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Relationship between health responsibility and disease acceptance, and its impact on dietary adherence in type 1 diabetic adolescents: the mediating role of eating disorders

Wpływ odpowiedzialności za zdrowie i akceptacji choroby na przestrzeganie diety u nastolatków z cukrzycą typu 1: medycyjna rola zaburzeń odżywiania

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Abstract

Introduction and objective: In type 1 diabetes, responsibility for health and disease acceptance can influence dietary adherence. This study examined how responsibility for health and disease acceptance affect dietary adherence in young patients with type 1 diabetes, considering the role of symptoms of eating disorders. **Materials and methods:** The observational cross-sectional online questionnaire study was conducted in 190 patients aged 12–18 years with type 1 diabetes, or in their parents, between May 2021 and May 2023. The study employed various scales including the Diabetes Dietary Guidelines Adherence Index, Acceptance of Illness Scale, Diabetes Eating Problem Survey-Revised Scale, and Sense of Responsibility for Health Scale. A model was developed from the literature data, showing the influence of responsibility for health and disease acceptance on dietary adherence, considering the mediating role of eating disorders. **Results:** The degree of dietary adherence by adolescents with type 1 diabetes depended on the level of their acceptance of the disease, sense of responsibility for their own health, and severity of symptoms of eating disorders. The level of acceptance of the disease had a negative impact on adherence to the diet, while the effect of the study participants' sense of responsibility for health on their dietary adherence was positive. The occurrence of symptoms of eating disorders had a negative impact on adherence to dietary recommendations. **Conclusions:** When designing and implementing educational interventions for patients with type 1 diabetes, actions aimed at strengthening the sense of responsibility for their own health and identifying the risk of eating disorders should be taken into account.

Keywords: diet, disease acceptance, type 1 diabetes, eating disorder, sense of responsibility for health

Streszczenie

Wprowadzenie i cel: W cukrzycy typu 1 odpowiedzialność za zdrowie i akceptacja choroby mogą wpływać na przestrzeganie diety. Zbadano, w jaki sposób odpowiedzialność za zdrowie i akceptacja choroby wpływają na przestrzeganie diety u młodych pacjentów z cukrzycą typu 1, biorąc pod uwagę rolę objawów zaburzeń odżywiania. **Materiał i metody:** Obserwacyjne, przekrojowe badanie kwestionariuszowe online przeprowadzono wśród 190 pacjentów w wieku 12–18 lat z cukrzycą typu 1 (lub w przypadku młodszych pacjentów wśród ich rodziców) w okresie od maja 2021 do maja 2023 roku. Użyto skal: Diabetes Dietary Guidelines Adherence Index, Acceptance of Illness Scale, Diabetes Eating Problem Survey-Revised Scale oraz Sense of Responsibility for Health Scale. Na podstawie literatury opracowano model pokazujący wpływ odpowiedzialności za zdrowie i akceptacji choroby na przestrzeganie diety, z uwzględnieniem pośredniczącej roli zaburzeń odżywiania. **Wyniki:** Stopień przestrzegania diety przez młodzież z cukrzycą typu 1 zależał do poziomu akceptacji choroby, poczucia odpowiedzialności za własne zdrowie oraz nasilenia symptomów zaburzeń odżywiania. Poziom akceptacji choroby miał negatywny wpływ na przestrzeganie diety, natomiast poczucie odpowiedzialności za zdrowie pozytywnie wpływało na przestrzeganie diety. Wystąpienie objawów zaburzeń odżywiania miało negatywny wpływ na przestrzeganie diety. **Wnioski:** Projektując i wdrażając

interwencje edukacyjne dla pacjentów z cukrzycą typu 1, należy uwzględnić działania mające na celu wzmacnianie poczucia odpowiedzialności za własne zdrowie oraz identyfikujące ryzyko wystąpienia zaburzeń odżywiania.

