]. Anderson RJ, Freedland KE, Clouse RE, et al. The prevalence of comorbid depression in adults with diabetes: a meta-analysis. *Diabetes Care.* 2001; 24:1069–78.
- [9]. Anderson RJ, Freedland KE, Clouse RE, et al. The prevalence of comorbid depression in adults with diabetes: a meta-analysis. *Diabetes Care.* 2001; 24:1069–78.
- [10]. Badran M, Laher I. Type II diabetes mellitus in Arabic-Speaking countries. *Internat. J. Endocrinology.* 2012; ID 902873:1-11.
- [11]. Bell RA, Smith SL, Arcury TA, Snively BM, Stafford JM, Quandt SA: Prevalence and correlates of depressive symptoms among rural older African Americans, Native Americans, and whites with diabetes. *Diabetes Care.* 2005, 2:823–829.
- [12]. Bener A, Saleh NM, and Al-Hamaq A. Prevalence of gestational diabetes and associated maternal and neonatal complications in a fast-developing community: global comparisons. *International journal of women health.* 2011; 3: 367–373.
- [13]. Bensbaa S, Agerd L, Boujraf B, Araab C, Aalouane R, Rammouz I, Ajdi F. Clinical assessment of depression and type 2 diabetes in Morocco: Economical and social components. *Journal of Neurosciences in rural practice.* 2014; 5(3): 250-254
- [14]. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale: an updated literature review. *J Psychosom Res.* 2002; 52(2):69-77.
- [15]. Breslau N, Kilbey M, Andreski P: Nicotine dependence, major depression, and anxiety in young adults. *Arch Gen Psychiatr.* 1991; 48(12):1069–1074.
- [16]. Castro MGT, Oliveira MS, Araújo RB, Pedroso RS. Relationship between gender and depressive and anxiety symptoms in smokers. *Rev Psiquiatr.* 2008; 30(1):25–30.
- [17]. Castro-Ake GA, Tovar-Espinosa JA, Mendoza-Cruz U. Association between depression and glycemic control disorder in patients with diabetes mellitus 2. *Revista medica del Instituto Mexicano del Seguro Social.* 2009; 47: 377–382.
- [18]. Ciechanowski PS, Katon WJ, Russo JE. Depression and diabetes: impact of depressive symptoms on adherence, function and costs. *Arch Intern Med.* 2006; 160:3278–3285
- [19]. Collins MM, Corcorant P, Perry IJ: Anxiety and depression symptoms in patients with diabetes. *Diabet Med.* 2009; 26(2):153–161.



- [20]. Colunga-Rodriguez C, Garcia de Alba JE, Salazar-Estrada JG, Angel- Gonzalez M. Type 2 diabetes and depression in Guadalajara, Mexico. *Revista de Salud Publica*. 2005; 10: 137–149.
- [21]. de Groot M, Doyle T, Hockman E, Wheeler C, Pinkerman B, Shubrook J, Gotfried R, Schwartz F. Depression among type 2 diabetes rural Appalachian clinic attendees. *Diabetes Care*. 2007; 30(6):1602–1604.
- [22]. El Mahalli AA. Prevalence and Predictors of Depression among Type 2 Diabetes Mellitus Outpatients in Eastern Province, Saudi Arabia. *International Journal of Health Science*. 2015; 9(2):119-26.
- [23]. El Raufae OE, Absood G. Validity study of the hospital anxiety and depression scale among a group of Saudi patients. *Br J Psychiatry*. 1987; 151:687–688.
- [24]. El Ruffaie OE, Absood GH, Abou-Saleh MT. Retesting the validity of the Arabic version of the hospital anxiety and depression (HAD) scale in primary health care. *Soc Psychiatry Psychiatr Epidemiol*. 1995; 30:26–31.
- [25]. Furuya M, Hayashino Y, Tsujii S, Ishii H, Fukuhara S. Comparative validity of the WHO-5 Well-Being Index and two-question instrument for screening depressive symptoms in patients with type 2 diabetes. *Acta Diabetol*. 2013; 50(2):117-21.
- [26]. Garduno-Espinosa J, Tellez-Zenteno JF, Hernandez-Ronquillo L. Frequency of depression in patients with diabetes mellitus type 2. *Revista de Investigacion Clinica; Organo del Hospital de Enfermedades de la Nutricion*, 1998; 50: 287–291.
- [27]. Garipey G, Wang J, Lesage A, Schmitz N. The interaction of obesity and psychological distress on disability. *Social Psychiatry and Psychiatric Epidemiology*. 2010; 45(5):531–540.
- [28]. Gary TL, Baptiste-Roberts K, Crum RM, Cooper LA, Ford DE, Brancati FL. Changes in depressive symptoms and metabolic control over 3 years among African Americans with type 2 diabetes. *Int J Psychiatry Med*. 2005; 35(4):377–82.
- [29]. Gavard JA, Lustman PJ, Clouse RE. Prevalence of depression in adults with diabetes. An epidemiological evaluation. *Diabetes Care*. 1993; 16(8):1167- 1178.
