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Associations of disordered eating behavior with the family diabetes environment in adolescents with type 1 diabetes

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Abstract

Objective—To examine associations of disordered eating behaviors with aspects of the family eating and diabetes management environments among adolescents with type 1 diabetes (T1D).

Method—Data were collected from 151 adolescents (*M* age = 15.6 years) with T1D and their parents. Adolescents and parents completed self-report measures of the family eating environment (priority, atmosphere and structure/rules surrounding family meals, and presence of restricted and special foods in the household), and diabetes family management environment (diabetes family conflict and responsibility sharing). Adolescents completed measures of parent modeling of healthy eating and disordered eating behaviors. Linear regression models were used to assess the relationship of disordered eating behaviors with aspects of the family eating and diabetes management environments.

Results—In unadjusted models, adolescent, but not parent, report of aspects of the family eating environment were associated with adolescents' disordered eating behaviors. Both adolescent and

parent report of diabetes family conflict were positively associated with disordered eating behaviors. The adjusted adolescent model including all family eating and diabetes management variables accounted for 20.8% of the variance in disordered eating behaviors ($p<.001$, $R^2=.208$). Factors associated with greater risk of disordered eating included being female ($\beta=.168$, $p=.029$), lower priority placed on family meals ($\beta=-.273$, $p=.003$), less parental modeling of healthy eating ($\beta=-.197$, $p=.027$), more food restrictions in the household $\beta=.223$, ($p=.005$), and greater diabetes family conflict ($\beta=.195$, $p=.011$).

Conclusions—Findings suggest that aspects of the family eating environment and diabetes family conflict may represent important factors for disordered eating risk in adolescents with T1D.

Keywords

disordered eating; type 1 diabetes; adolescents; family environment; diabetes management

Introduction

Adolescents with type 1 diabetes may be at greater risk for developing disordered eating behaviors than their peers with no chronic illness because of the focus on diet as part of their diabetes management regimen.^{1,2} Studies have reported varying rates of eating disorders and disordered eating in adolescents with type 1 diabetes ranging from 3.8% - 27.5% (i.e., bulimia nervosa or binge eating disorder) to 38 - 40% (i.e., when insulin omission is considered purging)¹⁻³ which are often higher eating disorder prevalence rates than the general population (range 0.3% - 4%).⁴ Other studies, however, have found no difference in the prevalence of eating disorders among adolescents with and without type 1 diabetes.⁵

Disordered eating behaviors are associated with numerous adverse health outcomes among adolescents in the general population. Many studies have shown a positive association between disordered eating and depression,⁷ suicide,⁸ and other mental health problems.⁹ Disordered eating is also associated with poor diet quality¹⁰ and obesity.¹¹ Additionally, among adolescents with type 1 diabetes, disordered eating is associated with poor metabolic control.^{2,12} Of particular concern is the practice of restricting insulin for weight management, resulting in dangerous short- and long-term diabetes complications such as retinopathy, neuropathy, coma, and even death.¹³

Multiple factors have been identified as important to the development of disordered eating in adolescents, including societal pressures for thinness, bodily changes during adolescence, and body dissatisfaction.¹⁴ While broader contextual factors provide fertile ground for the development of disordered eating, there is limited evidence to suggest why some adolescents are more susceptible than others. Suboptimal family functioning, including poor cohesion, communication, and support, is associated with the development of disordered eating in the general population.¹⁵ During adolescence, changing family dynamics may strain relationships among family members as adolescents seek their independence and parents struggle with boundaries.¹⁶ Among adolescents with type 1 diabetes, there are additional challenges to the parent-adolescent relationship due to parental concerns surrounding diabetes management as their adolescent seeks greater autonomy over their self-care.¹⁷ Consequently, poor family communication and family conflict are associated with greater

eating disturbances in adolescents with type 1 diabetes,¹⁸ while family cohesion is protective.¹⁹

