Original Research Article   **Medicine**

Disordered Eating Behaviors, Anxiety, and Depression among Adults with Type 1 Diabetes in Saudi Arabia

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Abstract

Background: Type 1 diabetes mellitus (T1DM) is a chronic condition characterized by hyperglycemia and typically managed with insulin. Improved glycemic control often results in weight gain, increasing the risk of comorbid disordered eating behaviors (DEBs) and eating disorders (EDs). Eating disorders (ED) are one of the most prevalent mental issues that today's teenagers confront, characterized by a distorted attitude toward weight and form, as well as a distorted sense of body shape. Patients with T1DM are also more prone to anxiety and depression, which may negatively impact metabolic control. ***Methodology:*** A cross-sectional descriptive study was conducted at the Diabetes Treatment Center (DTC) of Prince Sultan Military Medical City, Riyadh. A total of 150 adults with T1DM (aged 14–40 years) participated. Data were collected using a self-administered questionnaire, including demographic and clinical variables, the Diabetes Eating Problem Survey-Revised (DEPS-R) for DEBs, and the Hospital Anxiety and Depression Scale (HADS). Descriptive statistics and chi-square tests were performed using SPSS v23. ***Results:*** DEBs were reported in 32.0% of females and 25.3% of males, with no statistically significant gender difference. Depression prevalence was 4.0% in females and 1.3% in males. Anxiety was significantly higher in females (16.0%) compared to males (5.3%, p = 0.009). No significant associations were found between DEBs, anxiety, or depression and age, HbA1c, insulin type, BMI, smoking status, or duration of diabetes. ***Conclusion:*** Psychological comorbidities are common among adults with T1DM, particularly in females. Anxiety and DEB symptoms affect quality of life and should be prioritized in diabetes care. Routine screening and tailored interventions are recommended.
Keywords: Disordered Eating Behaviors; Anxiety; Depression Adults; Type 1 Diabetes; Saudi Arabia.

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune condition marked by hyperglycemia, commonly treated with lifelong insulin therapy. Improved glycemic control can lead to weight gain, placing patients at higher risk for disordered eating behaviors (DEBs) or eating disorders (EDs) due to frequent food monitoring and diabetes management requirements (Francisco, 2022). Globally, T1DM affects approximately one in 300 people, with an annual incidence increase of roughly 3% (Robert *et al.,* 2018).

Management of T1DM is multifaceted, including insulin therapy, blood glucose monitoring, dietary management, and physical activity (Delamater *et al.,* 2018). These lifestyle demands can negatively affect psychosocial well-being, and studies indicate higher rates of anxiety and depression among individuals with T1DM compared to the general population (American Diabetes Association, 2020; Meadows *et al.,* 2018). DEBs are one of the most common mental health comorbidities in this population (Priesterroth *et al.,* 2022; Salah *et al.,* 2022). Given their impact on metabolic control and overall health, identifying and addressing DEBs, anxiety, and depression is essential.

In today's health-conscious culture, the terms "health" and "fitness" have become iconic, yet dieting may be hazardous if it develops into an eating disorder (ED).

In recent years, psychiatry has acquired a better understanding of the nature of EDs, and has appropriately extended the definition to cover a wide

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range of issues such as anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), and avoidant/restrictive food intake disorder, and they have been included in the DSM-5 (2013), the Diagnostic and Statistical Manual of Mental Disorders (Sawyer *et al.,* 2016). Eating disorders are very long-term, sometimes lasting years, and they take a huge toll on individuals who suffer from them. Eating disorders impair interpersonal, vocational, and academic performance, as well as raising the likelihood of comorbid issues including anxiety, depression, and suicide (Sawyer *et al.,* 2016).

Study Objectives: This study aimed to examine the prevalence of DEBs, anxiety, and depression among Saudi adults with T1DM.

RESEARCH METHODOLOGY
Research Design and Setting:
A cross-sectional descriptive study was conducted at the Diabetes Treatment Center (DTC) in Riyadh's Prince Sultan Military Medical City (PSMMC). The DTC serves approximately 1,300 adults with T1DM. Participants were recruited from diabetes education and follow-up clinics.

