Diabetes-related distress among type 1 and type 2 diabetes patients in Saudi Arabia

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Abstract

Background: Studies have shown that diabetes negatively affects mental health, and that depression is twice as common among individuals with diabetes.

Aim: To evaluate diabetes-related distress and its association with complications, treatment adherence and clinical outcomes in Saudi Arabia.

Methods: This cross-sectional study collected data from 269 patients with type 1 and type 2 diabetes mellitus at a tertiary hospital in Riyadh, Saudi Arabia, using the Diabetes Distress Scale (DDS). The data were analysed using SPSS version 25.

Results: Overall, 12.3% of the participants reported diabetes-related high distress (DDS-17 score > 3), 38.7% moderate distress (> 2) and 49.0% little or no distress. The most reported type of distress was regimen-related distress (22.7%), followed by emotional burden (15.6%), physician-related distress (14.9%), and interpersonal distress (10.4%). Treatment adherence was significantly associated with lower distress levels across all domains ($P < 0.05$). Higher diabetes-related distress scores correlated with elevated haemoglobin A1c levels and diabetes-related complications. Females had significantly more neurologic and more visual complications than males ($P < 0.001$).

Conclusion: Our findings show that diabetes-related distress, particularly regimen-related and physician-related distresses, has significant effects on clinical outcomes for type 1 and type 2 diabetes mellitus patients. There is therefore a need for physicians to integrate diabetes-related distress assessment and management into routine diabetes care, including providing guidance on daily disease management and lifestyle changes as preventive measures for diabetes-related distress.

Keywords: diabetes, distress, mental health, complications, regimen, adherence, physician, Saudi Arabia

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Background

Diabetes mellitus (DM) is a chronic metabolic disorder characterised by persistent hyperglycaemia due to impaired insulin production or action. It is a major health concern globally that significantly impacts healthcare systems, economies and societies (*1*). In 2021, the International Diabetes Federation (IDF) estimated that 537 million people worldwide had diabetes, reflecting a 16% increase (74 million additional cases) over 2019 figures. Prevalence in Saudi Arabia in 2021 was 17.7%, ranking second in the Middle East and North Africa Region and seventh globally (*2*).

DM is a complex condition requiring comprehensive management and careful monitoring to achieve optimal glycaemic control. Poor glycaemic control is strongly linked to well-documented complications, which contribute to increased morbidity and mortality over time (*3*). Effective diabetes management requires adherence to dietary modifications, physical activity, continuous glucose monitoring and medication regimens. However, these self-care demands can be overwhelming, leading to psychological distress (*4*). The chronic nature of diabetes and the risk of complications further contribute to emotional burden and stress (*5*).

Diabetes-related distress (DRD) refers to the emotional strain associated with managing diabetes, including the burden of daily self-care and fear of long-term complications (*6*). DRD has been shown to negatively impact glycaemic control and treatment outcomes (*7,8*). Despite its clinical significance, DRD is rarely assessed in routine diabetes care. Data on its prevalence and impact in Saudi Arabia remain limited (*9,10*).

This study evaluated DRD levels among individuals with diabetes using the DDS-17 questionnaire and examined its associations with diabetic complications, treatment approaches and glycaemic management.

Methods

Study design and participants

This cross-sectional study recruited a convenience sample of 269 patients with type 1 and type 2 DM from the outpatient department of a tertiary hospital in Riyadh, Saudi Arabia. Participants were approached in waiting areas and invited to participate in the study.

Inclusion and exclusion criteria

Adults aged 18–80 years with a confirmed diagnosis of DM for at least one year and regular attendance at the hospital's DM follow-up clinic were eligible to participate. Exclusion criteria included patients with severe illness or diabetes-related complications that hindered their ability to complete the survey, as well as those who had difficulty understanding the questionnaire.

Sample size calculation

The sample size was determined using STATA Ver.16. With an estimated 38.2% prevalence of DRD and a ± 5% margin of error, the minimum required sample size was 197. To account for potential incomplete data, the sample size was increased to 269 participants *(9)*.

Data collection

Data were collected using a validated, pre-tested questionnaire developed following a literature review of similar studies. The questionnaire was originally developed in English and translated into Arabic by 2 bilingual individuals, back-translated and reviewed for face and content validity by public health and field experts. They confirmed that the questionnaire was clear, well-organised and appropriate for assessing the study variables.

The questionnaire had 3 sections. The first section covered sociodemographic data, including age, gender and marital status. The second addressed medical history, including DM type and duration, medication use, comorbidities and complications. Data on body mass index (BMI), lipid profile [target LDL cholesterol < 100 mg/dl (2.60 mmol/l)], triglycerides < 150 mg/dl (1.7 mmol/l), HDL cholesterol > 40 mg/dl (1.02 mmol/l) *(11)* and HbA1c levels (target < 7%) were collected from medical records. Participants with consistently elevated blood pressure (>140/90 mmHg) were excluded *(12,13)*.

The third section assessed DRD using DDS-17, which measures distress across 4 domains: regimen-related distress (RD), emotional burden (EB), physician-related distress (PD) and interpersonal distress (ID). The DDS-17 consists of 17 items rated on a 6 point Likert scale (1 = mild distress; 6 = serious distress). The total DDS-17 score was calculated by summing all item scores and dividing them by 17. DRD severity was classified as clinically significant DRD (DDS-17 score > 2) or high DRD (DDS-17 score > 3) *(6)*. The validated Arabic version of DDS-17 was used in this study *(14)*, with excellent internal consistency (Cronbach's alpha (α) = 0.92).

A pilot test involving 30 participants was conducted before data collection to assess questionnaire clarity, readability and completion time. Based on the feedback, minor modifications were to the text. Six trained medical doctors obtained verbal consent from the participants after explaining the study objectives to them before administering the questionnaire.