Słowa kluczowe: dieta, akceptacja choroby, cukrzyca typu 1, zaburzenia odżywiania, odpowiedzialność za zdrowie

INTRODUCTION

Dietary recommendations (DR) and physical activity are key elements of the strategy for treating diabetes mellitus. Adherence to DR is extremely important and has both immediate and long-term effects⁽¹⁾. However, such recommendations can be difficult to follow by children and adolescents.

Real-world evidence (RWE) data show that patients treated with modern insulin pumps integrated with continuous glucose monitoring systems are among the best metabolically balanced populations⁽²⁾. The shortcomings of diabetic care primarily revolve around psychological support, which may fail to meet the expectations of the system or the patients themselves. The majority of problems occur when a young patient moves from paediatric care to adult care in the health system. Due to the lack of appropriate psychological support, free access to an interdisciplinary diabetes team, and the stigmatisation of type 1 diabetes (T1D) in the society, patients encounter multiple problems that may contribute to non-compliance with therapeutic recommendations, including dietary advice, development of disordered eating symptoms (DES) or exclusion from social and professional life. Therefore, achieving optimal dietary adherence in adolescence is a difficult and self-control-intensive challenge. The period of adolescence is accompanied by physiological “hormone storm” making it difficult to achieve normoglycaemia and, at the same time, low self-acceptance, lack of sense of agency, and the desire to belong to a group of healthy peers. All these elements combined with T1D may lead to frustration, rebellion against the disease or depressive states. Understanding the factors that disrupt the implementation of the elements of T1D therapy may contribute to overcoming numerous barriers and improving the efficacy of behavioural therapy^(3,4).

Research on the predictors of dietary adherence is relatively new, and due to the complexity of the phenomenon, it has a limited scope⁽³⁻⁶⁾. However, adolescence is also associated with experimentation and risk-taking, which may affect the results of glycaemic self-control and determine the related clinical effects. It has been shown that adolescence is linked to careless self-control, and non-compliance with dietary and therapeutic recommendations. Such dismissive behaviour is usually unrelated to the lack of knowledge, but rather arises from difficulties associated with the cognitive and developmental characteristics of adolescence, during which making the right decisions is even more complex. Moreover, adolescence is a period of identity formation and gaining independence from the family. It is usually associated with a transition from parental care to strengthening relationships with

peers, which means that an increased risk of deteriorating diabetes control and psychological adaptation is common during this time^(7,8). Therefore, when discussing factors affecting adherence to DR by patients with T1D, attention should also be paid to psychological variables. Disease acceptance is one of them. Positive disease acceptance is believed to increase patient motivation to follow medical recommendations and adhere to therapy⁽⁹⁾. Results of studies analysing the role of this variable in T1D also corroborate this assumption⁽¹⁰⁾. However, it should be noted that disease acceptance is not constant over time. Therefore, an isolated analysis of disease acceptance may be insufficient, and other psychological variables, such as sense of responsibility for health (SRH), should also be considered. The discussed variable may be characterised as a personality disposition consisting of two components, i.e. a cognitive aspect constituting the basis for a potential course of action, and a motivational aspect, which is a state of readiness to take actions that are beneficial for health.

People with a high SRH are characterised by more health-promoting behaviours^(11,12). However, there are no existing studies that have analysed this particular variable in T1D. By analogy, it may be assumed that high intensity of SRH would translate into more common adoption of health-oriented eating behaviours by young people with T1D.

Dietary therapy in T1D might contain elements that are conducive to the occurrence of eating disorders (EDs) or DES^(13,14). Frequent engagement in such behaviours contributes to the development of a vicious circle and guilt, thereby increasing the risk of EDs or DES⁽¹⁵⁾. The development of EDs or DES is associated with more common abnormal eating behaviours. This translates into poorer metabolic control, and more frequent complications and recurrent episodes of hypoglycaemia^(13,16).

