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PREVALENCE AND ASSOCIATED FACTORS OF GENERALIZED ANXIETY DISORDER AMONG DIABETIC PATIENTS – A CROSS SECTIONAL STUDY IN A SPECIALIZED DIABETES CENTER IN TAIF, SAUDI ARABIA, 2020

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Abstract:
Background: *People with diabetes are almost twice as likely to suffer from anxiety and depression as the general population, but this often remains under-recognized and thus under-treated.* ***Method****: Descriptive questionnaire-based cross-sectional survey of a sample of diabetic patients attending King Abdul-Aziz Specialist Hospital in Taif, Saudi Arabia.* ***Results:*** *The study included (n= 370) diabetic patients. The point prevalence of anxiety was 37.6%. Of whom 5.1% had severe anxiety, 11.1% had moderate anxiety, and 21.4% had mild anxiety symptoms. Anxiety was higher in women (P = 0.000), particularly housewives (P= 0.000), and the obese (P =0.019). Glycaemic control and diabetic complications did not increase anxiety scores. Hypothyroidism was associated with anxiety symptoms (P = 0.014). Comorbid psychiatric illness was associated with higher anxiety (P = 0.002).* ***Conclusion:*** *Diabetic care should incorporate prevention, screening, and treatment for anxiety symptoms by encouraging physical activity and treating comorbid thyroid and psychiatric illnesses.*
Keywords: *Prevalence, Anxiety, Emotional problems, Diabetes, Saudi Arabia*

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INTRODUCTION:

Chronic and persistent worry characterizes generalized anxiety disorder (GAD). This multifocal (e.g., financial, health, and future) worry, excessive, and hard to manage, is usually followed by other non-specific psychological and physical symptoms. The phrase "generalized anxiety disorder" may incorrectly mean that symptoms are entirely unspecific, and this confusion may often lead to virtually any nervous patient misusing this diagnosis **(Stein and Sareen, 2015)**. A new concept was considered, but not accepted, for the fifth edition of the Medical Disorders Diagnostic and Statistical Manual (DSM-5). **(American Psychiatric Association)**.

GAD is especially common in primary care settings, as it occurs in 7-8% of patients. However, patients rarely report worry symptoms. The overall appearance in primary care settings is clinical symptoms such as headaches or gastrointestinal distress **(Kroenke et al., 2007)**. In children, GAD sometimes appears as chronic stomach pain and other physical complaints that can cause them to remain out of school. Patients with GAD have elevated chances of other mental and physical disorders **(Ramsawh et al., 2010)**. About 35% of people with GAD self-medicate with alcohol and drugs to relieve anxiety symptoms. This habit of use is believed to lead to a higher risk of alcohol and drug-use problems among this population. Given the significantly higher rates of coexisting disorders, GAD treatment involves attention to a potentially nuanced array of psychological and physical complaints that can mutually reinforce **(Robinson et al., 2010).**

Diabetes mellitus (DM), with a worldwide prevalence of 8.3%, is a chronic and disabling condition and is a significant cause of loss of life-adjusted impairment. DM and its complications place a great burden not only on a personal level but on a global level, i.e., public health systems **(Murray et al., 2012).** Co-occurring mental and physical diseases, also categorized as complicated chronic diseases, are new research areas **(Amos et al., 1997).** Chronic complexity disease is also characterized as multiple concurrent chronic diseases, regardless of causal mechanisms and associations. However, psychiatric disorders co-occurring with physical illnesses are also deemed discordant due to particular self-management problems and differing care schemes for co-occurring illnesses **(Banerjea et al., 2009)**.

Conditions typically found in DM patients include mental depression, anxiety disorder (AD), depressive effect, and diabetes-specific discomfort, all associated with detrimental effects on various bio-behavioral factors, including disease control, health care costs, days of work lost, and mortality **(Huang et al., 2012).** Research on GAD prevalence in T2DM patients is scant; most studies of co-occurring anxiety symptoms and AD have concentrated on DM patients. Moreover, they concentrated on symptoms or self-reported interventions rather than clinical diagnosis **(Camara et al., 2015).** This study aims to estimate the prevalence and associated factors of generalized Anxiety disorder among diabetic patients attending specialist diabetic centers in Taif, Saudi Arabia.

Study Objectives

1. To estimate the prevalence of anxiety and its severity among diabetic patients in Taif.
2. To identify the factors associated with anxiety among diabetic patients in Taif.
3. To Assess the relationship between anxiety and glycaemic control
4. To determine the relationship between Diabetes and Anxiety
5. To assess the Anxiety screening as a part of regular follow-up in the Diabetes program

METHODOLOGY:

Study design and setting.