Statistical analysis

Descriptive statistics, including median and interquartile ranges, were used for numerical variables and numbers and percentages for categorical variables. Independent t-tests and chi-square tests were used to compare numerical and categorical variables between males and females. Univariate analysis was performed to examine associations between DRD and its domains. Binary logistic regression was conducted to identify risk factors for DRD and potential gender differences, with DRD as the outcome variable. Variables with a univariate $P < 0.05$ were included as explanatory variables using the Enter method. Additional binary logistic regression analyses were conducted to determine factors associated with different DRD domains. Only significant factors from the bivariate analysis were included. A two-tailed P-value < 0.05 was considered statistically significant. All analyses were performed using SPSS version 25.

Ethics considerations

The study was conducted in accordance with the ethics principles outlined in the Declaration of Helsinki and approved by the Institutional Review Board (IRB) at Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia (IRB-PNU:19-0139). Informed verbal consent was obtained from all participants prior to their inclusion. The use of verbal consent was approved by the ethics committee, as the IRB permits this approach for survey-based research when the collected data do not pose risks such as participant identification, legal or employment repercussions, or harm to their reputation.

Results

Response rate and participant characteristics

Of the 305 invited participants, 269 completed the survey, yielding a response rate of 88.2%. The median age was 58 years (IQR: 12) and 68.8% were female. In terms of education, 38.7 % had a university degree or higher. Most participants were Saudis (94.4%), married (77.8%) and unemployed (69.5%). However, 77% reported sufficient income (Table 1).

Health-related behaviours and diabetes management

Regarding health-related behaviours, 62.1% exercised regularly and 86.6% were non-smokers. Among the participants, 87.4% had type 2 DM (T2DM), while 12.6% had type 1 DM (T1DM). The duration of diabetes was less than 10 years in 42.8% of the cases. Treatment adherence was reported by 91.4% of the participants, whereas

Table 1 Sociodemographic and disease-related characteristics of diabetic patients

Socio-demographic data		Total [No. (%)]	Male [No. (%)]	Female [No. (%)]	*P* value
Age in years (median, inter-quartile range)		58 (12.0)	60 (10.8)	55 (10.0)	< 0.001*
Nationality	Saudi	254 (94.4)	77 (91.7)	177 (95.7)	0.25
	Non-Saudi	15 (5.5)	7 (8.3)	8 (4.3)	
Education	Illiterate	38 (14.1)	2 (2.4)	36 (19.5)	< 0.001*
	Primary school	46 (17.1)	10 (11.9)	36 (19.5)	
	Middle and high school	81 (30.1)	24 (28.6)	57 (30.8)	
	University and higher education	104 (38.7)	48 (57.1)	56 (30.3)	
Marital status	Single	13 (4.8)	1 (1.2)	12 (6.5)	< 0.001*
	Married	208 (77.3)	81 (96.4)	127 (68.6)	
	Divorced	12 (4.5)	0	12 (6.5)	
	Widow	36 (13.4)	2 (2.4)	34 (18.4)	
Income	More than enough	28 (10.4)	15 (17.9)	13 (7.0)	0.001*
	Enough	207 (77)	53 (63.1)	154 (82.2)	
	Not enough	34 (12.6)	16 (19.0)	18 (9.7)	
Employment status	Unemployed	187 (69.5)	54 (64.3)	133 (71.9)	0.21
	Employed	82 (30.5)	30 (35.7)	52 (28.1)	
Regular physical activity	No	102 (37.9)	24 (28.6)	78 (42.2)	0.03*
	Yes	167 (62.1)	60 (71.4)	107 (57.8)	
Smoking status	Non-smoker	233 (86.6)	52 (61.9)	181 (97.8)	< 0.001*
	Ex-smoker	10 (3.7)	9 (10.7)	1 (0.5)	
	Current smoker	26 (9.7)	23 (27.4)	3 (1.6)	
Disease-related characteristics		**Total [No. (%)]**	**Male [No. (%)]**	**Female [No. (%)]**	***P* value**
Diabetes type	Type 1	34 (12.6)	11 (13.1)	23 (12.4)	0.88
	Type 2	235 (87.4)	73 (86.9)	162 (87.6)	
Duration of diabetes (years)	< 10 years	115 (42.8)	32 (38.1)	83 (44.9)	0.58
	10–19 years	81 (30.1)	27 (32.1)	54 (29.2)	
	≥ 20 years	73 (27.1)	25 (29.8)	48 (25.9)	
Treatment adherence	No	23 (8.6)	9 (10.7)	14 (7.6)	0.39
	Yes	246 (91.4)	75 (89.3)	171 (92.4)	
Blood glucose self-monitoring frequency	Not daily	159 (59.1)	49 (58.3)	110 (59.5)	0.86
	At least once daily	110 (40.9)	35 (41.7)	75 (40.5)	
HbA1C monitoring frequency	At least once every 3 months	226 (84)	69 (82.1)	157 (84.9)	0.57
	More than every 3 months	43 (16)	15 (17.9)	28 (15.1)	
Diabetes control	Uncontrolled	173 (68.1)	55 (70.5)	118 (67)	0.58
	Controlled	81 (31.9)	23 (29.5)	58 (33)	
HbA1C (median, interquartile range)		7.20 (2.2)	7.20 (2)	7.15 (2.1)	0.64
Diabetes complications	No complications	64 (23.8)	31 (36.9)	33 (17.8)	0.001*
	≥1 complication	205 (76.2)	53 (63.1)	152 (82.2)	
Neurological complications	No	131 (48.7)	51 (60.7)	80 (43.2)	0.008*
	Yes	138 (51.3)	33 (39.3)	105 (56.8)	
Visual complications	No	116 (43.1)	53 (63.1)	63 (34.1)	<0.001*
	Yes	153 (56.9)	31 (36.9)	122 (65.9)	
Renal complications	No	251 (93.3)	80 (95.2)	171 (92.4)	0.39
	Yes	18 (6.7)	4 (4.8)	14 (7.6)	
Diabetic foot	No	250 (92.2)	76 (90.5)	174 (94.1)	0.29
	Yes	19 (7.1)	8 (9.5)	11 (5.9)	
Cardiac complications	No	239 (88.8)	73 (86.9)	166 (89.7)	0.50
	Yes	30 (11.2)	11 (13.1)	19 (10.3)	
Dyslipidaemia	Normal lipid profile	28 (10.5)	8 (9.6)	20 (10.9)	0.76
	Abnormal lipid profile	239 (89.5)	75 (90.4)	164 (89.1)	
Hypertension	Normotensive	105 (39)	30 (35.7)	75 (40.5)	0.45
	Hypertensive	164 (61)	54 (64.3)	(9.5)	

