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# Eating Disorders and Suicidal Ideation in Morbid and Non-morbid Type 2 Diabetes Mellitus: A Cross-sectional Study

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## Abstract

**Background:** Patients with chronic illnesses like type 2 diabetes mellitus (T2DM) are at a higher risk of depression and psychiatric disorders, potentially leading to adverse outcomes. Eating disorders appear to be one of the factors contributing to T2DM and resulting in poor glycemic control and complications.
**Objectives:** This study aimed to compare the prevalence of eating disorders and suicidal ideation between morbid and non-morbid T2DM patients.
**Methods:** A cross-sectional questionnaire was conducted at the Yazd Diabetes Research Center from August 2021 to March 2022. A total of 232 T2DM patients aged between 30 and 65 were included in the study. Through convenience sampling, data were collected using structured questionnaires to assess eating disorders, suicidal ideation, and demographic information. Statistical analyses were performed to evaluate the associations between variables.
**Results:** The study revealed that there was no statistically significant difference in the prevalence of eating disorders between the two groups of T2DM patients (P = 0.083). However, upon considering age as a contributing factor, it was observed that younger patients afflicted with morbid T2DM exhibited a markedly higher incidence of eating disorders when compared to their non-morbid counterparts (P = 0.019). In contrast, a significant distinction emerged in terms of suicidal ideation between the two groups (P = 0.015), with patients suffering from morbid T2DM reporting elevated rates of contemplating suicide. Subgroup analyses further underscored a heightened prevalence of suicidal ideation among female patients and those aged 30 - 59 who were afflicted with morbid T2DM.
**Conclusions:** This study highlights the importance of mental health assessment in T2DM patients, particularly those with morbid disease, younger age, higher Body Mass Index (BMI), and poor glycemic control. Early detection and intervention for eating disorders and suicidal ideation could significantly improve the overall well-being and outcomes of T2DM patients.

*Keywords:* Eating Disorder, Suicidal Ideation, Type 2 Diabetes

## 1. Background

Diabetes is a metabolic condition characterized by elevated blood glucose levels (1-6). Diabetes Mellitus has several categories: Type 1, type 2, maturity-onset diabetes of the young (MODY), gestational diabetes, neonatal diabetes, and secondary due to other endocrine conditions. Type 2 diabetes mellitus (T2DM) accounts for 90% of all cases of diabetes, characterized by a diminished

response to insulin, known as insulin resistance (1). Type 2 diabetes mellitus is one of the most significant challenges of modern and developing societies. The course of the disease, mortality, and complications are substantial (2). There are many challenges in managing diabetes, and it's not limited to diagnosis and treatment. Diabetes is a progressive disorder, and even with proper treatments and follow-ups, diabetes complications may show up. Complications could be limited only to minor neuropathies or may result in severe disabilities for the patients, such as diabetic nephropathy, which may end up in end-stage renal disease (ESRD) (3). The protracted duration of the ailment and its adverse socioeconomic ramifications are additional focal points of apprehension (4). Furthermore, a substantial proportion of our therapeutic interventions demonstrate limited efficacy without concomitant patient adherence to behavioral modifications (5).

It has been demonstrated that the incidence of depression is elevated among individuals coping with chronic medical conditions. Additionally, certain psychiatric disorders, including but not restricted to depression, anxiety, and eating disorders, hold specific relevance within the context of diabetes. Major depressive disorder (MDD), for instance, affects approximately 6.7% of adults in the United States, and individuals afflicted with diabetes are twice as likely to experience depression in comparison to their non-diabetic counterparts (6). Only 25 - 50% of patients who have diabetes and depression at the same time get diagnosed and treated. Unfortunately, without proper treatment, depression often worsens (7). Evidence indicates that the lifetime prevalence of suicide attempts among individuals diagnosed with T2DM stands at 9.7%, which is double the corresponding rate observed in the general population (8). Diabetes and depression could affect each other. The psychological burden of diabetes may cause depression, and depression can also play an important role as a risk factor for T2DM (9, 10).

Besides its effects on physical, mental, and social well-being, depression can lead to poor adherence to medical treatment, lower quality of life, higher mortality and morbidity rates, and increased healthcare costs (4, 10, 11). Farooqi et al. demonstrated that the simultaneous presence of depression and diabetes could potentially result in a 36.7% rise in coronary heart disease and also a 47.9% elevation in cardiovascular mortalities (12).

