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Investigating trait emotional intelligence and perceived support from family and friends as buffering factors against disordered eating behaviours and poor glycaemic control in adolescents with type 1 diabetes

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ABSTRACT

Adolescents with type 1 diabetes (T1D) face an increased risk of developing disordered eating behaviours (DEBs), exacerbating glycaemic control issues. This study, involving 60 adolescents with T1D (61.7% females) aged 13–19 ($M = 15.92$, $SD = 1.99$), aimed to investigate how trait Emotional Intelligence (EI) and perceived support influence DEBs and glycaemic control. A path analysis explored: 1) the relationship between trait EI and HbA1c levels via perceived family and friend support and DEBs, and 2) the link between zBMI and HbA1c through DEBs. Covariates included sex, age, years since diagnosis and insulin dose. zBMI positively influenced HbA1c through DEBs (β = .21, 95% BC CI [.10, .39]). Trait EI negatively influenced HbA1c through DEBs and family support (β = -0.14, 95% BCCI [−.31, −.04]). The findings highlight the importance of trait EI and family support in reducing the risks of DEBs and elevated HbA1c levels in adolescents with T1D.

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Type 1 diabetes; adolescents; trait emotional intelligence; disordered eating behaviours; eating disorders; HbA1c

Introduction

Type 1 diabetes (T1D) is the most common endocrine and metabolic condition affecting children and adolescents worldwide (Patterson et al., 2019), with its global incidence and prevalence among youth steadily rising (Cherubini et al., 2022). T1D is characterized by persistent and complete insulin deficiency due to autoimmune destruction of pancreatic β-cells (Gregory et al., 2022), necessitating lifelong and demanding treatment, involving blood glucose monitoring, permanent insulin therapy, adequate dietary management, and regular exercise (Kim, 2022).

Managing T1D presents significant challenges for adolescents (Deeb et al., 2018), as evidenced by notable declines in treatment adherence observed during the transition from childhood to adolescence (Rausch et al., 2012). This period is characterized by notable physical changes and psychosocial maturation, during which adolescents strive to shape their personal identity amidst emotional instability and a constant desire for autonomy. In this transitional phase, adolescents may feel 'tied' by continuous blood checks and parental supervision and overwhelmed by the sense of perceiving themselves as 'different' from their peers due to diabetes (Kim, 2022). These tensions, besides contributing to greater difficulty with diabetes self-management, can lead to personal and family distress and psychological problems (Dabas et al., 2023), including disordered eating

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behaviours (DEBs), i.e. subclinical or milder forms of eating behaviours, including unhealthy dieting, binge eating, and purging (Cherubini et al., 2018; Troncone et al., 2022). Notably, compared to their peers without diabetes, adolescents with T1D exhibit a higher prevalence of DEBs (Troncone et al., 2020). Among weight loss methods, the intentional omission or restriction of necessary insulin doses for the purpose of weight loss is frequently observed in individuals with T1D (Wisting & Snoek, 2020). This behaviour is exclusive to people with diabetes and is sometimes informally referred to as 'diabulimia', although this term is criticized in the literature for its imprecision and potential to mislead (Wisting & Snoek, 2020). In individuals with T1D, the intentional omission of insulin, as well as the occurrence of DEBs more generally, can result in elevated levels of glycosylated haemoglobin (HbA1c), which are associated with an increased risk of morbidity due to diabetes-related complications (e.g. diabetic ketoacidosis, retinopathy, neuropathy, and nephropathy) and with a heightened risk of mortality (Dabas et al., 2023; Hall et al., 2021; Marks et al., 2024).

Given the substantial long- and short-term complications stemming from the co-occurrence of T1D and disordered eating, recent studies have sought to identify the underlying mechanisms of the association between T1D and DEBs. A higher risk of DEBs is associated with body image and weight dissatisfaction, higher body mass index z-scores (zBMI) (Neumark-Sztainer et al., 2002; Rancourt et al., 2019; Salah et al., 2022; Smith et al., 2020; Troncone et al., 2018, 2022), diabetes-specific dietary regimen, hunger/satiety disruptions, and diabetes-specific negative affect (Rancourt et al., 2019; Smith et al., 2020), emotional and behavioural problems (Troncone et al., 2020, 2022), and anxious-depressive symptoms (Salah et al., 2022). Female adolescents appear to be more susceptible to the onset of DEBs (Smith et al., 2020; Troncone et al., 2022). Moreover, previous research has found a positive association between zBMI and HbA1c via disordered eating in adolescents with T1D (Troncone et al., 2023).

