

## Original Article

# Mealtime interactions in families of pre-schoolers with type 1 diabetes

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**Abstract:** Objectives: Parents of pre-schoolers with type 1 diabetes report more behavioral feeding problems and concerns about the management of mealtime behavior than parents of age-matched healthy control children. We compared mealtime interactions of 26 families of pre-schoolers with type 1 diabetes (13 boys; mean age = 4.4 yr) and those of 26 families of age-matched control children by using direct observation of meals.

**Methods:** Families had three meals videotaped in their home. Trained coders independently scored each meal for parent, child, and child eating behaviors by using the Dyadic Interaction Nomenclature for Eating (DINE).

**Results:** The frequency of parent and child behaviors at mealtimes (such as instructions to eat, coaxing, feeding, refusing food, leaving the table, and non-compliance with instructions to eat) was similar for both groups. Children ate less and engaged in more behaviors incompatible with eating during the second half of meals than during the first half. Children, who took over 19 min to eat at meals (average duration for controls) played more and ate less than children, who ate more quickly.

**Conclusions:** Despite increased parental concern, pre-schoolers with type 1 diabetes do not have more challenging mealtime behaviors than age-matched healthy controls. Interventions to inform parents of pre-schoolers with type 1 diabetes about typical child mealtime behaviors and teach effective strategies for managing problematic behaviors are needed to reduce parental concerns and may be critical for improving adherence to diet if a relation between child behavior, adherence, and metabolic control is demonstrated. Further research is required to investigate whether these mealtime interactions adversely impact dietary adherence and blood glucose excursion.

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Nutrition is a cornerstone of the management of type 1 diabetes. The goal of conventional nutrition management in type 1 diabetes is to match caloric intake to insulin requirement in order to achieve blood glucose levels close to the normal range (1). Because of the complexity of the dietary regimen, patients with type 1 diabetes and their families are vulnerable to errors in dietary management (2–7). In addition, younger children may have more difficulty adhering to their dietary regimen because of normal variations in child behavior and development (e.g., increased insulin sensitivity, limited cognitive ability, transient food preferences, variations in the amount of food consumed, and emotional

lability) (2, 8, 9). Dietary mismanagement can increase the risk of hypo- and hyperglycemia, which can lead to serious complications and morbidity. Therefore, research investigating barriers to dietary adherence is needed to inform clinical interventions for young children with type 1 diabetes.

One factor that may influence dietary adherence in young children with type 1 diabetes is children's behavior at mealtimes and parent's attempts to manage mealtime interactions. Parents of pre-school children with type 1 diabetes report mealtime management as among the most challenging aspects of diabetes care (2). Specifically, in a study of mothers of pre-schoolers

with type 1 diabetes, children were described as frequently leaving the table during meals, dawdling before coming to meals, and expressing dissatisfaction with the food served during mealtime (2). In a more recent study, 40 parents of children with type 1 diabetes and 40 parents of children without a chronic illness completed questionnaires assessing parent and child behaviors at mealtimes and parenting stress (10). Parents of children with type 1 diabetes reported more child mealtime behavior problems and higher stress scores than parents of healthy control children. This study replicated previous findings, which suggest that parents of children with type 1 diabetes may especially have problems with their children leaving the table during meals and expressing dissatisfaction with the types of foods served during mealtime (10).

While parents of young children with type 1 diabetes report problematic mealtime behaviors and concerns about their ability to manage mealtime interactions, no study has sought to compare the mealtime interactions of children with type 1 diabetes and their parents to healthy control families via direct observation of meals. Direct observation of mealtimes through videotaped meals in the home setting can provide a measure of mealtime behavior interactions that is free of the bias introduced by self-report measures. In addition, the inclusion of an age-matched healthy control sample can allow for a parceling out of the unique contributions that developmental and disease factors may play in children's behavior at mealtimes. Thus, the aim of this study was to investigate the differences in the total frequency of mealtime behaviors of pre-schoolers with type 1 diabetes and their parents and healthy control pre-schoolers and their parents by using an objective measure of mealtime behavior interactions. Parent behaviors were identified as 'effective' and child behaviors were identified as 'disruptive and incompatible with eating' based on previous research (11–14). Behavior patterns that emerge over the course of meals were examined by comparing behaviors that occurred in the first half of the meal to behaviors that occurred in the second half of the meal and by comparing behaviors during fast meals (meals that were completed within 19 min – the average meal duration of the control sample) and behaviors during slow meals (meals that were longer than 19 min). Based on previous research (10, 11), it was hypothesized that:

