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DIABULIMIA IN YOUNG ADULTS WITH TYPE 1 DIABETES: THE POTENTIAL OF CONTINUOUS GLUCOSE MONITORING DATA FOR EARLY DETECTION OF DISORDERED EATING BEHAVIORS – A SYSTEMATIC REVIEW

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ABSTRACT

Diabulimia is a disorder that occurs in people with type 1 diabetes, characterized by the deliberate reduction or omission of insulin doses in order to lose weight. This behavior is associated with worse glycemic control and an increased risk of acute and chronic complications of diabetes. The aim of this review article was to analyze the current evidence on diabulimia in young adults with type 1 diabetes and to assess the potential of data from Continuous Glucose Monitoring (CGM) systems in the early detection of eating disorders. The literature review was based on publications retrieved from the PubMed, ScienceDirect, Scopus, and Google Scholar databases. The analysis showed that individuals who intentionally omit insulin are more likely to have higher HbA1c levels, experience episodes of diabetic ketoacidosis, and exhibit abnormal glycemic patterns visible in CGM data. The available studies suggest that analysis of CGM parameters may support earlier identification of patients at risk for diabulimia; however, further research is needed to confirm their diagnostic value.

KEYWORDS

Diabulimia, Type 1 Diabetes, Continuous Glucose Monitoring (CGM), Eating Disorders, Insulin Skipping, Young Adults

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Introduction

Type 1 diabetes is a chronic autoimmune disease characterized by the destruction of pancreatic β -cells, leading to complete insulin deficiency and the need for lifelong insulin therapy. Effective treatment of this disease requires regular insulin administration, continuous glucose monitoring, dietary planning, and the patient's active involvement in daily treatment decisions. Although modern technologies used in diabetes care have significantly improved glycemic control and reduced the risk of complications, the constant demands of self-management can negatively affect mental well-being, particularly among adolescents and young adults [1,2]. Early adulthood is a critical period during which people with type 1 diabetes take on greater responsibility for managing their condition while also facing challenges related to school, work, and social life. The pressure to maintain good glycemic control, combined with concerns about appearance and weight, may increase the risk of developing eating disorders. Previous studies have shown that eating disorders are more common among people with type 1 diabetes than in the general population, especially among young women, although they are also increasingly being diagnosed in men [3,4].

One of the most serious eating disorders associated with diabetes is diabulimia—a term commonly used to describe the deliberate reduction or skipping of insulin doses in order to lose weight. Although diabulimia is not formally recognized as a distinct psychiatric diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), it is widely recognized as a dangerous form of eating disorder characteristic of people with type 1 diabetes [5]. Skipping an insulin dose leads to persistent hyperglycemia and glycosuria, resulting in the loss of glucose and calories in the urine. As a result, patients may experience rapid weight loss, which reinforces the tendency to repeatedly reduce insulin doses despite serious health consequences [5,6]. The development of diabulimia is a complex process involving biological, psychological, and social factors.

Identified significant risk factors include: fear of weight gain after starting insulin therapy, body dissatisfaction, depression, anxiety, perfectionism, and diabetes-related stress [3,7]. Furthermore, the daily focus on counting carbohydrates, body weight, meals, and blood glucose measurements may inadvertently contribute to an unhealthy approach to nutrition and body image in individuals susceptible to this condition. Because missed insulin doses may go unnoticed for a long time, many patients are not diagnosed until serious metabolic complications have already developed [5,8].

Diabulimia is associated with both acute and long-term health consequences. Repeatedly skipping insulin doses significantly increases the risk of diabetic ketoacidosis (DKA), one of the leading causes of

hospitalization among young people with type 1 diabetes. In the long term, chronic hyperglycemia accelerates the development of microvascular complications, including diabetic retinopathy, nephropathy, and neuropathy, while also increasing the risk of cardiovascular disease and premature mortality [6,9]. Early identification of at-risk individuals is therefore crucial for improving clinical outcomes and reducing preventable complications. Many patients deliberately conceal missed insulin doses due to shame, social stigma, or fear of losing their independence in managing their diabetes. Consequently, there is growing interest in identifying objective indicators that could aid in the early detection of high-risk behaviors.