According to previous theoretical accounts (Treasure et al., 2015) the maintenance of DEBs in T1D may be influenced by environmental exposures relating to concerns about weight/shape (e.g. 'fat talk'). Within the context of diabetes management, these experiences may amplify the salience assigned to eating habits, body shape, weight, and efforts to manage them, potentially resulting in dietary restriction and/or insulin mismanagement to achieve weight loss (De Paoli & Rogers, 2018), depending on the individual's developmental stage, the quality of interpersonal environment and the individual vulnerability traits (Treasure et al., 2015).

Among the personality traits previously studied, perfectionism, emotional liability (Pollock-BarZiv & Davis, 2005), low self-directedness and high harm avoidance (Grylli et al., 2003) appear to be risk factors in the development of eating disorders in youths with T1D. However, studies investigating the impact of personality protective factors and environmental supports on the development of DEBs in adolescents with T1D are still limited, necessitating further investigations. Hence, the present work will focus on a specific personality trait, namely the trait Emotional Intelligence (EI), and on particular environmental factors, specifically perceived support by family and friends, that have been shown to act as buffering factors against eating disorders in preadolescence and adolescence (Cuesta-Zamora et al., 2018) and are still under-studied in adolescents with T1D.

Trait emotional intelligence

Trait EI refers to a constellation of emotion-related dispositions and self-perceptions located at the lower levels of personality (Petrides et al., 2007). It represents a distinct and compound construct concerning individuals' beliefs and perceptions regarding their own emotions (Petrides & Mavroveli, 2020). Trait EI has shown to effectively encompass the set of dimensions that capture the typical way in which individuals process emotional information and respond in emotionally challenging situations (Sarrionandia & Mikolajczak, 2020).

Recent research (Mancini et al., 2024) has underscored the protective function of trait EI for adolescent psychological well-being across diverse contexts. Adolescents exhibiting high trait EI appear less vulnerable to psychological disorders and somatic complaints, and more adept at

employing coping strategies for everyday challenges, compared to their peers with low trait EI (Mavroveli et al., 2007). Moreover, they demonstrate decreased inclination towards self-harm (Mikolajczak et al., 2009) and diminished reactivity in stressful circumstances (Lea et al., 2023) compared to those with lower trait EI levels.

Several studies have started to investigate the associations between trait EI and eating disorders, BMI, and body concerns (Andrei et al., 2018; Cuesta-Zamora et al., 2018). Specifically, Cuesta-Zamora et al. (2018) have proven the role of trait EI in predicting body image dissatisfaction and eating disorder symptoms in preadolescents and adolescents. Their study suggested further investigations on trait EI as it can be a key protective factor of eating problems.

Significantly, trait EI appears to be causally involved in the prediction of health outcomes (Sarrionandia & Mikolajczak, 2020). Recent research on college students at risk of diabetes showed that higher trait EI contributes to preventive actions against diabetes (Bhunga et al., 2023). Moreover, trait EI appears pivotal in the management of chronic conditions (Barberis et al., 2023; Benzo et al., 2016). Notably, in a study involving adults with type 1 and type 2 diabetes, trait EI significantly predicted diabetes self-management behaviours, partially mediated by diabetes-related distress (Schinckus et al., 2018). Despite the growing evidence supporting emotional intelligence as a protective factor in diabetes (Pérez-Fernández et al., 2021), Schinckus and colleagues' study (2018) remains the sole investigation assessing trait EI in people with diabetes, employing the Trait Emotional Questionnaire, in line with Petrides' theory. Furthermore, trait EI remains under-explored in samples of adolescents with T1D, leaving unresolved questions regarding its impact on adolescents' DEBs and glycaemic control.

Perceived support by family and friends

According to the literature, the contributions of family and friends to the quality of metabolic control and emotional support seem to be crucial for adolescents with T1D (Kakleas et al., 2009). Adolescents hailing from supportive and cohesive familial environments and experiencing high-quality relationships with their parents exhibit a propensity for stringent adherence to prescribed treatment regimens and display superior glycaemic control in comparison to those from less cohesive families; the familial support appears crucial especially in the initial phases subsequent to diagnosis (Burroughs et al., 1997). Whereas parental support for adherence (i.e. supporting the adolescent in appropriately following medical advice based on positive patient-medical specialist relationships) is associated with improved HbA1c levels, parental conflict seems to negatively affect glucose control (Yamaguchi et al., 2023).