This study was a cross-sectional questionnaire-based descriptive study. The study included a systematic random sample of diabetic patients attending King Abdul-Aziz Specialist Hospital in Taif, Saudi Arabia.

Population and study duration

The total number of subjects approached to participate in the study was (n= 370) diabetic patients. All agreed to take part in the study (response rate=100%).The study took place between 1st and 28th February 2019 in a randomly selected sample of diabetic patients.

Selection criteria

Inclusion criteria

All adult (18 years or above) diabetic patients attending the diabetic center at King Abdul-Aziz Specialist hospital were included.

Exclusion criteria

We excluded patients with gestational diabetes, children aged under 18 years, and those who refuse to participate.

Data collection tool

A standard questionnaire included the GAD-7 questionnaire in addition to various

sociodemographic factors. The following points were considered when designing the questionnaire:

1. The first part gathered personal data and determents: (age, gender, level of education, monthly income, marital status, smoking status, physical activity, employment status, BMI, HTN, and other chronic diseases)
2. The second part gathered Data about Diabetes status: (Type of DM, Duration, last HBA1C and FBG level, management, and complications)
3. The third part gathered data on anxiety disorder using the Arabic-translated pilot-tested version of the Generalized Anxiety Disorder Scale (GAD-7). The Generalized Anxiety Disorder-7 (GAD-7) is a valid and reliable instrument GAD-7 has a sensitivity of 89% and a specificity of 82% for GAD seven self-report items related to the frequency of anxiety symptoms over the previous 15 days. The GAD-7 yields a total score indicating the presence and severity of GAD symptoms as follows: absence (< 5), mild (≥ 5 and < 10), moderate (≥ 10 and < 15), and severe (≥ 15).

Data analysis

Data were analyzed using the R-Statistical Software version 3.4.1. Categorical data (such as educational level, sex, and income category) were summarised using frequencies and displayed using tables and bar graphs. Numerical continuous data, such as the GAD-7 score, were summarized using means and standard deviations and displayed using box-and-whiskers plots. The adjusted effect of categorical variables on the outcome variable (GAD-7 score) was determined using multiple Poisson generalized linear regression modelling. The level of significance was set at $P \leq 0.05$.

Ethical considerations

Both medical centres gave their approval to the protocol. At the time of patient enrolment, verbal informed consent was received voluntarily. The faculty ethics committee approved the verbal consent procedure. No names or ID numbers were collected, so all information was kept private.

RESULTS:

Among the participating patients, males were (n = 193, 52.2%) and scored a mean GAD-7 of 4.27 points. Females were (n = 177, 47.8%) and scored a mean of 6.57 points in GAD-7. This difference of anxiety score was significant (P = 0.000) indicative of higher anxiety among diabetic women.

Among the participating patients, the majority were school-educated (n = 146, 39.5%), followed by the uneducated (n = 108, 29.2%), with only (n = 91, 24.6%) patients were university-educated. The mean GAD-7 anxiety scores were 5.36, 5.67, and 5.11 points, respectively. Among the participating patients, the shear majority were married (n = 327, 88.4%), followed by those who were single (n = 32, 8.6%), and the divorced (n = 6, 1.6%), with only (n = 5, 1.4%) patients were widowed. The mean GAD-7 anxiety scores were 5.40, 5.16, 4.33, and 6.00 points, respectively. Although widowed patients scored the highest in terms of anxiety score, this difference was not significant (P = 0.932). **Table (1)**

Regarding employment status, most participants were officially employed (n = 97, 26.2%), followed by the unemployed and the retired both were (n = 86, 23.2%) in count, and housewives (n = 82, 22.2%), with only (n = 19, 5.1%) students. The mean GAD-7 anxiety scores were 4.1, 4.56, 4.93, 8.21, and 5.26 points, respectively. Housewives scored the highest anxiety score; this difference was significant (P = 0.000).

Regarding residence, most participants were from urban regions (n = 303, 81.9%), followed by those who came from rural areas (n = 67, 18.1%). The mean GAD-7 anxiety scores were 5.56 and 4.49 points, respectively. Among the participating patients, the majority were over 55 years (n = 168, 45.4%), followed by those aging from 36 and 55 years old (n = 166, 44.9%), with only (n = 36, 9.7%) patients under 35-year old. The mean GAD-7 anxiety scores were 5.32, 5.64, 4.33 points, respectively. The association between age category and anxiety score was not significant (P = 0.328). **Table (1)**