Study Population:
A total of 150 adults with T1DM, aged 14–40 years, participated.

Exclusion criteria included type 2 diabetes, illiteracy, severe mental illness, malignancy, pregnancy, or inability to complete a written questionnaire. Written informed consent was obtained from all participants.

Data Collection:
Data were collected using a self-administered questionnaire divided into three sections:
1. **Demographic and clinical information** (age, gender, weight, height, BMI, education, marital status, smoking, HbA1c, insulin regimen, blood pressure, and diabetes duration).
2. **Diabetes Eating Problem Survey-Revised (DEPS-R)**: 16-item diabetes-specific screening tool for DEBs scored on a 6-point Likert scale. A cut-off score ≥20 indicated abnormal eating behavior.
3. **Hospital Anxiety and Depression Scale (HADS)**: 14-item tool assessing anxiety and depression, scored 0–3 per item. Higher scores indicate greater severity.

Data Management and Analysis Plan:
Data were analyzed using SPSS V23, with using appropriate statistical methods for description and analysis. Descriptive statistics included means, standard deviations, counts, and percentages. Associations between categorical variables were tested using chi-square, with significance set at $p < 0.05$.

Ethical Considerations:
The study was approved by the Institutional Review Board at PSMMC. All participants provided informed written consent. Data was anonymous for patient confidentiality. Use of these anonymous data in this research project was reviewed and approved by the research ethics committee. The collected data was kept safely in a password protected computer.

RESULTS
Demographic and Clinical Characteristics:
The sample included 70 males (46.7%) and 80 females (53.3%). The majority were aged 14–18 years (31.3%) and single (77.3%). Most had school-level education (49.3%). Weight ranged from 30–90 kg for 92% of participants, and 58% were 156–170 cm tall. HbA1c levels were 6–8.9% in 48.0% of participants. Most participants used MDI (88%), and BMI was 18.5–24.9 in 44.7%. Blood pressure and smoking prevalence were within normal ranges. Nearly half (48.7%) had diabetes for less than 10 years (Table 1).

Table 1: Demographic and treatment characteristics of the studied population

Baseline Characteristics		Count	%
Gender	Male	70	46.7
	Female	80	53.3
Age (n = 150)	14 - 18 years	47	31.3
	19 - 23 years	34	22.6
	24 - 28 years	33	22.0
	29 - 33 years	24	16.0
	34 - 40 years	12	8.0
Marital Status (n = 150)	Single	116	77.3
	Married	30	20.0
	Widow	2	1.3
	Divorce	2	1.3
Education	School	74	49.3
	Diploma	24	16.0
	Bachelor	51	34.0
	Master	1	0.7

Baseline Characteristics		Count	%
Weight	30 – 60 kg	70	46.7
	61 – 90 kg	68	45.3
	> 90 kg	12	8
Height	140 – 155 cm	28	18.7
	156 – 170 cm	87	58.0
	> 170 cm	35	23.3
HBA1C	6 – 8.9	72	48.0
	9 – 11.9	63	42.0
	> 11.9	15	10.0
Type of insulin	MDI	132	88.0
	IP	18	12.0
BMI	< 18.5	15	10.0
	18.5 – 24.9	67	44.7
	25 – 29.9	47	31.3
	> 30	21	14.0
BP-systolic	< 120	59	39.3
	120 - 140	85	56.7
	> 140	6	4.0
BP-diastolic	< 80	101	67.3
	> 80	49	32.7
Smoking	Yes	11	7.3
	No	139	92.7
duration of Diabetes	< 10 years	73	48.7
	10 – 20 years	57	38.0
	> 20 years	20	13.3

Prevalence of DEBs, Anxiety, and Depression:

DEBs were reported in 32.0% of females and 25.3% of males, with no significant gender difference (p = 0.511). Depression prevalence was low, with 4.0% of females and 1.3% of males scoring above the HADS threshold (p = 0.285). Anxiety was significantly higher in females (16.0%) than in males (5.3%, p = 0.009) (Table 2).