Research in the general population further suggests the relevance of the family eating environment for preventing the development of disordered eating.²⁰ Among adolescent girls, the frequency of and priority placed on family meals is significantly associated with less disordered eating even after adjusting for potential confounders such as family cohesion, parental pressures to diet, body mass index, and sociodemographic characteristics.¹⁵ Family meals may create opportunities for parents to model healthy eating behaviors and may provide opportunities for increased communication and cohesion. Further, family meal times could help adolescents develop a healthier perception of self and eating. Conversely, negative food-related experiences within a family (e.g., parent modeling of dieting and weight control, comments about dieting) are associated with increased disordered eating.²¹

Despite the potential importance of the family environment in reducing the risk for disordered eating, limited research has previously examined associations of disordered eating with various aspects of the family environment among adolescents with type 1 diabetes. The purpose of this study was to examine associations of disordered eating with the family eating and diabetes management environments, as these dimensions encompass specific factors that could potentially be targeted in efforts to reduce disordered eating behaviors in adolescents with type 1 diabetes. It was hypothesized that a more optimal family eating environment, including greater priority placed on family meals, positive family eating atmosphere, structure/rules surrounding family meals, and positive parent modeling of healthful eating would be associated with fewer adolescent disordered eating behaviors, and that the presence of restricted and special foods in the household would relate to greater disordered eating behaviors. Additionally, it was hypothesized that a more optimal family diabetes environment, characterized by greater diabetes responsibility sharing and less diabetes family conflict would be associated with fewer adolescent disordered eating behaviors. Findings from this study may identify potential risk and protective factors associated with disordered eating behaviors in this at-risk population.

Methods

Sample & Procedures

Subjects were part of a larger cross-sectional study conducted at a pediatric diabetes center in Boston, MA. Eligible patients and their parents were recruited to participate by trained research staff at the time of a routine diabetes clinic visit. The entire study included youth who were 8-18 years old although the current investigation was limited to those 13 years old. Eligibility criteria included age 8 to 18 years, diagnosis of type 1 diabetes 1 year, daily insulin dose 0.5 units per kilogram, absence of any gastrointestinal disease such as celiac disease or use of medications that interfere significantly with diabetes management or glucose metabolism, and ability to communicate in English. Survey measures were completed at the time of the study visit; only adolescents ages 13 years and older completed the measure of disordered eating behaviors. Biomedical data were obtained from the electronic medical record. Of 455 eligible families invited to participate, 302 (66.4%) enrolled in the study. When multiple siblings participated, data from the sibling with the

longest diabetes duration was retained, resulting in elimination of 11 subjects. Of the remaining 291 families, 151 had youth aged 13 years or older and comprised the sample for this analysis. Informed parent consent and child assent were obtained. The study protocol was approved by the Committee on Human Subjects at the study site.

Measures

Dietary Eating Problems Survey-Revised (DEPS-R)—Adolescent report of disordered eating behaviors was assessed using a 16-item diabetes-specific measure²² of disordering eating behaviors ($\alpha = 0.79$). The measure was designed as a screening tool to identify risk for disordered eating. Items are scored on a 6-point Likert scale from “never” to “always” with higher scores indicating greater endorsement of disordered eating behaviors. Examples of items include: “I would rather be thin than have good control of my diabetes” and “After I overeat, I don’t take enough insulin to cover the food.” The DEPS-R has previously demonstrated good internal consistency ($\alpha = .86$) and was associated with multiple aspects of diabetes management including frequency of blood glucose monitoring, diabetes-specific burden, negative affect around blood glucose monitoring.²²

Family Eating Environment

Family Eating Habits—Adolescents and parents completed the Family Eating Habits 15-item questionnaire comprising three scales - priority of family meals (e.g., In my family, we are expected to be home for dinner; $\alpha = 0.74$ youth, $\alpha = 0.78$ parent; r youth/parent = .381, $p < .001$), atmosphere at family meals (e.g., In my family, mealtime is a time for talking with other family members; $\alpha = 0.80$ youth, $\alpha = 0.82$; r youth/parent = .308, $p < .001$), and structure/rules at family meals (e.g., Manners are important at our dinner table; $\alpha = 0.71$ youth, $\alpha = 0.57$ parent; r youth/parent = .478, $p < .001$). Responses range on a 4-point Likert scale from “strongly disagree” to “strongly agree.” Higher scores indicate greater priority of family meals, more positive atmosphere at family meals, or greater rules and expectations regarding mealtime behaviors. The scales demonstrate adequate psychometric properties and associations with unhealthy weight control behaviors in the general population.²³