## 2. Objectives

In this study, our aim is to estimate the prevalence of eating disorders and suicidal ideation among patients suffering from morbid T2DM who visited the Yazd Islamic Azad University Endocrinology Research Center.

## 3. Methods

### 3.1. Study Design and Participants

This cross-sectional survey was conducted at the Diabetes Research Center, Yazd, Iran, from August 2021 to March 2022. Participants were recruited from the diabetes research center if they had been diagnosed with T2DM at least a year ago, had their HbA1C checked at least three times, and were aged between 30 and 65. Patients without a complete medical record or who did not provide consent were excluded. The sample size was 240, with 80 having morbid diabetes and the remaining 160 classified as non-morbid diabetic individuals.

Morbid obesity was defined as diabetes with signs of diabetic foot, nephropathy, and retinopathy. Our sampling method was convenience-based, selecting participants based on their easy accessibility or availability, which offers practical advantages for data collection in certain contexts.

Patients were assured of the protection of their privacy and the confidentiality of the provided information. Information was gathered through conversations with participants using a specialized set of questions developed by psychiatrists.

### 3.2. Questionnaire

The questionnaire comprised three parts: The first part requested personal information such as age, place of residence, and the use of psychotropic agents. The second part included the Persian version of the Beck Scale for Suicide Ideation (BSSI) as a screening tool, validated by Esfahani et al. (Cronbach's alpha of 0.829) (13). It consists of 19 questions measuring thoughts about suicide in the week leading up to the assessment. Each item is scored from 0 to 2, with a total score ranging from 0 to 38. The third part featured the Persian version of the Eating Disorder Diagnostic Scale (EDDS), validated by Khabir et al., with a Cronbach's alpha of 0.84 (14). It comprises 22 questions and assesses Anorexia Nervosa, Binge-eating disorder, and Bulimia Nervosa according to DSM-V guidelines. Information about problems with small blood vessels (neuropathy, nephropathy, and retinopathy) was collected from patients' records.

### 3.3 Data Analysis

The data were transformed and analyzed using the Statistical Package for Social Sciences (SPSS Inc.) version 25. Results were presented as numbers and percentages.

Various tests (chi-square, Fisher exact, *t*-test, and ANOVA) were employed for data analysis. A P-value less than or equal to 0.05 was considered statistically significant. All subjects provided informed consent to participate in the study, and their information was kept confidential.

### 3.4. Inclusion and Exclusion Criteria

Patients aged 30 to 65 years with a definitive diagnosis of type 2 diabetes, diagnosed at least one year ago by the Yazd diabetes center doctor between 2021 and 2022, and having at least three hemoglobin A1C tests recorded in the same period, were included in the study. Exclusion criteria included incomplete patient information and files, patients' lack of consent to participate, and failure to meet the inclusion criteria.

### 3.5. Ethical Considerations

The study was conducted with the approval of the Yazd Islamic Azad University Ethics Committee (Ethics Code: IR.IAU.YAZD.REC.1400.021).

## 4. Results

This cross-sectional study included 232 participants, comprising 91 cases of morbid diabetes and 141 cases of non-morbid diabetes, with 133 (57.1%) women. The mean age of participants was 55.59 ± 8.42, ranging from 30 to 65. The mean Body Mass Index (BMI) was 28.87 ± 4.51, ranging from 17.90 to 40.01. The mean HbA1C was 7.70 ± 1.5, ranging between 5.2 and 12.8. The mean eating disorder score was 5.55 ± 5.17, ranging from 0 to 18. The mean suicidal ideation score was 1.13 ± 1.42, ranging from 0 to 18. Further demographic characteristics of the participants can be found in Table 1.

