Differences in Family Mealtime Interactions between Young Children with Type 1 Diabetes and Controls: Implications for Behavioral Intervention

Susana R. Patton,[1] PhD, Lawrence M. Dolan,[2] MD and Scott W. Powers,[2] PhD ABPP
[1]University of Michigan/C.S. Mott Children's Hospital and [2]Cincinnati Children's Hospital Medical Center

Objective We examine clinically relevant differences in family mealtime behaviors for young children with type 1 diabetes mellitus (T1DM) and matched controls. **Methods** One hundred and eighteen families (46% boys; *M* age = 5.0, SD = 1.5 years) had at least three home meals videotaped and coded for family behaviors. Analyses had adequate statistical power to detect medium effects. **Results** Parents of children with TIDM offered a higher rate and frequency of commands to eat than controls. As the meal progressed, all parents worked harder at controlling mealtimes, while children ate less. Behaviors associated with lower dietary adherence and poorer glycemic control occurred on average 9 min of a typical 19 min meal for children with TIDM. **Conclusions** When differences in family mealtime behaviors have been found in other pediatric groups (e.g., cystic fibrosis), the results have directly informed the development of effective interventions. The clinically relevant results of this study can be used to inform interventions for young children with TIDM.

Key words behavioral control; child rearing; chronic disease; nutrition; child, preschool.

In families of young children with type 1 diabetes mellitus (T1DM), parents are required to perform all daily cares to manage the diabetes successfully including frequent finger-stick blood glucose tests, multiple subcutaneous injections of insulin, and accurate monitoring of dietary carbohydrate intake (Fertig, Simmons, & Martin, 1995; Sperling, 1996). Normal developmental behaviors during childhood (opposition, emotional lability, independence-seeking) could interfere with the ability of parents to complete the tasks needed to achieve optimal blood glucose control (Golden, Russell, Ingersoll, Gray, & Hummer, 1985; Patton, Dolan, & Powers, 2006). Moreover, these typical childhood behaviors combined with changing food preferences and variable appetite may impact mealtime interactions between child and parent, and affect blood glucose control (Linscheid, Budd, & Rasnake, 2003; Patton et al., 2006).

Previous work established that mealtime behavior is a major challenge for families of young children who have chronic diseases (Mackner, McGrath, & Stark, 2001). For example, in children with cystic fibrosis mealtime behavior problems are common leading to poor nutrition (Powers et al., 2005b; Stark et al., 2000). Likewise, in young children with T1DM, the data have shown that mealtimes pose a significant challenge to parents (Patton et al., 2006; Powers et al., 2002a; Wysocki, Huxtable, Linscheid, & Wayne, 1989). Mealtimes involve multiple components of diabetes management including insulin administration, meal planning and dietary modification, and self-monitoring of blood glucose levels (Fertig et al., 1995). Moreover, because children often eat several snacks in addition to the typical three meals per day, feedings can be a regular and unavoidable source of stress for parents if they are experiencing mealtime behavior problems.

Using both questionnaire-based and observational techniques to obtain an assessment of mealtime behaviors, we have studied mealtimes in young children with T1DM and appropriately matched control subjects (Patton et al., 2004, 2006; Powers et al., 2002a). Our questionnaire based data indicated that parents of young children with T1DM report more problems with child behavior at mealtimes and more parenting stress than parents of children without diabetes

All correspondence concerning this article should be addressed to Susana R. Patton, PhD, Division of Child Behavioral Health, University of Michigan, 1924 Taubman Center, SPC#5318, 1500 East Medical Center Drive, Ann Arbor, MI 48109-5318, USA. E-mail: susanap@med.umich.edu

Journal of Pediatric Psychology 33(8) pp. 885–893, 2008
doi:10.1093/jpepsy/jsn026
Advance Access publication March 20, 2008

