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25 Years of psychological research investigating disordered eating in people with diabetes: what have we learnt?
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What’s new?
- This review provides a recent critical summary of the literature exploring disordered eating in people with diabetes over the past 25 years.
- We address key gaps; most notably, the absence of focus on people with type 2 diabetes and the urgent need for intervention strategies.
- We review challenges for healthcare professionals involved in the clinical care of individuals with comorbid diabetes and disordered eating, and provide recommendations for the direction of care, emphasizing a tailored, multidisciplinary approach.

Abstract
Disordered eating is a serious and under-recognized problem in people with diabetes. This narrative review summarizes the research contributions made by psychological science over the past 25 years to the study of disordered eating in people with type 1 or type 2 diabetes, and identifies gaps and future directions relevant to both healthcare professionals and researchers. Key focus areas of psychological research investigating disordered eating in people with diabetes have been: (1) defining and classifying types of disordered eating; (2) identifying demographic, diabetes-specific and psychosocial correlates of disordered eating, and developing theoretical models of disordered eating in people with type 1 diabetes; (3) identifying the physical and psychosocial consequences of disordered eating; and (4) developing screening measures to identify disordered eating in people with type 1 diabetes. Psychological science has made significant contributions over the past 25 years to our understanding of the nature of this problem and the multiple factors which may interrelate with disordered eating in people with diabetes. Key
areas for further attention include: (1) a better definition of disordered eating subtypes in people with type 1 diabetes; (2) characterizing disordered eating in people with type 2 diabetes; and (3) developing multidisciplinary, evidence-based prevention and treatment interventions for comorbid disordered eating and diabetes.

Introduction

Disordered eating in people with diabetes is a serious, under-recognized clinical problem associated with poor health outcomes. Over the past 25 years, there has been a steady increase in the evidence base characterizing the phenomenology underlying this behaviour, its associated risk factors, course, and its multiple adverse outcomes and potential treatments. This narrative review summarizes the contribution of psychological science over this period to our understanding of disordered eating in people with diabetes. It identifies key knowledge gaps, challenges and recommendations for healthcare professionals, and novel research directions for future work to address.

What we knew in 1995

Awareness of disordered eating in people with diabetes in clinical and research communities began with case reports in the 1970s and 1980s describing comorbid type 1 diabetes and eating disorders, predominantly in young women [S1,S2]. A key unique feature of these eating disorders was the restriction or omission of insulin for the purpose of weight control. This discovery prompted a series of observational studies in the 1980s and 1990s that aimed to ascertain the prevalence of eating disorders in type 1 diabetes, with conflicting results. For example, Steel et al. [1] reported a 7% prevalence of eating disorders in a sample of 208 young women with type 1 diabetes from a UK clinic (vs. 2% prevalence in those without diabetes). By contrast, Striegel-Moore et al. [2] observed minimal disordered eating in 46 adolescent girls with type 1 diabetes recruited from a case register in the USA (and similarly low disordered eating in 46 girls without type 1 diabetes). Another study found that although insulin omission was relatively common in 100 participants with type 1 diabetes from a UK outpatient clinic, clinical eating disorders were not more prevalent relative to a control group of 67 women without diabetes [3]. However, a landmark study conducted by Jones et al. [4] in 2000 showed that girls with type 1 diabetes (n = 356) were 2.4 times more likely to have a clinical eating disorder, and 1.9 times more likely to engage in subclinical disordered eating relative to an age-matched control group of girls without diabetes (n = 1098). This study used self-report and interview methods adjusted for the context of
diabetes, and its results prompted more consistent and methodologically robust investigations into both the prevalence and correlates of eating disorders and disordered eating in groups with type 1 diabetes.