**Significant, HbA1C: haemoglobin A1C, p-value obtained using the chi-square test (at a 95% significance level) for categorical variables and independent t-test (95% CI) for numerical variables.*

59.1% monitored their blood glucose irregularly. Of the participants, 84.0% monitored their HbA1c at least once every 3 months. In contrast, 68.1% had uncontrolled blood glucose levels. The median HbA1c was 2.20 (IQR: 2.2) (Table 1).

Diabetes-related complications

Overall, 76.2% of the participants had at least one diabetes-related complication. The most common was hyperlipidaemia (89.5%), followed by hypertension (61.0%). Other reported complications included visual impairment (56.9%), neurological complications (51.3%) and cardiac complications (11.2%). No significant gender differences were observed between diabetes-related characteristics, except for complications: females had significantly higher rates of neurologic and visual complications than males ($P < 0.001$) (Table 1).

The analysis of DDS-17 outcomes revealed that 12.3% of the participants exhibited DRD based on the overall questionnaire score. Among them, 33 patients (12.3%) had high distress (DDS-17 score > 2), 104 (38.7%) had moderate distress (score > 3) and 132 (49.0%) had little or no distress. There was no statistically significant difference in DRD levels between T1DM and T2DM (Table 2).

Associations between DRD and participant characteristics

Participants who engaged in regular exercise had significantly lower stress levels in the total score and PD domain ($P = 0.04$). Treatment adherence was significantly associated with lower stress levels across all domains ($P< 0.05$) (Table 3). Participants who monitored their HbA1c more frequently than every 3 months reported lower stress levels, with a significant association in the EB domain ($P = 0.03$). Better HbA1c control was significantly associated with lower stress levels, particularly in the total score ($P = 0.05$). Participants with insufficient income reported higher stress levels, especially in the PD domain ($P = 0.04$).

DRD and its domains were more pronounced among participants with renal, cardiac and diabetic foot complications. Participants with diabetic foot complications had higher stress levels in the total score, EB, PD and RD domains. Those with cardiac complications reported higher stress in the EB and PD domains, while those with renal complications had higher stress in the RD domain ($P < 0.05$). However, DRD and its domains were not associated with age, gender, education, marital status, nationality, employment status, smoking behaviour, or diabetes type and duration ($P > 0.05$). Patients experiencing one subtype of distress were significantly more likely to endure other subtypes ($P < 0.001$).

Regression analysis of DRD

Patients who did not exercise ($P < 0.04$), were non-adherent to treatment ($P < 0.006$) or had diabetic foot complications ($P = 0.002$) had a significantly higher risk of DRD (Model 1) (Table 4). Gender-specific analysis (Model 2 and 3) revealed that men with diabetic foot complications ($P = 0.001$) or higher HbA1c ($P < 0.02$) were at higher risk of DRD, while women were primarily affected by non-adherence to treatment ($P < 0.005$).

Domain-specific analysis

Non-adherence to treatment ($P = 0.008$), frequent HbA1c monitoring ($P = 0.02$) and cardiac complications ($P = 0.02$) were associated with higher EB (Table 5). For PD, insufficient income ($P = 0.05$), lack of exercise ($P = 0.03$) and non-adherence to treatment ($P = 0.04$) were significant predictors. However, for regime-related distress and interpersonal distress, only non-adherence to treatment predicted higher distress ($P = 0.002$) and ($P = 0.02$), respectively (Table 5).

Correlation between HbA1c and DRD

Participants with DRD had significantly higher HbA1c levels. A direct correlation was observed between HbA1c levels and all DRD domains, as indicated by Pearson's correlation coefficients, particularly for the total score ($r = 0.13$, $P = 0.03$) and RD ($r = 0.15$, $P = 0.02$) (Table 6).

DRD distribution by domain

RD was the most affected domain, while ID was the least affected. Specifically, 22.7% of the participants reported RD, 15.6% experienced EB, 14.9% reported PD and 10.4% demonstrated ID (Figure 1).

Discussion

Prevalence of DRD among individuals with diabetes

This study provides insight into the factors influencing DRD among the Saudi population. DRD prevalence among individuals with diabetes was 12.3%, which contrasts with findings from previous studies. For instance, a study in the United States of America using the DDS-17 scale reported moderate to high DRD in 51.3% of participants *(7)*. Similarly, studies from Bangladesh and China found DRD rates of 48.5%, and 43%, respectively, using the same scale *(15,16)*. In contrast, two German studies using the Problem Areas in Diabetes (PAID) questionnaire revealed lower distress rates of 8.9% and 10.7% *(17)*.

The variation in DRD prevalence across studies may be due to differences in measurement tools, including the use of the PAID questionnaire. Among those using DDS-17, factors such as sample size, health care accessibility and availability of medication refills may explain the discrepancies.

Socio-demographic and health-related characteristics

The mean HbA1c in this study was 7.4%, which is lower than the values reported in other studies on Saudi populations *(18–20)*. Unlike previous research *(21,22)*, we found no association between sociodemographic variables, diabetes type or duration, and diabetes distress.