Restricted and Designated Foods—Two items were developed by the study team to assess the presence of foods in the home that are either restricted from or designated for the child with diabetes. The presence of restricted foods was assessed with an item querying “There are many foods in the home that I am [my child with diabetes is] not supposed to eat” (r youth/parent = .116, $p = .158$). The presence of designated foods was assessed with the item “There are many foods in the home that are just for me [my child with diabetes]” (r youth/parent = .147, $p = .147$). Response options were on a 4-point Likert scale from “strongly disagree” to “strongly agree.” Higher scores indicate greater food restriction or designated foods in the home.

Parent Modeling of Healthful Eating—This 18-item measure assessed the adolescent’s perception of parent modeling of both healthy and unhealthy food choices (e.g., when I was with my parents, they ate...vegetables; ...salty snacks); responses provide a single modeling score. Responses are on a 4-point Likert scale ranging from “almost never” to “almost always” where higher scores indicate greater parental modeling of healthful eating. This

measure demonstrates adequate internal consistency ($\alpha = 0.67$) and relations with child dietary intake.²³

Family Diabetes Management Environment

Diabetes Responsibility Sharing—Adolescents and their parents completed the Diabetes Family Responsibility Questionnaire,²⁴ a 17-item instrument that assesses responsibility for diabetes-related tasks (e.g., taking more or less insulin according to results of blood sugar monitoring; $\alpha = 0.72$ youth, $\alpha = 0.81$ parent; r youth/parent = .555, $p < .001$). Response options include “I/Child take/s responsibility for this almost all the time”, “My parents and I/Parent(s) and child share responsibility for this about equally”, and “My parents/Parent(s) take responsibility for this almost all the time.” Higher scores indicate greater parent responsibility for diabetes-related tasks.

Diabetes Family Conflict Scale—Adolescents and parents completed the Diabetes Family Conflict Scale,²⁵ which assesses the level of family conflict for 19 diabetes management tasks (e.g., blood glucose checking, insulin administration) on a 3-point Likert scale of “almost never,” “sometimes,” or “almost always.” Higher scores indicate greater family conflict surrounding diabetes management. The measure has good internal consistency ($\alpha = 0.91$ youth, $\alpha = 0.83$ parent; r youth/parent = .248, $p = .002$) and is associated with diabetes management.²⁵

Biomedical and demographic data—Biomedical data including duration of diabetes, regimen, frequency of blood glucose monitoring, glycated hemoglobin (HbA1c), height, and weight were abstracted from the medical record. Demographic characteristics including parent education level and family income were provided by parent report.

Statistical Analysis

Sample characteristics were summarized using means and standard deviations or frequencies. Linear regression models were used to examine bivariate associations of disordered eating behaviors with family eating environment and family diabetes management environment variables for both adolescent and parent report. Two overall multiple regression models (one for adolescent- and one for parent report) evaluated the independent relationships of these variables with disordered eating behaviors. Since disordered eating is more prevalent in adolescent females compared to males,²⁶ sex was included as a covariate in the multiple regression models. Significance was set a priori at $p < .05$. Analyses were performed using SPSS 21.0 (SPSS Inc., 2008; Chicago, IL).

Results

Participants were 151 adolescents (52% male) aged 13 to 18 ($M = 15.6$; $SD = 1.5$) with T1D and their parents (Table 1). The majority of the adolescents were Caucasian (90.7 %) and the average duration of T1D was 7.7 years ($SD = 43.4$) and the average HbA1c was 8.8 % ($SD = 1.6$). The mean z-score for BMI was 0.71 ($SD = 0.76$). Nearly two-thirds (64.9%) of the adolescents reported using an insulin pump.