**What have the past 25 years of research told us?**

### Classification of disordered eating in people with diabetes

#### Disordered eating in people with type 1 diabetes

There is general consensus that both clinical eating disorders and subclinical disordered eating are over-represented in populations with type 1 diabetes, particularly in young women. Throughout the 21st century, the reported prevalence of clinical eating disorders has varied, ranging from 0% to 32% [5,6], which may largely be due to different study designs and sample characteristics (e.g. clinic vs. community samples). Another key reason for this wide range is that there is no consensus on the definition of disordered eating in type 1 diabetes. Furthermore, many eating disorder or disordered eating self-report questionnaires, diagnostic interviews and diagnostic criteria are not validated or applicable for use in people with type 1 diabetes, because they do not include diabetes-specific disordered eating cognitions and behaviours (namely, fear of weight gain with insulin and insulin omission as a compensatory purging behaviour, respectively). In addition, the current Diagnostic and Statistical Manual for Mental Disorders (DSM)-5 and International Classification of Diseases (ICD)-10 classifications for eating disorder and its variants do not yet include biomedical outcomes such as diabetic ketoacidosis, hyperglycaemia and recurrent hypoglycaemia as diagnostic criteria, even though these outcomes provide essential information about the risk of complications and mortality. Furthermore, weight loss in those with comorbid type 1 diabetes and disordered eating is often not as extreme as in those without diabetes for complex (and as yet poorly understood) physiological reasons. Thus, despite the high medical risk of life-threatening complications such as ketoacidosis, and accelerated rates of vascular complications, people with type 1 diabetes who use insulin omission as a purging behaviour often do not fulfil diagnostic criteria for eating disorders.

Despite difficulties with classification, it has been consistently observed that bulimia nervosa and ‘other specified feeding and eating disorders’ (formerly referred to as ‘eating disorder – not otherwise specified’) are more common in people with type 1 diabetes than in those without, but there appears to be no significant increase in the prevalence of anorexia nervosa [4,7–9]. However, although prevalence may not be higher, comorbid anorexia nervosa and type 1 diabetes is associated with greater mortality. For instance, a 10-year follow-up study reported that the
mortality rate in women with this comorbidity was 35%, compared with 6.5% and 2.5% for anorexia nervosa and type 1 diabetes alone, respectively [8], representing an almost sixfold increased risk of mortality. This needs to be distinguished from subclinical anorexia symptoms (e.g. restrictive eating behaviour and ‘atypical’ purging behaviour through insulin omission without being significantly underweight), which are common in people with type 1 diabetes. Because of the unique context and additional complexity involved in comorbid type 1 diabetes and disordered eating, and the disparity between medical risk and clinical diagnoses defined by the DSM-5 and ICD-10, it may be useful for clinicians and researchers to categorize disordered eating differently in people with type 1 diabetes. Categorization of disordered eating ‘subtypes’ in this group may be based on a combination of their medical risk (e.g. for ketoacidosis), clinical features (e.g. weight status), and the types and patterns of behaviours being engaged in (e.g. restrictive dieting, insulin omission, frequent or infrequent). Indeed, most studies conducted in the past 10 years examining prevalence of disordered eating in type 1 diabetes focus on symptoms rather than discrete diagnoses. Recently, investigations in adolescent, young adult and adult samples have shown that the prevalence of clinically significant disordered eating in populations with type 1 diabetes is ~ 20–25% [10–12], with lower rates in boys and men relative to girls and women (Table S1).

Early theoretical accounts of disordered eating in people with type 1 diabetes posit that disordered eating begins with the context of dietary constraint imposed by diabetes self-management requirements [13], from which restrictive (characterized by anorexia-like symptoms such as dietary restraint, rigidity and perfectionistic attitudes), and disinhibited (characterized by bingeing and purging behaviours, and emotional reactivity) disordered eating have been described. Insulin restriction for the purpose of weight control appears to be a salient feature in both restrictive and disinhibited subtypes, as it may be characterized as a control-seeking behaviour (when combined with dietary restraint or perfectionistic attitudes) or a compensatory purging behaviour (e.g. when engaged in after an episode of binge eating) [14,15]. Profiles or subtypes of disordered eating in type 1 diabetes may also differ with respect to their trajectories, with some investigations noting variability in the persistence of symptoms over time [5,6,16]. A recent study examining disordered eating at baseline and 1-year follow-up in 300 adolescents and young adults with type 1 diabetes observed that 19% of their sample had persistent disordered eating, 8% had worsening disordered eating, and only 7.3% had a reduction in disordered eating [17]. Goebel-Fabbri et al. [18] explored persistence of insulin restriction behaviours in a sample of women with type 1 diabetes (n = 207),
finding that those who ceased insulin restriction across the 11-year follow-up period showed less fear of weight gain with insulin, and fewer difficulties with diabetes self-management, relative to those who persisted. This provides a good starting point for intervention or prevention strategies; however, more studies to characterize the clinical features and trajectories over time are needed to help both people with diabetes and clinical teams improve recognition and develop interventions.