In terms of regular exercise, only (n = 129, 34.9%) did practice it and scored a mean anxiety score of 5.48; however, this difference was not significant (P = 0.740). Also, regarding family history of diabetes, (n = 264, 71.4%) declared it and scored a mean of 5.52 in anxiety score. The difference was not significant, though (P = 0.350). There were (n = 327, 11.6%) who reported smoking cigarettes. They scored a mean anxiety score of 4.47 (compared to a 5.49 score in non-smokers). The difference was not significant (P = 0.188). There were (n = 82, 22.2%) who reported passive smoking; their mean GAD-7 score was 5.42, slightly higher than non-passive smokers (mean GAD-7 score = 5.35). However, this difference was insignificant (P = 0.920). Regarding weight categorization according to BMI, most participants were obese (n = 173, 46.8%) or overweight (n = 109, 29.5%). Only (n = 75, 20.3%) were within the normal range and (n = 7, 1.9%) were underweight. The underweight category was the most anxious in GAD-7 score (mean = 8.00), with the rest

scoring, in increasing order of obesity 5.29, 5.07, and 5.53 points). This difference was not significant (P = 0.435). **Table (2)**

The mean BMI was 30.1 Kg/m^2 (SD = 6.29 Kg/m^2). The BMI readings ranged between a minimum of 16.5 and a maximum of 49.1 Kg/m^2. The median BMI was 29.4 Kg/m^2. As shown in **figure (3),** a positive association was noted between BMI and GAD-7 anxiety score (odds = 1.008, P = 0.019). This means that a one Kg/m^2 rise in BMI results in an increase in GAD-7 score by 0.008 points. **Table (2).**
The mean systolic BP was 140.2 mmHg (SD = 18.11 mmHg). The systolic BP readings ranged between a minimum of 100 and a maximum of 197 mmHg. The median systolic BP was 139 mmHg. As shown in figure (13), a non-significant positive association was noted between systolic BP and GAD-7 anxiety score (odds = 1.003, P = 0.249). This means that a one mmHg rise in systolic BP results in a non-significant increase in GAD-7 score by 0.003 points. The mean diastolic BP was 81.7 mmHg (SD = 10.7 mmHg). A non-significant association was noted between diastolic BP and GAD-7 anxiety score (odds = 1.001, P = 0.816). **Table (2)**

Regarding comorbid dyslipidemia (n = 112, 30.3%) reported among the participating diabetic patients. They scored slightly higher than those not having it: 6.04 vs. 5.11 mean GAD-7 scores, respectively; however, the difference was not significance (P = 0.087). However, the (n = 26, 7%) diabetic patients who had hypothyroidism scored significantly higher than the (n = 342, 92.4%) who were free from thyroid disease P = 0.014.

There were (n = 18, 4.9%) who have comorbid cardiac disease and score 4.39 on mean GAD-7 P = 0.374. Comorbid hypertension was found in (n = 130, 35.1%) of our participants. Their anxiety score mean was 5.25 points with non-significant difference (P = 0.737). The majority of the diabetic patients we interviewed were living with diabetes for over 5 years (n = 315, 85.1%). They scored a mean GAD-7 of 5.30 with non-statistical significance (P = 0.546). Most participants (n = 331, 89.5%) suffered type 2 diabetes and scored 5.41 in terms of mean GAD-7 score with non-significant difference (P = 0.689). The mean HbA1c was 8.5% (SD = 1.8%). The HbA1c readings ranged between a minimum of 5.2% and a maximum of 18.2%. The median HbA1c was 8.2%. As shown in, a non-significant association was noted between HbA1c and GAD-7 anxiety score (odds = 1.013, P = 0.299). This means that a 1% rise in HbA1c results in a non-significant increase in GAD-7 score by 0.013 points. **Table (3)**

The drug-free lifestyle category was the least anxious in terms of GAD-7 score (mean = 2.33), with the rest scoring, respectively, 6.12, 5.50, and 4.07 points). This difference was statistically significant (P = 0.004).

Most patients (n = 333, 90%) were adherent to medications with P = 0.391. Only (n = 52, 14.1%) reported history of hospitalization. Their anxiety score was higher than the non-hospitalized group P = 0.316. Also, (n = 35, 9.5%) reported history of comorbid stroke. Their anxiety score was slightly lower than the stroke-free group P = 0.774, indicative of non-significance. Only (n = 31, 8.4%) reported the complication of peripheral vascular disease. Their anxiety score was non-significantly lower than those who did not get the peripheral vascular disease P = 0.402. **Table (3)**

The mean fasting blood glucose was 178.9 mg/dL (SD = 72.85 mg/dL). The The median fasting blood glucose was 163 mg/dL. A non-significant association was noted between Fasting blood glucose and GAD-7 anxiety score (odds = 1.0005, P = 0.103). This means that a one mg/dL rise in Fasting blood glucose results in a non-significant increase in GAD-7 score by 0.0005 points. **Table (3)**