Continuous glucose monitoring (CGM) has become an essential component of modern diabetes care. In addition to improving glycemic control, CGM systems provide detailed information on glycemic trends, including time in range (TIR), time above range (TAR), time below range (TBR), glycemic variability, and the glycemic control index (GMI) [11]. These metrics can reflect behavioral patterns associated with skipping insulin doses, such as prolonged hyperglycemia, high glucose variability, and delayed correction of elevated glucose levels. Therefore, CGM data can serve as a valuable source of objective information for identifying individuals at risk of diabulimia before serious clinical complications develop [11,12].

Reviews method

A systematic search was conducted between 2010 and 2025, as they cover the most recent research on the use of CGM systems and eating disorders in people with type 1 diabetes. The review is from PubMed and Science Direct, Scopus and Google Scholar. Particular attention was given to studies published within the last five years to reflect recent advances in diabetes technology and digital health. The following keywords were used: diabulimia, type 1 diabetes, insulin omission, intentional insulin restriction, eating disorders, disordered eating, continuous glucose monitoring, CGM, glucose variability, time in range, hyperglycemia, artificial intelligence and diabetes. An initial selection of titles and abstracts was conducted, followed by an analysis of the full texts of the selected articles. The bibliographies of the most important articles were also reviewed. Studies not directly related to the topic, non-peer-reviewed sources, and conference abstracts lacking complete data were excluded.

Results

Characteristics and the prevalence of diabulimia

The scientific literature has consistently shown that people with type 1 diabetes are at greater risk of developing eating disorders than people without diabetes [3,4,7]. Although the reported prevalence rates vary across studies, mainly due to the use of different screening tools and study populations, young adults are considered one of the highest-risk groups. It affects female patients more frequently; however, recent studies indicate that skipping insulin doses and other eating behavior disorders also occur in men, suggesting that this problem should not be viewed as unique to women [3,5,7]. Diabulimia is characterized by the deliberate restriction or skipping of insulin doses for the purpose of weight loss. This behavior is unique to people with type 1 diabetes and differs from other eating disorders in that manipulating insulin doses becomes the primary method of weight control [5,12]. Several studies have noted that many patients do not openly admit to skipping insulin doses, which makes it difficult to estimate the true prevalence. As a result, diabulimia is believed to be underdiagnosed in routine clinical practice [5,8].

Factors Associated with Skipping Insulin Doses

The studies included in this review identified several factors associated with the development of diabulimia. Dissatisfaction with body image and fear of weight gain after starting insulin therapy were the most commonly reported reasons for intentionally reducing insulin doses [3,5,7]. Psychological factors, such as depression, anxiety, diabetes-related stress, and low self-esteem, were also frequently associated with a higher prevalence of eating disorders [4,8]. The daily demands of managing diabetes may also contribute to this problem. Constant attention to meals, carbohydrate counting, body weight, and blood glucose levels may increase the risk of unhealthy eating behaviors, especially among young adults, who are already susceptible to social pressure regarding physical appearance [4,5].

Table 1. Major risk factors associated with diabulimia

Risk factory	Clinical significance
female sex	most studies reported a higher prevalence
fear of weight gain	there are frequent reports of a lack of motivation to reduce insulin intake
body dissatisfaction	strong predictor of insulin omission
depression and anxiety	increase the likelihood of being unable to control insulin dosage
perfectionism	associated with disordered eating behaviours
diabetes distress	may contribute to intentional insulin omission

Clinical consequences of diabulimia

Deliberately skipping insulin doses has serious clinical consequences. Most studies indicate that patients with diabulimia have poorer glycemic control, as reflected in higher HbA1c levels and more frequent episodes of prolonged hyperglycemia [5,6,9]. Recurrent diabetic ketoacidosis (DKA) was one of the most common acute complications and often resulted in hospitalization [6,9].

Long-term reduction of insulin doses was also associated with an increased risk of microvascular complications, including diabetic retinopathy, nephropathy, and neuropathy. Furthermore, some prospective studies have shown a higher mortality rate among patients who persistently skip insulin doses compared to those who adhere to insulin therapy recommendations [6,9].

Current methods used to identify diabulimia

Several screening methods have been proposed for identifying eating disorders in people with type 1 diabetes. The Diabetes Eating Problem Survey-Revised (DEPS-R) is currently the most widely used questionnaire tailored to the needs of people with diabetes and has demonstrated good accuracy in identifying patients at increased risk [10]. Other methods include structured clinical interviews, psychological assessment, and analysis of the patient's diabetes history.