**Disordered eating in people with type 2 diabetes**

Even less research has been directed at characterizing disordered eating in people with type 2 diabetes. Almost exclusively, studies have focused on disordered eating characterized by ‘over-eating’ (i.e. binge eating disorder and night eating syndrome), perhaps due to the established link between increased weight status and type 2 diabetes onset. In 2001, one of the first studies reported a binge eating disorder prevalence of 26%, and this was associated with greater disordered eating and higher BMI, but the sample size was very small \( n = 43 \) [19]. Subsequent studies have observed low rates of binge eating disorder \( 1.4–2.5\% \) and night eating syndrome \( 3.8\% \) [20,21], and a recent systematic review found relatively low rates of \( 1.2–8\% \) for binge eating disorder and \( 3.8–8.4\% \) for night eating syndrome in adults with type 2 diabetes, and no associations between eating disorder status and HbA\(_1c\) (although only two studies had explored this association) [22]. However, some recent studies have indicated higher rates of subclinical disordered eating in younger populations with type 2 diabetes [23]. For instance, Nip et al. [11] observed that in young people with insulin-treated type 2 diabetes \( n = 149 \), 50% reported disordered eating compared with 21% of those with type 1 diabetes \( n = 2156 \). Given that the management and experience of insulin-treated type 2 diabetes and type 1 diabetes can be quite similar, this large discrepancy is surprising, and should be further explored in future research. One possibility for the difference reported by Nip et al. is that disordered eating may be relatively over-reported in groups with type 2 relative to type 1 diabetes. This could be due to different messaging/focuses in the management of type 2 vs. type 1 diabetes, which may emphasize weight management and individual responsibility for food/meal decisions to a greater degree, priming individuals to report perceived ‘disordered’ behaviours in this domain [24]. Overall, the dearth of basic observational research in this field is an urgent priority for redress as it is precluding detection and development of interventions.

**What is contributing to the problem of disordered eating in people with diabetes?**

**Demographic factors**
Girls and young women with type 1 diabetes are particularly at risk for disordered eating [6,9]. Rates of clinical eating disorders and subclinical disordered eating in young women are commonly reported at 2–10% and 30–50%, respectively, relative to 0–1% and 10–20%, respectively, in men [4,9,25,S3,S4] (Table S1). Explanations for higher prevalence in girls and young women have suggested societal (e.g. pressure to conform to a ‘thin ideal’) and pubertal/developmental factors (e.g. peripubertal weight gain resulting in increased body dissatisfaction) [17,26,S5]. However, although lower rates have been observed, disordered eating is still over-represented in boys and men with type 1 diabetes relative to their those without diabetes [10], and body dissatisfaction in young men with type 1 diabetes has been reported to be high. For example, Araia and colleagues [25] reported body dissatisfaction in 76% of their sample of adolescent boys from a national registry in Australia (n = 180). In people with type 2 diabetes, younger age appears to be associated with greater disordered eating (perhaps due to the social and developmental context surrounding an earlier diagnosis of type 2 diabetes, e.g. peer group influences, pubertal body changes), but gender has not as yet been shown to relate to disordered eating prevalence [11,19,23].