Considering the small number of studies focused on determining links between the psychological factors in the implementation of dietary recommendations and EDs among patients with T1D, our study is one of the few conducted in Poland, which makes it a novel contribution to the field. The study aimed at the empirical verification of the relationship between the sense of responsibility for health and disease acceptance, and its impact on dietary adherence in T1D adolescents, considering the mediating role of ED symptoms.

MATERIALS AND METHODS

Sample and setting

The observational cross-sectional online questionnaire study was conducted in 190 patients aged 12–18 years with

T1D, or in their parents, between May 2021 and May 2023. Non-probability sampling of study participants was used. The inclusion criteria were as follows: a minimum one-year history of T1D and informed consent to participate in the study. The study was anonymous, and participation was voluntary. The participants were free to withdraw from the study at any time. The questionnaire was distributed via the Google Forms web survey platform. The link to the questionnaire was shared via the social media (Facebook) on groups associating patients with T1D [groups: mojacukrzyca.org, CUKRZYCA 24h INFO (DIABETES 24h INFO), Cukrzyca typu 1 – życie bez barier i na kolorowo (Diabetes mellitus type 1 – life without barriers and in full colour)] with the consent of the administrators of the sites. The questionnaire was also distributed individually in groups of T1D patients and via personal contacts of the members of the study group (“the snowball method”).

After giving their consent to participate in the study and meeting the inclusion criteria, each prospective respondent received a link to the online survey. Each link was active only once. In practice, this meant that one respondent could complete only one online survey. Each completed survey was registered anonymously in the database.

Due to the anonymous character of the questionnaire and no possibility of tracking sensitive data, the study required no approval of the Ethics Committee. Data owners gave their permission to use the data.

Instruments

The questionnaire consisted of several parts, and all the tools used had been validated. In the present authors' part, data were collected on the socio-demographic aspects of the respondents (sex and place of residence) and clinical information (body weight, height, current HbA_{1c} value, method of insulin administration, duration of disease, number of hypo- and hyperglycaemic episodes, daily number of insulin units and insulin units per kg of body weight – declared by patients). Body height and weight data were used to calculate the body mass index (BMI) according to the standard formula and in relation to centile charts⁽¹⁷⁾ with interpretation according to the OTF Criteria⁽¹⁸⁾.

In the second part, four scales were used. The first scale was the Diabetes Dietary Guidelines Adherence Index (DDGA Index). The index combines current recommendations concerning healthy eating for the population and guidelines on behavioural therapy issued by the Polish Diabetes Association⁽¹⁹⁾. It considers both regular meal consumption and recommended frequency of consuming 29 groups of products. Higher DDGA Index values were interpreted as a higher degree of adherence to DR⁽¹⁹⁾.

The Acceptance of Illness Scale (AIS) contains eight statements describing the consequences of poor health regarding the recognition of limitations imposed by the disease, lack of self-sufficiency, sense of dependence on other people, and lowered self-esteem. The total of 8–40 is a general

measure of the degree of disease acceptance: the greater the acceptance, the better the adaptation and the lower the sense of psychological discomfort⁽²⁰⁾.

Moreover, we used the Diabetes Eating Problem Survey-Revised Scale (DEPS-R), which is a diabetes-specific tool for screening for EDs. The DEPS-R consists of 16 items. The overall DEPS-R score ranges from 0 to 80, so patients with higher total DEPS-R scores are more likely to have an ED. According to the original version of the DEPS-R, the total score equal to or above 20 was set as a threshold point indicating greater disturbances⁽²¹⁾.

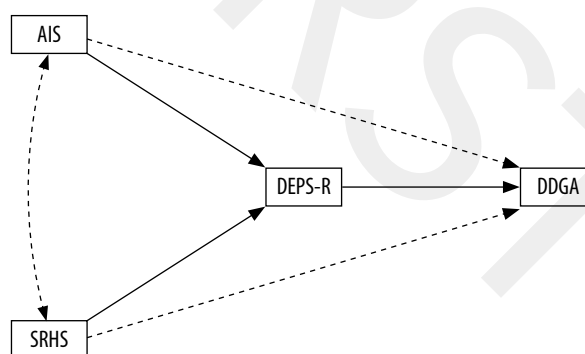
Another tool allowed the determination of the general level of responsibility for one's own health – the Sense of Responsibility for Health Scale (SRHS)⁽²²⁾. The scale consists of 14 items. In the present study, only the total level of self-responsibility for health was assessed. Cronbach's alpha for SRHS was 0.724.