Table 2 **Associations between diabetes-related distress subscales and socio-demographic and disease-related characteristics (bivariate analysis)**

Socio-demographic data		Diabetes-related distress subscales									
		Emotional burden N (%)		Physician-related distress N (%)		Regimen-related distress N (%)		Interpersonal distress N (%)		Total diabetes-related distress N (%)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Age (years)		**58 (8.5)**	**57 (12)**	**59 (9)**	**57 (12)**	**58 (9)**	**58 (12)**	**58 (9.5)**	**58 (12)**	**58 (7.5)**	**57.5 (12)**
P-value		0.43		0.06		0.96		0.12		0.29	
Gender	Male	11 (13.1)	73 (86.9)	17 (20.2)	67 (79.8)	18 (21.4)	66 (78.6)	10 (11.9)	74 (88.1)	10 (11.9)	74 (88.1)
	Female	31 (16.8)	154 (83.2)	23 (12.4)	162 (87.6)	43 (23.2)	142 (76.8)	18 (9.7)	167 (90.3)	23 (12.4)	162 (87.6)
P-value		**0.44**		**0.10**		**0.74**		**0.59**		**0.90**	
Nationality	Saudi	39 (15.4)	215 (84.6)	38 (15)	216 (85)	58 (22.8)	196 (77.2)	26 (10.2)	228 (89.8)	30 (11.8)	224 (88.2)
	Non-Saudi	3 (20)	12 (80)	2 (13.3)	13 (86.7)	3 (20)	12 (80)	2 (13.3)	13 (86.7)	3 (20)	12 (80)
P-value		0.63		0.86		0.80		0.70		0.35	
Education	Illiterate	8 (21.1)	30 (78.9)	7 (18.4)	31 (81.6)	9 (23.7)	29 (76.3)	3 (7.9)	35 (92.1)	7 (18.4)	31 (81.6)
	Primary school	9 (19.6)	37 (80.4)	7 (15.2)	39 (84.8)	15 (32.6)	31 (67.4)	4 (8.7)	42 (91.3)	8 (17.4)	38 (82.6)
	Middle/high school	14 (17.3)	67 (82.7)	12 (14.8)	69 (85.2)	18 (22.2)	63 (77.8)	11 (13.6)	70 (86.4)	10 (12.3)	71 (87.7)
	University and higher education	11 (10.6)	93 (89.4)	14 (13.5)	90 (86.5)	19 (18.3)	85 (81.7)	10 (9.6)	94 (90.4)	8 (7.7)	96 (92.3)
P-value		**0.31**		**0.91**		**0.29**		**0.72**		**0.21**	
Marital status	Single	0	13 (100)	0	13 (100)	2 (15.4)	11 (84.6)	1 (7.7)	12 (92.3)	0	13 (100)
	Married	32 (15.4)	176 (84.6)	31 (14.9)	177 (85.1)	46 (22.1)	162 (77.9)	21 (10.1)	187 (89.9)	25 (12)	183 (88)
	Divorced	2 (16.7)	10 (83.3)	1 (8.3)	11 (91.7)	3 (25)	9 (75)	1 (8.3)	11 (91.7)	1 (8.3)	11 (91.7)
	Widow	8 (22.2)	28 (77.8)	8 (22.2)	28 (77.8)	10 (27.8)	26 (72.2)	5 (13.9)	31 (86.1)	7 (19.4)	29 (80.6)
P-value		**0.31**		**0.26**		**0.80**		**0.90**		**0.29**	
Employment status	Unemployed	26 (13.9)	161 (86.1)	30 (16)	157 (84)	43 (23)	144 (77)	20 (10.7)	167 (89.3)	23 (12.3)	164 (87.7)
	Employed	16 (19.5)	66 (80.5)	10 (12.2)	72 (87.8)	18 (22)	64 (78)	8 (9.8)	74 (90.2)	10 (12.2)	72 (87.8)
P-value		0.24		0.41		0.85		0.82		0.98	
Regular physical activity	No	20 (19.6)	82 (80.4)	21 (20.6)	81 (79.4)	29 (28.4)	73 (71.6)	14 (13.7)	153 (91.6)	18 (17.6)	84 (82.4)
	Yes	22 (13.2)	145 (86.8)	19 (11.4)	148 (88.6)	32 (19.2)	135 (80.8)	14 (8.4)	88 (86.3)	15 (9)	152 (91)
P-value		0.16		0.04*		0.08		0.16		0.04*	
Smoking status	Non-smoker	36 (15.5)	197 (84.5)	34 (14.6)	199 (85.4)	53 (22.7)	180 (77.3)	23 (9.9)	210 (90.1)	28 (12)	205 (88)
	Smoker	6 (16.7)	30 (83.3)	6 (16.7)	30 (83.3)	8 (22.2)	28 (77.8)	5 (13.9)	31 (86.1)	5 (13.9)	31 (86.1)
P-value		**0.85**		**0.75**		**0.94**		**0.46**		**0.75**	

Table 3 **Associations between diabetes-related distress subscales and disease-related characteristics (bivariate analysis) (*Continued*)**