**Diabetes-specific factors**

There are several factors unique to people with diabetes compared with those without that may predispose them to disordered eating and eating disorders. First, significant weight loss pre-diagnosis due to insulinopaenia in type 1 diabetes is common, resulting in a catabolic state with significant dehydration due to glucosuria. This is followed by rapid weight re-gain once insulin therapy has commenced [4,26], which can be emotionally difficult and can result in body dissatisfaction due to perceived larger body size. Second, the ease with which it is possible to omit a proportion of the recommended insulin dose in order to lose weight without having to actively restrict food intake, purge or excessively exercise also increases the risk of disordered eating. Third, the burden of type 1 diabetes is a constant psychological vulnerability that can result in feelings of loss of control, and insulin omission can be perceived as a method for regaining that control. Fourth, episodes of hypoglycaemia can trigger binge-eating episodes and relative over-insulinization, driving weight gain. People with type 1 diabetes and optimal glycaemic management are on average heavier than either people with less optimal glycaemia or same-aged peers without diabetes [26]. Compensatory behaviours can emerge from this context, often starting through coincidental discovery that insulin omission leads to weight loss (through ‘self-experiment’), and becoming entrenched in an ‘addictive’ pattern [27,28]. Fifth, the complex and
burdensome self-care tasks required to manage diabetes, combined with the unpredictability of blood glucose levels, can result in frustration, particularly in people with perfectionist personality traits [14,27]. The dietary aspects of self-management (e.g. carbohydrate counting) can prompt a preoccupation with food, and present a risk factor for engagement in disordered eating behaviours [15]. This is applicable to both type 1 and type 2 diabetes, however, particularly in those with type 1 diabetes, the need to balance dietary factors (e.g. calories, glycaemic index) with insulin dosage, along with exercise, blood glucose monitoring, neglect of hunger and satiety cues (especially in regard to treating hypoglycaemia), and various other situational factors (e.g. time of day, weather, illness status) can create an emotional, cognitive and behavioural burden that together constitutes a risk for disordered behaviours.

**<H3>Psychosocial factors**

Research has also focused on exploring psychosocial factors involved in the association between disordered eating and diabetes. Most commonly, these investigations have explored and demonstrated associations between depression and anxiety symptoms, coping styles (e.g. avoidance coping), and family relationships (e.g. maternal attitudes to weight and shape) and disordered eating in people with type 1 diabetes [29,30,56,57] and type 2 diabetes [11,23,29]. In addition to these general psychological factors, some research has also addressed the role of diabetes-specific distress [31] and diabetes-specific family conflict [32], finding positive relationships with disordered eating and shape/weight concerns in populations with type 1 diabetes. Although it is not completely clear whether these psychological factors are causes or consequences of disordered eating, or whether they simply covary with disordered eating, some recent studies using ecological momentary assessment methods have provided valuable insight. Two studies have identified negative emotional states and diabetes-related negative affect as direct precursors to insulin restriction and binge eating episodes, respectively [33,34], suggesting that these are possible risk factors for disordered eating.

**<H3>Theoretical models of disordered eating in type 1 diabetes**

Recent theoretical work has aimed to conceptualize models of disordered eating in people with (type 1) diabetes. The modified dual pathway model focuses on both the physiological/behavioural aspects of type 1 diabetes (dietary regimen, insulin therapy and resultant weight gain, disruptions to hunger and satiety processes, blood glucose fluctuations) that can predispose people to engage in compensatory weight control behaviours, as well as the psychosocial risk factors (body dissatisfaction, negative affect) [28]. Recent research has shown empirical support in youth and
young adults with type 1 diabetes for the link between disordered eating and certain aspects of this model (e.g. hunger/satiety disruption, dietary regimen, negative affect) [15,35]. In parallel to development of the modified dual pathway model, Treasure et al. [14] proposed a new theoretical maintenance model of disordered eating in type 1 diabetes, taking into account aspects of Fairburn’s transdiagnostic model [S8] and the dual pathway model. It involves similar pathways to the modified dual pathway model but has a greater focus on psychosocial factors such as interpersonal aspects, personality and self-esteem. De Paoli and Rogers [36] recently expanded this model, making the first attempt to differentiate between types of disordered eating (dietary restriction, binge eating, purging). However, this model does not identify distinct pathways to either restrictive or disinhibited disordered eating subtypes. Overall, although these models provide a promising foundation for understanding disordered eating in type 1 diabetes, further work is required to provide empirical support for all hypothesized aspects/pathways in these models. Longitudinal investigations, further investigation of the role of age (especially the transition from childhood to adulthood) and gender in these relationships, and further distinction between subtypes and severity of disordered eating, should be a focus of future work in this area.