(Powers et al., 2002a). However, as these findings were the subjective report of the parents, we sought next to employ direct observation of mealtimes (Patton et al., 2004). When direct observation was used, we found no differences in mealtime behaviors for parents and children with T1DM and controls suggesting that parents' report of mealtime problems may simply be related to their perceptions of meals (Patton et al., 2004). Our post hoc analyses revealed medium to small effect sizes, indicating that our initial study had insufficient power to detect potentially clinically relevant group differences in mealtime interactions. In the absence of adequate power, there is an increased likelihood of committing a Type 2 error. From a clinical standpoint, failure to detect true differences in mealtime behaviors may prevent identification of specific targets for intervention for families of young children with T1DM. Moreover, these data could give a false impression of the level of impairment families of young children with T1DM may experience at mealtimes. Indeed, in a related study, we found moderate strength correlations (r's = .45–.87) between parent and child mealtime behaviors and children's dietary adherence and average blood glucose levels for a sample of 35 young children with T1DM (Patton et al., 2006). This related study used direct observation of family mealtimes to evaluate parents' and children's mealtime interactions. To measure dietary adherence, children's recommended carbohydrate units per meal were compared to children's actual food intake. Children's glycemic control was evaluated using average daily blood glucose levels for the two weeks children participated in the videotaping. Our findings suggest that how parents and children behave at mealtimes can relate to children's health status and provides further support for research investigating mealtimes and interventions targeting improved mealtime interactions in families of young children with T1DM (Patton et al., 2006). Therefore, because of the limitations of the first study as well as the clinical significance of understanding the experience of feeding a young child with T1DM, a more thorough examination of mealtime interactions of families of young children with T1DM, and controls is warranted.

The purpose of this study was to improve our understanding of parent–child mealtime interactions in families with young children with T1DM via direct observation of family mealtimes in a larger sample of young children with T1DM and matched controls. To accomplish these goals, we identified the following hypotheses:

1. Young children with T1DM would engage in more mealtime behaviors incompatible with eating than young children without T1DM.
2. Parents of young children with T1DM would use more behaviors (both effective and ineffective strategies) to manage mealtimes and to promote eating than parents of healthy children.
3. Families of young children with T1DM would engage in a higher rate of behaviors incompatible with eating at mealtimes than control families.
4. Young children with T1DM 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.

We tested these hypotheses by recruiting an additional 33 families of young children with T1DM to achieve a final sample size of 59 families. It was expected that outcomes demonstrating differences in the mealtime interactions of families of young children with T1DM and controls as well as an interaction between diagnosis and meal duration would provide specific targets for behavioral interventions.

Methods

Participants

Children with T1DM and their families were recruited from the Pediatric Diabetes Center (PDC) at Cincinnati Children's Hospital Medical Center (CCHMC). Children were eligible to participate if they were between the ages of 2 and 8 years, had a confirmed diagnosis of T1DM for at least 6 months duration; had no other disease/condition known to affect growth; and spoke English as the primary language in their home. Exclusion criteria for this study included children with developmental delay and children who were taking medications known to affect carbohydrate metabolism other than replacement insulin. Subject recruitment occurred in two cohorts. The first cohort, recruited 26 families of young children with T1DM and these data have been presented in an earlier publication (Patton et al., 2004). The second cohort recruited an additional 33 families of young children with T1DM. The second cohort of participants was recruited to allow for the examination of parent–child mealtime interactions in a larger sample of children with T1DM. For both cohorts, families were contacted by the research team and invited to participate in one or more research studies that involved both questionnaires and videotaping of home meals (Patton et al., 2004, 2006; Powers et al., 2002a). Overall, we recruited 130 families of young children with T1DM to participate in a research study. Of these, 59 families agreed to complete the videotaping, suggesting a recruitment rate of 45%.

An examination of relevant child and family demographic variables for the two cohorts revealed no significant differences for child age, gender and ethnicity distribution, parents' marital status, or families' level of socioeconomic status (SES). There was a difference with respect to child insulin regimen between the two cohorts, as the first cohort did not include any children on intensive insulin therapy. Presently, there is no research demonstrating a difference in parent mealtime perceptions or the behavior of families of young children with T1DM using intensive insulin therapy. For both conventionally and intensively managed children, mealtimes require blood glucose monitoring and regulation of insulin and carbohydrate levels (Kaufman, Halvorson, Fisher, & Pitukcheewanont, 1999). Thus, the decision was made to combine the two cohorts to allow greater power to exam parent–child mealtime interactions.

For the sample of 59 children with T1DM, ~85% of children 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. The remaining 15% of children followed an intensive insulin therapy regimen, which consisted of either multiple daily injections of short- and long-acting insulin or continuous insulin infusion. At the time these studies were conducted, ~85% of children in this age range who attended the PDC were following a conventional insulin regimen.