- pre-schoolers with type 1 diabetes would engage in more mealtime behaviors incompatible with eating than pre-schoolers without type 1 diabetes,
- parents of pre-schoolers with type 1 diabetes would use more behaviors (both effective and ineffective strategies) to manage mealtimes and to promote eating than parents of healthy pre-schoolers,
- children with type 1 diabetes would eat less and engage in more behaviors incompatible with eating

in the second half of the meal than the first half of the meal, and

- children with type 1 diabetes would demonstrate a higher rate of behaviors incompatible with eating during long meals than during short meals.

## Methods

### Participants

Children with type 1 diabetes were recruited from the Pediatric Diabetes Center (PDC) at Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA. The inclusion/exclusion criteria for this study were child age between 24 and 72 months, a confirmed diagnosis of type 1 diabetes for at least 6-month duration, no other disease/condition known to affect growth, and English as a primary language in the home. Fifty-nine families of children with type 1 diabetes were initially selected for study recruitment from a patient database maintained by the PDC. Of these, 53 families were successfully contacted about the study and 50 families consented to participate in the study (94%). All of the families were asked whether they would participate in a study investigating mealtime behaviors that involved questionnaires and videotaping in the home. Twenty-six families agreed to complete both the questionnaires and the videotaping; twenty-four families agreed to complete the questionnaires only. This study reports on the 26 families of children with type 1 diabetes and the 26 age-matched control children, who completed the videotaping in their home. No differences in demographic, physiologic, or parental report of mealtime behaviors were found for the 26 families of children with type 1 diabetes, who participated in the videotaping, and the 24 families, who did not. All of the children in the current study participated in the previously reported questionnaire-based study, which examined parent report of mealtime behaviors and parenting stress (10).

All of the children with type 1 diabetes, who participated in this study, followed a conventional insulin therapy regimen, which consisted of two to three injections each day of short- and intermediate-acting insulin and a regular schedule of meals and snacks timed to coincide with the peak effectiveness of the insulin. Approximately 85% of children with type 1 diabetes, who attended the PDC at the time of this study, were managed according to a conventional insulin regimen.

Non-chronically ill control children were recruited from the local community through pediatricians' offices. Pediatricians, who participated in the recruitment of control families, were asked to introduce the study to all families of children in the desired age range. This procedure was used in order to reduce the likelihood of obtaining a control sample that over selected

for families who had concerns about mealtime behavior problems, or for children for whom the pediatrician had concerns about mealtime behavior problems or growth. Control families were matched to families of children with type 1 diabetes on child age (within 3 months), sex, socio-economic status (within two strata; Hollingshead, AB, unpublished master's thesis, 1975), and the number of parents and siblings typically present at mealtimes.

## Procedure

This study was reviewed and approved by the Cincinnati Children's Hospital Institutional Review Board, Cincinnati, OH, USA. During the first home visit, parents signed the informed consent form and were taught how to weigh and measure their child's food intake. For subsequent home visits, the research assistant arrived approximately 30 min before the family's typical mealtime and a video camera was set up to record the meal. While children and parents ate, the research assistant waited in a separate room or outside of the house until the meal was completed. In order to assess for reactivity to the video recording, parents were asked to rate meals based on the target child's typical behavior and food intake at mealtimes, the number of people present at the meal (siblings and parents), and the duration of the mealtime. Three meals rated as typical by parents were used for the final data analyses. The mean number of home visits needed to obtain at least three representative meals was  $3.12 \pm 0.50$ . In addition to videotaped observations of mealtimes, parents completed a diet record of the foods eaten during each filmed meal. The diet records of the children were analyzed by a registered dietitian using the Minnesota Nutrition Program, a nutritional software program. Also, in order to describe the samples, the weight and the height of the children were obtained according to a standardized protocol within 2 weeks of study enrollment (10).