Despite these tools, early diagnosis remains challenging because many patients deliberately conceal their failure to take insulin doses. In clinical practice, recurrent episodes of diabetic ketoacidosis (DKA), unexplained weight loss, and persistently elevated HbA1c levels often raise suspicion of an eating disorder, although these symptoms typically do not appear until the disease has progressed [5,10].

Continuous Glucose Monitoring and early detection of disordered eating behaviours

Recent publications have highlighted the growing role of continuous glucose monitoring (CGM) in identifying patterns that may indicate a missed insulin dose [11]. Unlike HbA1c, which reflects average glycemic control over several months, CGM provides continuous information on daily fluctuations in glucose levels. This allows healthcare professionals to assess parameters such as time in range (TIR), time above range (TAR), time below range (TBR), glucose variability, and the glycemic control index (GMI) [11].

In the studies analyzed, individuals suspected of skipping insulin doses often exhibited prolonged periods of hyperglycemia, increased time above target (TAR), reduced time in range (TIR), and greater glucose variability compared to patients adhering to their insulin therapy [11,13]. Although these patterns alone are not sufficiently specific to diagnose diabulimia, they can help clinicians identify patients requiring further psychological evaluation [10,11].

The literature also suggests that CGM should be viewed as a supplementary rather than a substitute screening tool. Combining CGM metrics with questionnaires, such as the DEPS-R, and routine clinical assessment may improve the early identification of patients at risk for eating disorders [10,11,14].

Table 2. Potential CGM-derived markers associated with missed insulin doses

CGM metric	Potential finding in diabulimia
Time in Range (TIR)	decreased
Time Above Range (TAR)	increased
average glucose level	elevated
glucose variability	increased
Glucose Management Indicator (GMI)	elevated
prolonged hyperglycemia	frequently observed
delayed correction of hyperglycemia	this may indicate missed insulin doses

Discussion

Interpretation of the main findings

The studies included in this review indicate that eating disorders are more common among people with type 1 diabetes than in the general population. Although the reported prevalence varies across studies, most authors agree that intentionally skipping insulin doses is one of the most characteristic and clinically significant behaviors associated with diabulimia [3,5,7]. This finding is particularly important because skipping insulin doses is a phenomenon unique to people with type 1 diabetes and may go unnoticed for a long time.

Another important observation is that diabulimia should not be viewed solely as an eating disorder. The reviewed literature suggests that it is a complex condition influenced by metabolic, psychological, and social factors. It appears that the following contribute to the reduction of insulin doses: fear of weight gain, dissatisfaction with body image, depression, anxiety, and stress related to diabetes [4,7,8]. Therefore, effective treatment requires collaboration among endocrinologists, psychologists, dietitians, and diabetes educators, rather than focusing solely on glycemic control.

Clinical significance of CGM in the early detection of diabulimia

One of the most important findings of this review is the potential role of continuous glucose monitoring (CGM) in the early detection of eating disorders in people with type 1 diabetes. Although CGM systems were developed primarily to improve glycemic control, recent studies suggest that the data generated by these devices may also provide insight into patients' self-management behaviors [11,14].

Traditional markers, such as HbA1c, continue to play an important role in diabetes care; however, they provide only an average glucose value over the past two to three months. Consequently, HbA1c does not reflect daily fluctuations in glucose levels nor does it allow for the identification of specific behavioral patterns that might suggest intentional skipping of insulin doses. In contrast, CGM provides continuous glucose measurements, allowing clinicians to assess time in range (TIR), time above range (TAR), glucose variability, and the glycemic control index (GMI) [11].

A review of the literature indicates that individuals who intentionally restrict their insulin administration often exhibit characteristic glycemic profiles. These include prolonged hyperglycemia, a shortened TIR, a prolonged TAR, and delayed correction of elevated glucose levels [11,13]. Although these findings are not specific to diabulimia, they may alert healthcare providers to the need to consider conducting an additional psychological evaluation. This is particularly important because many patients do not openly report skipping insulin doses during routine clinical visits [5,10].