While parental and familial support remain crucial for managing diabetes throughout childhood and adolescence, peer relationships assume greater significance during adolescence (Wysocki & Greco, 2006). However, their impact on treatment adherence remains uncertain (Datye et al., 2015), and research on the association between peer relations and diabetes yields mixed findings. While some studies suggest that friendships can provide a unique support, complementing parental involvement and enhancing adolescents' diabetes management (Wysocki & Greco, 2006), others indicate that social conflict and increased orientation towards peers may adversely affect diabetes outcomes (Palladino & Helgeson, 2012).

Limited research exists on the familial and peer support's impact on DEBs in young individuals with T1D. Family cohesion has been identified as negatively related to DEBs (Neumark-Sztainer et al., 2002). Furthermore, specific aspects of the family environment, including increased conflict surrounding diabetes-related management tasks, reduced emphasis on family meals, limited parental modelling of healthy eating behaviour and a higher presence of food restriction in the household appear to serve as significant risk factors for DEBs among adolescents with T1D; conversely, a higher presence of restricted foods in the household seems to play the role of a protective factor (Caccavale et al., 2015).

The impact of perceived support from friends on DEBs among young individuals with T1D remains even less explored. However, research in non-diabetic populations has observed that deficits in perceived peer support predict future increases in eating disorder symptoms (Stern et al., 2023). Moreover, DEBs intensify within peer groups due to negative pressures like shared concerns about eating behaviours and body shape (more prevalent among females) and the perception of being more socially accepted with a thin body (more common among males) (Al-Sheyab et al., 2018). Lastly, a greater diabetes stigma is associated with disordered eating in adolescents with T1D (Eitel et al., 2023).

Aims

Examining protective factors that contribute to resilient outcomes can enhance literature's understanding of diabetes adaptation and carry significant implications for clinical practice (de Wit et al., 2022). The literature underscores the role of trait EI and perceived social support in buffering challenges associated with chronic illness management. Therefore, the present study aims to test a model in adolescents with T1D to identify whether the trait EI and perceived support from family and from friends may be associated with DEBs and HbA1c levels. It is hypothesized that the trait EI is positively linked to perceived support from family and friends which, in turn, have a negative association with DEBs. DEBs, in sequence, are hypothesized to be positively associated with HbA1c levels. Consistent with the literature, the model also tests the association among zBMI, DEBs, and glycaemic control. In particular, zBMI is hypothesized to be positively associated with DEBs, which, in turn, are positively linked to HbA1c levels. Lastly, in the hypothesized model, sex, age, years since diagnosis and insulin dose were considered as covariates based on evidence demonstrating their impact on the outcomes under consideration (Boccolini et al., 2023; Clements et al., 2016; Nansel et al., 2013; Pinna et al., 2017).

The hypothesized model is shown in Figure 1.

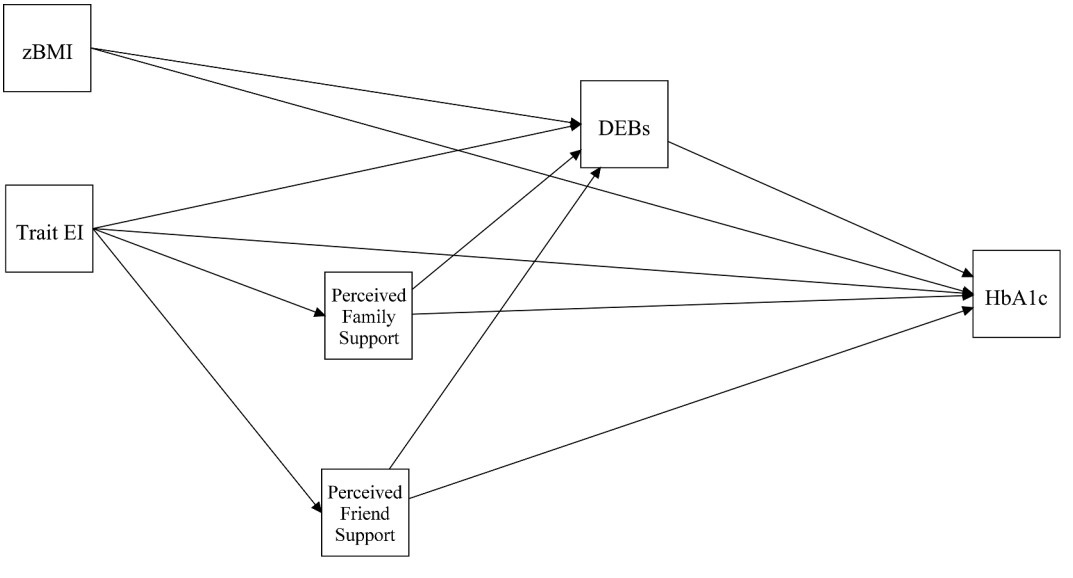

Figure 1. The hypothesized model. The model accounts for the covariates: sex, age, years since diagnosis, and insulin dose. zBMI = standardized body mass index; trait EI = trait emotional intelligence; DEBs = Disordered Eating Behaviours; HbA1c = glycated haemoglobin values.