## Dependent measures

All videotaped meals were coded by using a valid behavioral coding system, namely the Dyadic Interaction Nomenclature for Eating (DINE), developed for the assessment of mealtime interactions in young children and their parents (11, 15, 16). The DINE consists of three categories of behaviors – parent behaviors, child behaviors, and child eating behaviors. For parent behaviors, meals were coded for direct commands, interrupted commands, coaxes, parent talks, reinforcement, physical prompts, and feeds. For child behaviors, meals were coded for non-compliance with direct commands, food refusals/complaints, requests for food, child talks, and child

away from table/food. For child eating behaviors, meals were coded for bites and sips. According to the DINE, the majority of behaviors were coded on an occurrence/non-occurrence basis within 10-s intervals. However, select behaviors were coded according to the frequency of occurrence of these behaviors within 10-s intervals. These behaviors included direct and interrupted commands, feeds, bites, and sips. The operational definitions for each of the behaviors are available upon request.

Observers watched each meal a minimum of three times. During the first viewing, the meals were scored for child eating behaviors. During the second and third viewings, the meals were scored for child behaviors and parent behaviors, respectively. A primary observer, who was unaware of children's group status (i.e., type 1 diabetes or control), scored all of the videotaped meals. Inter-rater reliability was assessed by using a random subset of the videotapes (33%), which were scored independently by a second observer, who was also unaware of the children's group status. Kappa statistics were calculated on the agreement of the occurrence of each behavior within each 10-s interval. Kappa is a stringent measure of reliability that corrects for the influence of chance agreements among observers (17). The average Kappa coefficient was 0.73 for parent behaviors, 0.78 for child behaviors, and 0.89 for child eating behaviors. Kappa coefficients of 0.60 or greater are considered acceptable for inter-rater reliability (17).

## Statistical analyses

For each child, the frequency of mealtime behaviors was averaged across all three meals. Behaviors were divided into three categories – (i) parent behaviors (direct commands, interrupted commands, reinforcement, parent talks, coax, physical prompts, and feeds), (ii) child behaviors (talk, away, refuse, request, and non-compliance), and (iii) child eating behaviors (bites and sips). To test the *a priori* hypotheses 1 and 2, we performed a series of multivariate analyses of variance tests (MANOVA) to compare children with type 1 diabetes to control children on the absolute frequency of parent, child, and child eating behaviors during the meals. Follow-up univariate tests were performed in order to identify differences, if the MANOVA tests were significant. Similarly, to test the *a priori* hypothesis 3, we compared the frequency of behaviors for both groups between the first and second half of the meal by using MANOVA tests and performed follow-up univariate tests, when MANOVA results were significant. To test the *a priori* hypothesis 4, the rate of behaviors (the number of 10-s intervals with occurrence of the behavior/the total number of 10-s intervals in the meal) for children who completed meals within 19 min vs. children who took more than 19 min to eat, was compared

using MANOVA tests. Nineteen minutes was considered the time cut-off because it was the average meal duration for control children. Families participating in this study had three meals videotaped and each meal was categorized as either a 'fast meal' or a 'slow meal', resulting in 156 observations. Follow-up univariate tests were performed in order to identify differences, if the MANOVA tests were significant.

**Results**

**Participants**

As shown in Table 1, children with type 1 diabetes were similar to their age-matched non-chronically ill peers on demographic and anthropometric measures. In addition, both groups took about 20 min to complete their meals and consumed a similar amount of carbohydrates per meal. For the control group, parent ratings of mealtime behavior problems, observed mealtime behaviors, and anthropometric characteristics were consistent with published normative values or findings from other healthy control groups of similar age children recruited in the same fashion in prior studies (18, 19). As such, the control group in this study is generally representative of the range of mealtime behaviors typical of healthy pre-schoolers.

