

國立成功大學教師研究計劃報告

題目：第一型糖尿病青少年的問題飲食行爲

系所：護理學系

報告者：許玉雲

報告日期：**2007/8**

Title

Disturbed Eating Behaviors in Taiwanese Adolescents with Type 1 Diabetes Mellitus: A Comparative Study

Authors

國立成功大學護理學系 許玉雲

Hsu, Yu-Yun Alice, RN, PhD

Affiliation: Department of Nursing, School of Medicine, National Cheng Kung University, Taiwan.

Address: 1 Ta- Hsueh Road, Tainan 701, Taiwan

E-mail: yuht12@mail.ncku.edu.tw

Disturbed Eating Behaviors in Taiwanese Adolescents with Type 1 Diabetes Mellitus: A Comparative Study

ABSTRACT

Objective: This study was to: 1) compare the disturbed eating behaviors and attitudes in adolescents with type 1 diabetes mellitus (T1D) compared to their non-diabetic peers in Taiwan; 2) to examine the relationships of disturbed eating behaviors to body mass index (BMI) and metabolic control among adolescents with T1D.

Method: A cross-sectional study of 71 male and female adolescents aged 10-22 with T1D and 71 age and gender matched non-diabetic adolescents was conducted in Southern Taiwan. Adolescents completed two self-reported measures of disturbed eating behaviors which are the Bulimic Investigatory Test, Edinburgh (BITE) and the Eating Attitude Test-26 (EAT-26). Fisher's exact tests were performed to examine group differences in the proportions of subthreshold eating disorders. Independent t-tests were used to examine group differences in disturbed eating behaviors and attitudes. Hierarchical multiple regressions were performed to determine the predictors of disturbed eating behaviors for adolescents with T1D.

Results: Both adolescent females and males with T1D had more disturbed eating behaviors compared to their non-diabetic peers. Adolescent females with T1D reported more symptoms of bulimia, bulimic behaviors and dieting behaviors than

comparable non-diabetic adolescent females. Adolescent males with T1D reported more bulimic behavior than comparable non-diabetic adolescent males. There were no group differences in the proportion of subthreshold eating disorders. After controlling for duration of disease, gender, and age, the BMI, not metabolic control predicted disturbed eating behaviors.

Conclusions: Both adolescent females and males with T1D exhibited a higher level of eating disturbances than their non-diabetic adolescent peers. Preventive programs that address disturbed eating behaviors should be provided for adolescents with T1D, particularly for adolescents with a high BMI.

Keywords: disturbed eating behaviors; type 1 diabetes mellitus; adolescents

Introduction

Disturbed eating behavior is a significant health concern for adolescents with type 1 diabetes mellitus (T1D), and is generally considered to be related to poor glycemic control, ketoacidosis, hospitalization, and microvascular complications.^{1,2} It is believed that adolescents with T1D are at greater risk of developing disturbed eating behaviors than their peers, particularly young females.³⁻⁵ Previous research showed that eating disorders which met DSM-IV diagnostic criteria are more than twice (10%) as common in young females with T1D compared to their non-diabetic peers in Western society.^{4,6} In addition, disturbed eating behaviors that do not meet the diagnostic criteria of the DSM-IV are even more common among adolescent females, with 12-40% omitting insulin to control weight and 60-80% engaging in binge-eating.^{4,7} Yet, other studies found that the prevalence of eating disorders was not different between female adolescents with T1D and without T1D.^{8,9}

Literature has demonstrated a gender difference in the prevalence of disordered eating behavior in adolescents with T1D, with a higher prevalence of eating behaviors in young females. It is possible that young males may also experience disturbed eating behaviors. For example, bingeing and purging eating behaviors were significantly more prevalent among adolescent males with T1D than among the comparison group.¹⁰ In addition, gender appears to be a particular factor that affects the features of

disturbed eating behaviors among adolescents with T1D. The adolescent females were more likely to diet, skip meals, and omit insulin; whereas adolescent males were rarely omitted insulin omission or dieted.¹⁰ Few studies have explored disturbed eating behaviors among the adolescent males with T1D; nevertheless, these studies on disturbed eating behaviors in adolescent males have yielded contradictory results. Some studies found the adolescent males with T1D had more bulimic behaviors than comparable non-diabetic adolescents.^{8,11} In contrast, some studies found the adolescent males with T1D had less bulimic behaviors than their similar age male adolescents without diabetes.⁹