**What are the consequences of disordered eating in people with diabetes?**

**Physical consequences**

Disordered eating in type 1 diabetes can have particularly severe, life-threatening consequences. Goebel-Fabbri et al. [37] over an 11-year follow-up period reported that insulin restriction in women with type 1 diabetes was associated with a threefold increase in mortality compared with those who had never restricted insulin. Additional investigations have shown relationships between disordered eating in those with type 1 diabetes and both higher HbA1c and an increased risk of diabetes complications such as retinopathy, neuropathy and other microvascular complications [5,16,S9–S11]. In addition to these longer-term complications arising from disordered eating, studies have identified other adverse outcomes such as fatigue and sleep disturbances, excessive hunger/thirst, electrolyte imbalance, dehydration, oedema, muscle atrophy, menstrual/hormone disturbances, digestive problems, ketoacidosis among others [S12]. Researchers have cautioned that even ‘mild’ forms of disordered eating should be considered clinically important in populations with type 1 diabetes, as these still impact significantly on self-care behaviours and blood glucose levels, and thus have to potential to lead to serious health consequences [16]. Taken together, this evidence strongly highlights the importance of directing
attention and resources towards the prevention and treatment of eating disturbances in individuals with diabetes.

**<H3>Psychological consequences**

Just as psychological factors such as depression and anxiety symptoms and diabetes distress can be risk factors for disordered eating, disordered eating can also lead to reduced psychological functioning, and reduced quality of life. A number of recent studies have proposed bi-directional relationships between disordered eating and depression symptoms, anxiety symptoms and quality of life in populations with type 1 and type 2 diabetes [11,12]; however, the direction of causality remains unknown. Insights from qualitative work have pointed at emotional/mental health concerns arising as a consequence of prolonged disordered eating in women with type 1 diabetes [38]. However, it is likely that the relationship between disordered eating and the range of psychological distress is temporally parallel, with each exacerbating the other.

**<H1>Translation/implementation: to what extent has the evidence been put into clinical practice?**

**<H2>Screening for disordered eating in people with diabetes**

The most commonly used measure to screen for disordered eating in people with type 1 diabetes is the Diabetes Eating Problems Survey-Revised (DEPS-R), which was published 10 years ago, predominantly as a tool for research [39]. The DEPS-R has been widely implemented and validated in both adolescents and adults with type 1 diabetes [S13,S14], and may be a useful clinical tool for identifying those at risk for clinically significant disordered eating using a cut-off score of \( \geq 20 \) (although it reportedly has low predictive value for clinical eating disorder diagnoses) [S15]. The DEPS-R, and similar screening instruments such as the mSCOFF, [40] have been criticized, however, for directly inquiring about dangerous behaviours (i.e. insulin restriction/omission), which could be construed as ‘suggestive’ to vulnerable individuals with type 1 diabetes, although there is disagreement regarding the level of risk involved in this versus the clinical necessity of identifying these behaviours.