Disease-related characteristics		Diabetes related distress subscales									
		Emotional burden N (%)		Physician-related distress N (%)		Regimen-related distress N (%)		Interpersonal distress N (%)		Diabetes-related distress N (%)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Type of diabetes	Type 1	5 (14.7)	29 (85.3)	5 (14.7)	29 (85.3)	6 (17.6)	28 (82.4)	2 (5.9)	32 (94.1)	4 (11.8)	30 (88.2)
	Type 2	37 (15.7)	198 (84.3)	35 (14.9)	200 (85.1)	55 (23.4)	180 (76.6)	26 (11.1)	209 (88.9)	29 (12.3)	206 (87.7)
***P*-value**		**0.88**		**0.98**		**0.45**		**0.36**		**1**	
Duration (years)	< 10 years	16 (13.9)	99 (86.1)	16 (13.9)	99 (86.1)	27 (23.5)	88 (76.5)	14 (12.2)	101 (87.8)	11 (9.6)	104 (90.4)
	10–19 years	11 (13.6)	70 (86.4)	14 (17.3)	67 (82.7)	16 (19.8)	65 (80.2)	9 (11.1)	72 (88.9)	9 (11.1)	72 (88.9)
	≥ 20 years	15 (20.5)	58 (79.5)	10 (13.7)	63 (86.3)	18 (24.7)	55 (75.3)	5 (6.8)	68 (93.2)	13 (17.8)	60 (82.2)
***P*-value**		**0.40**		**0.77**		**0.74**		**0.49**		**0.23**	
Treatment adherence	No	8 (34.8)	15 (65.2)	7 (30.4)	16 (69.6)	12 (52.2)	11 (47.8)	6 (26.1)	17 (73.9)	8 (34.8)	15 (65.2)
	Yes	34 (13.8)	212 (86.2)	33 (13.4)	213 (86.6)	49 (19.9)	197 (80.1)	22 (8.9)	224 (91.1)	25 (10.2)	221 (89.8)
***P*-value**		**0.015***		**0.03***		**<0.001***		**0.02***		**0.003***	
Blood glucose self-monitoring frequency	Not daily	22 (13.8)	137 (86.2)	29 (18.2)	130 (81.8)	35 (22)	124 (78)	16 (10.1)	143 (89.9)	20 (12.6)	139 (87.4)
	Once daily	6 (9.5)	57 (90.5)	5 (7.9)	58 (92.1)	8 (12.7)	55 (87.3)	6 (9.5)	57 (90.5)	5 (7.9)	58 (92.1)
	More than once daily	14 (29.8)	33 (70.2)	6 (12.8)	41 (87.2)	18 (38.3)	29 (61.7)	6 (12.8)	41 (87.2)	8 (17)	39 (83)
***P*-value**		**0.009***		**0.14**		**0.006***		**0.84**		**0.35**	
HbA1C monitoring frequency	at least once every 3 months	40 (17.7)	186 (82.3)	34 (15)	192 (85)	52 (23)	174 (77)	25 (11.1)	201 (88.9)	30 (13.3)	196 (86.7)
	more than every 3 months	2 (4.7)	41 (95.3)	6 (14)	37 (86)	9 (20.9)	34 (79.1)	3 (7)	40 (93)	3 (7)	40 (93)
***P*-value**		**0.03***		**0.85**		**0.77**		**0.42**		**0.25**	
Diabetes control	Controlled	10 (12.3)	71 (87.7)	13 (16)	68 (84)	16 (19.8)	65 (80.2)	10 (12.3)	71 (87.7)	9 (11.1)	72 (88.9)
	Uncontrolled	30 (17.3)	143 (82.7)	25 (14.5)	148 (85.5)	42 (24.3)	131 (75.7)	17 (9.8)	156 (90.2)	23 (13.3)	150 (86.7)
***P*-value**		**0.31**		**0.74**		**0.42**		**0.54**		**0.63**	
HbA1c (Median, interquartile range)		7.5 (2.6)	7.1 (2)	7.2 (2.88)	7.2 (2.1)	7.2 (2.15)	7.2 (2.1)	7.1 (3.1)	7.2 (2.1)	7.55 (2.9)	7.1(2.02)
***P*-value**		**0.14**		**0.44**		**0.41**		**0.42**		**0.05**	
Neurological complications	No	42 (16.5)	212 (83.5)	40 (15.7)	214 (84.3)	60 (23.6)	194 (76.4)	28 (11)	226 (89)	33 (13)	221 (87)
	Yes	0	15 (100)	0	15 (100)	1 (6.7)	14 (93.3)	0	15 (100)	0	15 (100)
***P*-value**		**0.14**		**0.14**		**0.20**		**0.38**		**0.23**	
Visual complications	No	18 (15.5)	98 (84.5)	19 (16.4)	97 (83.6)	24 (20.7)	92 (79.3)	14 (12.1)	102 (87.9)	14 (12.1)	102 (87.9)
	Yes	24 (15.7)	129 (84.3)	21 (13.7)	132 (86.3)	37 (24.2)	116 (75.8)	14 (9.2)	139 (90.8)	19 (12.4)	134 (87.6)
***P*-value**		**0.97**		**0.55**		**0.50**		**0.44**		**0.93**	
Renal complications	No	38 (15.1)	213 (84.9)	37 (14.7)	214 (85.3)	53 (21.1)	198 (78.9)	26 (10.4)	225 (89.6)	30 (12)	221(88)
	Yes	4 (22.2)	14 (77.8)	3 (16.7)	15 (83.3)	8 (44.4)	10 (55.6)	2 (11.1)	16 (88.9)	3 (16.7)	15 (83.3)
***P*-value**		**0.42**		**0.82**		**0.04***		**1**		**0.56**	
Diabetic foot	No	34 (13.6)	216 (86.4)	34 (13.6)	216 (86.4)	52 (20.8)	198 (79.2)	24 (9.6)	226 (90.4)	26 (10.4)	224 (89.6)
	Yes	8 (42.1)	11 (57.9)	6 (31.6)	13 (68.4)	9 (47.4)	10 (52.6)	4 (21.1)	15 (78.9)	7 (36.8)	12 (63.2)
***P*-value**		**0.004***		**0.04***		**0.02***		**0.12**		**0.004***	

Table 3 Associations between diabetes-related distress subscales and disease-related characteristics (bivariate analysis) (*Concluded*)