In light of the potential factors related to disturbed eating behaviors for adolescents with T1D, the predictors of disturbed eating behavior have been limited to data from adolescent females. In studies of duration of disease, body weight, and metabolic control among adolescent females,^{2,9,12} body weight has emerged as a consistent factor in the prediction of eating behaviors. Previous studies showed that adolescent females with T1D place a greater emphasis on weight control, and more body dissatisfaction than adolescent females without diabetes.^{11,13} Moreover, disturbed eating behaviors have been related to metabolic control in adolescent females.^{4,14}

Eating disorders refer to culture-bound syndromes, prevailing at upper – middle

class Caucasian women within Western societies (Dolan, 1991; Crago et al., 1996). It is believed that the rate of disturbed eating behaviors among adolescent females is increasing in non-Western societies such as Asia in which being thin is the preferred body shape^{4,15}. A study conducted in Taiwan revealed that Taiwanese adolescent females had higher body dissatisfaction and more disturbed eating behaviors compared to Western adolescent females¹⁶.

Disturbed eating behavior is a common concern for adolescent females; and the existing literature primarily focuses on examining the disturbed eating behaviors in adolescent females with T1D. Little research has examined the disturbed eating behaviors among adolescent males with T1D. Moreover, previous research findings are based on adolescents who live in westernized countries, despite evidence that body dissatisfaction is an increasing problem among industrialized non-westernized countries^{4,16}. Few studies address the disturbed eating behaviors among adolescents with T1D from non-Western societies. It is imperative to understand the disturbed eating behaviors among adolescents with T1D who live in non-westernized societies. The aims of this study were: 1) to compare the disturbed eating behaviors between adolescents with T1D and without T1D in Taiwan; 2) to examine the relationships of disturbed eating behaviors to BMI and metabolic control among adolescents with T1D.

Method

Participants

The participants included a case group of 71 adolescent with T1D (mean age = 15.90 years, range = 10.92-22.50 years; 29 males, 42 females). The group was matched with a control group of 71 adolescents without diabetes on age and gender (mean age = 15.95 years, range = 10.83 – 22.25 years; 29 males, 42 females). The participants' demographics and clinical features are presented in **Table 1**. The adolescents with T1D were recruited from diabetes clinics at three hospitals in Southern Taiwan. These adolescents were diagnosed with T1D at least six months prior and were being followed in a pediatric endocrine or diabetes clinics in the three hospitals. Of the 85 adolescents with T1D who were approached, 79 adolescents agreed to participant in the study and 71 adolescents completed the study, with a response rate 84%. The duration of diabetes averaged 6.02 years (SD = 3.67; range = 0.6 -13.7). The mean age of T1D onset was 9.90 years (SD = 3.59; range = 2.0 – 17.2). In addition, the adolescents without diabetes were recruited from the community. Most adolescents were students (89.2% in T1D; 97.3% in non-diabetes).

Insert Table 1

Procedures

The university research ethics committee approved the study. The adolescents with T1D were invited into this study by nurses or physicians when they had a health visit with their physicians. For eligible participants under the ages of 18, an informed parental consent and adolescent assent were obtained; whereas for eligible participants older than age of 18 years, written consent forms were obtained from the adolescent participants themselves. The demographic information was obtained in an interview with the adolescents by the research assistant, and the self-report questionnaires were completed by adolescents at their home.

For the control group, the non-diabetic adolescents were introduced and matched to one diabetic adolescent of similar in the age (\pm 6 months) and gender. Nursing students were asked to invite their friends, relatives or neighbors to participate in the study. When these potentially non-diabetic adolescents expressed interest in the study, the researchers telephoned them to explain the study to them and their parents. If they agreed to participate in the study, questionnaires were mailed to the participants and completed by them at home and returned by mail.