Materials and methods

Procedure

The study employs an observational and cross-sectional design. Participants were recruited during their diabetologist visits to the Center for Diabetes in Children and Adolescents at Parma University Hospital. Informed consent was obtained from the parents of the participants or from the participants themselves if they were adults. Clinical data (i.e., zBMI and HbA1c) were collected concurrently, during the clinical visit at which the recruitment for the study occurred. Each participant was assigned a code, and the correspondence between the participant's code and personal information were registered into an electronic database accessible exclusively to the centre's staff. Demographic and clinical data were extracted from the medical records and entered into an anonymized electronic database, linked to the respective patient code. Additionally, participants were instructed to follow a link and complete an online questionnaire created with Qualtrics XM, using their assigned codes. The completion of the questionnaires followed the collection of clinical data and did not exceed 1 month from the visit. Data collection occurred in January and February 2024. The study was approved by the Ethical Committee of the Parma University Hospital (Approval number: 6534) and was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

Participants

Sixty individuals from the Center for Diabetes in Children and Adolescents of the Parma University Hospital were recruited. Inclusion criteria were: 1) presence of Type 1 diabetes diagnosis for at least 1 year; 2) age between 13 and 19 years. Details on participants are reported in Table 1.

Measures

Demographic and clinical data

Clinicians collected from medical records a set of demographic and clinical data including sex, age, place of birth, duration of T1D diagnosis, occurrence of coeliac disease and thyroid diseases, type of insulin treatment, insulin dose, zBMI according to Centers for Disease Control and Prevention growth charts (Kuczmarski et al., 2002). Additionally, at the time of the latest clinical evaluation, glycated haemoglobin (HbA1c) value, milestone marker of the patient's glycaemic control, was collected. In alignment with clinical guidelines, HbA1c levels > 7% (53 mmol/mol) were considered above glycaemic targets (Taş et al., 2020). Moreover, via the online questionnaire, participants were asked to specify the gender they identify with. Response options included 'Male,' 'Female,' and 'Other.' To encompass all possible gender identities, the 'Other' option allowed participants to freely express their gender identity through an open-ended response.

Disordered eating behaviours

The Italian version of the Diabetes Eating Problems Survey-revised (DEPS-R, Pinna et al., 2017) was used to measure DEBs. The survey includes 16 items, rated on a 6-point Likert scale (0 = never; 1 = rarely; 2 = sometimes; 3 = often; 4 = usually; 5 = always). Higher scores reflect more disordered eating behaviours and scores ≥20 indicate the presence of DEBs (Markowitz et al., 2010; Troncone et al., 2023). The original DEPS-R shows good psychometric properties in samples of young people with T1D (Markowitz et al., 2010) and the overall reliability and validity of the scale in the Italian version was demonstrated (Pinna et al., 2017). In the current study, the DEPS-R showed a good internal consistency (Cronbach's alpha = .86).

Table 1. Demographic and clinical characteristics, DEPS-R, TEIQue-ASF, friends, and family support of the whole sample.

Characteristics	Sample N = 60
Born in Italy (Yes) *N (%)*	57 (95.0)
Sex *N (%)*	
Females	37 (61.7)
Males	23 (38.3)
Gender Identity *N (%)*	
Cisgender	59 (98.3)
Transgender/Nonbinary	1 (1.7)
Age (Years) *mean (SD) [range]*	15.92 (1.99) [13.00–19.00]
Years since diagnosis *mean (SD) [range]*	7.88 (4.66) [1.00–18.00]
zBMI *mean (SD) [range]*	.42 (.82) [−2.26–1.78]
Comorbidities *N (%)*	
Coeliac disease	7 (11.7)
Thyroiditis	11 (18.3)
Type of therapy *N (%)*	
SAP	45 (75.0)
MDI + GS	14 (23.3)
ODBII + SMBG	1 (1.7)
Insulin dose *mean (SD) [range]*	47.31 (18.03) [8.10–98.40]
HbA1c *mean (SD) [range]*	5 (.82) [5.30–9.90]
DEPS-R *mean (SD) [range]*	16.75 (11.85) [.00–52.00]
TEIQue-ASF *mean (SD) [range]*	4.70 (.86) [3.13–6.67]
Family *mean (SD) [range]*	22.30 (6.43) [4.00–28.00]
Friends *mean (SD) [range]*	22.50 (5.77) [8.00–28.00]

