


Review

# Bidirectional Relationships between Eating Disorders and Type 1 and 2 Diabetes: A Scoping Review

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**Abstract:** Eating disorders (ED) represent complex conditions with multifactorial etiopathogenesis. Recent scientific findings suggest that diabetes, a chronic disease profoundly influencing eating habits, could significantly contribute to the risk of developing ED. Both type 1 diabetes (T1DM) and type 2 diabetes (T2DM) patients are identified as susceptible to developing binge eating disorder (BED) and other dysfunctional eating behaviors, such as diabulimia, a condition not yet officially recognized by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Diabulimia is characterized by a deliberate choice to omit or limit necessary insulin doses, with the aim of losing weight or limiting weight gain. This scoping review aims to consolidate the latest evidence on the bidirectional relationship between ED and diabetes, as well as their impact on patients' quality of life. The findings from various studies reveal varied prevalence estimates, as diabetic patients often do not meet the formal diagnostic criteria for ED. Nonetheless, having diabetes appears to increase the risk of developing dysfunctional eating patterns. Simultaneously, the presence of an ED may heighten the risk of developing T2DM. Given this bidirectional relationship between ED and diabetes, this evidence underscores the importance for healthcare professionals, particularly those in diabetes care, to implement screening programs aimed at preventing and/or treating ED. Such initiatives could significantly improve patient outcome and quality of life.

**Keywords:** eating disorders; dysfunctional eating behaviors; diabetes; diabulimia



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## 1. Introduction

Eating disorders are complex and heterogeneous pathologies, united by a multifactorial etiopathogenesis [1], which in accordance with the bio-psycho-social model, interpellates heredo-constitutional, sociocultural, environmental, familial and intrapsychic factors [2]. The DSM (Diagnostic and Statistical Manual of Mental Disorders), in its fifth edition, does not give a clear definition either, though it fills in the weak structuring of the diagnostic categories presented in the DSM-III-R and outlines a clinical picture related to food-related behaviors that result in altered food consumption or intake and impaired physical health or social functioning. There is consensus in the literature that eating disorders are common in people with diabetes [3]. The prevalence, clinical features, and medical consequences of disturbed eating behavior (DEB and eating disorders (ED) in individuals with diabetes have received increasing attention since clinical cases of this dangerous combination were first published in the 1980s [4]. Diabetes is a chronic condition that profoundly affects eating habits and the relationship patients have with food and their bodies. Unlike nondiabetic individuals, they must constantly monitor their diet and sugar intake to better manage their blood sugar. The management difficulties inherent in this condition create frustrations and negative perceptions in diabetic patients who see disordered eating behavior as an attempt to regain control that they feel has been stolen from them by the disease [4]. Patients with type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM) constitute an at-risk group for the development of binge eating

disorder (BED) and bulimia [5,6]; for this reason, the condition requires a multidisciplinary care approach. BED was first added to the Diagnostic and Statistical Manual of Mental Disorders (DSM) in 1994 as a feature of eating disorder not otherwise specified (EDNOS) and only gained formal recognition as a psychiatric condition in its own right in 2013 in DSM-5 [7]. To meet the criteria for BED, patients must present with recurrent episodes of binge eating, defined as the consumption of an objectively large amount of food with an attached feeling of loss of control over it. Such binges must occur on average once a week in the previous 3 months, cause severe distress, and occur in the absence of compensatory behaviors (e.g., self-induced vomiting, laxative abuse). Some research has identified a complex combination of environmental and genetic risk factors for the development of comorbidity between eating disorders and the disease of diabetes, such as high body mass index, female gender, excessive preoccupation with shape and weight, certain personality traits such as perfectionism and emotional instability low self-esteem, and emphasis on food control [8,9]. In fact, many people with diabetes, particularly type 1, are concerned about weight gain because insulin therapy can lead to increased fat accumulation, concomitant with distorted body image, potential disturbances in physical appearance, or exacerbation of eating disorder-related symptoms [8]. Stigma and misunderstanding surrounding diabetes can lead to feelings of isolation and social pressure due to body image maintenance [10]. The latter is exacerbated by the emphasis on meticulous diet and treatment regimens by health care providers and family members. Constant diabetes management can lead to significant psychological distress, including anxiety, depression, and burnout [8]. Patients report fearing diabetes-related health complications and feeling overwhelmed by the management of their condition and feelings of ineffectiveness about being unable to live up to the standards of diabetes management [11]. The desire for control over one's life may contribute to disordered eating behaviors such as diabulimia. So, the term diabulimia refers to a condition that has not yet been recognized as a diagnostic entity; nevertheless, at the moment it seems to be able to fall under nutrition and eating disorders without specification. It is characterized by the deliberate choice to omit or limit necessary insulin doses, with the aim of losing weight or limiting weight gain. In recent years, it has been gaining more attention from the medical and psychiatric community: in 2017, the National Institute for Health and Care Excellence (NICE) included for the first time, within the guidelines for the treatment of eating disorders, a specific section on diabetes [12]. So, based on the existing literature, the purpose of this review is to emphasize how eating disorders significantly affect the physical and emotional health of people with diabetes and are associated with impaired metabolic control and an elevated risk of medical complications including retinopathy and nephropathy, microvascular complications, major episodes of diabetic ketoacidosis, hospitalizations [13], and higher mortality rates [14].