Only (n = 52, 14.1%) reported the complication of retinopathy. Their anxiety score was non-significantly higher than the group who did not get retinopathy P = 0.665. There were (n = 49, 13.2%) reported the complication of diabetic kidney disease. Their anxiety score was non-significantly lower than the patients without diabetic kidney disease P = 0.290. Also, (n = 74, 20%) reported being bothered by hypoglycemia. Their anxiety score was non-significantly higher than the group who did not get hypoglycemia P = 0.172. A further (n = 140, 37.8%) reported the complication of neuropathy. Their anxiety score was non-significantly higher than the neuropathy-free cohort P = 0.308. **Table (4)**

Our sample's prevalence of anxiety disorder was estimated at (n = 149, 37.6%). Of whom (n = 19, 5.1%) were in the severe anxiety category, (n = 41, 11.1%) in the moderate anxiety block, and (n = 79, 21.4%) had mild anxiety symptoms.

Some (n = 3, 0.8%) reported history of mental illness with significantly higher anxiety score P = 0.002. Those (n = 3, 0.8%) reported taking psychiatric medications with significantly higher anxiety score P = 0.000. Only (n = 2, 0.5%) reported family history of mental illness with significantly higher anxiety score P = 0.000.

Inferential statistics

The mean GAD-7 total score was 5.37 (SD = 4.78, range: 0 to 20, median = 4). The prevalence of anxiety disorder in our sample was estimated at (n = 149, 37.6%). Of whom (n = 19, 5.1%) were in the severe anxiety category, (n = 41, 11.1%) in the moderate anxiety block, and (n = 79, 21.4%) had mild anxiety symptoms.

Even after adjusting for the effect of all other factors, males were significantly less anxious than females (odds = 0.808, P = 0.00031), housewives were far more anxious by (odds = 1.614, P = 0.000), having a psychiatric illness increased anxiety odds by (odds = 0.928, P = 0.000). Treatment modalities differ significantly in terms of anxiety; insulin (odds = 0.738, P 0.000), lifestyle (odds = 0.497, P = 0.009), and OHA (odds = 0.899, P = 0.040). **Figure (1).**

Table 1. Baseline demographics of the study participants

Parameter	No. (%)	GAD-7 score Mean ± SD (Min-Max)	P value
Age			
• **Under 35**	36 (9.7%)	4.33 ± 3.95 (0-16)	0.328
• **36-55**	166 (44.9%)	5.64 ± 5.05 (0-20)	
• **Over 55**	168 (45.4%)	5.33 ± 4.66 (0-20)	
Gender			
• **Men**	193 (52.2%)	4.27 ± 4.05 (0-20)	**0.000**
• **Women**	177 (47.8%)	6.57 ± 5.22 (0-20)	
Education			
• **Uneducated**	108 (29.2%)	5.67 ± 4.79 (0-19)	0.433
• **School-educated**	146 (39.5%)	5.36 ± 4.8 (0-20)	
• **University-educated**	116 (31.4%)	5.11 ± 4.77 (0-19)	
Residence			
• **Urban**	303 (81.9%)	5.56 ± 4.62 (0-19)	0.098
• **Rural**	67 (18.1%)	4.49 ± 5.39 (0-20)	
Marital status			
• **Divorced**	6 (1.6%)	4.33 ± 2.07 (2-8)	0.932
• **Married**	327 (88.4%)	5.4 ± 4.87 (0-20)	
• **Widowed**	5 (1.4%)	6 ± 2 (3-8)	
• **Single**	32 (8.6%)	5.16 ± 4.54 (0-18)	
Employment			
• **Employed**	97 (26.2%)	4.1 ± 3.95 (0-16)	**0.000**
• **Unemployed**	86 (23.2%)	4.56 ± 4.56 (0-20)	
• **Retired**	86 (23.2%)	4.93 ± 4.32 (0-20)	
• **Student**	19 (5.1%)	5.26 ± 4.87 (0-19)	
• **Housewife**	82 (22.2%)	8.21 ± 5.28 (0-19)	