Multiple aspects of the family eating and diabetes environments were significantly associated with adolescents' disordered eating behaviors in unadjusted models (Table 2). Specifically, adolescent report of less priority placed on family meals ($\beta = -.204, p = .012$), less parental modeling of healthy eating ($\beta = -.168, p = .039$), and greater presence of restricted foods in the household ($\beta = .223, p = .006$) were each associated to greater disordered eating behaviors. Adolescent report of atmosphere of family meals, structure of family meals, and presence of special foods in the household were not independently associated with disordered eating behaviors. Parent report of family eating environment variables (atmosphere of family meals, priority of family meals, structure of family meals, presence of restricted foods in household, and presence of special foods in the household) were not independently related to adolescent disordered eating behaviors. Both adolescent and parent report of greater diabetes family conflict ($\beta = .205, p = .012$; $\beta = .243, p = .003$ respectively), but not diabetes responsibility sharing, were associated with greater disordered eating behaviors.

The overall adolescent model including all family eating and diabetes management variables accounted for 20.8% of the variance in disordered eating behaviors ($p < .001, R^2 = .208$; Table 2, adjusted model). Significant constructs in the overall model included being female ($\beta = .168, p = .029$), less priority placed on family meals ($\beta = -.273, p = .003$), less parental modeling of healthy eating ($\beta = -.197, p = .027$), greater presence of restricted foods in the household ($\beta = .223, p = .005$), and greater diabetes family conflict ($\beta = .195, p = .011$). The overall parent model including all family eating and diabetes management variables approached statistical significance ($R^2 = .099$; $p = .057$).

Discussion

Findings of this study suggest that aspects of the family eating and diabetes management environments may represent important risk and protective factors for disordered eating behaviors in adolescents with type 1 diabetes. Specifically, disordered eating behaviors in adolescents with type 1 diabetes were inversely associated with adolescent report of priority of family meals and parental modeling of healthful eating, and positively associated with restricted foods in the home. In addition, both adolescent and parent report of greater diabetes family conflict surrounding diabetes-related management tasks was associated with greater endorsement of disordered eating behaviors, although parent reported conflict may only be considered significant in the unadjusted model.

The associations of lower endorsement of disordered eating behaviors with a more optimal family meal environment is consistent with two previous studies in the general population.^{15, 20} The pathways by which family meals is associated with lower risk for disordered eating behaviors have not been examined; it is possible that regular family meals provide opportunities for modeling of healthful eating behaviors and may help parents identify eating problems or issues early. Regular family meals may be associated with greater family cohesion and may provide a venue for regular family communication. Recent literature suggests a decline in the frequency of family meals;²⁷ and our findings add to this research and suggest that an important area for further study is the utility of interventions to increase family meal frequency for promoting healthful eating behaviors. In order to

promote family meals, support should be provided around meal planning for healthy and easy-to-prepare meals as well as methods to organize the family schedule to increase the frequency of family meals.²⁰

In the current study, parental modeling of healthful eating was associated with lower endorsement of disordered eating behaviors in adolescents with type 1 diabetes. Previous research suggests the importance of parents in fostering healthy eating habits in children through parental modeling and regularly providing a healthy food selection.²⁸ Notably, parent modeling of unhealthy behaviors such as dieting, use of unhealthy weight control methods (e.g., laxative, diuretics) and comments about dieting to lose weight are associated with more disordered eating in the general population²¹ and among adolescent girls with type 1 diabetes²⁹.

Findings regarding an association of disordered eating behaviors with adolescent report of restriction of foods in the home highlight a potentially important area for intervention within families of adolescents with type 1 diabetes. In the general population, parental control in the form of restricting certain foods as well as pressuring to eat healthful foods may lead to the development of disordered eating or overeating.²⁸ Restriction of foods for adolescents with type 1 diabetes similarly treats the adolescent differently than others in the family, which could increase negative affect and conflict. There is a need for future research in this population addressing adolescent and parent perceptions of how and what foods are restricted in addition to the reason behind restricting certain foods.

Differences between adolescents and parents were observed in the association of the family eating environment with adolescent disordered eating behaviors, indicating difference in the reporting of the family environment by adolescents and parents. These may reflect either true differences in perception or potential differential influence of social desirability bias. Differences are not likely due to varying interpretation of the items, as the measure has previously been validated for use in both youth and parents. Findings highlight the importance of multi-informer information for researchers and clinicians.