## 2. Materials and Methods

### 2.1. Search Strategies

In April and May 2024, a series of searches was conducted using the University of Catania's internal research database, Discovery, to gather relevant studies on the relationship between diabetes and eating disorders. We chose this database due to its comprehensive collection of specialized and peer-reviewed literature, ensuring access to high-quality and pertinent studies. Discovery includes access to multiple reputable databases such as PubMed, Health & Medical Collection, PubMed Central, Springer Online Journals Complete, ScienceDirect Journals, ScienceDirect Freedom Collection 2021, and Wiley Online Library. To focus on a target group of adults, the search was conducted using the following terms: (diabetes) AND (eating disorders) NOT (adolescent); (eating disorders) OR (diabulimia) AND (adults) NOT (adolescent). This review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram to describe the research methodology and selection of articles included [15]. Additional bibliography, not reported in the flow diagram, has been extrapolated from full-text articles and included as references.

## 2.2. Eligibility Criteria

Every article meeting the following criteria was included:

- Studies investigating the correlation between diabetes, treated with different types of insulin, such as insulin pens, intermediate-acting insulins and long-acting insulins and eating disorders in adults.
- All studies published in PubMed, Health & Medical Collection, PubMed Central, Springer Online Journals Complete, ScienceDirect Journals, Science direct Freedom Collection 2021 and Wiley Online Library.

Every article meeting the following criteria was excluded:

- Studies published in non-scientific or non-peer-reviewed sources.
- All articles explore the association between diabetes and eating disorders with a focus on adolescents.
- Articles of which the full text cannot be found.

## 2.3. Data Collection

The data collection process was independently carried out by four reviewers (A.B., F.L.G., R.M., L.M.). Any discrepancies that arose were addressed through dialogue or with the aid of a fifth reviewer (G.C.P.).

## 3. Results

### 3.1. Characteristics of the Included Studies

In this literature review, a total of six full-text articles were included to analyze the correlation between diabetes and eating disorders (Figure 1).