**Frequency of parent, child, and child eating behaviors**

Findings of the MANOVA tests for the frequency of parent and child behaviors revealed no differences for children with type 1 diabetes and control children ( $p = 0.16$  and  $p = 0.80$ , respectively). A significant difference was found when comparing children on child eating behaviors ( $p = 0.05$ ). Follow-up univariate tests revealed that children with type 1 diabetes averaged more bites ( $M = 57.5 \pm 16.4$ ) and more sips ( $M = 10.9 \pm 7.1$ ) during meals than control children ( $M = 50.4 \pm 20.6$ ,  $M = 7.2 \pm 4.8$ , bites and sips, respectively) (Table 2).

**Comparisons of first half and second half of the meal**

No differences were found for meal half for parent behaviors. A significant main effect for meal half was found, when child behaviors were examined ( $p = 0.01$ ). Regardless of child group, children were more non-compliant with parent commands to eat in the second half ( $M = 0.93 \pm 1.4$ ) of the meal, compared to the first half ( $M = 0.50 \pm 0.8$ ;  $p = 0.05$ ). Children also refused and complained about food more often in the second half ( $M = 7.8 \pm 7.1$ ) of the meal, compared to the first half ( $M = 3.4 \pm 5.2$ ;  $p = 0.01$ ). Looking at child eating behaviors, a main effect for meal half was found

Table 1. Demographic, anthropometric, physiologic, and meal information

Variable	Type 1 diabetes (n = 26)		Comparison (n = 26)	
	M	SD	M	SD
Age (years)	4.4	1.2	4.3	1.1
Weight (kg)	18.4	3.1	17.4	2.8
Height (cm)	102.0	12.1	104.4	7.6
Average carbohydrate/filmed meal	41	16	44	16
Average meal duration (minutes)	20.3	7.7	19.7	9.3
Average HbA1C level	7.9	0.97		
	Frequency	Percentage	Frequency	Percentage
Sex				
Male	13	50	13	50
Female	13	50	13	50
Race				
Non-Caucasian	3	11	0	0
Caucasian	23	89	26	100
SES factor score (Hollingshead scale)*				
I	1	4	0	0
II	2	8	0	0
III	4	16	1	4
IV	10	38	12	46
V	9	34	13	50
Family marital status				
Married	22	85	24	92
Unmarried	4	15	2	8

\*The Hollingshead four-factor scale is measured from I (lowest level) to V (highest level). No statistically significant differences were found between the groups. HbA1c, hemoglobin A1c; SES, socio-economic status.

Table 2. Average frequency of parent and child behaviors by illness group.

	Frequency by illness group		p-value	Effect size* $\eta^2$
	Type 1 diabetes M (SD)	Comparison M (SD)		
Parent behaviors				
Direct commands	5.93 (6.53)	3.71 (2.03)	0.10	
Indirect commands	3.94 (4.22)	3.92 (4.94)	0.99	
Coax	4.92 (2.99)	4.41 (3.38)	0.56	
Feed	2.46 (5.80)	1.52 (3.29)	0.48	
Physical prompt	2.25 (2.00)	3.46 (4.38)	0.21	
Reinforcement	0.43 (0.54)	0.54 (0.78)	0.58	
Parent talk	44.43 (30.22)	56.27 (42.69)	0.20	
Child behaviors				
Away from table	10.49 (7.20)	11.92 (14.12)	0.65	
Child talk	49.07 (29.96)	46.85 (21.06)	0.76	
Food refusal	2.95 (2.53)	2.30 (2.23)	0.33	
Requesting food	1.47 (1.40)	1.13 (1.09)	0.33	
Non-compliance	1.74 (2.59)	1.10 (1.09)	0.25	
Child play	3.87 (8.30)	5.10 (22.09)	0.79	
Child eating				
Bites	57.51 (16.37)	50.42 (20.64)	0.04	0.11
Sips	10.92 (7.13)	7.25 (4.79)	0.03	0.09

\*For effect size, we used  $\eta^2$ , interpreted as 0.01 = small effect, 0.09 = medium effect, 0.25 = large effect.

( $p = 0.001$ ). ANOVA comparisons found that children in both groups took fewer bites in the second half of the meal ( $M = 22.1 + 9.3$ ), compared to the first half ( $M = 31.8 \pm 11.0$ ;  $p = 0.001$ ) (Table 3).