Measurements

Disturbed Eating Behaviors. The Eating Attitude Test-26 (EAT-26) is a self-reported questionnaire measuring disturbed eating behaviors and attitudes. The EAT-26

consists of three subscales: dieting, bulimia/food preoccupation, and oral control.

Each item is answered on a 6-point-Likert scale (1 = never, 6 = always). The total score of EAT-26 was computed by the three subscales, with higher scores indicative of more highly disturbed eating behaviors and attitudes. A cutoff score of 20 was developed to identify subthreshold eating disorders. The EAT-26 has evidence of good psychometric properties among adolescents with T1D.^{6,14} The internal reliability of the EAT-26 for this study was satisfied, with Cronbach's alpha = 0.76.

Bulimic Behaviors. The self-report Bulimic Investigatory Test, Edinburgh (BITE; was used to measure bulimic behaviors. The scale was modified from the BITE developed by Henderson and Freeman in 1987 and translated into the Chinese version.¹⁷ The BITE includes two subscales which measure the symptoms of bulimia and the severity of bulimia. The clinical cutoff scores for symptoms, severity, and total score were 20, 5, and 26, respectively, when subthreshold eating disorders were identified. The BITE has been demonstrated to have a good internal consistency, with intra- class correlation reliability (ICCR) was 0.86- 0.88.¹⁷ The internal reliability of the BITE for this study was satisfied, with Cronbach's alpha of 0.83 in this study.

Body Mass Index (BMI). The BMI was calculated using the formula of weight/height². Adolescents were asked to report their height and weight.

Metabolic Control. The metabolic control was assessed by hemoglobin A1c (A1C)

levels, which were obtained from the diabetic adolescents' most recent clinical data.

The level of A1C represents the mean glycemic control over the last 8-12 weeks.

According to the American Diabetes Association recommendations, the goal of A1C for adolescents with diabetes is less than 7%.¹⁸

Statistical Analyses

The data obtained were processed using the SPSS statistical package. The group differences in the proportions of subthreshold eating disorders and of specific features of disturbed eating behaviors were examined by the Fisher's exact tests. Independent-t tests were conducted to compare the group differences in the scores on the EAT subscales and the BITE subscales between the adolescents with T1D and the non-diabetic adolescents. Male and females were analyzed separately. Multiple hierarchical linear regressions were performed with the each EAT subscale and each BITE subscale as a dependent variable, along with age, gender, duration of disease, BMI, and A1C as independent variables. The level of significance was set at $p < .05$ for all tests.

Results

Group Comparisons in Bulimia and Disturbed Eating Behaviors

Because there is a gender difference in disturbed eating behaviors, a female

predominance, the adolescents with T1D were compared to the non-diabetic adolescents based on gender subgroups. **Table 2** shows that the group comparison on the proportion of clinical cutoff on the BITE (BITE symptom ≥ 20 , severity ≥ 5 , and total score ≥ 26) and the EAT-26 (total score ≥ 20). If the scores are greater than one of the cutoff scores this means a subthreshold eating disorder. Adolescent females with T1D reported more bulimia (4.8%) compared to the non-diabetic adolescent females (2.4%). Adolescent males with T1D reported more bulimia (3.4%) compared to the non-diabetic adolescent males (0.0 %). However, the proportion of bulimia did not differ significantly neither between the adolescent females with T1D and the non-diabetic adolescent females nor between the adolescent males with T1D and the non-diabetic adolescent males. Furthermore, 23.8% of adolescent females with T1D and 17.2% of adolescent males with T1D reported disturbed eating behaviors based on the total score of EAT -26 ≥ 20 . The proportion of disturbed eating behaviors did not differ significantly, neither between the adolescent females with T1D and the comparison adolescent females, nor between the adolescent males with T1D and the comparison adolescent males. Because we were interested in which bulimic behaviors were prevalent among adolescents with T1D, we examined the bulimic behaviors using the four items in the BITE. The results showed that no group differences in the proportion of adolescents who took laxatives, used diet pills, took

diuretics, and induced vomiting in the adolescent females as well as in the adolescent males. The most frequent bulimic behaviors reported by the adolescent females with T1D was induced vomiting ($n = 3$), followed by used diet pills ($n = 2$). The most frequent bulimic behaviors reported by the adolescent males with T1D was induced vomiting ($n = 1$) and used diet pills ($n = 1$).