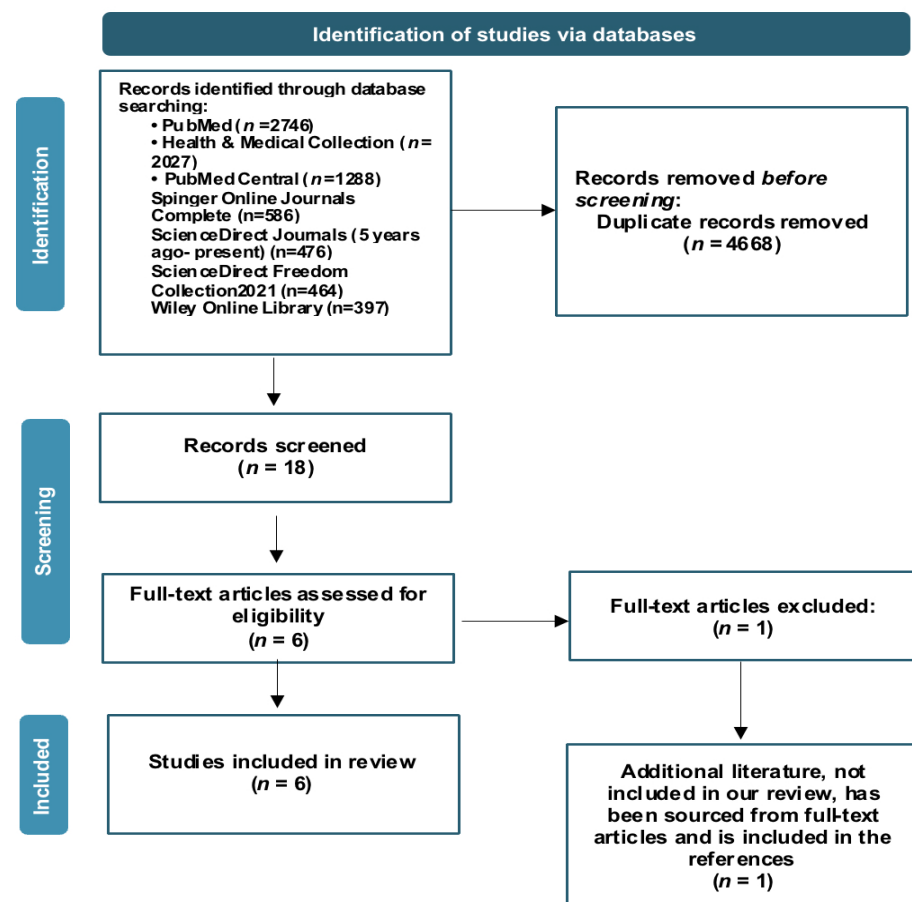


Figure 1. PRISMA 2020 [15] flow diagram.

This scoping review provides a summary of six studies that explore the presence of eating disorders in people with diabetes. The studies included in this review are a case-control study, a longitudinal study, a qualitative study, and a cross-sectional study (Table 1). The studies were analyzed qualitatively and the findings were synthesized to provide an overview of the current state research in this area. A synopsis of these studies is presented in Table 1. The limitations of the studies and the implications for future research are also discussed.

**Table 1.** Data extraction.

Author	Year	Title	Type of Study	Focus	Sample	Measures	Results
Falcao M. A., Francisco R.	2017	Diabetes, eating disorders and body image in young adults: an exploratory study about "diabulimia".	Case-control analytic study.	To compare ED and BID among young adults with type 1 diabetes and their peers without diabetes, to investigate the consequences of diabetes for food, body image, and weight in individuals with diabetes and to identify the behavior of insulin omission as a weight loss strategy.	A total of 55 young adults with diabetes and 73 without diabetes.	Demographic and personal data questionnaire, EDE-Q, CDRS, questionnaire on personal experience about found and body image.	Several changes resulting from diabetes in terms of food, body image and weight that interfere with the day-to-day life of individuals with diabetes; 7.3% of these participants reported insulin omission as a weight loss strategy.
Jaworki M., Panczyk M., Silwczynski A., Brzozowska M., Janaszek K., Malkowski P., Gotlib J.	2018	A ten-year longitudinal study of prevalence of eating disorders in the general Polish type 2 diabetes population.	Longitudinal study.	Evaluate the prevalence of ED in T2DM in the years 2008–2017 in state medical care.	3071 (In 10 years)	NFZ, GUS, ICD-10.	The prevalence of EDs in T2DM patients in the whole patient population with diagnosed T2DM ranged from 0.059% (in 2017) to 0.086% patients (in 2010). Differences in subcategories of EDs were noted.
Petroni M.L., Barbanti F.A., Bonadonna R., Bruno G., Caletti M.T., Crocchi M., D'Eusebio C., Dei Cas A., Invitti C., Merlo F., Molteni A., Pontiroli A., Trento M., Veronelli A., Vigli de Kreutzenberg S., Marchesini G.	2019	Dysfunctional eating in type 2 diabetes mellitus: A multicenter Italian study of socio-demographic and clinical associations.	Cross-sectional observational study	Assess the prevalence of dysfunctional eating in a large population of people with T2DM in Italy recruited in a real-life multicenter clinical setting, as well as its association with socio-demographic characteristics.	895	Body weight, height, waist circumference, biochemical data, EAT-26, BES, NEQ, MDS, QMV.	Critical EAT and BES values were associated with higher BMI and dysfunctional eating is present across the whole spectrum of T2DM.

Table 1. Cont.