Another advantage of continuous glucose monitoring (CGM) is that it provides objective data, independent of the patient's self-report. Previous studies have shown that screening questionnaires, such as the DEPS-R, are useful for identifying individuals at increased risk of eating disorders; however, they rely on honest responses and may underestimate the actual prevalence of insulin skipping [10,14]. Combining questionnaire results with CGM data may therefore improve the identification of patients requiring additional assessment. Overall, the available data suggest that continuous glucose monitoring (CGM) may become an important component of a multidisciplinary approach to detecting eating disorders in people with type 1 diabetes. Nevertheless, additional prospective studies involving larger populations are needed to determine which CGM parameters have the greatest diagnostic value and whether they can be included in future screening guidelines [11,14].

Comparison with previous studies

The available data indicate a high degree of agreement on the relationship between missed insulin doses and poor glycemic control. Most studies have reported higher HbA1c levels, more frequent episodes of diabetic ketoacidosis (DKA), and an increased risk of chronic diabetic complications in individuals with suspected diabulimia [5, 6, 9]. Long-term reduction of insulin doses was associated with a higher risk of diabetes-related morbidity and mortality, underscoring the serious consequences of this behavior [20].

Previous studies have also consistently shown that people with type 1 diabetes are at greater risk of developing eating disorders than those without diabetes. One of the earliest studies conducted showed that adolescent girls with type 1 diabetes reported significantly more eating-related behavioral disorders than those in the control group, suggesting that diabetes itself may increase susceptibility to eating disorders [18]. These findings were later confirmed by a higher prevalence of eating disorders among women with type 1 diabetes across various populations [21]. Recent systematic reviews have reached similar conclusions, although they also emphasize that the reported prevalence varies significantly depending on the study population and the screening methods used [3,7]. Despite consensus on the link between insulin dose skipping and adverse clinical outcomes, significant differences still exist among individual studies. Some authors have reported a relatively low rate of insulin dose skipping, while others have found that this behavior was significantly more common, particularly among adolescent girls and young women [3,7,22]. These discrepancies likely stem from differences in study design, sample size, participants' ages, and the screening tools used to identify eating disorders. Furthermore, many studies relied on self-reported questionnaires, which may lead to an underestimation of the actual prevalence, as patients are often reluctant to admit to intentionally skipping insulin doses [10,14].

Another key difference concerns the definition of diabulimia itself. There is still no universally accepted diagnostic definition for this condition, and many studies use varying terminology [16]. This failure to standardize makes it difficult to compare studies and may partly explain why prevalence estimates vary widely in the literature. The studies analyzed also suggest that psychological factors play a significant role in the development of insulin-skipping behavior. Fear of weight gain, body dissatisfaction, depression, and diabetes-related stress have been repeatedly identified as major factors contributing to eating disorders [5,8,17]. It has been shown that disturbed eating attitudes are associated with poorer metabolic outcomes, indicating that mental well-being and diabetes management are closely linked [19]. Overall, the available literature supports the view that diabulimia should be treated not only as a metabolic problem but also as a psychological condition requiring multidisciplinary treatment.

Strengths and limitations of current evidence

A review of the literature suggests a growing interest in the relationship between technology used in diabetes and eating disorders. Over the past decade, there has been a significant increase in the number of studies on insulin skipping, diabetes-related stress, and the potential role of continuous glucose monitoring (CGM) [7,11]. This has led to a better understanding of the clinical characteristics of diabulimia and has highlighted the importance of early diagnosis and multidisciplinary management. Another strength of the current state of knowledge is the growing availability of screening tools designed specifically for people with diabetes. Tools such as the revised Diabetes Eating Problem Survey (DEPS-R) have improved the identification of individuals at increased risk for eating disorders and are now widely recommended in both research and clinical practice [10]. Moreover, the latest clinical guidelines published by the American Diabetes Association and the International Society for Pediatric and Adolescent Diabetes emphasize the importance of routine psychological assessment as part of comprehensive diabetes care [24,25]. These recommendations reflect a growing realization that mental health is an essential component of effective diabetes treatment. Despite this progress, several significant limitations remain. Most of the available studies are observational or retrospective in nature, making it difficult to establish cause-and-effect relationships between insulin skipping and clinical outcomes [7,14]. Although many studies show strong associations, it is not always possible to determine whether psychological problems lead to insulin skipping or whether poor diabetes control contributes to psychological stress.