Insert Table 2

Table 3 displays the group comparisons on the scores of the subscales in the BITE and the EAT-26. For adolescent males, independent t-test indicated that the adolescent males with T1D reported significantly more symptoms of bulimia than the comparison group, $t(56) = 2.03, p < 0.05$, indicating that those who had T1D reported more bulimic symptoms than adolescent males without diabetes. Similarly, the adolescent females with T1D reported more symptoms of bulimia than the comparable adolescent females, $t(82) = 3.74, p < .001$. Neither adolescent females nor adolescent males showed group differences existed in the severity of bulimic.

With respect to the mean scores of each subscale in the EAT-26, the adolescent males with T1D reported more bulimic behaviors than the non-diabetic adolescent males, $t(56) = 3.06, p < .01$. Similarly, the adolescent females with T1D reported more bulimic behaviors than the non-diabetic adolescent females, $t(82) = 4.41, p$

< .001. By contrast, there were no significant differences between the adolescent males with T1D and the non-diabetic adolescent males in dieting and in oral control behaviors. Likewise, no significant differences in dieting and in oral control behaviors were found between adolescent females with T1D and those without diabetes.

Insert Table 3

Prediction of BMI and Metabolic Control on Disturbed Eating Behaviors among Adolescents with Diabetes

Table 4 presents the results of separate hierarchical regressions predicting two subscales of BITE and three subscales of EAT-26 among adolescents with T1D.

Predictor variables were entered into the hierarchical regression models as follows: gender, age, and duration of disease at Step 1, BMI at Step 2, and A1C at Step 3.

Predictors of Bulimia Subscale Scores. With age, gender, duration of disease accounted for, BMI ($\beta = .09, t = .66, p = .51$) and A1C ($\beta = .11, t = .95, p = .35$) did not significantly predict the symptoms of bulimia. In contrast, accounting for age, gender, duration of disease, both BMI ($\beta = .27, t = 2.08, p = .04$) and A1C ($\beta = .30, t = 2.62, p = .01$) were significant predictors for the severity of bulimia.

Predictors of Disturbed Eating Behaviors Subscale Scores. The variables of age, gender, duration of disease, BMI, and A1C, were entered, while three subscales

(dieting, bulimia, oral control) of the EAT-26 were regarded separately as dependent variables. Regression analyses indicated that BMI ($\beta = .25, t = 1.97, p = .05$) had a significant impact, and A1C ($\beta = -.21, t = -1.95, p = .06$) had a marginal impact on the dieting behaviors. In addition, BMI ($\beta = -.30, t = -2.14, p = .05$), but not A1C ($\beta = -.15, t = -1.25, p = .22$), had a significant impact on oral control behaviors. However, both BMI and A1C did not significantly predict bulimic behaviors.

Insert Table 4

Discussion

The aim of this study was to understand the disturbed eating behaviors among adolescents with T1D compared to non-diabetic adolescents. Also, the predictors of disturbed eating behaviors among adolescents with T1D were explored. Neither adolescent males nor females with T1D had a higher proportion of subthreshold eating disorders compared to their counterparts without diabetes. The proportion results of subthreshold eating disorders found in this study are consistent with findings reported by Mannucci et al.⁵ and Friedman et al.⁸. But the findings of Jones et al.⁶ showed twice the prevalence rate of eating disorders in adolescent females with T1D as in their non-diabetic peers. Our findings extend a cross-cultural difference in disturbed eating behaviors. Cross-cultural differences in disturbed eating behaviors

have been considered widely.^{15,19} It is possible that the prevalence rates of eating disorders in some Asia countries such as Taiwan, Japan are still lower than Western societies. One study of eating disorders among Taiwanese adolescents showed that the prevalence rate of bulimia was 2.1% in females and 0.25% in males.²⁰ Both the prevalence rates are significantly lower than those in Western countries.