Assumptions of the mediation model

Based on indirect data from a literature review, a theoretical model was developed to reflect the impact of SRHS and AIS on DDGA by patients with T1D, considering the mediating role of DEPS-R. In this model, based on the rationale derived from the literature, SRHS and AIS should have a positive influence on DDGA. However, the occurrence of DEPS-R should exhibit a negative correlation with compliance with dietary recommendations. Moreover, the development of DEPS-R should weaken the positive correlation between SRHS and AIS and compliance with DR (Fig. 1).

Statistical analysis

Data collected for all dependent and independent variables were presented using descriptive statistics. For categorical variables, the number (*n*) and frequency (%) were employed, while for quantitative variables, the mean (*M*), standard deviation (*SD*), coefficient of variation (*CV*), and range (min–max) were utilised.



AIS – Acceptance of Illness Scale; **DDGA** – Diabetes Dietary Guidelines Adherence Index; **DEPS-R** – Diabetes Eating Problem Survey-Revised Scale; **SRHS** – Sense of Responsibility for Health Scale.

Fig. 1. Conceptual model incorporating mediation and correlation of independent variables

The relationship between selected independent variables (AIS, DEPS-R, and SRHS) and the dependent variable (DDGA) was assessed with univariate regression analysis. For each independent variable, the unstandardised (b) and standardised (β) regression coefficients were determined, with a 95% confidence interval (95% CI) calculated using the bootstrap percentile method. The parameters of the regression equation were estimated with the least squares method. The assumptions for the linear regression model were satisfied, as indicated by the Ramsey Regression Equation Specification Error Test, White's test, and the Jarque–Bera test. The presence of autocorrelation was also evaluated by calculating the variance inflation factor (VIF). The adjusted coefficient of determination ($R^2_{adj.}$) was calculated for each regression equation.

The indirect effect of independent variables (AIS and SRHS) on the dependent variable (DDGA), with the mediating role of DEPS-R, was assessed using Generalised Linear Model Mediation Analysis. Standardised regression coefficients (β) were determined for each independent variable and mediator, with a 95% CI calculated using the bootstrap percentile method. The value of partial mediation was also calculated. Data were analysed using IBM SPSS (Version 28) for the descriptive analyses, and jamovi (Version 2.3.0), with jAMM module (Version 1.2.0) to test the mediation model^(23,24). For all analyses, a p -value less than 0.05 was deemed to be statistically significant.

RESULTS

The general characteristics of T1D patients are presented in Tabs. 1 A and 1 B.

The majority of patients knew their insulin-to-carbohydrate exchange ratio, knew how many exchanges they consumed each day, and knew the calorie content of their diet (Tab. 2). The characteristics of DDGA, AIS, and SRHS, and the symptoms of ED are presented in Tab. 3.

Linear regression analysis was conducted to assess the relationship between the independent variables and the dependent variable. DDGA was the dependent variable, while independent variables included AIS, SRHS, and DEPS-R. Three separate univariate regression models were employed

Variable	<i>n</i>	%
Sex		
Women	118	62.1
Men	72	37.9
Place of residence		
Village	51	26.8
Town	84	44.2
City	55	28.9
Type of insulin therapy		
Pen	55	28.9
Insulin pump	135	71.1

Tab. 1 A. Characteristics of selected sociodemographic variables of the respondents

Variable	<i>M</i>	<i>SD</i>	Min	Max	<i>CV</i> [%]
Age [years]	16.3	1.7	12.0	18.0	10.8
Duration of disease [years]	7.5	2.8	1.0	18.0	37.1
Body weight [kg]	59.7	13.8	30.0	100.0	23.2
Height [cm]	166.9	9.6	132.0	194.0	5.8
BMI [kg/m ²]	21.2	3.7	13.2	34.1	17.6
HbA _{1c} [%]	7.7	1.7	5.6	15.7	22.0
Insulin units per day	36.8	17.2	7.0	85.0	46.5
Calculator insulin/kg body weight	0.6	0.26	0.12	1.3	41.1

BMI – body mass index; **CV** – coefficient of variation; **M** – mean value; **SD** – standard deviation.