Disease-related characteristics		Diabetes related distress subscales									
		Emotional burden N (%)		Physician-related distress N (%)		Regimen-related distress N (%)		Interpersonal distress N (%)		Diabetes-related distress N (%)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Cardiac complications	No	31 (13)	208 (87)	32 (13.4)	207 (86.6)	51 (21.3)	188 (78.7)	24 (10)	215 (90)	27 (11.3)	212 (88.7)
	Yes	11 (36.7)	19 (63.3)	8 (26.7)	22 (73.3)	10 (33.3)	20 (66.7)	4 (13.3)	26 (86.7)	6 (20)	24 (80)
***P*-value**		**0.002***		**0.1**		**0.14**		**0.53**		**0.23**	
Dyslipidaemia	Normal lipid profile	4 (14.3)	24 (85.7)	8 (28.6)	20 (71.4)	6 (21.4)	22 (78.6)	3 (10.7)	25 (89.3)	5 (17.9)	23 (82.1)
	Abnormal lipid profile	37 (15.5)	202 (84.5)	32 (13.4)	207 (86.6)	55 (23)	184 (77)	25 (10.5)	214 (89.5)	28 (11.7)	211 (88.3)
***P*-value**		**1**		**0.04***		**0.85**		**1**		**0.36**	
Hypertension	Normotensive	30 (16.8)	149 (83.2)	27 (15.1)	152 (84.9)	39 (21.8)	140 (78.2)	19 (10.6)	160 (89.4)	22 (12.3)	157 (87.7)
	Hypertensive	11 (12.5)	77 (87.5)	12 (13.6)	76 (86.4)	21 (23.9)	67 (76.1)	8 (9.1)	80 (90.9)	10 (11.4)	78 (88.6)
***P*-value**		**0.36**		**0.75**		**0.70**		**0.70**		**0.84**	

**Significant, HA1C: haemoglobin A1C, P value obtained using the chi-square test (at 95% significance level) and independent t-test.*

Table 4 Multiple logistic regression of diabetes-related distress (total score)

Variable		All sample (Model 1)			Male (Model 2)			Female (Model 3)		
		Crude OR (95% CI)	Adjusted OR (95% CI)	*P*-value	Crude OR (95% CI)	Adjusted OR (95% CI)	*P*-value	Crude OR (95% CI)	Adjusted OR (95% CI)	*P*-value
Regular physical activity	Yes	0.46 (0.22–0.96)	0.43 (0.19–0.97)	0.04*	0.56 (0.14–2.18)	0.60 (0.11–3.23)	0.55	0.42 (0.17–1.03)	0.43 (0.17–1.13)	0.09
	No	Ref	Ref		Ref	Ref		Ref	Ref	
Treatment adherence	Yes	0.21 (0.08–0.55)	0.23 (0.08–0.65)	0.006*	0.42 (0.07–2.37)	0.37 (0.04–3.65)	0.40	0.15 (0.05–0.48)	0.17 (0.05–0.60)	0.005*
	No	Ref	Ref		Ref	Ref		Ref	Ref	
Diabetic foot	Yes	5.03 (1.82–13.89)	6 (1.95–18.45)	0.002*	11.67 (2.31–58.80)	23.14 (3.37–159.02)	0.001*	2.89 (0.71–11.78)	2.37 (0.47–11.86)	0.30
	No	Ref	Ref		Ref	Ref		Ref	Ref	
HbA1c (per unit increase)			1.22 (0.98–1.51)	0.07		1.60 (1.06–2.40)	0.02*		1.10 (0.81–1.44)	0.60

**Significant, OR = odds ratio, CI = confidence interval*

Table 5 Multiple logistic regression of diabetes-related distress (subscales)

		Emotional burden (Model 1)			Physician-related distress (Model 2)			Regimen-related distress (Model 3)			Interpersonal distress (Model 4)		
		Crude OR (95 CI)	Adjusted OR (95 CI)	*P*-value	Crude OR (95 CI)	Adjusted OR (95 CI)	*P*-value	Crude OR (95 CI)	Adjusted OR (95 CI)	P-value	Crude OR (95 CI)	Adjusted OR (95 CI)	*P*-value
Income	More than enough	–	–	–	0.4 (0.11–1.45)	0.54 (0.14–2.07)	0.37	–	–	–	–	–	–
	Enough	–	–		0.34 (0.15–0.80)	0.4 (0.16–0.98)		–	–		–	–	
	Not enough	–	–		Ref	Ref	0.05*	–	–		–	–	
Regular physical activity	Yes	–	–	–	0.50 (0.25–0.98)	0.45 (0.22–0.92)	0.03*	–	–	–	–	–	–
	No	–	–		Ref	Ref		–	–		–	–	
Treatment adherence	Yes	0.30 (0.12–0.76)	0.25 (0.09–0.69)	0.008*	0.35 (0.14–0.93)	0.33 (0.12–0.94)	0.04*	4.39 (1.83–10.53)	4.13 (1.66–10.24)	0.002*	3.59 (1.29–10.05)	3.59 (1.29–10.05)	0.02*
	No	Ref	Ref		Ref	Ref		Ref	Ref		Ref	Ref	
HbA1C monitoring frequency	More than every 3 months	0.23 (0.05–0.98)	0.15 (0.03–0.73)	0.02*	–	–	–	–	–	–	–	–	–
	At least once every 3 months	Ref	Ref		–	–		–	–		–	–	
Glucose monitoring frequency	Once daily	0.66 (0.25–1.70)	0.58 (0.21–1.60)	0.29	–	–	–	0.52 (0.22–1.18)	0.57 (0.24–1.33)	0.19	–	–	–
	More than once daily	2.64 (1.22–5.71)	1.99 (0.85–4.64)		–	–		2.20 (1.010–4.42)	1.99 (0.94–4.2)		–	–	
	Not daily	Ref	Ref	0.11	–	–		Ref	Ref	0.07	–	–	
Diabetic foot	Yes	4.62 (1.73–12.31)	2.87 (0.9–9.03)	0.07	2.93 (1.04–8.24)	2.17 (0.69–6.79)	0.18	3.43 (1.32–8.87)	2.05 (0.67–6.27)	0.21	–	–	–
	No	Ref	Ref		Ref	Ref		Ref	Ref		–	–	
Cardiac complications	Yes	3.89 (1.69–8.94)	3.23 (1.26-8.33)	0.02*	2.35 (0.97–5.73)	2.61 (0.92–7.41)	0.07	–	–	–	–	–	–
	No	Ref	Ref		Ref	Ref		–	–		–	–	
Renal complications	Yes	–	–	–	–	–	–	2.99 (1.12–7.95)	1.91 (0.62–5.86)	0.26	–	–	–
	No	–	–		–	–		Ref	Ref		–	–	
Dyslipidaemia	Yes	–	–	–	0.39 (0.16–0.95)	0.33 (0.13–0.85)	0.02*	–	–	–	–	–	–
	No	–	–		Ref	Ref		–	–		–	–	