This study illustrates that both male and female adolescents with T1D had higher scores related to bulimia behaviors than their counterparts without diabetes. Similar findings with females had been reported in previous studies, in which adolescent females were more likely to exhibit bulimia behaviors and attitudes.^{8,9,13} In the past, disturbed eating behaviors in adolescents with T1D were considered to be more pervasive in females than in males. It is interesting to note that adolescent males with T1D are more likely to have bulimia behaviors and attitudes than their non-diabetic counterparts. However, other studies did not support this findings^{9,21}. Meltzer et al.⁹ reported that the adolescent males with T1D were significantly less likely to have disturbed eating behaviors. Differences in the bulimic behaviors appear to be due to a strict diet management among adolescents with T1D. Taiwanese adolescents with T1D may be demanded by their parents to maintain a good metabolic control through a strict diet plan. Thus, the adolescents may use bulimic behaviors to cope with the strict diet management.

As expected, the BMI was a significant predictor of the severity of bulimia, diet behavior, and oral control, respectively. Diabetic adolescents with greater BMI tend to have more severe bulimic symptoms, more diet behavior, and fewer oral control behaviors. These findings are consistent with other studies conducted in westernized countries.^{9,22} High BMI is a risk factor that may lead to unhealthy weight control practices; a high BMI is related to body dissatisfaction¹⁰. Particularly, Taiwan adolescents are more likely to report body dissatisfaction than Western adolescents.¹⁶

Previous research showed that disturbed eating behaviors were associated with the level of metabolic control.^{10,23} However, this study revealed that metabolic control (A1C) was not a significant predictor of disturbed eating behaviors. In addition, the final regression models show that BMI and metabolic control accounted for a low percentage of variance (1% to 8%) for disturbed eating behaviors. These results indicate that other factors may contribute to disturbed eating behaviors. Recently, few studies found that mood disturbance and impaired parent-relationship account for disturbed eating behaviors among adolescents with T1D.^{22,24} More research is needed to fully assess the associations of family relationships and adolescents' moods to disturbed eating behaviors among Taiwanese adolescents with T1D.

The present study has several limitations. One of the which is that participants were recruited from Southern Taiwan as a convenience sample, and may not represent

all Taiwanese adolescents with T1D. Second, the cross-sectional findings do not permit conclusions about the cause-effect relationship of metabolic control, body weight and disturbed eating behaviors. Finally, the self-reported measures of disturbed eating behaviors used in the current study were screening tools used to identify adolescents at risk for eating disorders. These self-reported measures are not an appropriate substitute for clinical judgment of eating disorders.

In conclusion, both adolescent females and males with T1D had more disturbed eating behaviors than non-diabetic comparison adolescents. The bulimic behaviors are noteworthy for adolescents with T1D. Also, for adolescent females with T1D, dieting behaviors are a matter to which researchers and clinicians need to pay greater attention. BMI, but not A1C was found to be a significant factor affecting disturbed eating behaviors. As research guides practice, an improved understanding of adolescent risks and behaviors of disturbed eating behaviors will help clinicians and researchers intervene and affect change in the negative behaviors, and improve the health of adolescents with diabetes.

Acknowledgements: This study was supported by the Faculty Research Grant of the National Cheng-Kung University. We thank the adolescents and their families who participated in this research. Special thanks is given to Dr. Lin, Shio Jean, Ms. Tsai, Ming-Yam, Ms. Chang, Jai-Shing for assisting with data collection.