Tab. 1 B. Characteristics of selected clinical variables of the respondents

Variable	<i>n</i>	%
BMI categories (18)		
Underweight	40	21.0
Normal weight	124	65.3
Overweight	23	12.1
Obese	3	1.6
Hypoglycaemic episodes		
Every day	23	12.1
5–6 times a week	32	16.8
3–4 times a week	40	21.1
1–2 times a week	36	18.9
Only once	36	18.9
Never	23	12.1
Hyperglycaemic episodes		
Every day	38	20.0
5–6 times a week	36	18.9
3–4 times a week	49	25.8
1–2 times a week	38	20.0
Only once	15	7.9
Never	14	7.4
Knows the insulin-to-carbohydrate exchange ratio		
Yes	167	87.9
No	23	12.1
Knows how many exchanges are consumed daily		
Yes	153	80.5
No	37	19.5
Knows the energy value of the diet		
Yes	59	31.1
No	131	68.9

BMI – body mass index.

Tab. 2. Characteristics of the respondents in terms of selected clinical parameters

to evaluate each predictor independently (Tab. 4). DDGA exhibited a decrease with the AIS ($\beta = -0.156$, $p = 0.032$, $R^2_{adj.} = 0.03$) and the DEPS-R ($\beta = -0.228$, $p = 0.002$, $R^2_{adj.} = 0.05$), and an increase with SRHS ($\beta = 0.305$, $p < 0.001$, $R^2_{adj.} = 0.09$).

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>CV</i> [%]
AIS	27.3	8.3	8.0	40.0	30.3
DEPS-R	16.6	12.1	0.0	71.0	72.9
SRHS	52.9	9.9	28.0	78.0	18.9
DDGA	16.9	3.9	6.0	27.0	22.8

AIS – Acceptance of Illness Scale; **CV** – coefficient of variation;
DDGA – Diabetes Dietary Guidelines Adherence Index; **DEPS-R** – Diabetes Eating Problem Survey-Revised Scale; **M** – mean value; **SD** – standard deviation; **SRHS** – Sense of Responsibility for Health Scale.

Tab. 3. Characteristics of psychological variables [points]

Predictor	<i>b</i>	β	95% CI		<i>t</i>	<i>p</i>
			Lower	Upper		
Intercept	18.949	-	-	-	19.730	<0.001
AIS	-0.073	-0.156	-0.298	-0.014	-2.160	0.032
Intercept	18.173	-	-	-	39.010	<0.001
DEPS-R	-0.073	-0.228	-0.368	-0.088	-3.210	0.002
Intercept	10.719	-	-	-	7.410	<0.001
SRHS	0.118	0.305	0.168	0.442	4.390	<0.001

AIS – Acceptance of Illness Scale; **b** – unstandardised regression coefficient; β – standardised regression coefficient; **CI** – confidence interval computed with bootstrap percentile method; **DEPS-R** – Diabetes Eating Problem Survey-Revised Scale; **p** – significance level; **SRHS** – Sense of Responsibility for Health Scale; **t** – statistical value.