To obtain a control sample of nonchronically ill children and families, children were recruited from the local community via pediatrician's offices. To reduce bias, pediatricians were asked to introduce the study to all of their patients who were between 2- and 8-years old. Families who were interested in participating in the study were then referred to the principal investigator for enrollment. Because the pediatricians introduced the study to all of their patients between 2- and 8-years old, data are not available for the total number of families approached. Of the families who were interested in participating, over 90% were matched to children with T1DM and enrolled in the study. Control families were matched to families of children with T1DM according to child age (within 3 months), child gender, family SES (within two strata; Hollingshead, unpublished master's thesis, 1975), and the number of adults and children typically present for mealtimes. Similar to the procedure for obtaining the diabetes sample, children in the control group were recruited in two cohorts. The first cohort recruited 26 children and their data were published previously (Patton et al., 2004). The second cohort of control families included 33 families of young children. There were no differences in child and family demographics for the two control cohorts. In all cases, children with T1DM were matched to controls within each cohort (i.e., a family with T1DM recruited in the first cohort was matched to a control family recruited in the first cohort).

Procedure

The study was reviewed and approved by the Cincinnati Children's Hospital Institutional Review Board. Families who were interested in participating in the study were contacted by telephone by a member of the research team to schedule a home visit. During the first home visit, families signed the informed consent form and were taught how to record their child's food intake according to a standard protocol (Patton et al., 2004; Powers et al., 2002b). Families completed videotaping of their first meal at the time of their first home visit. The remaining meals were videotaped at subsequent home visits that were scheduled within 2 weeks of the first meal. Research assistants followed a standard protocol for home visits, which was designed to minimize reactivity to the videotaping (Patton et al., 2004; Powers et al., 2002b). Research assistants arrived to the home and set up the video camera at least 30 min prior to the meal to allow the child and family time to acclimate to the camera. During the meal, the research assistant waited in a separate room or outside of the home. 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. Only meals rated ''typical'' were included in the final analyses and the mean number of home visits needed to obtain at least three typical meals was 3.12 ($SD = 0.41$). In addition to videotaping, parents completed a diet record of the foods eaten by children for each of the videotaped meals and children's weight and height were obtained according to a standardized protocol within 2 weeks of study enrollment (Powers et al., 2002b; Stark et al., 1995).

Dependent Measures

Videotaped meals were coded using the Dyadic Interaction Nomenclature for Eating (DINE), a valid behavioral coding system developed to assess parent–child mealtime interactions in young children (Powers et al, 2002c; Stark et al., 2000). The DINE is comprised of three categories of behaviors: parent behaviors, child behaviors, and child eating behaviors. Parent behaviors include: direct commands, indirect commands, coaxes, parent talks, reinforcement, physical prompts, and feeds. Child behaviors include: noncompliance to commands, food refusals/complaints, requests for food, child talk, and child away from table/food. Child eating behaviors include: bites and sips. The DINE codes the majority of behaviors on an occurrence/nonoccurrence basis within 10 s intervals. However, five behaviors are coded according to their frequency of occurrence within 10 s intervals. These behaviors include: direct and indirect commands, feeds, bites, and sips. The operational definitions for each of the behaviors are available upon request from the developers of the DINE (Stark et al., 2000).

Meals were coded for parent–child interactions according to the procedure established by the developers of the DINE (Stark et al., 2000). All meals were watched a minimum of three times. For each viewing, observers coded only one category of behavior and the order of coding was Child Eating, Child, and Parent behaviors. All meals were assigned to a primary coder who was blind to children's group status (i.e., T1DM or control). To measure inter-rater reliability, a subset of meals (33%) was coded by a second coder who was also blind to children's group status. The inter-rater reliability was measured using the κ-statistic, a conservative measure of reliability that is recommended for behaviors that are measured on an occurrence/nonoccurrence basis (Cohen, 1960; Hartman, 1977). Mean κ-coefficients for the samples were: .90, .80, and .68 for Child Eating, Child, and Parent behaviors, respectively. The minimum κ-coefficient for acceptable reliability is .60 (Hartman, 1977).