Table 2. Baseline clinical characteristics of the study participants

Parameter	No. (%)	GAD-7 score Mean ± SD (Min-Max)	P value
Exercise			
• **Yes**	129 (34.9%)	5.48 ± 5.24 (0-20)	0.740
• **No**	241 (65.1%)	5.31 ± 4.53 (0-20)	
Family history of DM			
• **Yes**	264 (71.4%)	5.52 ± 4.74 (0-20)	0.350
• **No**	106 (28.6%)	5 ± 4.89 (0-20)	
Smoking			
• **Yes**	43 (11.6%)	4.47 ± 4.27 (0-20)	0.188
• **No**	327 (88.4%)	5.49 ± 4.84 (0-20)	
Passive Smoking			
• **Yes**	82 (22.2%)	5.41 ± 4.69 (0-20)	0.920
• **No**	288 (77.8%)	5.36 ± 4.81 (0-20)	
BMI (Mean±SD)	30.1±6.3	odds = 1.008	**0.019**
Systolic BP (Mean±SD)	140.2±18.1	odds = 1.003	0.249
Diastolic BP (Mean±SD)	81.9±10.7	odds = 1.001	0.817
BMI category			
• **Underweight**	7 (1.9%)	8 ± 4.55 (1-15)	0.435
• **Normal**	75 (20.3%)	5.29 ± 4.56 (0-19)	
• **Overweight**	109 (29.5%)	5.07 ± 4.99 (0-20)	
• **Obese**	173 (46.8%)	5.53 ± 4.79 (0-19)	
Comorbid psychiatric illness			
• **Yes**	3 (0.8%)	13.67 ± 6.81 (6-19)	**0.002**
• **No**	367 (99.2%)	5.3 ± 4.71 (0-20)	
Psychiatric treatment history			
• **Yes**	3 (0.8%)	14.25 ± 5.12 (7-19)	**0.000**
• **No**	367 (99.2%)	5.27 ± 4.69 (0-20)	
Family history of mental illness			
• **Yes**	2 (0.5%)	17 ± 2.83 (15-19)	**0.000**
• **No**	368 (99.5%)	5.31 ± 4.71 (0-20)	

Table 3. Baseline diabetes-related characteristics of the study participants

Parameter	No. (%)	GAD-7 score Mean ± SD (Min-Max)	P value
Hypertension			
• **Yes**	130 (35.1%)	5.26 ± 4.81 (0-20)	0.737
• **No**	240 (64.9%)	5.43 ± 4.77 (0-20)	
Dyslipidaemia			
• **Yes**	112 (30.4%)	6.04 ± 5.13 (0-20)	0.087
• **No**	256 (69.6%)	5.11 ± 4.6 (0-20)	
Thyroid disease			
• **Hyperthyroidism**	2 (0.5%)	5 ± 2.83 (3-7)	**0.014**
• **Hypothyroidism**	26 (7%)	8 ± 6.27 (0-20)	
• **No**	342 (92.4%)	5.17 ± 4.61 (0-20)	
Cardiac disease			
• **Yes**	18 (4.9%)	4.39 ± 5.51 (0-19)	0.374
• **No**	352 (95.1%)	5.42 ± 4.74 (0-20)	
Duration of diabetes			
• **Under 5 years**	55 (14.9%)	5.73 ± 4.71 (0-16)	0.546
• **Over 5 years**	315 (85.1%)	5.31 ± 4.8 (0-20)	
Type of diabetes			
• **Type 1**	38 (10.3%)	5.08	0.689
• **Type 2**	331 (89.5%)	5.41	
HBA1c (Mean±SD)	8.5±1.8	Odds = 1.013	0.299
Diabetes management			
• **Insulin**	89 (24.1%)	4.07 ± 4.08 (0-18)	**0.005**
• **Oral hypoglycaemic agents**	118 (31.9%)	5.51 ± 4.97 (0-20)	
• **Both**	157 (42.4%)	6.12 ± 4.89 (0-20)	
• **Lifestyle**	6 (1.6%)	2.33 ± 2.88 (0-7)	
Adherence			
• **Yes**	334 (90.3%)	5.44 ± 4.83 (0-20)	0.391
• **No**	36 (9.7%)	4.75 ± 4.29 (0-18)	
History of admission			
• **Yes**	52 (14.1%)	4.75 ± 4.49 (0-18)	0.316
• **No**	318 (85.9%)	5.47 ± 4.82 (0-20)	
• ***Fasting Blood glucose (Mean±SD)***	178.9±72.9 mg/dL	Odds = 1.0005	0.103
Anxiety Category			
• **No anxiety**	231 (62.4%)	2.28 ± 1.64 (0-5)	**0.000**
• **Mild**	79 (21.4%)	7.77 ± 1.35 (6-10)	
• **Moderate**	41 (11.1%)	12.59 ± 1.38 (11-15)	
• **Severe**	19 (5.1%)	17.42 ± 1.43 (16-20)	