Both adolescents' and parents' reports of family conflict were associated with greater adolescent endorsement of disordered eating behaviors in unadjusted models; adolescent report of conflict was also associated in the adjusted model. Previous research has demonstrated that adolescents with type 1 diabetes experience greater family conflict compared to adolescents without type 1 diabetes because of stress in the parent-adolescent relationship regarding diabetes management tasks.^{29,30} Greater diabetes-specific family conflict has also been associated with poorer treatment adherence and glycemic control.¹⁸ It is not known whether diabetes-related conflict represents a risk for or a result of disordered eating behaviors, nor to what extent conflict may serve as an indicator of overall family functioning. Future research is required to addressing these research gaps.

Limitations of this study include the cross-sectional study design, which precludes determination of causality of the observed associations. This study also may not be representative of all adolescents with type 1 diabetes as participants were recruited from one clinical center. Single items developed for this study were used to measure restricted and

designated foods, which limits the depth of information available for these constructs. Study strengths include the relatively large sample size and assessment of multiple eating-related and diabetes-related family environmental constructs.

Treatment modalities for adolescents with type 1 diabetes currently include the family as an important component in managing and coping with the disease. This study suggests the relevance of the family eating and diabetes environments, specifically parental modeling of healthy eating, priority of family meals, food restriction, and family conflict, for disordered eating behaviors among adolescents with type 1 diabetes. Future longitudinal research is needed to determine whether these constructs increase the risk of developing disordered eating behaviors. Findings from this study further support the potential importance of the family eating and diabetes management environments at reducing the risk for disordered eating behaviors in youth with type 1 diabetes.

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Table 1
Sample Characteristics (N=151)

	Mean (SD) or <i>n</i> (%)
<u>Demographics</u>	
Age	15.6 (1.5)
Gender	
Female	73 (48.3)
Male	78 (51.7)
Race/ethnicity	
White, not Hispanic	137 (90.7)
Hispanic	6 (4.0)
Black	5 (3.3)
Other	3 (1.3)
Highest parent education level	
High school or equivalent	14 (9.3)
Junior college, technical, or some college	28 (18.5)
College degree	69 (45.7)
Graduate education	40 (26.5)
Family income	
<30,000	16 (10.6)
30,000-49,999	12 (7.9)
50,000-69,999	23 (15.2)
70,000-99,999	27 (17.9)
100,000-149,000	34 (22.5)
>150,000	35 (23.2)
<u>Diabetes and health-related characteristics</u>	
Duration of diabetes	7.7 (3.6)
Regimen	
Injection	53 (35.1)
Pump	98 (64.9)
Daily frequency of blood glucose monitoring	5.44 (2.2)
A1c	8.8 (1.6)
zBMI	.71 (.76)
Diabetes Eating Problems Survey- Revised	12.6 (10.1)

Table 2
Unadjusted and adjusted linear regression models predicting endorsement of disordered eating among adolescents with type 1 diabetes (N=151)

	Unadjusted		Adjusted*	
	β	p	β	p
Gender (Female)	---	---	.168	.029
Atmosphere of Family Meals	-.078	.339	.094	.327
Priority of Family Meals	-.204	.012	-.273	.003
Structure of Family Meals	-.019	.815	.158	.089
Parent Modeling of Healthful Eating	-.168	.039	-.197	.027
Restricted Foods	.223	.006	.223	.005
Special Foods	.090	.273	.077	.329
Diabetes Responsibility Sharing	.070	.392	.100	.190
Diabetes Family Conflict	.205	.012	.195	.011

* The adjusted model includes gender and all family environment variables in a single model ($R^2 = .208$; $p < .001$)

Table 3
Unadjusted and adjusted linear regression parent report models predicting endorsement of disordered eating among adolescents with type 1 diabetes ($N = 151$)

	Unadjusted		Adjusted*	
	β	p	β	p
Gender (Female)	---	---	.173	.034
Atmosphere of Family Meals	-.066	.424	-.030	.763
Priority of Family Meals	-.091	.265	-.068	.462
Structure of Family Meals	.099	.911	.014	.871
Restricted Foods	.085	.297	.050	.570
Special Foods	-.021	.794	-.054	.540
Diabetes Responsibility Sharing	.030	.714	-.027	.756
Diabetes Family Conflict	.243	.003	.245	.004

*The adjusted model includes gender and all family environment variables in a single model ($R^2 = .099$; $p = .057$)