SAP = Sensor-augmented pump; MDI = Multiple daily injections; GS = Glucose sensor; ODBII = Once-daily basal insulin injection; SMBG = Self-monitoring of blood glucose; zBMI = standardized Body Mass Index; HbA1c = glycated haemoglobin values; DEPS-R = Diabetes Eating Problem Survey – Revised; TEIQue-ASF = Trait Emotional Intelligence – Adolescent Short Form (global score); Friends = Friends dimension of the Multidimensional Scale of Perceived Social Support; Family = Family dimension of the Multidimensional Scale of Perceived Social Support.

*$p < .05$ **$p < .01$ ***$p < .001$.

Trait EI

The Trait Emotional Intelligence Questionnaire – Adolescent Short Form (TEIQue-ASF, Petrides et al., 2006) was used to assess trait EI. It includes 30 items designed to measure global trait EI, rated on a 7-point Likert scale (from 1 = 'completely disagree' to 7 = 'completely agree'). In the present work, the global trait EI score was considered, with higher scores reflecting higher levels of trait EI. In the current study, the internal consistency reliability of the global score was .85.

Perceived support from family and friends

The subscales 'Family' and 'Friends' of the Multidimensional Scale of Perceived Social Support (MSPSS, Zimet et al., 1988; Italian version by; Prezza & Principato, 2002) were used to measure the support adolescents perceive from their family and friends. Each subscale is composed of four items rated on a 7-point Likert scale (from 1 = 'strongly disagree' to 7 = 'strongly agree'). Higher scores reflect greater perceived support. Both the subscales showed a good internal consistency ('Family' Cronbach's alpha = .91; 'Friends' Cronbach's alpha = .94).

Data analysis

The software SPSS (IBM Corp., 2017) was used to generate descriptive statistics and preliminary analysis. Pearson's correlation coefficients were calculated to examine the relationships between continuous variables of interest.

The software Mplus 8 (Muthen & Muthen, 2017) was used to conduct a path analysis using maximum likelihood estimation to evaluate the hypothesized pathways. Model fit was assessed using the chi-square statistic, the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI) and the standardized root mean square residuals (SRMR) (Hu & Bentler, 1999; Marsh et al., 2005; Yu, 2002). Associations among constructs as outlined by the hypothesized model (see Figure 1) were estimated within the overall sample. Sex, age, years since diagnosis and insulin dose were included as covariates on all paths. Exploratory tests of indirect effects were conducted using the MODEL INDIRECT command. In adherence to mediation research recommendations (Mackinnon et al., 2004; Preacher & Hayes, 2004), the study employed the bootstrapping technique with 10,000 bootstrap resamples and bias-corrected confidence intervals (BC CIs) to detect significant indirect effects. The mediating effect was considered significant only if the confidence interval did not contain 0.

Results

Preliminary descriptives

Clinical and demographic characteristics and scores at DEPS-R, TEIQue-ASF and Friends and Family dimensions of the MSPSS are shown in Table 1. The 30.0% of the respondents screened positive for DEBs presence (DEPS-R scores ≥ 20).

Pearson correlations between the variables considered in the path analysis are shown in Table 2.

Path analysis

The fit measures of the model were $\chi^2(4) = 3.27$, $p = .514$, RMSEA = 0.0 (0.0; 0.2), CFI = 1.00, TLI = 1.06, SRMR = .02, indicating a good fit. As shown in Figure 2, the results indicated that trait EI was significantly and positively associated with support from family and from friends. Support from family but not support from friends, was significantly and negatively associated with DEBs. Moreover, zBMI was significantly and positively associated with DEBs. DEBs in turn, were significantly and positively associated with HbA1c values. Nor trait EI, zBMI, perceived support from friends and from family were directly and significantly associated with HbA1c values.

In terms of the effects of covariates, as can be observed in Table 3, higher insulin dose was correlated with greater zBMI and HbA1c values. Moreover, sex was significantly associated with zBMI,

Table 2. Pearson's correlations between the variables considered in the path analysis. The correlations shown are unadjusted for any covariates.