Table 2: Relation between Gender & Anxiety, Depression, and DEB among the studied population

Variables		Gender					
		Male		Female		Total	P- value
		Count	%	Count	%		
DEB	Normal	32	21.3	32	21.3	64	0.511
	Abnormal	38	25.3	48	32.0	86	
	Total	**70**	**46.7%**	**80**	**53.3%**	**150**	
Depression	Normal	68	45.3	74	49.3	142	.285
	Abnormal	2	1.3	6	4.0	8	
	Total	**70**	**46.7%**	**80**	**53.3%**	**150**	
Anxiety	Normal	62	41.3	56	37.3	118	0.009
	Abnormal	8	5.3	24	16.0	32	
	Total	**70**	**46.7%**	**80**	**53.3%**	**150**	

Chi-square test

Associations with Demographic and Clinical Variables

No significant associations were found between DEBs, depression, or anxiety and age, HbA1c, insulin type, BMI, smoking, or diabetes duration (p > 0.05) (Table 3).

Table 3: Association between DEB and Gender, Age, and Marital status among the studied population

Variables (mean ± SD)		DEB		Depression		Anxiety		P- value
		Count	%	Count	%	Count	%	
Age (23.3 ± 6.94)	14 - 18 years	29	22.0	3	2.0	6	4.0	0.592
	19 - 23 years	15	10.0	2	1.3	8	5.3	
	24 - 28 years	20	13.3	1	0.7	7	4.7	

	29 - 33 years	13	8.7	1	0.7	6	4.0	
	34 - 40 years	9	6.0	1	0.7	5	3.3	
	Total	**68**	**57.3**	**8**	**5.3**	**32**	**21.3**	
HBA1C (9.4 ± 2.02)	6 – 8.9	35	23.3	2	1.3	14	9.3	0.254
	9 – 11.9	39	26.0	3	2.0	11	7.3	
	> 11.9	12	8.0	3	2.0	7	4.7	
	Total	**86**	**57.3**	**8**	**5.3**	**32**	**21.3**	
Type of insulin (1.1 ± 0.32)	MDI	76	50.6	8	5.3	30	20.0	0.364
	IP	10	6.7	0	0.0	2	1.3	
	Total	**86**	**57.3**	**8**	**5.3**	**32**	**21.3**	
Smoking (1.9 ± 0.26)	Yes	7	4.7	0	0.0	1	0.7	0.739
	No	79	52.7	8	5.3	31	20.7	
	Total	**86**	**57.3**	**8**	**5.3**	**32**	**21.3**	
BMI (24.2 ± 4. 78)	< 18.5	8	5.3	1	0.7	2	1.3	0.662
	18.5 – 24.9	39	26.0	3	2.0	12	8.0	
	25 – 29.9	26	17.3	3	2.0	15	10.0	
	> 30	13	8.7	1	0.7	3	2.0	
	Total	**86**	**57.3**	**8**	**5.3**	**32**	**21.3**	
Duration of Diabetes (10.9 ± 7.39)	< 10 years	45	30.0	5	3.3	17	11.3	0.296
	10 – 20 years	29	19.3	2	1.3	7	4.7	
	> 20 years	12	8.0	1	0.7	8	5.3	
	Total	**86**	**57.3**	**8**	**5.3**	**32**	**21.3**	

DISCUSSION

Eating disorders are some of the most under-researched and difficult to diagnose psychiatric conditions, with a high mortality rate. The Multi-Service Eating Disorders Association (MEDA) 4 revealed that nearly 15% of women in the age group of 17 to 24 have eating disorders of some type. Earlier thought to be only a western problem, eating disorders are now seen in adolescents of all racial and socioeconomic groups and more than 75% of these cases begin during adolescence. Prevalence estimates of current EDs among college students range from 8% to 17% (Eisenberg, D., 2011).