References

1. Peveler RC, Bryden KS, Neil HAW, Fairburn CG, Mayou RA, Dunger DB, et al. The relationship of disordered eating habits and attitudes to clinical outcomes in young adult females with type 1 diabetes. *Diabetes Care* 2005;28:84-88.
2. Rydall AC, Rodin GM, Olmsted MP, Devenyi RG, Daneman D, Rydall AC, et al. Disordered eating behavior and microvascular complications in young women with insulin-dependent diabetes mellitus. *New England Journal of Medicine* 1997;336:1849-1854.
3. Mellin AE, Neumark-Sztainer D, Patterson J, Sockalosky J. Unhealthy weight management behavior among adolescent girls with type 1 diabetes mellitus: The role of familial eating patterns and weight-related concerns. *Journal of Adolescent Health* 2004;35:278-289.
4. Rodin G, Olmsted MP, Rydall AC, Maharaj SI, Colton PA, Jones JM, et al. Eating disorders in young women with type 1 diabetes mellitus. *Journal of Psychosomatic Research* 2002;53:943-949.
5. Mannucci E, Ricca V, Rotella CM, Mannucci E, Ricca V, Rotella CM. Clinical features of binge eating disorder in type I diabetes: A case report. *International Journal of Eating Disorders* 1997;21:99-102.
6. Jones JM, Lawson ML, Daneman D, Olmsted MP, Rodin G. Eating disorders in adolescent females with and without type 1 diabetes: Cross-sectional study. *British Medical Journal* 2000;320:1563-1566.
7. Pollock M, Kovacs M, Charron-Prochownik D, Pollock M, Kovacs M, Charron-Prochownik D. Eating disorders and maladaptive dietary/insulin management among youths with childhood-onset insulin-dependent diabetes mellitus. *Journal of the American Academy of Child & Adolescent Psychiatry* 1995;34:291-296.
8. Friedman S, Vila G, Timsit J, Boitard C, Mouren-Simeoni MC. Eating disorders and insulin-dependent diabetes mellitus (IDDM): relationships with glycaemic control and somatic complications. *Acta Psychiatrica Scandinavica* 1998;97:206-212.
9. Meltzer LJ, Johnson SB, Prine JM, Banks RA, Desrosiers PM, Silverstein JH. Disordered eating, body mass, and glycemic control in adolescents with type 1 diabetes. *Diabetes Care* 2001;24:678-682.
10. Neumark-Sztainer D, Patterson J, Mellin A, Ackard DM, Utter J, Story M, et al. Weight control practices and disordered eating behaviors among adolescent females and males with type 1 diabetes: Associations with sociodemographics, weight concerns, familial factors, and metabolic outcomes. *Diabetes Care*

- 2002;25:1289-1296.
11. Neumark-Sztainer D, Story M, Toporoff E, Cassuto N, Ressenick MD, Blum RW. Psychosocial predictors of binge eating and purging behaviors among adolescents with and without diabetes mellitus. *Journal of Adolescent Health* 1996;19:289-296.
 12. Stewart SM, Emslie GJ, Klein D, Haus S, White P. Self-care and glycemic control in adolescents with type I diabetes. *Children's Health Care* 2005;34:235-244.
 13. Engstrom I, Kroon M, Arvidsson CG, Segnestam K, Snellman K, Aman J, et al. Eating disorders in adolescent girls with insulin-dependent diabetes mellitus: a population-based case-control study. *Acta Paediatrica* 1999;88:175-180.
 14. Surgenor LJ, Horn J, Hudson SM. Links between psychological sense of control and disturbed eating behavior in women with diabetes mellitus: Implications for predictors of metabolic control. *Journal of Psychosomatic Research* 2002;52:121-128.
 15. Tsai G. Eating disorders in the Far East. *Eating & Weight Disorders* 2000;5(4):183-197.
 16. Tsai G, Curbow B, Heinberg L. Socialcultural and developmental influences on body dissatisfaction and disordered eating attitudes and behaviors of Asian women. *Journal of Nervous and Mental Disease* 2003;191:309-318.
 17. Tseng MC, Lee MB, Lee YJ. Reliability and validity of Chinese version of the Bulimic Investigatory Test. *Taiwanese Journal of Psychiatry* 1997;11:141-155.
 18. Silverstein J, Klingensmith G, Copeland K, Plotnick L, Kaufman F, Laffel L, et al. Care of children and adolescents with type 1 diabetes: a statement of the American Diabetes Association. *Diabetes Care* 2005;28:186-212.
 19. Dolan B. Cross-cultural aspects of anorexia and bulimia: A review *International Journal of Eating Disorders* 1991;10:67-78.
 20. Chen KY, Lin LY, Chen CC, Hu WH. Prevalence of bulimia nervosa in students of two high schools. *Taiwanese J Psychiatry* 2000;12:27-37.
 21. Fairburn CG, Peveler RC, Davies B, Mann JI, Mayou RA. Eating disorders in young adults with insulin dependent diabetes mellitus: A controlled study. *BMJ* 1991;303:17-20.
 22. Grylli V, Hafferl-Gattermayer A, Wagner G, Schober E, Karwautz A. Eating disorders and eating problems among adolescents with type 1 diabetes: Exploring relationships with temperament and character. *Journal of Pediatric Psychology* 2005;30:197-206.
 23. Affenito SG, Lammi-Keefe CJ, Vogel S, Backstrand JR, Welch GW, Adams CH. Women with insulin-dependent diabetes mellitus (IDDM) complicated by eating disorders are at risk for exacerbated alterations in lipid metabolism.