Author	Year	Title	Type of Study	Focus	Sample	Measures	Results
Coleman S.E. Caswell N.	2020	Diabetes and eating disorders: an exploration of "Diabulimia".	Qualitative study.	The aim of this study was to conduct an exploratory analysis into the views and experience of diabulimia.	55	EDE-Q; 16 open-ended questions analyzed using thematic analysis.	EDE-Q score 3.96; weight concerns, coping issues, trauma, negative healthcare experiences, diabulimia consequences noted.
Salvia M.G., Ritholz M.D., Craig K.L.E., Quattromoni P.A.	2022	Managing type 2 diabetes or prediabetes and binge eating disorder: a qualitative study of paties' perceptions and lived experiences.	Qualitative study	Qualitatively explore the experiences of women concurrently managing T2DM/prediabetes and BED.	21	EDE-Q and semi-structured interviews.	BED often predates diabetes diagnosis; BED treatment helps manage diabetes.
Muley A., Deshmane A., Mahajan A., Shah J.	2024	Eating disorders: assessing its prevalence and pattern among adults with type 2 diabetes	Cross-sectional study	To assess the risk of EDs among T2DM.	254	SCOFF, EDE-Q	The 35% of the total population with T2DM had a high risk of EDs.

BES = Binge Eating Scale; BID = Body Image Dissatisfaction; CDRS = Contour Drawing Rating Scale; EAT-26 = Eating Attitude Test; EDE-Q = Eating Disorder Examination questionnaire; GUS = webpage of Statistics Poland; ICD-10 = International Statistical Classification of Diseases and Related Health Problems 10th Revision; NEQ = Night Eating Questionnaire; NFZ = Polish National Health Found; MDS = Mediterranean Diet Score; QMV = Quanto Mangio Veramente; SCOFF = Sick, Control, One, Fat, Food questionnaire.

### 3.2. Eating Disorders in Patients with Type 2 Diabetes

Eating disorders (ED) can arise from a complex interplay of biological, psychological, and social factors, with certain medical conditions, such as type 2 diabetes mellitus (T2DM), playing a significant role. The constant vigilance required to monitor blood glucose levels, dietary restrictions, and concerns about body image and weight management inherent in diabetes management can contribute to the development of ED [15]. A cross-sectional study involving 254 T2DM participants found that 35% were at risk of developing an eating disorder [14]. Conversely, the relationship between ED and T2DM can also follow an inverse path. While T2DM may contribute to the emergence of ED symptoms, individuals with ED are at a higher risk of obesity, potentially leading to the development of T2DM [16]. For instance, a 2019 study by Petroni et al. found a close correlation between critical values on binge eating disorder (BED) symptom detection tests and increased body mass index (BMI) in T2DM individuals [16]. BED, characterized by recurrent episodes of binge eating without compensatory behaviors, tends to result in a higher BMI compared to other eating disorders [17]. Longitudinal studies also indicate a correlation between eating behaviors and T2DM. A study conducted over a decade in Poland found increasing trends in symptoms of bulimia nervosa (BN) and atypical AN among T2DM patients [18]. Although not meeting diagnostic criteria, these symptoms suggest a manifestation of eating disorders in individuals with T2DM [18]. Similarly, qualitative analyses reveal the bidirectional relationship between T2DM and BED, with participants reporting feelings of guilt and shame associated with dysfunctional eating behaviors and diabetes diagnosis [19]. However, BED treatment has shown promise in improving awareness, reducing binge eating, and enhancing T2DM control [19]. Gender differences in the prevalence of ED among individuals with T2DM are evident across studies. While Petroni et al. found higher EAT-26 and BES scores among women, Jawroski et al. noted an increasing number of men with BED and T2DM over a ten-year period [18]. Muley et al.'s study in 2024 further

highlighted gender disparities, with 21% of high-risk individuals being men compared to 14% being women [14]. These variations in gender-specific findings and BED prevalence could stem from differences in study periods, screening instruments, sample characteristics, and inclusion criteria. Nonetheless, all studies underscore the risk of developing ED in individuals with T2DM and vice versa, emphasizing the importance of implementing screening tools in diabetes departments [20,21].