Statistical Analyses

To estimate power for this study with a sample of 59 families of young children with T1DM and 59 control families, preliminary effect sizes from the original mealtime interaction study were used (Patton et al., 2004). Based on the original data, medium to small effect sizes were expected for the group comparisons for Parent, Child, and Child Eating behaviors (Patton et al., 2004). Findings revealed ample power (0.85–0.86) to detect medium effects for multivariate analyses of covariance (MANCOVA) ($d = .13$) for Parent and Child Eating behaviors. In the original study, only small effect sizes were found for Child Behaviors ($d = .04$) and at 59 families, power to detect differences was estimated at .31. Therefore, with 59 families per group, this study was not powered to detect a small effect size.

The planned statistical analyses for this study replicate the analyses performed in the earlier publication (Patton et al., 2004). For all of the analyses, coded observations from three "typical" home meals were used. The frequency of parent–child behaviors were averaged across all three meals and divided into three categories: parent behaviors (direct commands, indirect commands, reinforcement, parent talks, coax, physical prompts, and feeds); child behaviors (talk, away, refuse, request, and noncompliance) and child eating behaviors (bites and sips). To correct for skewed data, data were transformed to achieve more normal distributions. In addition, because of within-group negative correlations between child age and the dependent variables, child age was included as a covariate in all of the primary analyses. To examine Hypotheses 1 and 2, MANCOVA were used to compare the frequency of mealtime behaviors for families of children with T1DM and control families. Hypothesis 3 was examined using MANCOVA to compare the rate of mealtime behaviors (the number of 10 s intervals with occurrence of the behavior/the total number of 10 s intervals in the meal) for families of children with T1DM and controls. To examine Hypothesis 4, MANCOVA were used to compare the frequency of mealtime behaviors by subject group and meal half. For all of the analyses, post hoc univariate tests were used to identify specific differences in cases where the MANCOVA tests were significant.

Results

Participants

The final sample consisted of 59 children with T1DM and 59 matched control children. Children had a mean age of 5.0 ($SD = 1.5$) years. For children with T1DM, there were 27 boys and 32 girls. Table I summarizes all the demographic and anthropometric information collected for children. Comparisons revealed no differences between the T1DM and control samples on the matching criteria. Notably, for children in the control group, parent ratings of mealtime behavior and observed mealtime behaviors were consistent with findings from similar published studies which used a healthy comparison group of a similar age (Stark et al., 2000). Therefore, it is expected that the mealtime behaviors demonstrated by control children are representative of the types of behaviors common in preschool and young children.

Mealtime Characteristics

Independent sample *t*-tests were used to examine group differences in meal length and carbohydrate intake. Recording of meal length began when the target child took a bite of food and ended when the target child either indicated that he/she was done or had eaten all of the

Table I. Demographic, Anthropometric, Physiologic, and Meal Information

	Type 1 diabetes ($n=59$)		Comparison ($n=59$)		
Variable	*M*	*SD*	*M*	*SD*	*p*
Age (years)	5.0	1.5	5.0	1.5	.88
Average carbohydrate/filmed meal	45.0	16	43.0	18	.63
Average meal duration (min)	17.5	9.1	19.6	8.9	.02
Average HbA1c level	8.1	0.96			
	Frequency	%	Frequency	%	
Gender					
Male	27	46	27	46	
Female	32	54	32	54	
Race					
Non-Caucasian	10	17	4	7	.09
Caucasian	49	83	55	93	
SES factor score (Hollingshead scale)					
I	5	8	5	8	.52
II	4	7	1	2	
III	12	20	9	15	
IV	26	45	27	46	
V	12	20	17	29	
Family marital status					
Married	46	78	51	86	.43
Unmarried	13	22	8	14	

Table II. Average Frequency of Parent and Child Mealtime Behaviors By Illness Group