#### Characteristics of fast vs. slow meals

The overall MANOVA comparisons for fast vs. slow meals demonstrated a main effect for type of meal among child behaviors ( $p = 0.01$ ) and child eating behaviors ( $p = 0.001$ ). Univariate comparisons of

child behaviors found that regardless of chronic illness status, children who took more time to eat at meal-times were less likely to refuse food directly and complain about food (i.e., verbal refusal and pushing the food away) ( $p = 0.05$ ), but played more during the meal than children who ate their meal within 19 min ( $p = 0.05$ ). Children in both groups took more bites ( $p < 0.001$ ) and more sips ( $p = 0.004$ ) during fast meals than during slow meals. However, there was no difference in average calorie or carbohydrate intake for fast vs. slow meals ( $p = 0.47$ ) (Table 4).

Table 3. Average frequency of parent and child behaviors by meal half

	Frequency by meal half (all people)		p-value	Effect size* $\eta^2$
	First half M (SD)	Second half M (SD)		
Parent behaviors				
Direct commands	1.87 (2.03)	2.95 (3.17)	0.04	0.04
Indirect commands	1.17 (1.41)	2.76 (3.74)	0.01	0.08
Coax	2.07 (1.49)	2.59 (1.97)	0.13	
Feed	0.77 (2.59)	1.22 (2.55)	0.37	
Physical prompt	1.12 (1.37)	1.74 (2.29)	0.09	
Reinforcement	0.16 (0.33)	0.32 (0.51)	0.06	
Parent talk	24.29 (15.19)	26.02 (16.04)	0.57	
Child behaviors				
Away from table	1.01 (3.21)	2.86 (6.31)	0.85	
Child talk	24.58 (14.03)	23.38 (12.31)	0.65	
Food refusal	3.42 (5.18)	7.79 (7.08)	0.001	0.11
Requesting food	0.61 (0.58)	0.70 (0.98)	0.56	
Non-compliance	0.50 (0.84)	0.93 (1.36)	0.05	0.04
Child play	2.08 (8.14)	2.40 (8.54)	0.85	
Child eating				
Bites	31.83 (11.05)	22.13 (9.27)	0.001	0.19
Sips	5.00 (4.08)	5.92 (4.53)	0.48	

\*For effect size, we used  $\eta^2$ , interpreted as 0.01 = small effect, 0.09 = medium effect, 0.25 = large effect.

Table 4. Average rate of child behaviors for fast and slow meals

	Rate by meal type (all people)		p-value	Effect size* $\eta^2$
	Meal $\leq$ 19 minutes M (SD)	Meal >19 minutes M (SD)		
Child behaviors				
Away from table	0.09 (0.13)	0.10 (0.09)	0.62	
Child talk	0.38 (0.20)	0.43 (0.18)	0.10	
Food refusal	0.03 (0.04)	0.02 (0.02)	0.02	0.04
Requesting food	0.01 (0.02)	0.01 (0.01)	0.92	
Non-compliance	0.009 (0.02)	0.01 (0.01)	0.36	
Child play	0.01 (0.04)	0.04 (0.13)	0.05	0.03
Child eating				
Bites	0.55 (0.20)	0.42 (0.20)	0.001	0.10
Sips	0.09 (0.08)	0.06 (0.05)	0.004	0.05

\*For effect size, we used  $\eta^2$ , interpreted as 0.01 = small effect, 0.09 = medium effect, 0.25 = large effect.

**Discussion**

Parents of pre-schoolers with type 1 diabetes commonly report child mealtime behavior problems and concerns about their ability to manage mealtime interactions (2, 10). In this study, we compared the mealtime interactions of pre-schoolers with type 1 diabetes and their parents to the mealtime interactions of age-matched healthy control children and their parents by using direct observation methodology. Pre-schoolers with type 1 diabetes were recruited from a large, tri-state geographic region in the mid-western US and were matched to children without type 1 diabetes by means of previously tested matching criteria (10, 15, 16, 18). The current sample was composed of a subset of a larger sample, which compared mealtime behaviors by using a valid parent-report questionnaire (10). Families, who participated in the current study, reported concerns about mealtime interactions and management of mealtime behaviors similar to families, who had participated in the larger study. Children in the control group were representative of healthy pre-schoolers, in general, in terms of mealtime behaviors and growth based on data consistent with prior reports and norms. Contrary to our hypothesis, when direct observation methodology was applied, mealtime behaviors of children with type 1 diabetes and control children were found to be similar. The mealtime behaviors of parents of pre-schoolers with type 1 diabetes and those of parents of control children were also found alike. When meals were examined according to meal half, all children were found to eat less and exhibit more behaviors incompatible with eating during the second half of the meal than during the first half of the meal. Moreover, a difference in child behavior was found when fast and slow meals were compared, with children in both groups who took more time to eat their meals engaging in more dawdling behaviors than children who ate more quickly. It is well known that mealtime behaviors during the developmental period from age 2 to 6 can be challenging for parents to effectively