	1.	2.	3.	4.	5.	6.
1. TEIQue-ASF	-	.570**.	352**	−.137	−.585**	−.046
2. Family		-	.224	.080	−.472**	.100
3. Friends			-	.113	−.194	.006
4. zBMI				-	.385**	.334**
5. DEPS-R					-	.395**
6. HbA1c						-

TEIQue-ASF = Trait Emotional Intelligence – Adolescent Short Form (global score); Friends = Friends dimension of the Multidimensional Scale of Perceived Social Support; Family = Family dimension of the Multidimensional Scale of Perceived Social Support; zBMI = standardized Body Mass Index; DEPS-R = Diabetes Eating Problem Survey – Revised; HbA1c = glycated haemoglobin values.

* $p < .05$ ** $p < .01$ *** $p < .001$.

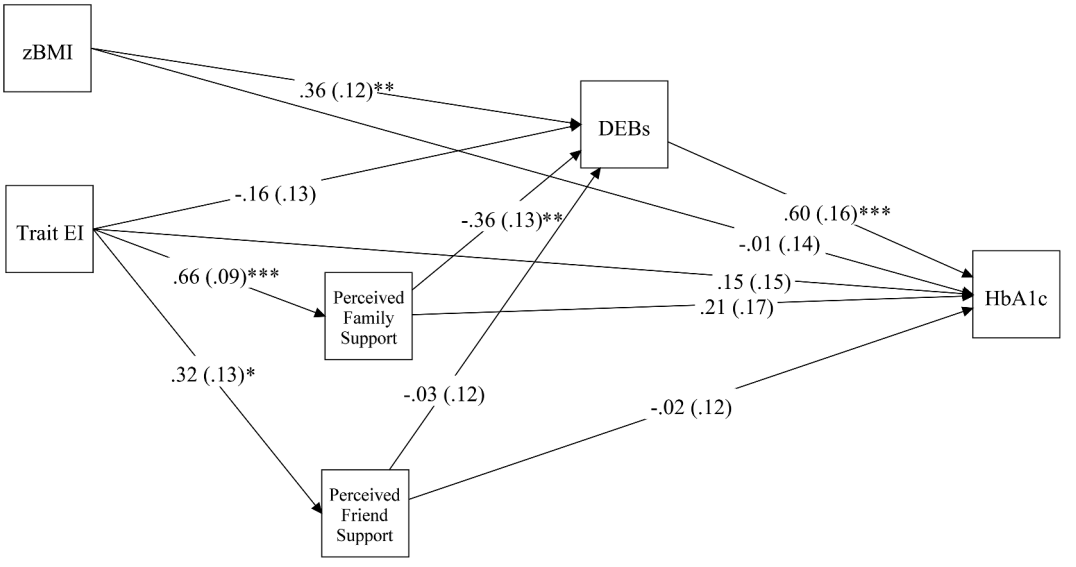

Figure 2. Relations between zBMI, trait EI, perceived support from family and from friends, DEBs, and HbA1c values. Standardized path coefficients. The paths shown are adjusted for covariates: Sex, age, years since diagnosis, and insulin dose. zBMI = standardized body mass index; trait EI = trait emotional intelligence; DEBs = Disordered Eating Behaviours; HbA1c = glycated haemoglobin values. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 3. Standardized effects of the covariates sex, age, years since diagnosis, insulin dose on zBMI, trait EI, support from family and from friends, DEBs and HbA1c values.

	Trait EI	Family	Friends	zBMI	DEBs	HbA1c
Sex	−0.93 (0.24)***	0.53 (0.25)*	−0.15(0.29)	0.55 (0.27)*	0.62 (0.21)**	0.05 (0.27)
Age	0.24 (0.14)	0.3 (0.12)	−0.07 (0.15)	0.20 (0.13)	−0.17 (0.09)	0.07 (0.13)
Years since diagnosis	0.03 (0.13)	0.03 (0.13)	0.07 (0.18)	−0.21 (0.12)	0.03 (0.11)	0.13 (0.13)
Insulin dose	0.13 (0.09)	0.13 (0.12)	0.07 (0.17)	0.41 (0.12)**	−0.11 (0.12)	0.32 (0.15)*

TEIQue-ASF = Trait Emotional Intelligence – Adolescent Short Form (global score); Friends = Friends dimension of the Multidimensional Scale of Perceived Social Support; Family = Family dimension of the Multidimensional Scale of Perceived Social Support; zBMI = standardized Body Mass Index; DEPS-R = Diabetes Eating Problem Survey – Revised; HbA1c = glycated haemoglobin values.
*$p < .05$ **$p < .01$ ***$p < .001$.