European Journal of Clinical Nutrition 1997;51:462-466.

24. Maharaj S, Rodin G, Connolly J, Olmsted M, Daneman D. Eating problems and the observed quality of mother-daughter interactions among girls with type 1 diabetes. *Journal of Consulting & Clinical Psychology* 2001;69:950-958.

Table 1. Sociodemographic characteristics of participants

	T1D (n = 71)	Non- DM (n =71)
	Mean (SD)	Mean (SD)
Age	15.90 (3.14)	15.94 (3.10)
Body height (cm)	159.76 (11.32)	162.32 (8.75)
Body weight (kg)	53.07 (11.73)	54.96 (12.67)
BMI (kg/m ²)	20.58 (2.92)	20.67 (3.49)
Age at onset of diabetes (yrs)	9.90 (3.59)	-
Duration of diagnosis	6.02 (3.67)	-
A1C	9.08 (1.96)	-
	N (%)	N (%)
Gender		
Male	29 (41.9%)	29 (41.9%)
Female	42 (58.1%)	42 (58.1%)
Job		
Student	66 (93.0%)	70 (98.6%)
Non-student	5 (7.0%)	1 (1.4%)
Father education		
Under high school	23 (32.9%)	13(18.3%)
High school	31 (44.3%)	32(45.1%)
Beyond high school	16 (22.9%)	26 (36.6%)
Missing	1	
Mother education		
Under high school	24 (34.3%)	16 (18.3%)**
High school	39 (55.7%)	33 (46.5%)
Beyond high school	7 (10.0%)	25 (35.2%)
Missing	1	
Parent marital status		
Married	61(85.9%)	59 (83.1%)
Divorce/widow/separation	10(14.1%)	12 (16.9%)

Note: $p < .05$; ** $p < .01$

T1D = Adolescents with type 1 diabetes; Non-DM = Adolescents without diabetes;