**Table 1.** Demographic Characteristic of the Study Participants

| Variables | Values |
|---|---|
| **Age** | 55.59 ± 8.42 |
| **Sex** | |
| Men | 100 (42.9) |
| Women | 133 (57.1) |
| **HbA1c** | 7.70 ± 1.5 (5.2 - 12.8) |
| **Eating disorders** | 5.55 ± 5.17 (0 - 18) |
| **Suicidal ideation** | 1.13 ± 1.42 (0 - 18) |
| **BMI** | 28.87 ± 4.51 (17.9 - 40.01) |
| **Education** | |
| Illiterate and primary school | 53 (22.7) |
| Elementary school | 90 (38.6) |
| High school diploma | 64 (27.5) |
| Academic | 26 (11.2) |
| **Morbidity** | |
| Nephropathy | 29 (12.4) |
| Retinopathy | 68 (29.2) |
| Diabetic foot | 20 (8.6) |

For suicidal ideation, the patients were categorized into three groups based on their score on the BSSI test: No suicidal ideation, low risk, and high risk. In the case group, the prevalence was 36, 52, and 3, respectively, for the three categories mentioned above, and for the control group, it was 80, 60, and 1, respectively. The P-value was 0.015, suggesting a significant difference in suicidal ideation between the two groups.

We also explored the interplay between age, gender, educational background, HbA1c levels, and the nature of morbidity concerning suicidal ideation. Within the female subgroup, comprising 51 individuals, it was observed that 15 exhibited no signs of suicidal ideation, 34 were classified as low-risk, and 2 fell into the high-risk category for suicide. In contrast, among the 82 individuals in the control group, 42 displayed no suicidal ideation, 40 were deemed low-risk, and none were categorized as high-risk. Our analysis suggested a significant difference in suicidal ideation between morbid and non-morbid patients aged between 30 and 59 (P-value = 0.018). Further information is available in Table 2.

By conducting Pearson's correlation measurement for BMI and eating disorders, the r and P-values for the case and control groups were respectively (r = 0.442, P-value = 0.000) and (r = 0.196, P-value = 0.020). The correlation between HbA1c and eating disorders in the case and control groups were respectively (r = 0.163, P-value = 0.123) and (r = 0.188, P-value = 0.026). For HbA1c and suicidal ideation, the r and P-values for the case and control groups were respectively (r = 0.281, P-value = 0.007) and (r = 0.095, P-value = 0.264). Further information is provided in Table 3.

## 5. Discussion

In this cross-sectional study conducted at Yazd Islamic Azad University, we aimed to estimate the prevalence of eating disorders and suicidal ideation among patients suffering from morbid or non-morbid T2DM.

One of the main mechanisms linking eating disorders and diabetes is the role of insulin resistance. Insulin resistance, a condition where the body's cells become less responsive to insulin, can lead to elevated blood sugar levels and an increased risk of developing T2DM.