- [30]. Gemeay EM, Moawed SA, Mansour EA, Ebrahiem NE, Moussa IM, Nadrah WO. The association between diabetes and depression. *Saudi Medical Journal*. 2015 ;36(10):1210-5.
- [31]. Georgiades A, Zucker N, Friedman KE, Mounic CJ, Applegate K, Lane JD, Feinglos MN, Surwit RS: Changes in depressive symptoms and glycemic control in diabetes mellitus. *Psychosom Med*. 2007; 69(3):235–241.
- [32]. Gois CJ, Ferro AC, Santos AL, Sousa FP, Ouakinin SR, do Carmo I, Barbosa AF. Psychological adjustment to diabetes mellitus: highlighting self-integration and self-regulation. *Acta Diabetol*. 2012; 49 Suppl 1:S33-40.
- [33]. Gortmaker S.L. Must A, Perrin J.M., et al. Social and economic consequences of overweight in adolescence and young adulthood. *N Engl J Med*. 1993; 329:1008- 1012
- [34]. Hasan, S.S., Thiruchelvam, K., Ahmed, S.I. et al. Relation between mental health-related variables and glycemic control in Malaysian women with type 2 diabetes mellitus (T2DM). *Int J Diabetes Dev Ctries*. 2015; 35(3): 211-8.
- [35]. Heckbert SR, Rutter CM, Oliver M, Williams LH, Ciechanowski P, Lin EH, Katon WJ, Korff MV. Depression in Relation to Long-term Control of Glycemia, Blood Pressure, and Lipids in Patients with Diabetes. *Journal of General Internal Medicine*. 2010; 25(6): 524–529.
- [36]. Hermann C. International experiences with the Hospital Anxiety and depression Scale. A review of validation data and clinical results. *J Psychosom Res*. 1997; 42:17–41.
- [37]. Huang C, Chiu H, Lee M, Wang S. Prevalence and incidence of anxiety disorders in diabetic patients: a national population-based cohort study. *General Hospital Psychiatry*. 2011; 33(1): 8-15.
- [38]. International Diabetes Federation. *IDF Diabetes Atlas, 7<sup>th</sup> ed.* Brussels, Belgium: International Diabetes Federation; 2015. Available from: <http://www.idf.org/diabetesatlas/news/fifth-%20edition-release>. [Accessed 2016 Oct.].
- [39]. Katon W, von Korff M, Ciechanowski P. Behavioral and clinical factors associated with depression among individuals with diabetes. *Diabetes Care*. 2004; 27(4):914–20.
- [40]. Kaur G, Tee GH, Ariaratnam S, Krishnappillai AS and China K. Depression, anxiety and stress symptoms among diabetics in Malaysia: a cross sectional study in an urban primary care setting. *Family Practice*. 2013; 14-69.

- [41]. Kendzor DE, Chen M, Reininger BM, Businelle MS, Stewart DW, Fisher-Hoch SP, McCormick JB. The association of depression and anxiety with glycemic control among Mexican Americans with diabetes living near the U.S.-Mexico border. *BMC Public Health*. 2014; 14:176; 1-9.
- [42]. 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 Metab Syndr*. 2010; 2:72.
- [43]. Kruse J, Schmitz N, Thefeld W; German National Health Interview and Examination Survey. On the association between diabetes and mental disorders in a community sample: results from the German National Health Interview and Examination Survey. *Diabetes Care*. 2003; 26(6):1841-6.
- [44]. Lefèbvre P, Pierson A. The global challenge of diabetes. *World Hosp Health Serv*. 2004; 40(3):37-40.
- [45]. Li CY, Mokdad AH, Ford ES, Strine TW. Prevalence of depression among US adults with diabetes - findings from the 2006 behavioral risk factor surveillance system. *Diabetes Care*. 2008; 31: 105-107.
- [46]. Liu LL, Lawrence JM, Davis C, Liese AD, Pettitt DJ, Pihoker C, Dabelea D, Hamman R, Waitzfelder B, Kahn HS; SEARCH for Diabetes in Youth Study Group. Prevalence of overweight and obesity in youth with diabetes in USA: the SEARCH for Diabetes in Youth study. *Pediatr Diabetes*. 2010; 11(1):4-11.
- [47]. Lloyd CE, Dyer PH, Barnett AH: Prevalence of symptoms of depression and anxiety in a diabetes clinic population. *Diabet Med*. 2000; 17(3):198-202.
- [48]. Lloyd CE, Roy T, Nouwen A, et al. Epidemiology of depression in diabetes: international and cross-cultural issues. *J Affect Disord*. 2012; 142(Suppl):S22-9.
- [49]. Lustman PJ, Anderson RJ, Freedland KE, deGroot M, Carney RM, Clouse RE. Depression and poor glycaemic control: a meta-analytic review of the literature. *Diabetes Care*. 2000; 23:934-942.
- [50]. Mezuk B, Eaton WW, Albrecht S, et al. Depression and type 2 diabetes over the lifespan: a meta-analysis. *Diabetes Care*. 2008; 31:2383-90.