manage (20). This situation, combined with the added demands of meeting the expectations of the diet regimen for a young child with type 1 diabetes (e.g., specific carbohydrate unit requirements per meal/snack vs. no set requirement for carbohydrate intake) and the immediate and long-term health consequences resulting from poor dietary adherence (e.g. hypoglycemia if insulin administered but carbohydrate requirements not eaten), may make typical child behaviors at meal-times of greater clinical importance and concern for families of young children with type 1 diabetes. Indeed, parents of children with type 1 diabetes report more concerns about typical child mealtime behaviors than parents of same age healthy peers (10). Thus, early dietary interventions for families of young children with type 1 diabetes may need to include parent training to change the ways parents respond to typical child mealtime behaviors throughout the meal, to address the tendency for more disruptive behaviors to occur during the second half of the meal, and to make meals more efficient and of shorter duration. It is reasonable to assume that more optimal care might result from intervening with pre-schoolers with type 1 diabetes early to prevent or effectively manage mealtime behavior problems as the child develops, thereby making it more likely for families to reduce mealtime stress and enhance adherence to their prescribed diet regimen.

In this study, children in both groups were found to engage in a similar frequency of disruptive behaviors at mealtimes, such as non-compliance with instructions to eat, refusing offers of food, complaining about food served, leaving the table, and playing during the meal. Parents, in turn, responded to their children by using several common strategies. Specifically, all parents were observed to use verbal commands (direct and indirect), coaxing, non-verbal physical prompts (e.g. pointing to the food), and feeding to encourage their child to eat. Notably, parents in both samples infrequently offered reinforcement for child eating. In fact, across both groups, the frequency of parent reinforcement for meals was about 10% of the frequency of commands or coaxes

issued to children and about 5% of the frequency of physical prompts used with children. Child behavioral therapy has demonstrated the effectiveness of combining direct commands with praise and reinforcement as a method of increasing desired behaviors (12). Direct commands provide children with a clear understanding of the behaviors that are expected of them. Likewise, by offering praise for compliance or ignoring non-compliance (known as differential attention), children can receive immediate feedback regarding their behavior. Similar child-behavior-management strategies have been used effectively in order to manage problematic mealtime behaviors and to promote eating in children with cystic fibrosis and feeding disorders (21–27). Because of the need for parents of young children with type 1 diabetes managed via conventional therapy to ensure that a specific amount of carbohydrate is eaten at every meal or snack, typical parenting behavior at mealtime may be insufficient to consistently get pre-schoolers to eat as directed by the type 1 diabetes regimen. It may be that this is a notable source of the stress parents of young children with type 1 diabetes have reported in prior studies (2, 8–10). Therefore, as an intervention for parents of young children with type 1 diabetes who are struggling to manage child mealtime behaviors or are working to effectively manage typical mealtime behaviors of pre-schoolers and prevent the development of problematic behaviors, it may be helpful to teach parents how to pair direct commands and differential attention in order to increase compliance with the type 1 diabetes diet regimen, while decreasing coercive interactions and family stress at mealtimes.