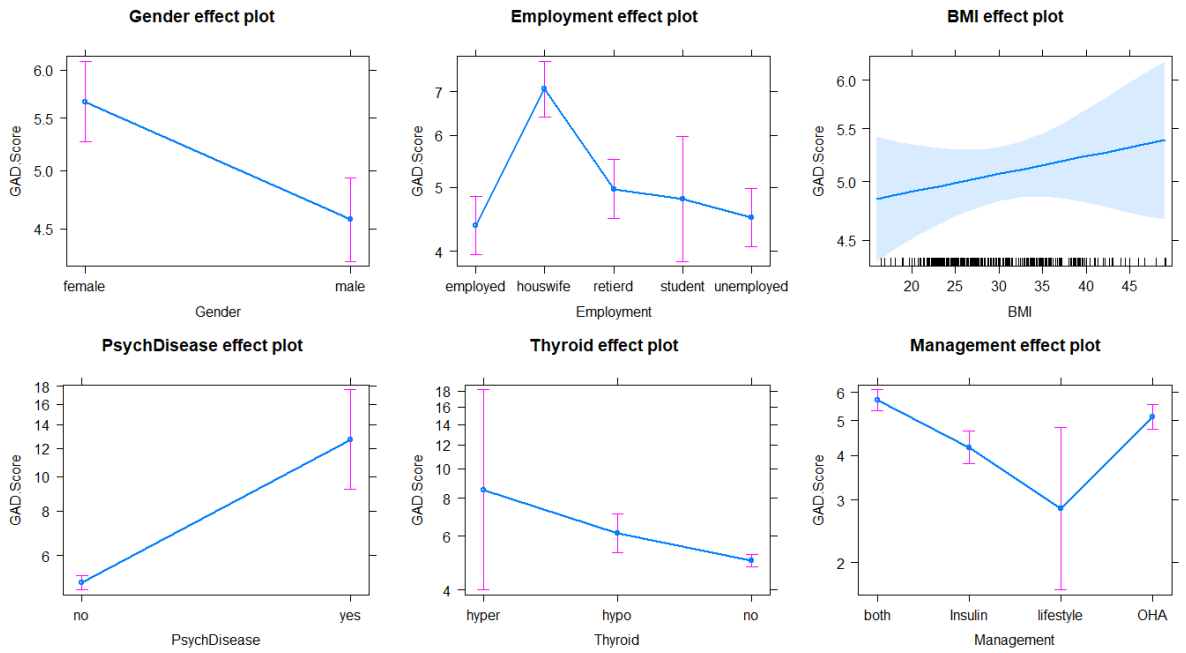
Table 4. Diabetic complications of the study participants

Parameter	No. (%)	GAD-7 score Mean ± SD (Min-Max)	P value
Stroke			
• **Yes**	35 (9.5%)	5.17 ± 5.29 (0-19)	0.774
• **No**	335 (90.5%)	5.42 ± 4.75 (0-20)	
Peripheral Vascular Disease			
• **Yes**	31 (8.4%)	4.68 ± 3.91 (1-18)	0.402
• **No**	339 (91.6%)	5.43 ± 4.85 (0-20)	
Retinopathy			
• **Yes**	52 (14.1%)	5.63 ± 5.68 (0-20)	0.665
• **No**	318 (85.9%)	5.33 ± 4.63 (0-20)	
Diabetic kidney disease			
• **Yes**	49 (13.2%)	4.71 ± 3.9 (0-14)	0.290
• **No**	321 (86.8%)	5.47 ± 4.9 (0-20)	
Hypoglycaemia			
• **Yes**	76 (20.5%)	4.75 ± 4.35 (0-17)	0.172
• **No**	294 (79.5%)	5.53 ± 4.88 (0-20)	
Neuropathy			
• **Yes**	140 (37.8%)	5.7 ± 4.65 (0-19)	0.308
• **No**	230 (62.2%)	5.17 ± 4.86 (0-20)	

Table 5. Estimates for the effects of impactful background factors on the GAD-7 score

Parameter	Estimate	Odds (95% CI)	SE	P value
Gender: Male	-0.213	0.808 (0.558 - 1.411)	0.059	**0.000**
Employment: Housewife	0.479	1.614 (0.719 - 0.907)	0.076	**0.000**
Employment: Retired	0.128	1.137 (1.390 - 1.874)	0.073	0.077
Employment: Student	0.094	1.098 (0.986 - 1.311)	0.124	0.447
Employment: Unemployed	0.028	1.029 (0.862 - 1.400)	0.075	0.702
BMI	0.003	1.003 (0.889 - 1.191)	0.004	0.381
Psychiatric disease	0.928	2.529 (0.996 - 1.010)	0.166	**0.000**
Thyroid disease: Hypothyroidism	-0.329	0.719 (1.827 - 3.501)	0.394	0.403
Thyroid disease: None	-0.536	0.585 (0.332 - 1.558)	0.388	0.166
Management: Insulin	-0.304	0.738 (0.274 - 1.251)	0.065	**0.000**
Management: Lifestyle	-0.699	0.497 (0.650 - 0.838)	0.271	**0.009**
Management: OHA	-0.107	0.899 (0.292 - 0.845)	0.052	**0.040**