	Frequency by Illness Group				
	Type 1 diabetes *M (SD)*	Comparison *M (SD)*	*F*	*p*	η^{2a}
Parent behaviors			2.27	0.03	0.13
Direct commands	4.27 (5.14)	2.53 (1.96)	3.76	0.05	0.03
Indirect commands	3.39 (4.30)	2.51 (3.72)	5.12	0.03	0.04
Coax	4.40 (4.15)	3.27 (3.28)	2.73	0.10	0.02
Feed	2.98 (10.04)	0.94 (2.45)	2.51	0.12	0.02
Physical prompt	1.74 (1.81)	2.13 (3.28)	0.54	0.47	0.00
Reinforcement	0.39 (0.50)	0.39 (0.80)	0.09	0.77	0.00
Parent talk	39.83 (25.56)	38.88 (31.73)	0.18	0.67	0.00
Child behaviors			1.21	0.31	0.11
Away from table	12.84 (15.01)	9.93 (11.79)	2.93	0.09	0.04
Child talk	45.23 (31.02)	40.40 (24.26)	0.80	0.78	0.00
Food refusal	2.27 (2.28)	1.82 (1.80)	1.67	0.20	0.02
Requesting food	1.11 (1.26)	0.86 (1.00)	0.33	0.57	0.00
Non-compliance	1.38 (2.03)	0.89 (0.94)	1.71	0.19	0.03
Child play	6.15 (28.73)	2.68 (14.73)	1.67	0.20	0.03
Child eating			7.91	0.00	0.13
Bites	60.03 (19.99)	51.61 (24.40)	6.53	0.01	0.03
Sips	9.27 (6.04)	6.66 (4.11)	14.77	0.00	0.06

Note: [a]Eta-squared, a measure of effect size, interpreted as 0.01, small effect; 0.09, medium effect; 0.25, large effect.

food presented. Findings revealed a significant difference in meal length by group. Children with T1DM had a mean meal length of 19.6 ($SD=8.9$) min, while control children had a mean meal length of 17.5 ($SD=9.1$) min, $t(360)=-2.28$, $p=0.02$ (95% CI -4.01 to -0.29). With respect to average grams of carbohydrate consumed during the videotaped meals, no group differences were found. Children with T1DM averaged 45.0 ($SD=16$) grams of carbohydrates per videotaped meal, while control children averaged 43.0 ($SD=18$) grams of carbohydrates per videotaped meal.

Frequency of Parent, Child, and Child Eating Behaviors

Hypotheses 1 and 2 tested group differences in Child and Parent mealtime behaviors while controlling for child age within each group. Contrary to Hypothesis 1, findings of the MANCOVA test for frequency of Child behaviors revealed no differences in the mealtime behaviors of young children with T1DM and control children ($\eta^2=0.11$). In support of Hypothesis 2, the MANCOVA for Parent behaviors revealed a significant difference in mealtime behaviors for parents of young children with T1DM and parents of control children ($\eta^2=0.13$). Follow-up univariate analyses found that parents of young children with T1DM averaged more direct ($\eta^2=0.03$) and indirect ($\eta^2=0.04$) commands during meals than control parents. When Child Eating behaviors were examined, the overall MANOVA revealed a significant main effect for child group ($\eta^2=0.13$). Follow-up univariate tests found that children with T1DM averaged more bites ($\eta^2=0.03$) and sips ($\eta^2=0.06$) per meal than control children (Table II).

Rate of Parent, Child, and Child Eating Behaviors

Hypothesis 3 predicted a higher rate of behaviors incompatible with eating for families of young children with T1DM versus controls. Consistent with Hypothesis 3, results of the MANCOVA test for Parent Behaviors found a significant difference in the rate of behaviors for parents of young children with T1DM and controls ($\eta^2=0.10$), with parents of young children with T1DM offering a higher rate of direct commands to eat than control parents ($\eta^2=0.04$). Likewise, with respect to Child Eating behaviors, a significant difference was found between young children with T1DM and controls ($\eta^2=0.04$), with young children with T1DM averaging a higher rate of sips at meals than control children