Many studies also involve relatively small sample sizes and are conducted at specialized diabetes centers, which may limit the generalizability of the results. Participants recruited from specialized clinics often receive more intensive diabetes care than the general population of people with type 1 diabetes, meaning that the reported prevalence of eating disorders may not fully reflect routine clinical practice [16,22]. Another drawback is the previously mentioned lack of a universally accepted definition of diabulimia, which makes it difficult to

compare studies [10,14,16]. Furthermore, insulin skipping is often assessed using self-report questionnaires, which increases the risk of systematic error, as many patients may intentionally conceal this behavior [5,17].

The available literature focuses primarily on adolescent girls and young women. Although this group is considered to be at the highest risk, relatively few studies have examined eating disorders in men, older adults, or individuals from diverse cultural and socioeconomic backgrounds [18,21,22]. This limits our understanding of how diabulimia may manifest in different patient populations.

Although recent studies suggest that CGM may support the early identification of insulin skipping, the evidence for this remains limited. Most published studies evaluate glycemic outcomes rather than the diagnostic effectiveness of CGM-derived metrics in detecting disordered eating behaviors [11,14]. Large prospective studies are still needed to determine which CGM parameters are the most reliable indicators of insulin skipping and how they should be incorporated into routine diabetes care.

Future directions and clinical relevance

Even though interest in diabulimia has increased significantly over the past decade, many questions remain regarding its diagnosis and treatment. One of the most promising areas is the use of data from continuous glucose monitoring (CGM). The current evidence suggests that CGM can identify recurring trends of prolonged hyperglycemia, increased glycemic variability, and reduced time in range (TIR), which may be associated with intentional skipping of insulin doses [11]. However, these observations are based primarily on observational studies, and there remains limited evidence to determine which CGM parameters are the most accurate indicators of diabulimia. Future prospective studies should assess the sensitivity and specificity of individual CGM indicators and determine whether they can reliably distinguish insulin skipping from other causes of poor glycemic control. Another important area is the integration of different sources of clinical information. Instead of analyzing only CGM data, future screening strategies could combine glycemic profiles with insulin pump records, HbA1c results, questionnaires such as the DEPS-R, and information obtained during routine clinical visits [10,11,14]. Several authors have also highlighted the growing role of digital health technologies and artificial intelligence in diabetes care [11,16]. In the future, machine learning algorithms may be able to identify blood glucose patterns that are difficult to detect during routine clinical evaluation. Although these technologies are still in the early stages of development, they may support healthcare workers by identifying patients who could benefit from further psychological assessment. Nevertheless, further research is needed before these tools can be implemented in routine clinical practice. Standardizing diagnostic criteria would improve the comparability of future studies and facilitate the development of evidence-based clinical practice guidelines. It would also facilitate the estimation of the true prevalence of insulin skipping and the evaluation of the effectiveness of various interventions. Several professional organizations, including the American Diabetes Association (ADA) and the International Society for Pediatric and Adolescent Diabetes (ISPAD), emphasize the importance of integrating psychological care into routine diabetes management [24,25]. Future research should therefore focus not only on new diagnostic technologies but also on evaluating interdisciplinary interventions that combine diabetes care, psychology, nutritional counseling, and diabetes education.

Conclusions

In young adults with type 1 diabetes, diabulimia and related eating disorders are consistently associated with poorer glycemic outcomes, including longer time spent outside the target range, shorter time spent within the target range, greater glycemic variability, and more frequent inappropriate use or skipping of insulin doses. In the studies I found, CGM patterns alone were not sufficient to diagnose eating disorders, but they did reveal a recognizable risk signal: persistent hyperglycemia, unstable glycemic trends, and behavioral patterns-such as skipping bolus doses or concealing insulin administration-which should prompt further psychosocial evaluation. The most compelling interpretation is that CGM is best viewed as an early-warning tool rather than a standalone screening test. It can help doctors identify patients who may be struggling with issues before they become clinically apparent, but it cannot replace routine screenings or direct discussions about nutrition, insulin use, body image, and stress. This makes CGM potentially valuable for early detection, especially when combined with validated questionnaires and multicomponent monitoring. However, the evidence still comes from small observational studies and reviews, so this is more of a promising sign than an established diagnostic strategy. These results come from a preliminary search, so more targeted searches could reveal additional studies specifically focusing on young adults and newer CGM systems.

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