### 3.3. Eating Disorders in Patients with Type 1 Diabetes

Reducing or omitting insulin in individuals with type 1 diabetes mellitus (T1DM) is often pursued as a means to achieve rapid weight loss. This practice, however, triggers a cascade of health consequences. Withheld insulin leads to elevated blood glucose levels, prompting rapid breakdown of protein (catabolism), hyperglycemia, and subsequent calorie loss through urine as glucose [22,23]. The manipulation of insulin dosing, involving reduction, delayed intake, or complete omission, can result in severe complications, including diabetic ketoacidosis (DKA), an acute and perilous complication of diabetes [24]. Long-term consequences of insulin omission, also known as diabulimia, encompass both microvascular and macrovascular complications, such as retinopathy (vision loss) and neuropathy (kidney damage) [21]. Notably, insulin omission increases the risk of mortality by 3.2 times [25]. Despite diabulimia not yet being recognized as a distinct diagnostic entity, existing studies shed light on its complexities. For instance, a study by Falcão and Francisco (2017) revealed that body image dissatisfaction (BID) significantly predicts disordered eating (DE) among T1DM patients [26]. Interestingly, insulin omission as a weight loss strategy was predominantly reported by female participants, suggesting a gender-specific association with DE [26]. Another study by Coleman and Caswell (2020) highlighted various factors correlated with ED development in T1DM patients, including weight concerns, difficulties coping with diabetes, past trauma, and relational importance [27]. Their findings indicated that weight loss served as a primary motivator for insulin restriction, perpetuating dysfunctional behaviors [27]. Moreover, Coleman and Caswell's study illuminated the emotional toll of diabetes management, with participants expressing overwhelming feelings and loss of control over their bodies [27]. While some exhibited self-harming behaviors, many struggled to discontinue insulin restriction despite awareness of its consequences [27]. Similarly, Falcão and Francisco found that although T1DM patients were cognizant of insulin omission's short-term and long-term effects, weight loss remained paramount, perpetuating the cycle of dysfunctional behavior [26]. These insights underscore the complex interplay between insulin misuse, body image dissatisfaction, and disordered eating behaviors among individuals with T1DM. Despite knowledge of the detrimental effects, the desire for weight loss often outweighs concerns about health consequences, perpetuating a cycle of disordered eating behaviors. Understanding these dynamics is crucial for developing targeted interventions to address diabulimia and its associated complications.

## 4. Discussion

This study aims to elucidate the prevalence and impact of eating disorders and BED in adults with type 2 diabetes (T2D) and type 1 diabetes (T1D), highlighting the differences in clinical presentation and challenges in diagnosis and management. By examining the existing literature and identifying gaps, we seek to improve understanding and provide better guidance for clinicians. Few studies have examined the prevalence rates of BEDs and eating disorders in adults with T2D; the studies available to date report widely varying prevalence estimates, between 2 and 26 percent. This variability appears to be primarily influenced by geographic factors, with higher prevalence observed in countries with Anglo-Saxon cultural backgrounds and lower prevalence in continental Europe [28,29]. While uncontrolled eating disorder affects a notable yet still minority fraction of type 2 diabetes patients, a larger proportion experience recurrent binge eating episodes, albeit at a frequency below the threshold required for an uncontrolled eating disorder diagnosis

(typically two per week on average) [29–31]. Thus, eating disorders represent merely the visible tip of an iceberg, with underlying minor alterations in eating behavior capable of significantly impacting metabolic control. Indeed, even modest deviations in eating behavior, as measured by various parameters, correlate with metabolic outcomes in type 2 diabetes patients [31]. Calorie restriction/constraint and uncontrolled eating are more common DEB symptoms in patients with T2D than those with T1D. There are few longitudinal studies on eating disorders, but those that do exist have noted the persistence of DEB and eating disorders over time in patients with T1D and T2D [32].

Eating disorders, though more prevalent in individuals with type 1 diabetes compared to the general population, present distinct clinical features in these patients, complicating diagnosis. These features include insulin therapy manipulation for weight control and the potential for weight loss associated with recurrent binge eating, even in the absence of compensatory behaviors that could affect metabolic control and long-term prognosis. The type of insulin used by patients can play a significant role in the management and potential misuse related to eating disorders. Patients may use insulin pens or semi- and long-duration insulins, each presenting unique management challenges. Understanding the type of insulin involved is crucial, as the omission of a dose of long-acting insulin may not pose immediate danger but can contribute to poor glycemic control over time. Conversely, manipulation of rapid-acting insulin doses can result in more immediate and severe metabolic consequences. The literature suggests that different metrics should be used to monitor eating disorders in people with T1DM; while a low body mass index (BMI) can often help clinicians identify an eating disorder in the normal population, diabetics who omit insulin may have a deceptively normal BMI but elevated HbA1c levels as well as elevated blood ketone and glucose levels [33]. This can make the diagnosis of an eating disorder in an individual with T1DM particularly difficult, a difficulty that may be exacerbated by the existence of little guidance to help clinicians address the challenges associated with identifying this specific group of patients and the nonexistence of clear pathways for treating them. However, mild or moderate alterations in eating behavior, falling short of DSM diagnostic criteria, may still exert profound effects on metabolic control and prognosis. Consequently, seemingly minor issues such as sporadic loss of control or excessive preoccupation with body shape, typically tolerated in other contexts, can pose significant clinical challenges in the context of type 1 diabetes.