When meals were examined for meal half differences, children in both groups were more non-compliant with parent commands to eat, refused food more often, complained about the food offered to them more often, and took fewer bites during the second half of the meal than during the first half. In spite of this, there were no meal half differences for parent behavior management efforts. Parents in this sample were observed to command, coax, prompt, and feed their child at approximately the same frequency throughout the meal. In the face of escalating child resistance, parents of young children with type 1 diabetes may become vulnerable to feelings of stress and frustration at mealtimes, especially if they perceive their parenting strategies as ineffective. Moreover, because of the importance of timely carbohydrate intake in the management of type 1 diabetes, parents of children with type 1 diabetes may be particularly vulnerable to feelings of distress (10), which may influence their perception of typical child mealtime behaviors and their reactions to typical mealtime challenges inherent in raising a young child. Therefore, findings of this study suggest that parents of pre-schoolers with type 1 diabetes may benefit from limiting the duration of mealtime and parent training interventions that can teach them new ways to respond

to typical child mealtime behaviors throughout the meal and minimize the emergence of disruptive behaviors during the second half of meals.

Children, in this study, who took more time to eat at mealtimes were more likely to engage in play than children who took less time to eat their meals. Dawdling behaviors, such as play, can be improved via behavioral interventions – e.g., establishing rules for mealtime duration and using differential attention to reinforce eating behaviors throughout the meal. Interestingly, children in both groups took more bites and more sips during short meals than during long meals, offering further support for interventions that limit meal duration as a method of promoting eating behaviors at mealtimes (15, 16, 18). Therefore, behavioral intervention may be indicated for families of young children with type 1 diabetes, who are frustrated with long mealtimes.

We assessed mealtime behaviors in children and families recruited from a tri-state region of the mid-western US. Children and families were mostly middle to upper middle class and from two-parent households. Although the families who participated in this study were representative of the patient population and communities from which they were recruited, future research will need to recruit a larger sample of children with more diverse backgrounds in order to assess the generalizability of these data. Such replication should make it possible to detect smaller differences in the eating avoidance practices of the children and parents' efforts to manage mealtime interactions that could be clinically important and inform the development of interventions for families of young children with type 1 diabetes. In addition, all of the children with type 1 diabetes who participated in this study followed a conventional insulin therapy regimen. Conventional insulin therapy remains a primary regimen for young children with type 1 diabetes, supporting the representativeness of this sample to many young children in the US. However, intensive insulin therapy is an effective alternative regimen for families of young children with type 1 diabetes and research concerning the interaction among parent concerns, mealtime behavior, dietary adherence, and metabolic control will be needed to inform the delivery of these new technologies to families of young children with type 1 diabetes. In this study, we did not assess adherence to carbohydrate or caloric intake recommendations for children with type 1 diabetes nor did we obtain measures of children's glycemic excursion while participating in the study. Therefore, future research is needed to examine the associations between mealtime interactions of families of young children with type 1 diabetes and health outcomes, such as dietary adherence and metabolic control. If mealtime interactions are found to adversely impact dietary adherence and/or blood glucose excursion, it would be critical to advise parents

about typical child mealtime behaviors and teach them more effective strategies for managing challenging behaviors at mealtimes. Because nutrition is a cornerstone of the management of type 1 diabetes, testing whether parental concerns about mealtimes are related to health outcomes for children with this disease could lead to clinically significant changes in the standard of nutritional care.

### Implications and conclusions

It is concluded that parents of young children with type 1 diabetes report concerns about children's mealtime behaviors and their ability to manage typical mealtime behaviors (10). We found similarities in the frequency of mealtime behaviors incompatible with eating for pre-schoolers with type 1 diabetes and pre-schoolers without type 1 diabetes. Moreover, the frequency of child management behaviors at mealtimes was similar for parents of pre-schoolers with type 1 diabetes and parents of control children. Children in both groups were found to exhibit challenging behaviors that were incompatible with eating at mealtimes and to escalate in such behaviors the longer they stayed at the table. Because of the importance of timely carbohydrate intake in children with type 1 diabetes, it is possible that parents may be more likely to perceive their child's non-eating behavior as resistant or disruptive than parents of pre-schoolers without type 1 diabetes (10). Future research should attempt to replicate the findings of this study in a larger sample, develop interventions to inform parents about typical child mealtime behaviors and effective strategies for managing challenging behaviors, and examine the relationship between nutrition, mealtime behaviors, and subsequent metabolic control in pre-school-age children with type 1 diabetes.

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