DEPS-R, Family and TEIQue-ASF scores. Specifically, females exhibited significantly higher zBMI, more severe DEBs, greater perceived support from family and lower levels of trait EI.

With regard to the bootstrapping method, the analysis of the indirect effects showed the following relationships: trait EI was negatively associated with DEBs via support from family ($\beta = -0.24$, SE = 0.10, BC CIs = [−5.93, −1.078]) and with HbA1c levels via support from family and DEBs ($\beta = -0.14$, SE = 0.08, BC CIs = [−0.309, −0.043]). Moreover, zBMI was positively associated with HbA1c values via DEBs ($\beta = 0.21$, SE = 0.09, 95% BC CIs = [0.102, 0.392]). Trait EI was not associated with DEBs via support from friends ($\beta = -0.01$, SE = 0.04, 95% BC CIs = [−1.260, 0.669]), nor with HbA1c via support from friends and DEBs ($\beta = -0.01$, SE = 0.03, 95% BC CIs = [−0.052, 0.027]).

Discussion

The present study aimed to expand upon established links found in the literature regarding zBMI, DEBs, and HbA1c, by taking into account trait EI and perceived support from family and from friends that may serve as protective factors for DEBs and suboptimal glycaemic control in adolescents with T1D.

In support of the study hypothesis, perceived support from family and DEBs severity serially mediated the relation between trait EI and HbA1c. Specifically, adolescents exhibiting higher levels of trait EI reported greater perceived family support, which, in turn, was associated with a decrease in the severity of DEBs, ultimately resulting in lower HbA1c levels. However, contrary to the study hypothesis, trait EI was not indirectly related to HbA1c nor to DEBs through perceived support from friends. Lastly, consistent with previous evidence (Troncone et al., 2023), the model indicated that, among adolescents with T1D, a higher zBMI is associated with an increased DEBs severity, which in turn is negatively associated with glycaemic control.

Nearly 30% of the participants in our study screened positive for the presence of DEBs, aligning with prior research findings which indicated comparable prevalence rates among samples of Italian adolescents as well as adolescents from diverse international settings (Cherubini et al., 2018; Troncone et al., 2020, 2023; Yafei et al., 2023). Our results suggest that female adolescents with T1D in this sample face greater overall difficulties compared to males. In line with previous research (e.g. Rancourt et al., 2019; Troncone et al., 2022), this study observed that female adolescents displayed more severe DEBs, higher zBMI, and elevated HbA1c levels. Additionally, females reported lower trait EI scores compared to males. However, the literature regarding gender differences in trait EI shows contradictory or inconclusive findings (Shahzad & Bagum, 2012).

Our investigation seems to endorse the idea that perceived support from family, but not perceived support from friends, could potentially mitigate the risks associated with disordered eating, resulting in better glycaemic control. Extensive previous research has underlined that the core of eating disorders is significantly linked to various factors related to family-of-origin (Wilfley et al., 2003). Moreover, research conducted among late adolescent populations without T1D has revealed that peer support is directly associated with adolescents' body dissatisfaction but not with their disordered eating, while low levels of family support resulted directly linked to increased disordered eating (Kirsch et al., 2016). It is worth noting that the type of perceived support examined in this study is emotional in nature. One possible explanation for the lack of significant results regarding the link between perceived support from friends and HbA1c values may be that emotional support (e.g. companionship, helping the adolescent feel accepted), typically provided by peers to friends with T1D (Kyngäs & Rissanen, 2001), may have a lesser impact on glycaemic control compared to a more instrumental and practical support (e.g. reminders for glucose testing), which appears to be even more favoured by adolescents with chronic illnesses, albeit less frequently received (Doe, 2018; Lehmkuhl et al., 2009; Palladino & Helgeson, 2012). In contrast, parental support, particularly from mothers, is considered more reliable by emerging adults compared to support from peers (Johansen et al., 2020; Sparud-Lundin et al., 2010). Indeed, the family plays a crucial role in providing multifaceted support to adolescents with T1D, including practical assistance (e.g. aiding with self-care routines), imparting information (e.g. enhancing knowledge on relevant topics), and offering emotional reinforcement (e.g. providing reassurance, encouragement, and understanding) (Johansen et al., 2020). According to our study, even perceived emotional support from family alone appears to mitigate the risk of elevated HbA1c levels.