Our study was a cross-sectional descriptive study, conducted at the Diabetes Treatment Center (DTC) in Riyadh's Prince Sultan Military Medical City (PSMMC). This study aimed to examine the prevalence of DEBs, anxiety, and depression among Saudi adults with T1DM. Participants were recruited from diabetes education and follow-up clinics. A total of 150 adults with T1DM, aged 14–40 years, participated.

The study found a higher prevalence of DEBs among females (32.0%), consistent with international findings, though prevalence rates vary. Roohafza et al. (2016) reported 67.9% in Iranian females, Wisting et al. (2018) 24.8% in Norwegian females, and Oslo University 9.6% (Wisting *et al.,* 2020). Gender differences may be influenced by illness perceptions, as females tend to perceive chronic conditions as more severe (Pesut *et al.,* 2014).

Depression rates were slightly higher in females (4.0%) than males (1.3%), contrasting with Norwegian data where males had higher prevalence (Wisting *et al.,* 2018). Differences may be due to methodological variations, including HADS cut-off points. A conservative cut-off of 11 was used in this study to reduce over-pathologizing.

Anxiety was significantly more prevalent in females (16.0%), in line with Norwegian studies (Wisting *et al.,* 2018). No significant associations were found between DEBs, depression, or anxiety and age, HbA1c, insulin type, BMI, smoking, or diabetes duration, differing from Wisting *et al.,* (2018), who reported significant associations with these factors. This discrepancy may reflect sample size, cultural, or methodological differences.

CONCLUSION

Psychological comorbidities, particularly anxiety and DEBs, are common among adults with T1DM, especially females. These conditions may negatively impact quality of life and should be addressed in diabetes management.

RECOMMENDATIONS

- Routine screening for DEBs and psychological distress, particularly in females and adolescents transitioning to adult care.
- Clinicians should be vigilant about eating disturbances in T1DM patients.
- Develop tailored interventions to improve eating behaviors and mental health outcomes.
- Future studies should include larger, more diverse samples to enhance generalizability.

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APPENDICES
Diabetes Eating Problem Survey – Revised (Deps-R)
Validated questionnaire

Living with diabetes can sometimes be difficult, particularly regarding eating and diabetes management. Listed below are a variety of attitudes and behaviors regarding diabetes management. For each statement, choose the ONE answer that indicates how often this is true for you during the PAST MONTH.

	Always	Never	Rarely	Some-times	Often	Usually
1. Losing weight is an important goal to me.	⓪	①	②	③	④	⑤
2. I skip meals and/or snacks.	⓪	①	②	③	④	⑤
3. Other people have told me that my eating is out of control.	⓪	①	②	③	④	⑤
4. When I overeat, I don't take enough insulin to cover the food.	⓪	①	②	③	④	⑤
5. I eat more when I am alone than when I am with others.	⓪	①	②	③	④	⑤
6. I feel that it's difficult to lose weight and control my diabetes at the same time.	⓪	①	②	③	④	⑤
7. I avoid checking my blood sugar when I feel like it is out of range.	⓪	①	②	③	④	⑤
8. I make myself vomit.	⓪	①	②	③	④	⑤
9. I try to keep my blood sugar high so that I will lose weight.	⓪	①	②	③	④	⑤

10. I try to eat to the point of spilling ketones in my urine.	⓪	①	②	③	④	⑤
11. I feel fat when I take all of my insulin.	⓪	①	②	③	④	⑤
12. Other people tell me to take better care of my diabetes.	⓪	①	②	③	④	⑤
13. After I overeat, I skip my next insulin dose.	⓪	①	②	③	④	⑤
14. I feel that my eating is out of control.	⓪	①	②	③	④	⑤
15. I alternate between eating very little and eating huge amounts.	⓪	①	②	③	④	⑤
16. I would rather be thin than have good control of my diabetes.	⓪	①	②	③	④	⑤

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like 'butterflies' in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book or radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:
Total score: Depression (D) _____   Anxiety (A) _____
0-7   = Normal
8-10   = Borderline abnormal (borderline case)
11-21 = Abnormal (case)