Resulting from this concern, Powers et al. [41] developed the Screen for Early Eating Disorder Signs (SEEDS) tool, which taps into body image concerns and feelings regarding disordered eating and quality of life, but does not screen for engagement in actual disordered eating behaviours. Additionally, despite being a tool developed specifically for people with type 1 diabetes, the SEEDS questionnaire does not include any diabetes-specific items. This is an issue due to the close link between diabetes and disordered eating, including the focus on food, pressure
for optimal self-management of diabetes, and the link between insulin therapy and weight status. The same issue with the SEEDS arises with the use of non-diabetes-specific screening tools (such as the Eating Disorder Examination Questionnaire, the Eating Disorder Inventory and the Eating Attitudes Test), which are also widely used, but which may yield inaccurate conclusions regarding disordered eating in people with type 1 diabetes. These measures do not take into account that diabetes self-management includes monitoring diet, counting carbohydrates and counterintuitive eating practices such as eating when not hungry to treat hypoglycaemia [9,42]. Another key issue with existing screening instruments including the DEPS-R, mSCOFF and SEEDS, is that these measures do not differentiate between subtypes or severity of disordered eating or eating disorders, despite evidence for different pathways and symptom profiles for disordered eating in this group.

**<H2>Treatment for disordered eating in people with diabetes**

There is limited evidence of effective interventions for reducing disordered eating and insulin omission and improving glycaemic management. Six intervention studies have been published [43]. Although there was an improvement in eating disorder symptom scores in some interventions [S16], none showed a significant improvement in HbA$_1$c. The main components of these interventions were based on psychotherapies identifying and challenging cognitions and affect about disordered eating, but not diabetes knowledge, diabetes-related negative affect, diabetes self-management skills or safe insulin management. This lack of diabetes integration into the disordered eating treatment may partly explain why these interventions did not improve glycaemic management. Moreover, healthcare professionals who see people with type 1 diabetes and disordered eating perceive that they do not have the skills to treat comorbid type 1 diabetes and disordered eating, and lack the support and specialist care pathway to do so [44,45]. Specific pathways and multidisciplinary approaches delivering specialized care in type 1 diabetes and eating disorders or disordered eating, are considered essential for future interventions, by both healthcare professionals and people with lived experience of type 1 diabetes and eating disorders [44]. Novel ideas regarding preventative or treatment strategies for this complex comorbid condition should clearly be explored. A useful starting point for researchers and clinicians is Goebel-Fabbri’s 2017 book [46] which collates evidence from qualitative interviews and clinical experience regarding disordered eating in women with type 1 diabetes, and details possible pathways for effective interventions. As yet, screening and diabetes-specific interventions for
disordered eating in type 2 diabetes have not received adequate attention in research or clinical practice.

**What are the current gaps? Remaining questions and future research directions for disordered eating in people with diabetes**

There remain key gaps in our knowledge which are impeding our options to support people with comorbid disordered eating and diabetes. First, more mixed-methods research is needed to improve understanding of the key risk factors, their interactions with each other, and the onset and course of disordered eating. Some key diabetes-related psychosocial factors (e.g. diabetes distress, diabetes burnout, fear of hypoglycaemia/hyperglycaemia) have received limited research attention regarding their potential role in disordered eating; thus, future investigations should ascertain relationships between these and disordered eating. Furthermore, the possible distinct patterns of disordered eating, as well as the varied trajectories of disordered eating, should be explored further, to allow for the possibility of tailored treatment and/or preventative approaches.

Preliminary investigations are exploring factors that may fill gaps in the current conceptualization of disordered eating in diabetes, and which may present opportunities for treatment and prevention efforts for this comorbidity. For example, although there is an existing evidence-base for general cognitive difficulties (i.e. unrelated to the acute experience of hypo- or hyperglycaemia) in both people with type 1 diabetes and type 2 diabetes [S17,S18], research is yet to draw clear links between cognitive vulnerabilities and disordered eating in this clinical group. However, two recent studies showed unique relationships between cognitive functioning (self-reported executive functioning and early attentional processing, respectively) and disordered eating in young adults with type 1 diabetes relative to control groups without diabetes [47,48]. These investigations are preliminary and require replication in larger independent samples; however, further investigation into cognitive correlates of disordered eating in diabetes could be fruitful, as cognitive interventions for disordered eating have been explored in populations without diabetes [S19] and may present an opportunity for treatment or prevention in people with diabetes.