**Table 2.** Prevalence of Eating Disorders Among Study Participants: Group-Wise Comparison [a]

| Variables | Eating Disorders | | Total | P-Value |
|---|---|---|---|---|
| | Positive | Negative | | |
| **Overall** | | | | 0.083 |
| Control | 15 (10.6) | 126 (89.4) | 141 (100) | |
| Case | 17 (18.7) | 74 (81.3) | 91 (100) | |
| Total | 32 (13.8) | 200 (86.2) | 232 (100) | |
| **Gender** | | | | |
| Male | | | | 0.177 |
| Control | 5 (8.5) | 54 (91.5) | 59 (100) | |
| Case | 7 (17.5) | 33 (82.5) | 40 (100) | |
| Total | 12 (12.1) | 87 (87.9) | 99 (100) | |
| Female | | | | 0.245 |
| Control | 10 (12.2) | 72 (87.8) | 82 (100) | |
| Case | 10 (19.6) | 41 (80.4) | 51 (100) | |
| Total | 20 (15) | 113 (85) | 133 (100) | |
| **Age** | | | | |
| 30 - 59 | | | | 0.019 |
| Control | 10 (10.1) | 89 (89.9) | 99 (100) | |
| Case | 9 (26.5) | 25 (73.5) | 34 (100) | |
| Total | 19 (14.3) | 114 (85.7) | 133 (100) | |
| 60 - 65 | | | | 0.756 |
| Control | 5 (11.9) | 37 (88.1) | 42 (100) | |
| Case | 8 (14) | 49 (86) | 57 (100) | |
| Total | 13 (13.1) | 86 (86.9) | 99 (100) | |
| **Morbidity** | | | | |
| Nephropathy | 4 (14.3) | 24 (85.7) | 28 (100) | |
| Retinopathy | 14 (20.6) | 54 (79.4) | 68 (100) | |
| Diabetic Foot | 4 (20) | 16 (80) | 20 (100) | |
| **Psychotropic agent use** | | | | 0.257 |
| Control | 3 (60) | 2 (40) | 5 (100) | |
| Case | 5 (71) | 2 (29) | 7 (100) | |
| Total | 8 (66) | 4 (34) | 12 (100) | |
| **HbA1c** | | | | |
| $\leq 7$ | | | | $\approx 1$ |
| Control | 5 (7.1) | 65 (92.9) | 70 (100) | |
| Case | 1 (5) | 19 (95) | 20 (100) | |
| Total | 6 (6.7) | 84 (93.3) | 90 (100) | |
| $> 7$ | | | | 0.193 |
| Control | 10 (14.1) | 61 (85.9) | 71 (100) | |
| Case | 16 (22.5) | 55 (77.5) | 71 (100) | |
| Total | 26 (18.3) | 116 (81.7) | 142 (100) | |
| **Education** | | | | |
| Illiterate and Primary School | | | | $\approx 1$ |
| Control | 3 (12.5) | 21 (87.5) | 24 (100) | |
| Case | 4 (14.3) | 24 (85.7) | 28 (100) | |
| Total | 7 (13.5) | 45 (86.5) | 52 (100) | |
| Elementary School | | | | 0.052 |
| Control | 6 (10.7) | 50 (89.3) | 56 (100) | |
| Case | 9 (26.5) | 25 (73.5) | 34 (100) | |
| Total | 15 (16.7) | 75 (83.3) | 90 (100) | |
| High School Diploma | | | | 0.670 |
| Control | 5 (10.6) | 42 (89.4) | 47 (100) | |
| Case | 3 (17.6) | 14 (82.4) | 17 (100) | |
| Total | 8 (12.5) | 56 (87.5) | 64 (100) | |
| Academic | | | | $\approx 1$ |
| Control | 1 (7.1) | 13 (92.9) | 14 (100) | |
| Case | 1 (8.3) | 11 (91.7) | 12 (100) | |
| Total | 2 (7.7) | 24 (92.3) | 26 (100) | |

[a] Values are expressed as No. (%).

**Table 3.** Correlations Between Variables: Eating Disorders and Suicidal Ideation, BMI, and HbA1c

| Variables | Eating Disorders | | Suicidal Ideation | |
|---|---|---|---|---|
| | r | P-Value | r | P-Value |
| **Control** | | | | |
| Suicidal ideation | 0.143 | 0.091 | - | - |
| BMI | 0.196 | 0.020 | 0.172 | 0.043 |
| HbA1c | 0.188 | 0.026 | 0.095 | 0.0264 |
| **Case** | | | | |
| Suicidal ideation | 0.082 | 0.440 | - | - |
| BMI | 0.442 | 0.000 | 0.083 | 0.435 |
| HbA1c | 0.163 | 0.123 | 0.281 | 0.007 |

Restrictive eating behaviors, purging, and binge eating, common in individuals with eating disorders, can contribute to insulin resistance. Moreover, fluctuations in weight and body composition, typical in eating disorders, can also contribute to insulin resistance and the development of diabetes. The relationship between eating disorders and diabetes is complex and requires a multidisciplinary approach for effective management and treatment. It is crucial for healthcare professionals to address both conditions simultaneously to improve overall health outcomes for individuals affected by these disorders (15).

Our study did not find a significant difference in the prevalence of eating disorders between morbid and non-morbid T2DM patients. This result might have various reasons such as a low sample size and the lack of a completely healthy group for comparison. Additionally, due to serious complications in some participants with morbid diabetes, some were excluded for being unable to answer questions. This factor might have influenced the result and made it different from similar studies.

Further analysis considering age as a factor revealed that younger patients suffering from morbid T2DM have a significantly higher rate of eating disorders compared to their non-morbid counterparts. This finding underscores the importance of assessing eating disorders, especially in younger diabetic patients, to prevent morbidities. This result could be because of that younger Iranian people were more at the risk of suicide (29.8 for men and 27.4 for women as meta-analysis of Sharif Nia et al. discussed (16).

Our findings are consistent with the results of Petroni et al.'s multicenter study in Italy, which included 1 250 patients suffering from T2DM. They found a higher prevalence of eating disorders among females and younger patients. Additionally, they stated that patients with higher BMI, a longer course of the disease, and comorbid depression are more likely to have eating disorders (17). Krishnamurthy et al. studied 512 Indian T2DM patients to explore the relationship between eating disorders, glycemic control, and metabolic parameters (18). Their findings revealed a significant elevation in HbA1c levels among individuals with T2DM and concurrent eating disorders. Evidence also suggests a positive correlation between HbA1c levels and binge eating disorder (BED) in T2DM patients (19). Further studies are needed to investigate anorexia and HbA1c.