**Significant, OR = odds ratio, CI = confidence interval, Ref = reference category*

Table 6 Correlation between HbA1C and diabetes-related distress subscales

Diabetes related distress subscales	HbA1C Pearson's correlation coefficient	Value
Emotional burden	0.9	0.15
Physician-related distress	0.13	0.50*
Regimen-related distress	0.15	0.02*
Interpersonal distress	0.10	0.12
Diabetes-related distress	0.13	0.03*

**Significant*

In contrast, a study conducted on diabetes melitus patients in Saudi Arabia reported that younger age was associated with higher diabetes distress levels *(9)*. Another study found significant gender differences, with females being 2.67 times more likely than males to experience diabetes distress *(22)*. A cross-sectional study of 267 adults with type 2 diabetes identified younger age, higher BMI, unhealthy diet and limited healthcare provider support as key mediators of DRD *(21)*. Geographic and cultural differences may account for these variations in diabetes distress factors within the Saudi population.

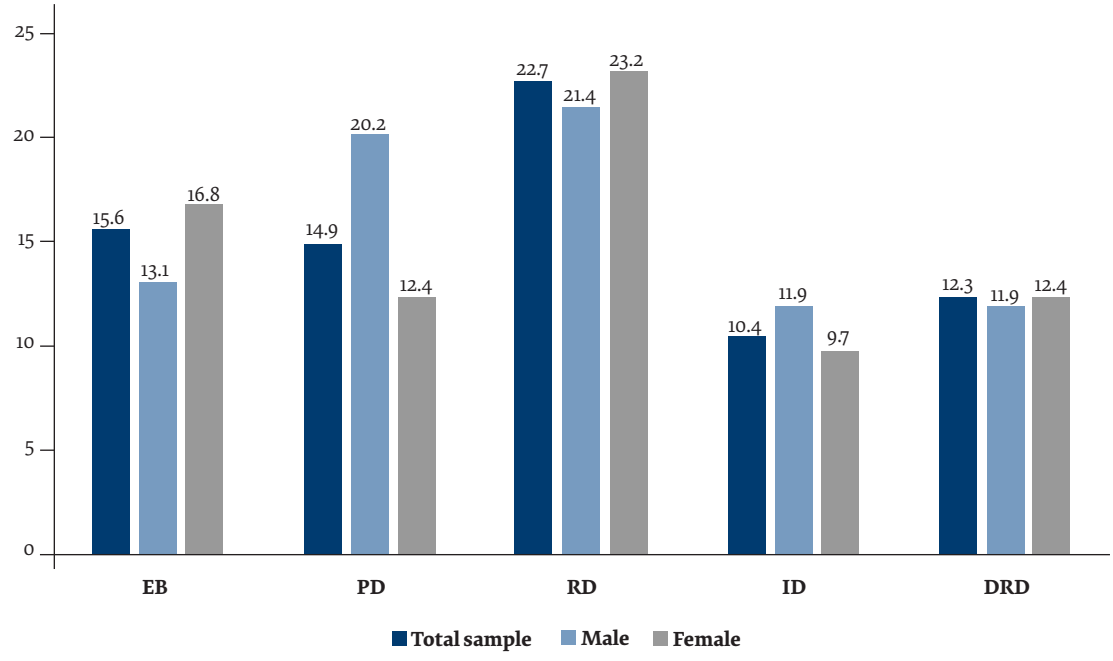
Diabetic complications and DRD

The prevalence of diabetic complications in our study was 76.2%, closely matching rates reported among individuals with diabetes at primary health care centres in the Al Ahsa District of Saudi Arabia *(23)*. DRD was significantly higher among participants with renal, cardiac and diabetic foot complications. These findings align with other studies that demonstrate a significant association between DRD and diabetic complications *(24,25)*. The chronic and complex nature of diabetes, along with associated comorbidities, likely contributed to the increased distress observed in affected individuals.

Risk factors associated with DRD

Our study revealed that lower DRD levels were associated with regular physical activity, treatment adherence and lower HbA1c levels. Evidence suggests that diabetic physically inactive individuals are more prone to higher DRD levels *(26,27)*. Consistent with other studies, DRD levels were higher among patients with lower treatment adherence rates. Elevated HbA1c values were linked to higher DRD, mediated by poor treatment adherence *(24,28)*. These findings highlight the importance of diabetes self-management and compliance with physical activity guidelines, which significantly influence DRD.

Figure 1 Diabetes-related distress by domain, assessed using the DDS-17 scale, Saudi Arabia (N = 269)



Notably, a bi-directional relationship between these mediators and DRD may exist.

Existing data indicate that diabetes-related distress is strongly associated with self-management and glycaemic control *(29)*. While glycaemic control is significantly influenced by self-care behaviours, social support and medication adherence *(30,31)*, achieving optimal HbA1c levels is closely related to proper treatment adherence. However, psychological factors, such as depression, DRD, emotional distress and self-efficacy, are known to influence treatment adherence *(19)*. This study reinforces existing evidence by highlighting the strong relationship between treatment adherence, glycaemic control and various domains of DRD.

Notably, this study shows that the DDS-17 mean score was linked to RD, with PD and EB following closely behind. Conversely, the lowest mean scores were recorded for interpersonal distress. These findings show that patients' primary concerns revolve around their ability to adhere to a healthy regimen, perform regular blood sugar testing and manage their diabetes effectively. They emphasize the importance of physician guidance on daily disease management and the role of lifestyle changes in preventing diabetes-related distress.