Tab. 4. Effect of psychological factors on adherence to dietary recommendations in patients with T1D

Mediation model

The analysis of mediation revealed a significant direct negative relationship between AIS ($\beta = -0.253$, $p < 0.001$) and a positive effect of SRHS ($\beta = 0.319$, $p < 0.001$) on DDGA. Notably, no statistically significant mediating role of DEPS-R was observed in the relationship between AIS and DDGA ($\beta = 0.008$, $p = 0.345$). Conversely, a statistically significant mediating role of DEPS-R was noted in the relationship between SRHS and DDGA ($\beta = 0.054$, $p = 0.050$). The developed model indicates that the observed mediation

effect was partial, and explained 14.5% of the variance of the dependent variable (Tab. 5).

DISCUSSION

The present study aimed at the empirical verification of the effects of SRHS and AIS on DDGA, with the mediating role of ED symptoms. However, the mediating role of the development of ED symptoms was only partial, and explained about 15% of variance.

The study revealed a significant direct negative effect of AIS on DDGA. The AIS is a multistage process⁽²⁵⁾. At times, diabetic patients may come to terms with their condition, yet various factors prevent them from adhering to DR. Additional elements that may contribute to developing improper eating habits include fatigue due to long-lasting therapy, anger or resignation from treatment. In literature reports, non-compliance with therapeutic recommendations in diabetes was a very common phenomenon and affected from 21% to 95% of the respondents^(25–28). Adolescence and T1D constitute a double challenge for physicians, parents, caregivers, and young patients themselves. During adolescence, diabetes gives rise to many problems in the daily lives of patients and their families⁽²⁹⁾. Patients with T1D had more difficulty following DR than taking insulin^(30,31). The findings confirm the need for further research on adherence to DR and the corresponding determinants related to psychological factors in order to improve and increase the efficacy of education and re-education.

In the study, we noted a positive effect of SRHS on DDGA. In general, SRHS determines the extent to which a person is motivated to undergo treatment. Patients with a high intensity of SRHS will be characterised by a good understanding of the positive impact of their eating behaviours on their health. Moreover, they will be motivated to engage in behaviours promoting the metabolic control of diabetes. The observations made are consistent with the results of preliminary research⁽¹¹⁾. Therefore, the present study is the

Type	Effect	95% CI		β	<i>z</i>	<i>p</i>
		Lower	Upper			
Indirect	SRHS → DEPS-R → DDGA	-0.003	0.045	0.054	1.945	0.050
	AIS → DEPS-R → DDGA	-0.006	0.018	0.008	0.944	0.345
Component	SRHS → DEPS-R	-0.740	-0.261	-0.397	-4.068	<0.001
	DEPS-R → DDGA	-0.098	0.007	-0.135	-2.087	0.037
	AIS → DEPS-R	-0.296	0.120	-0.059	-0.838	0.402
Direct	SRHS → DDGA	0.070	0.182	0.319	4.512	<0.001
	AIS → DDGA	-0.180	-0.057	-0.253	-3.950	<0.001
Total	SRHS → DDGA	0.093	0.200	0.372	5.393	<0.001
	AIS → DDGA	-0.178	-0.051	-0.245	-3.551	<0.001

AIS – Acceptance of Illness Scale; β – standardised regression coefficient; **CI** – confidence interval computed with bootstrap percentile method; **DDGA** – Diabetes Dietary Guidelines Adherence Index; **DEPS-R** – Diabetes Eating Problem Survey-Revised Scale; **p** – significance level; **SRHS** – Sense of Responsibility for Health Scale; **z** – statistical value.

Tab. 5. Analysis of mediation effect

first one which analysed SRHS in T1D. The topic requires further empirical analyses.

In practice, this relationship may be used in nutritional education. Introducing appropriate measures aimed at strengthening SRHS may have a positive impact not only in terms of increasing the efficacy of DDGA, but also improving the sense of disease control.

The role of the severity of symptoms related to DEPS-R appeared to be an interesting finding in the context of adherence to DDGA. Regression showed a negative effect of DEPS-R on DDGA, which is consistent with the reports of other researchers⁽¹¹⁾. The present study analysed a slightly different relationship. It was assumed that the occurrence of EDs or DES would negatively influence DDGA. The assumption was verified empirically. Therefore, it can be presumed that there is a vicious cycle of aggravating ED symptoms in T1D. Dietary restrictions constituted one of the causes underlying the development of ED symptoms^(12–14). This study complemented the observations and emphasised that the onset of ED symptoms in T1D might affect adherence to dietary recommendations. This translates into greater difficulties in adhering to dietary recommendations, meaning poorer metabolic control, as well as more frequent complications and recurrent episodes of hypoglycaemia.