Our findings highlight that higher levels of trait EI are associated with greater perceived social support. This is consistent with the literature indicating that individuals with high trait EI have enhanced abilities to develop and maintain supportive social bonds (Kong et al., 2012; Perera & DiGiacomo, 2013). Additionally, our results suggest that the association between greater perceived familial support and lower risk of DEBs and poor glycaemic control may be further strengthened by elevated levels of trait EI. It is noteworthy that certain family attitudes and behaviours, such as parental overreaction and excessive worrying, tend to be negatively perceived by adolescents and may hinder their access to support (Camara et al., 2017). In such circumstances, possessing strong emotional competencies could be crucial for adolescents to mitigate the impact of negative emotions, particularly in stressful situations (Perera & DiGiacomo, 2013). In adolescents with T1D, higher trait EI might enable them to effectively identify and manage their own and others' emotions, better understand their family's concerns, and consequently respond in a manner that is less dismissive

towards family members (e.g. allowing themselves to be supported by others) and less detrimental to themselves. This could lead to a reduction in the inclination to resort to disordered eating as a coping mechanism and effectively address challenges associated with diabetes management, thereby improving glycaemic control.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, self-report measures may have introduced bias due to potential misinterpretation or social desirability. Second, the small sample size limits the generalizability of our results. However, it should be noted that our study found consistency with previous evidence in terms of DEBs prevalence rates and greater vulnerability of female participants. Third, employing path analysis with cross-sectional designs does not allow to establish causal relationships among variables, as it does not account for temporal sequencing or directionality of effects. Particularly, findings derived from cross-sectional study designs are vulnerable to the problem of reverse causation. This issue is particularly relevant to our study, given the interrelated nature of the variables analysed, among which effects could be multidirectional. Notably, as the clinical data (zBMI, HbA1c) and the self-report measures (TEIQue-ASF, DEPS-R, MSPSS) were collected at different moments, important limitations of our study could be the temporality of data collection and the heterogeneity in lag time between measurements. However, the completion of the self-report measures by participants did not exceed 1 month from the visit during which the clinical data were collected. Furthermore, the exclusive focus on emotionally based support measures may overlook other forms of support that could impact outcomes differently. Lastly, additional variables that were not accounted for in the model (e.g. body dissatisfaction, interpersonal conflict/concerns regarding diabetes management, perfectionism, low self-esteem) could be linked to the outcomes of the path analysis. The omission of these variables might have resulted in a model which potentially may overlook other significant factors that could influence the observed associations. These limitations underscore the need for cautious interpretation and suggest avenues for future research to address these methodological constraints.

Conclusions

Despite the above-mentioned limitations, this study advances understanding of DEBs and glycaemic control in adolescents with T1D, investigating the potential protective role of trait EI and perceived support from family and friends. To our knowledge, this is the first study to examine the associations among these variables of interest within a single model.

The investigation of trait EI, a higher-order personality factor, within the framework of T1D, addresses a notable gap in the literature regarding how personality traits are associated with DEBs and suboptimal glycaemic control among T1D-diagnosed adolescents. By exploring trait EI in this population, the study underscores the importance of certain dispositional emotional factors in managing the emotional challenges of T1D. Moreover, the research underscores the crucial role of familial emotional support, as opposed to friends' support, in mitigating risks associated with DEBs and suboptimal glycaemic control among adolescents with T1D.

Recent guidelines from the International Society for Pediatric and Adolescent Diabetes (ISPAD) advocate considering psychosocial factors, including social and family support, in tailoring therapies for young people with diabetes and recommends evidence-based psychosocial interventions for families dealing with conflicts, communication issues, or diabetes distress (de Wit et al., 2022). Aligning with these guidelines and informed by our research findings, we suggest that providing trait EI trainings (Petrides et al., 2016) to adolescents and their families may be crucial within the T1D context. Enhancing the emotional competencies of family members caring for adolescents with T1D could improve parenting styles (Argyriou et al., 2016). This change might improve families' capacity to offer adolescents with T1D that emotional support that seems to play a substantial protective role

against the risks of DEBs and suboptimal glycaemic control. Furthermore, enhancing emotional skills may help adolescents with T1D to develop and maintain supportive social connections and identify and manage emotions more adeptly (Nelis et al., 2009), thus fostering more effective coping strategies to address the multifaceted challenges associated with T1D.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, F.A., upon reasonable request.

Author contributions

Conception and design: F.A., C.Z. and R.B.; Data collection: C.Z., P.L., R.F. and B.I.; Analysis and interpretation of the data: F.A. and R.B.; writing – original draft preparation, F.A. and R.B.; writing – review and editing: F.A., C.Z., P.L., R.F., B.I. and R. B.; supervision: B.I. and R.B.
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