- [51]. Michopoulos I, Douzenis A, Kalkavoura C, Christodoulou C, Michalopoulou P, Kalemi G, Fineti K, Patapis P, Protopoulos K, Lykouras L. Hospital Anxiety and Depression Scale (HADS): validation in a Greek general hospital sample. *Psychiatriki*. 2007; 18(3): 217-24.
- [52]. Mishra SR, Sharma A, Bhandari PM, Bhochohibhoya S, Thapa K. Depression and Health-Related Quality of Life among Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study in Nepal. *PLoS One*. 2015; 10(11):1-13.
- [53]. Noh JH, Park JK, Lee HJ, Kwon SK, Lee SH, Park JH, Ko KS, Rhee BD, Lim KH, Kim DJ. Depressive symptoms of type 2 diabetics treated with insulin compared to diabetics taking oral anti-diabetic drugs: a Korean study. *Diabetes Res Clin Pract*. 2005; 69(3):243-8.
- [54]. Rezvanfar MR, Salehi B, Rafiee M, Shirian F. Correlation of HbA1c and Major Depressive Disorder in Type 2 Diabetic Patients. *Iranian journal of diabetes and obesity*. 2010; 2(1):16-19.
- [55]. Ruddock, S., Smith, A., Meadows, K., & Crown, A. Measuring psychological morbidity for diabetes commissioning. A cross-sectional survey of patients attending a secondary care diabetes clinic. *Practical Diabetes International*, 2010; 27(1):22-26.
- [56]. Snaith RP. The hospital anxiety and depression scale. *Health Qual Life Outcomes*. 2003; 1:29.
- [57]. Spangler JG, Summerso JH, Bell RA, Konen JC: Smoking status and psychosocial variables in type 1 diabetes mellitus. *Addict Behav*. 2001; 26(1):21-29.
- [58]. St John PD, Montgomery PR: Marital status, partner satisfaction, and depressive symptoms in older men and women. *Can J Psychiatr*. 2009; 54(7):487-492.
- [59]. Strine TW, Mokdad AH, Balluz LS, Gonzalez O, Crider R, Berry JT, et al: Depression and anxiety in the United States: findings from the 2006 Behavioral Risk Factor Surveillance System. *Psychiatr Serv*. 2008; 59(12):1383-1390.
- [60]. Stutzer A, Bruno SF: Does marriage make people happy, or do happy people get married? *J Socio Econ*. 2006; 35:326-347.
- [61]. Sulaiman N, Hamdan A, Tamim H, Mahmood DA, Young D. The prevalence and correlates of depression and anxiety in a sample of diabetic patients in Sharjah, United Arab Emirates. *Family Practice*. 2014; 11:80-87.
- [62]. Sweileh WM, Abu-Hadeed HM, Al-Jabi SW and Zyoud SH. Prevalence of depression among people with type 2 diabetes mellitus: a cross sectional study in Palestine. *Public Health*. 2014; 14: 163-174.

- [63]. Tann SS, Yabiku ST, Okamoto SK, Yanow J, Tri ADD. The risk for alcohol abuse, depression, and diabetes multimorbidity in the American Indian and Alaskan native population. *Am Indian Alsk Native Ment Health Res.* 2007; 14(1):1–23.
- [64]. Tovilla-Zárate C, Juárez-Rojop I, Peralta Jimenez Y, Jiménez MA, Vázquez S, Bermúdez-Ocaña D, Ramón-Frías T, Genis Mendoza AD, García SP, Narváez LL. Prevalence of anxiety and depression among outpatients with type 2 diabetes in the Mexican population. *PLoS One.* 2012; 7(5):1-6.
- [65]. Tsujii S, Hayashino Y, Ishii H; Diabetes Distress and Care Registry at Tenri Study Group. Diabetes distress, but not depressive symptoms, is associated with glycaemic control among Japanese patients with type 2 diabetes: Diabetes Distress and Care Registry at Tenri (DDCRT 1). *Diabet Med.* 2012; 29:1451–5.
- [66]. Weaver LJ, Madhu SV. Type 2 Diabetes and Anxiety Symptoms Among Women in New Delhi, India. *Am J Public Health.* 2015; 105(11):2335-40.
- [67]. World Health Organization (WHO). Obesity: Preventing and managing the global epidemic. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation; 1998.
- [68]. WHO. The global burden of disease: 2004 update. Geneva, Switzerland: World Health Organization; 2008.
- [69]. WHO: Prevention of mental disorders, effective interventions and policy options. WHO Geneva 2004.
- [70]. Zheng L, Sun Z, Li J, Zhang R, Zhang X, Liu S, Li J, Xu C, Hu D, Sun Y. Pulse pressure and mean arterial pressure in relation to ischemic stroke among patients with uncontrolled hypertension in rural areas of China. *Stroke.* 2008; 39(7):1932-7.
- [71]. Zigmond AS, Sanith RP. The hospital anxiety and depression scale. *Acta Psychaitr Scand.* 1983; 67:361–370.

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