Figure (1): Adjusted effects of background factors on GAD-7 Score



DISCUSSION:

The results of our current study estimated the point prevalence of GAD in diabetic patients at 37.6%; a figure closely mirrors the 38.3% estimate found by **(*Alzahrani* et al., 2019)** investigation in the Western part of Saudi Arabia. This indicates that, following our findings, over one out of every three diabetic patients in Saudi Arabia has some anxiety disorder. Severe anxiety was found to affect 5% of our sample. This is quite concerning, given the considerable impact anxiety has on the quality of life among diabetic patients **(*Ozdemir* and *Sahin*, 2020).** Furthermore, anxiety symptoms could worsen the diabetic symptoms and, worse, enhance the progression from –pre-diabetes to full-blown diabetic picture **(*Jiang* et al., 2020).** This is consistent with established evidence from the earliest surveys in diabetology literature. In the past two decades ago, the prevalence of anxiety in the diabetic population was double the prevalence of anxiety in the general population **(*Anderson* et al., 2001).** Between 5-7% of all diabetic patients in the Netherlands met the criteria for anxiety and depressive disorder in a nationwide survey **(*Vogtschmidt* et al., 2020).** The increase in the prevalence of anxiety disorder was twice that in the general population during the last two decades **(*Huang* et al., 2020).** All the subtypes of anxiety disorder were more prevalent among diabetic patients, particularly generalized anxiety disorder and panic disorder **(*Chaturvedi* et al., 2019).** Even children exposed to gestational diabetes were found to have higher anxiety levels **(*Alves* et al., 2020)**, likely related to impaired prenatal attachment styles in diabetic mothers **(*Napoli* et al., 2020).**

Several theories exist to explain how anxiety symptoms develop in diabetic patients. Trust in healthcare provision was shown to relate conversely with anxiety symptoms, especially in Saudi patients **(*AlRuthi* et al., 2020).** Improvement of the quality of care diabetic patients receive could accentuate their anxiety and improve their quality of life. Furthermore, sleep disruption related to diabetic symptoms correlates with anxiety symptoms **(*Dong* et al., 2020).** One most recent explanation for anxiety symptoms development in the context of diabetes is the emotional burden that accompanies a diagnosis of diabetes, regarded as one of the three diabetes-related internal distress subtypes, in addition to fatigue and lack of knowledge **(*Arifin* et al., 2020).**

Glycaemic control did not significantly affect anxiety scores among the diabetic patients we recruited in our study. Literature indicates a bidirectional relationship between impaired glucose control and anxiety. Fear of hypoglycemia remains a significant issue among diabetic patients, particularly in the younger age category and their immediate carers **(*Abitbol* and *Palmert*, 2020)**. Anxiety and depressive symptoms established themselves as recognized risk factors for

developing type 2 diabetes **(*Deschênes* et al., 2018).** A new line of inquiry is the differential relationship between glycaemic control and depressive symptoms (rather than anxiety symptoms) among diabetic individuals **(*Dehesh* et al., 2020).** More recent local studies have confirmed that poor glycaemic control is associated with higher levels of 'emotional distress, intricately linked to depressive rather than anxiety symptomatology **(*Aljuaid* et al., 2018)**. Earlier studies indicated that disordered eating behavior is closely related to glycaemic control, more so than depressive and anxiety symptoms **(*Wisting* et al., 2018).** The reason for such a differential relationship remains unclear.

We found over 75% of diabetic patients who participated in the study either overweight or obese. Our results indicate a positive association between BMI readings and the total GAD-7 score. This corroborates previous research findings of a substantial correlation between anxiety and BMI among diabetic patients **(*Martínez Hernández* et al., 2014)**. Obesity was one of the earlier moderators identified in large-scale population-based research to influence the diabetes-anxiety association **(*Mezuk* et al., 2013).**

Gender difference among our participants in terms of anxiety was quite pronounced. We found that women with diabetes were far more anxious than their male counterparts. Women were found to perceive diabetes as a threat to them more than men **(*Zawadzka and Domańska*, 2020).** Men tend to develop a more flexible relationship with diabetes, perceiving the many opportunities it could offer **(*Zawadzka and Domańska*, 2020)**. However, recent studies show that men and women effectively use spirituality and acceptance as coping mechanisms with diabetes **(*Arifin* et al., 2020).** This gender-based gap in anxiety symptomatology among diabetic patients seems to be further widened in obese individuals **(*Svenningsson* et al., 2012).** The question of the underpinnings for such difference remains largely an unanswered one.