In order to further explore both the contributing factors and the patterns/trajectories of disordered eating in diabetes, studies with longitudinal or time-series designs are needed. A particularly promising methodology for establishing the temporal relationships between disordered eating and related factors is ecological momentary assessment. Studies conducted thus far on this topic using ecological momentary assessment methods [33,34] have provided valuable evidence regarding the
antecedents and consequences of disordered eating in groups with type 1 diabetes, and the field
would benefit from further investigations of this nature.
Finally, there is a clear paucity of research examining the nature, associated risk factors and
consequences of disordered eating in people with type 2 diabetes. Very little is currently known
regarding the similarities (or differences) between the aetiologies and correlates of disordered
eating in type 1 diabetes compared with type 2 diabetes. It is possible that research in this area has
been somewhat stunted by the idea that the relationship between disordered eating and type 2
diabetes is simply increased caloric intake leading to increased weight status, and increased weight
status leading to type 2 diabetes. Indeed, some evidence suggests that, in contrast to in people with
type 1 diabetes, where diabetes diagnosis almost always precedes disordered eating, binge
eating/disordered eating may constitute a risk factor for the development of type 2 diabetes, via
relationships with weight status (reflecting an opposite relationship) [29]. However, this may also
be explained by the higher average age of onset for type 2 diabetes, as diagnosis often occurs after
the peak risk period for developing disordered eating has passed. Some accounts have also posited
that insulin resistance may be a key mediator between disordered eating (particularly binge eating)
and type 2 diabetes [49]. However, research is too limited at this stage to draw firm conclusions
regarding this, and more longitudinal investigations are needed. It may also be the case that there
is a shared pathophysiological mechanism for both diabetes and disordered eating, as a link
between insulin sensitivity and eating disorders has been found in a genome-wide association
study [50], and this hypothesis should also be explored in future studies. Although research is
limited, there is enough evidence to suggest that disordered eating may be a significant problem
for people living with type 2 diabetes [11,29], and thus, research in this area should move forward.

**Conclusion**
The past 25 years of psychological research into disordered eating in people with diabetes has
contributed substantially to characterizing the problem in people with type 1 diabetes,
understanding the risk factors and mechanisms involved in precipitating and perpetuating the
problem, and, to a much lesser degree, exploring opportunities for intervention and prevention.
However, substantial gaps remain, particularly regarding definition of the different disordered
eating pathologies that can occur in people with diabetes, and effective preventative and treatment
interventions. There is a substantial lack of research regarding the mechanisms and treatment of
disordered eating in people with type 2 diabetes.
Healthcare professionals working in this area face considerable challenges at this stage. There is a need for those who have experienced positive outcomes in the care of individuals with comorbid diabetes and disordered eating to disseminate their experiences to the wider clinical community. Additionally, healthcare professionals need to remain cognizant that current screening tools and diagnostic categories for disordered eating in people with diabetes are limited, and make every effort to tailor care individually (taking into account medical risk), with multidisciplinary input wherever possible. Alongside this, research from a psychological perspective, in the context of a broader, multidisciplinary approach, is essential in this area, due to the inherent complexity of living with diabetes and the various factors and inter-relationships involved in shaping and maintaining eating patterns. There is still significant work to be achieved, in order to better characterize the different (and potentially aetiologically distinct) features of disordered eating in people with type 1 and type 2 diabetes, improve the identification of these in clinical settings, and develop and implement evidence-based, effective interventions to prevent and treat this serious problem.

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**References**


Nip ASY, Reboussin BA, Dabelea D, Bellatorre A, Mayer-Davis EJ, Kahkoska AR et al. Disordered eating behaviors in youth and young adults with type 1 or type 2 diabetes receiving insulin therapy: the SEARCH for Diabetes in Youth Study. *Diabetes Care* 2019; **42**: 859–866.


Supporting Information

Additional Supporting Information may be found in the online version of this article.

Doc. S1. Supplementary references.

Table S1. Key studies exploring the prevalence of eating disorders and/or disordered eating in people with type 1 and type 2 diabetes since 1995.