Table 2. Number of subthreshold eating disorders and bulimic behaviors by groups

	Females (n = 84)			Males (n =58)		
	T1D	Non-DM	<i>p</i> value	T1D	Non-DM	<i>p</i>
Subthreshold Eating Disorders						
BITE Symptoms ≥ 20	2 (4.8%)	1 (2.4%)	1.00	1 (3.4%)	0 (0.0%)	
BITE Severity ≥ 5	2 (4.8%)	0 (0.0%)	.49	2 (6.9%)	1 (3.4%)	
BITE Total ≥ 26	2 (4.8%)	0 (0.0%)	.49	1 (3.4%)	0 (0.0%)	
EAT-26 Total ≥ 20	10 (23.8%)	7 (16.7%)	.59	5 (17.2%)	1 (3.4%)	
Bulimic Behaviors						
Diet Pills	2 (4.8%)	0 (0.0%)	.49	1 (3.4%)	0 (0.0%)	
Diuretics	0 (0%)	0 (0.0%)	N.S ^a	0 (0%)	0 (0.0%)	
Laxatives	1 (2.4%)	1 (2.4%)	1.00	0 (0%)	0 (0.0%)	
Vomiting	3 (7.1%)	0 (0.0%)	.24	1 (3.4%)	0 (0.0%)	

Note: ^a = No statistics were computed;

T1D = Adolescents with type 1 diabetes; Non-DM = Adolescents without diabetes;

BITE = Bulimic Investigatory Test, Edinburgh; Eat-26 = Eating Attitude Test-26

Table 3. Group comparisons in the subscales of BITE and EAT-26

	Male (N = 58)		t	Female (N = 84)	
	Mean \pm SD			Mean \pm SD	
	T1D	Non-DM		T1D	Non-DM
BITE score					
Symptoms	6.97 \pm 5.28	4.66 \pm 3.08	2.03*	9.88 \pm 5.42	5.98 \pm 4.05
Severity	1.00 \pm 1.60	0.76 \pm 1.33	.62	1.05 \pm 1.56	0.64 \pm 1.01
Total	7.97 \pm 6.39	5.41 \pm 3.66	1.86	10.93 \pm 6.47	6.62 \pm 4.71
EAT-26 score					
Dieting	5.79 \pm 5.34	3.76 \pm 4.49	1.55	9.57 \pm 6.66	6.83 \pm 6.83
Bulimia	3.97 \pm 2.76	2.24 \pm 1.27	3.06**	3.64 \pm 2.43	1.76 \pm 1.32
Oral control	2.03 \pm 2.53	2.83 \pm 2.75	-1.14	1.81 \pm 2.51	2.95 \pm 3.12
Total	11.76 \pm 8.02	8.83 \pm 5.39	1.63	15.02 \pm 8.45	11.55 \pm 8.74

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

T1D = Adolescents with type 1 diabetes; Non-DM = Adolescents without diabetes;

BITE = Bulimic Investigatory Test, Edinburgh; Eat-26 = Eating Attitude Test-26

Table 4. Regression models predicting the BITE Subscales and EAT subscales among T1D adolescents

Dependent variables	Predictors	b	t	P	R ₂	F
Bite symptoms	Age	.26	1.76	0.08	0.18	2.62 *
	Gender	.29	2.45	0.02		
	Duration of disease	-.18	-1.38	0.17		
	BMI	.09	0.66	0.51		
	AIC	.11	0.95	0.35		
Bite severity	Age	.13	0.93	0.35	0.22	3.46**
	Gender	-.01	-0.06	0.96		
	Duration of disease	-.21	-1.61	0.11		
	BMI	.27	2.08	0.04		
	AIC	.30	2.62	0.01		
Diet	Age	.28	2.06	0.04	0.29	4.99***
	Gender	.36	3.18	0.00		
	Duration of disease	-.27	-2.16	0.04		
	BMI	.25	1.97	0.05		
	AIC	-.21	-1.95	0.06		
Bulimia	Age	-.00	0.02	0.99	0.05	.56
	Gender	-.01	0.04	0.97		
	Duration of disease	-.20	1.36	1.79		
	BMI	.02	0.13	.90		
	AIC	-.09	0.73	.47		
Oral	Age	.27	1.78	.08	0.13	1.85
	Gender	-.01	0.04	.97		
	Duration of disease	-.21	1.57	.12		
	BMI	-.30	-2.14	.04		
	AIC	-.15	-1.25	.21		

Note: * $p < .05$; ** $p < .01$; *** $p < .001$ Non-DM = Adolescents without diabetes;

BITE = Bulimic Investigatory Test, Edinburgh; Eat-26 = Eating Attitude Test-26