Our results also indicated a high level of anxiety among diabetic patients with comorbid hypothyroid disease. This finding was unexpectedly counterintuitive. This finding, however, provides some evidence to the long-proposed theory that anxiety among diabetic patients is influenced by both the hypothalamic-pituitary-adrenal axis and hypothalamic-pituitary-thyroid axis **(*Liu* et al., 2017).**

Diabetic patients on lifestyle management with no drugs to be taken were the least anxious among our participants. Those on both insulin and oral agents were the most anxious among the diabetic patients. Physical activity was shown, across international studies, to bear a converse relationship with anxiety and depressive burden **(*Razieh* et al., 2019).** On the other hand, physical inactivity constituted an essential predictor for anxiety disorder in diabetic patients **(*Khuwaja* et al., 2010).** Indeed, the encouragement of healthy eating and an active lifestyle has shown beneficial effects in depressive and anxiety symptoms among diabetic patients **(*Gallagher* et al., 2014).** Such association between an active lifestyle and reduced anxiety scores could be due to the healthy sense of achievement and the ability to control weight and engage in a healthy routine **(*Ruusunen* et al., 2012).** Specific lifestyle interventions based on stress management and yoga principles showed promising results in reducing anxiety scores among diabetic patients **(*Gupta* et al., 2006).**

Our results also uncovered high levels of anxiety among housewives. That could have well inflated the results for anxiety scores we found among women. Previous surveys found that diabetic housewives endure substantial stress levels that put them at greater risk of anxiety and depressive disorders **(*Kuar* et al., 2013).**

Despite rarity among our participants, a comorbid psychiatric illness was the most impactful factor in terms of anxiety score. We expect psychiatric comorbidity due to stigma, which is far more prevalent than we found out in our current survey. Some large-scale studies estimate as many as 42% of all diabetic patients to have at least one psychiatric comorbidity **(*Kanwar* et al., 2019).** Somatization and anger-hostility were more prevalent among diabetic patients than the general public **(*Dogan* et al., 2019).** This puts further challenges on healthcare services. Many health systems moved towards integrated psychiatric-diabetes clinics focusing on this group of patients whose needs are quite complex **(*Wong* and *Mehta*, 2020).**

None of the diabetic complications was impactful in terms of GAD-7 anxiety score. This was another unexpected finding. Fear of diabetic complications was a long-recognized source of anxiety for diabetic patients **(*Buckloh* et al., 2008).** Diabetic neuropathy, due to its close relationship with pain and discomfort, was found to be associated with increased levels of anxiety **(*Naranjo* et al., 2020).** Engagement in regular proprioceptive exercises was efficacious in

reducing the anxiety burden among diabetic patients who developed neuropathic pains complication **(*Abdelbasset* et al., 2020).**

The current investigation has several strengths. We have interviewed a large sample size, and the response rate was extremely high. We used systematic random sampling to enhance the representativeness and external validity of our results. However, a range of limitations must be taken on board before making valid interpretations of the findings. The study's design is one-off cross-sectional, making it difficult to avoid directionality in terms of cause-effect relationships that we claim. Furthermore, selection bias could have impacted our results due to the inherent difficulty that extremely anxious patients may find it challenging to complete the research questionnaire. Very unwell patients may not even attend the outpatient clinic.

CONCLUSION AND RECOMMENDATIONS:

This study demonstrated that anxiety symptoms are quite prevalent among diabetic patients, and holistic care for diabetic patients should incorporate screening for anxiety symptoms and prompt treatment of anxious patients. We also found that treating underlying thyroid disease is imperative for all diabetic patients to control any hormonal disruption that could increase the risk for anxiety disorder symptoms. We suggest that diabetic patients should be encouraged to adopt a healthy, active lifestyle given its proven beneficial effects on psychological and physical well-being. The high-risk group for anxiety among diabetic patients is the housewives, and family physicians and diabetes specialists should focus on their psychological well-being. Research should explore specific psychosocial interventions that could alleviate anxiety symptoms in diabetic patients. Treatment of diabetic patients who have comorbid mental disorders should adopt close collaboration with consultation-liaison psychiatric services.

Further research in anxiety and diabetes should attempt to identify the path between the two disorders utilizing a longitudinal multiple follow-up methodology. Further research is required to focus on diabetes-related factors such as life-threatening emergencies and sleep disruption in accentuating the development of fear and nervousness among diabetic subjects.

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