In our study, we observed a modest correlation between BMI and eating disorders within the control group and a moderate correlation within the case group. Regarding HbA1c and eating disorders, we found a slight association in the control group, but this association did not manifest in the case group. The absence of this relationship in the case group may be due to the constraints of our sample size or the influence of other factors contributing to elevated HbA1c levels in patients with morbid T2DM.

These preliminary findings underscore the need for further research involving larger and more diverse cohorts to delve deeper into the intricacies of these associations and their potential implications for the management of diabetes. Regarding suicidal ideation, our study demonstrated that the morbid T2DM group has a higher rate of suicidal thoughts. This significant difference was also observed in the female subgroup and younger patients. Assessing mental health in diabetic patients is of high priority due to T2DM's long-term chronic course and complications, which may impose a significant psychological burden. A study conducted by Bidaki et al. at Yazd, involving a population of 360 samples, including 180 morbid T2DM patients comparing suicidal ideation and self-injurious between the two groups reported no significant difference in the prevalence of suicidal ideation and self-injury between the two groups of morbid and non-morbid T2DM patients (20). However, this

contradiction could stem from differences in the criteria used to classify participants into the morbid group. In our study, patients with Nephropathy, Retinopathy, or Diabetic Foot were considered as the morbid group, whereas their criteria were broader. Sharif et al. studied 504 T2DM patients in Karachi, Pakistan (21), and posited that elevated fasting blood sugar (FBS) levels, urban residence, physical disability, and limited social support are risk factors for depression and suicidal ideation. Our study found a significant link between HbA1c levels and suicidal ideation in both groups. High BMI was associated with suicidal ideation in the non-morbid group but not in the morbid group. This discrepancy may result from our sample size or other factors influencing BMI in morbid T2DM patients. Further research is needed to validate these findings and explore other potential factors contributing to suicidal ideation in diabetic patients.

### 5.1. Strengths and Limitations of the Study

Overall, this cross-sectional study offers valuable insights into the prevalence of eating disorders and suicidal ideation in patients with morbid and non-morbid T2DM. The findings underscore the importance of mental health assessment and intervention strategies for diabetic patients, particularly those with morbid T2DM, younger age, higher BMI, female gender, and poor glycemic control. This study had some limitations. One limitation was our relatively small sample size, which may necessitate caution in interpreting the results. Additionally, the use of a questionnaire for data collection and societal stigma surrounding suicide could be other limitations of this study. However, despite these constraints, this study provided valuable data on the prevalence of eating disorders and suicidal ideation in the context of morbid and non-morbid Type 2 Diabetes Mellitus. Future longitudinal studies with larger cohorts are needed to validate these findings and explore the complex interplay between diabetes, mental health, and potential risk factors for complications more comprehensively.

### 5.2. Conclusions

While eating disorders did not differ significantly between groups, there were intriguing nuances observed among younger individuals. The higher prevalence of suicidal ideation underscores the importance of addressing mental health in diabetes care. Gender and age played significant roles in these trends, and correlations between variables were identified. However, the study's limitations, including a small sample size, underscore the need for further research to achieve a more comprehensive understanding.

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## Footnotes

**Authors' Contribution:** A.S, H.O, H.G, S.T were performed the design, and conduct of the study and the analysis and clarification of the results. A.W. wrote the first draft of the manuscript, and all authors edited, reviewed, and approved the final version of the manuscript. A.W. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Conflict of Interests:** The authors state that they do not have any personal or financial relationships that could influence the publication of this article.

**Data Availability:** The dataset presented in the study is available on request from the corresponding author during submission or after its publication. The data are not publicly available due to privacy.

**Ethical Approval:** The study was performed under the approval of the Yazd Islamic Azad University Ethics Committee (Ethics Code: IR.IAU.YAZD.REC.1400.021)

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**Informed Consent:** Informed consent was performed from all individual participants having the inclusion criteria for the study. All patient data used in this study were de-identified to make sure of confidentiality and privacy.

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