Another important observation was the lack of a statistically significant mediating role of the severity of ED symptoms in the relationship between AIS and DDGA. It may be explained by the occurrence of two independent paths. The first path concerns the effect of AIS, while the second one concerns the severity of the symptoms of DEPS-R. Those two pathways, independently of each other, were found to have a negative effect on DDGA.

Social influence is a factor that may have a powerful impact on AIS and potential development of ED. Numerous adolescents who do not follow DR report that their family, friends and school environment can often negatively influence their adherence to dietary recommendations^(32,33). It appears that providing a good-quality healthcare and social support system might contribute to improving the situation. The occurrence of EDs symptoms has a negative influence on the sense of control of one's eating behaviours and the mental state of a given person. As a consequence, it may lead to a decline in an individual's belief in their ability to control their own behavior, impact the treatment process and, at the same time, reduce the level of motivation for treatment.

In practice, rapid identification of ED symptoms is crucial, similarly to the identification of factors that might increase their risk. This will not only reduce the risk of non-adherence to dietary recommendations, but may also have a positive effect on the patient's mental state.

The practical aspect of the presented study results is significant for the development and implementation of suitable educational activities aimed at increasing the level of adherence to the recommendations. AIS alone seems to be insufficient. It is, therefore, necessary to pay more attention to

the acceptance of behavioural therapy recommendations, which could contribute to better adherence. Current needs and values relevant to the adolescent may be more important and divergent from T1D therapeutic goals at a given time. Improving adherence to recommendations, including dietary advice, requires the identification of psychosocial problems and a prompt response from the physician/nurse/educator/psychologist/parents.

The strength of this study lies in being among the pioneering research efforts to address the role of psychological factors in the context of DDGA among young people with T1D. In addition, few studies to date have analysed adherence to DR in T1D patients. Previously, research mainly focused on adherence to insulin therapy. The observed relationships are also of practical significance in the context of developing and implementing educational interventions.

However, the study also had some limitations. Only 190 participants were recruited, 62% of whom were girls and young women. Non-probability sampling was used, so the results obtained are not representative of the population of T1D patients. Furthermore, the study is of a cross-sectional nature. No assessment of the patients' personality traits was performed, which may have a significant effect on AIS. What is more, the present study did not analyse the effect of the method of insulin administration on the implementation of recommendations and acceptance of the disease. Functional insulin therapy (insulin pumps) is known to facilitate the use of correction bolus and give the patients more independence.

Psychological factors, such as the sense of responsibility for health and disease acceptance, affect the level of adherence to dietary recommendations in patients with T1D aged 12–18. However, the relationship in question is not stable and may be sensitive to external factors, such as the occurrence of the symptoms of EDs.

Therefore, when developing and implementing educational interventions for patients with T1D, actions aimed at strengthening their sense of responsibility for health should be taken into account, as this variable has a positive impact on adherence to dietary recommendations. Conversely, it is important to quickly identify the symptoms of EDs, and to determine factors that might increase their risk. This will not only reduce the risk of non-adherence to dietary recommendations, but may also have a positive effect on the patient's mental state.

Conflict of interest

The authors report no financial or personal relationships with other individuals or organisations that could adversely affect the content of the publication and claim ownership of this publication

Author contributions

Original concept of study: BS, MJ. Collection, recording and/or compilation of data: BS, MP. Analysis and interpretation of data: BS, MJ, AK, MP. Writing of manuscript: BS, MJ, AK, AKK. Critical review of manuscript: BS. Final approval of manuscript: BS, MJ, AK, AKK, MP.

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