Study limitations

This study highlights the importance of diagnosing DRD in patients with DM. However, several limitations should be acknowledged. First, the study would have benefited from a multicentre, multiregional approach to enhance the generalisability and validity of its findings. Second, the use of interviewer-administered questionnaire might have introduced response bias, as respondents might have been influenced by social desirability or sensitivity, potentially compromising the accuracy of their responses. Third, the cross-sectional design limits causal inferences and the non-probability sampling method may further limit the generalisability of the results.

Conclusion

In conclusion, this study identifies mediators of DRD among patients with diabetes in Saudi Arabia. Regimen-related and physician-related distresses emerged as the most prominent contributors to DRD. The findings highlight the critical role of treatment adherence in mitigating DRD and its potential adverse effects on glycaemic control. Early recognition of these risk factors by health care providers is essential for timely interventions. Further research is needed to identify additional risk factors for DRD and to explore its impact on self-management, glycaemic control and long-term complications.

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Conflict of interest: None declared.

Détresse liée au diabète chez les patients atteints de diabète de types 1 et 2 en Arabie saoudite

Résumé

Contexte : Des études ont montré que le diabète a des effets négatifs sur la santé mentale et que la dépression est deux fois plus fréquente chez les personnes touchées par cette maladie.

Objectif : Évaluer la détresse liée au diabète et son association avec les complications, l'observance thérapeutique et les résultats cliniques en Arabie saoudite.

Méthodes : La présente étude transversale a permis de recueillir des données auprès de 269 patients atteints de diabète sucré de types 1 et 2 dans un hôpital de soins tertiaires à Riyad (Arabie saoudite), en utilisant l'échelle de détresse liée au diabète à 17 items (Diabetes Distress Scale, DDS-17). Les données ont été analysées à l'aide du logiciel SPSS version 25.

Résultats : Dans l'ensemble, 12,3 % des participants ont fait état d'une détresse liée au diabète (score > 3 telle que mesurée par le questionnaire DDS-17), 38,7 % d'une détresse modérée (> 2) et 49,0 % d'une détresse faible ou inexistante. Le type de détresse le plus signalé était celui lié au schéma thérapeutique (22,7 %), suivi de la charge émotionnelle (15,6 %), de la détresse liée aux médecins (14,9 %) et de la détresse interpersonnelle (10,4 %). L'observance thérapeutique était significativement associée à des niveaux de détresse plus faibles dans l'ensemble des domaines (p < 0,05). Des scores plus élevés de détresse liée au diabète étaient corrélés à des taux élevés d'hémoglobine glyquée (HbAIC) et à des complications liées à cette maladie. Les femmes présentaient significativement plus de complications neurologiques et visuelles que les hommes (p < 0,001).

Conclusion : Nos résultats indiquent que la détresse liée au diabète, en particulier celle liée au schéma thérapeutique et aux médecins, a des effets considérables sur les résultats cliniques des patients atteints de diabète sucré de types 1 et 2. Il est donc nécessaire que les médecins intègrent l'évaluation et la prise en charge de cette détresse dans les soins habituels du diabète. Ils doivent notamment fournir des conseils sur la prise en charge quotidienne de la maladie et les changements de mode de vie en tant que mesures préventives de ce type de détresse.

الضغوط المرتبطة بداء السكري بين مرضى السكري من النمط 1 والنمط 2 في المملكة العربية السعودية

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الخلاصة

الخلفية: أظهرت الدراسات أن داء السُّكَّري يؤثر سلبًا على الصحة النفسية، وأن الاكتئاب أكثر شيوعًا بمعدل الضعف بين الأشخاص المصابين به.

الأهداف: هدفت هذه الدراسة الى تقييم الضغوط المرتبطة بمرض السُّكَّري وعلاقتها بالمضاعفات ومستوى الالتزام بالعلاج والنتائج السريرية في المملكة العربية السعودية.

طرق البحث: جَمعت هذه الدراسة المقطعية بيانات من 269 مريضًا مصابين بداء السُّكَّري من النوع 1 والنوع 2 في مستشفى للرعاية الثالثية في الرياض، المملكة العربية السعودية، باستخدام مقياس ضغوط السُّكَّري. وحُللت البيانات بالإصدار 25 من برنامج SPSS.

النتائج: بوجه عام، أبلغ 12.3٪ من المشاركين عن ضغوط مرتبطة بالسُّكَّري (درجة 3 < DDS-17)، وأبلغ 38.7٪ عن ضغوط متوسطة (< 2) وأبلغ 49.1٪ عن ضغوط قليلة أو معدومة. وأكثر أنواع الضغوط المُبلَغ عنها هو الضغوط المرتبطة بالنظام العلاجي (22.7٪)، يليها العبء العاطفي (15.6٪)، والضغوط المرتبطة بالطبيب (14.9٪)، وضغوط العلاقات بين الأشخاص (10.4٪). وارتبط الالتزام بالعلاج بشكل كبير بمستويات ضغوط أقل في جميع المجالات (القيمة الاحتمالية < 0.05). وارتبط ارتفاع درجات الضغوط المرتبطة بالسُّكَّري الأعلى بمستويات مرتفعة من اختبار الهيموجلوبين A1C ومضاعفات مرتبطة بمرض السُّكَّري. وكانت المضاعفات العصبية والبصرية لدى الإناث أكثر بكثير من الذكور (القيمة الاحتمالية < 0.001).

الاستنتاجات: تُظهر نتائجنا أن الضغوط المرتبطة بداء السُّكَّري، وخاصة الضغوط المرتبطة بالنظام العلاجي والضغوط المرتبطة بالطبيب، لها تأثيرات كبيرة على النتائج السريرية لمرضى السُّكَّري من النوع 1 والنوع 2. لذلك، ثمة حاجة إلى أن يُدمج الأطباءُ تقييم الضغوط المرتبطة بالسُّكَّري وإدارتها ضمن الرعاية الروتينية لداء السُّكَّري، ولا سيما التوجيه بشأن الإدارة اليومية للمرض وتغييرات نمط الحياة بوصفها إجراءات للوقاية من الضغوط المرتبطة بالسُّكَّري.

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