Just as eating disorders can profoundly disrupt diabetes management, the presence of diabetes complicates their treatment. Therefore, thorough evaluation of eating behavior is warranted in patients experiencing suboptimal glycometabolic control despite insulin therapy optimization. Non-adherence to treatment in young people with T1D is reason to initiate screening for an eating disorder or disordered eating behavior, especially in the context of risk factors such as female gender, high body mass index before T1D diagnosis, dissatisfaction with body appearance, and low self-esteem [8]. In addition, screening could reveal feelings of distress, frustration, and suppression arising from aspects of diabetes management such as constant attention to nutrition and medication [34], preventing the potential onset of eating disorders [11]. Indeed, diabetes management imposes a degree of perceived dietary restriction, particularly in patients who eat according to a predetermined eating plan rather than in response to internal signals of hunger and satiety. Such neglect of internal signals may contribute to diet dysregulation in predisposed individuals [35].

In cases where disturbed eating behavior is identified in type 1 diabetes patients, efforts should be directed towards minimizing dietary rigidity. In severe instances, referral to specialized psychotherapeutic and/or pharmacological interventions may be necessary, recognizing the inherent challenges posed by type 1 diabetes in addressing eating behavior disorders. The professionals will need to be able to anticipate the psychological effects of daily diabetes self-management and be aware that feelings of distress could potentially lead to diabulimia or other disordered eating behaviors. [11]. Indeed, the management of these conditions requires a multidisciplinary team consisting of an endocrinologist/diabetologist, a nurse educator, a nutritionist, a psychologist and, often, a psychiatrist. Treatment of

patients with type 1 diabetes with DEB should include the following components: diabetes treatment, nutritional management, and psychological therapy [35,36].

### *Limitations*

While our scoping review provides valuable insights, it is not without its limitations. The first is the heterogeneity of the included studies, which encompass qualitative studies that may be subject to bias and interpretation. This choice was necessary due to the scarcity of randomized studies available in the literature. However, including these studies offered important information about participants' experiences and perceptions. Additionally, the samples varied widely in socio-cultural level and age, and the different evaluation methods made it challenging to obtain consistent results across studies. These limitations should be considered when interpreting the results of the scoping review, and future research should aim to address them by conducting more homogeneous studies in terms of sample and instruments used. An additional limitation of this systematic review concerns the limited consideration of socioeconomic factors and educational level in the analyzed research. Most of the included studies did not provide detailed information on the socioeconomic status or educational level of participants, factors that could significantly influence both diabetes management and the development of eating disorders. These variables could have a significant impact on access to care, understanding of the disease, treatment adherence, and eating habits. The lack of data on these aspects limits our ability to fully comprehend how socioeconomic and educational factors may mediate the relationship between diabetes and eating disorders. Future research should explicitly consider these factors to provide a more comprehensive and nuanced understanding of the phenomenon.

### **5. Conclusions**

Based on the reviewed literature, it can be concluded that although symptoms develop differently in the two types of diabetes, both conditions can be considered risk factors for the development of eating disorders. The psychological burden of managing a chronic illness like diabetes, coupled with dietary restrictions and focus on food/weight, can contribute to unhealthy relationships with food and body image issues. Additionally, the shame, stigma, and distress associated with eating disorders can further exacerbate difficulties in diabetes management. Therefore, it is desirable for physicians in diabetes departments to receive training in recognizing psychological risk factors and managing this risk. Routine screening for disordered eating attitudes and behaviors should be introduced for early detection of eating disorder symptoms. Early detection would enable timely referral to specialized centers where treating the psychological components of eating disorders could aid in the comprehensive management of diabetes, and vice versa. Integrating mental health support within diabetes care is crucial for addressing the mind–body connection and improving overall well-being.

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