Table III. Average Rate of Parent and Child Mealtime Behaviors By Illness Group

	Rate[a] by Illness Group				
	Type 1 diabetes *M* (*SD*)	Comparison *M* (*SD*)	*F*	*p*	η^{2b}
Parent behaviors			3.76	0.00	0.10
Direct commands	0.03 (0.04)	0.02 (0.02)	9.13	0.00	0.03
Indirect commands	0.03 (0.04)	0.02 (0.04)	1.88	0.17	0.00
Coax	0.03 (0.03)	0.03 (0.03)	0.76	0.38	0.00
Feed	0.02 (0.07)	0.01 (0.02)	3.02	0.08	0.01
Physical prompt	0.02 (0.02)	0.02 (0.03)	0.83	0.36	0.00
Reinforcement	0.39 (0.50)	0.39 (0.80)	0.54	0.46	0.00
Parent talk	0.33 (0.19)	0.38 (0.21)	3.21	0.07	0.01
Child behaviors			1.86	0.09	0.04
Away from table	0.10 (0.11)	0.10 (0.11)	0.58	0.45	0.00
Child talk	0.38 (0.19)	0.39 (0.17)	0.54	0.46	0.00
Food refusal	0.02 (0.02)	0.02 (0.02)	0.05	0.82	0.00
Requesting food	0.01 (0.02)	0.01 (0.01)	0.48	0.49	0.00
Non-compliance	0.01 (0.02)	0.01 (0.01)	3.44	0.06	0.01
Child play	0.04 (0.13)	0.02 (0.07)	4.06	0.04	0.01
Child eating			4.52	0.01	0.03
Bites	0.52 (0.26)	0.51 (0.26)	0.04	0.83	0.00
Sips	0.08 (0.07)	0.06 (0.05)	9.05	0.00	0.03

Note: [a]Rate was calculated as the number of 10 s intervals with occurrence of the behavior/the total number of 10 s intervals in the meal. [b]Eta-squared, a measure of effect size, interpreted as 0.01, small effect; 0.09, medium effect; 0.25, large effect.

Table IV. Average Frequency of Parent and Child Mealtime Behaviors by Meal Half

	Frequency by meal half ($n = 118$)				
	1st Half *M* (*SD*)	2nd Half *M* (*SD*)	*F*	*p*	η^{2a}
Parent behaviors			2.41	0.02	0.11
Direct commands	1.27 (1.65)	2.13 (2.55)	8.96	0.00	0.06
Indirect commands	0.90 (1.29)	2.05 (3.12)	14.38	0.00	0.09
Coax	1.65 (1.75)	2.19 (2.34)	4.58	0.03	0.03
Feed	0.82 (3.80)	1.14 (3.76)	0.40	0.53	0.00
Physical prompt	0.78 (1.10)	1.15 (1.75)	3.20	0.08	0.02
Reinforcement	0.13 (0.32)	0.25 (0.46)	4.42	0.04	0.03
Parent talk	19.13 (14.01)	20.22 (15.46)	1.83	0.18	0.01
Child behaviors			1.44	0.22	0.16
Away from table	3.53 (5.60)	7.86 (8.79)	2.25	0.14	0.04
Child talk	21.95 (14.40)	20.86 (14.12)	0.18	0.67	0.00
Food refusal	0.59 (0.77)	1.45 (1.59)	3.65	0.06	0.07
Requesting food	0.50 (0.60)	0.49 (0.80)	0.15	0.70	0.00
Non-compliance	0.39 (0.66)	0.74 (1.13)	1.40	0.24	0.03
Child play	2.08 (11.09)	2.34 (11.79)	2.60	0.11	0.05
Child eating			18.52	0.00	0.14
Bites	32.51 (13.25)	23.31 (10.82)	36.52	0.00	0.14
Sips	3.85 (3.63)	4.11 (3.03)	0.74	0.39	0.00

Note: [a]Eta-squared, a measure of effect size, interpreted as 0.01, small effect; 0.09, medium effect; 0.25, large effect.

($\eta^2 = 0.04$). Contrary to Hypothesis 3, no differences were found for the rate of child behaviors for young children with T1DM and controls (Table III).

Comparisons of First Half to Second Half of the Meal

Hypothesis 4 predicted that young children with T1DM would eat less and engage in more disruptive behaviors in the second half of meals versus the first half of meals. Contrary to Hypothesis 4, no differences were found in Child Behaviors from the first half of the meal to the second. For Child Eating behaviors, a significant main effect for meal half was revealed ($\eta^2 = 0.14$) and follow-up tests showed that all children averaged fewer bites in the second half of the meal versus the first half ($\eta^2 = 0.14$). However, there was no interaction by child group. Finally, MANCOVA tests for Parent behaviors found a statistically significant main effect for meal half ($\eta^2 = 0.11$) with no interaction by child group. Specifically, all parents were found to average more direct and indirect commands in the second half of the meal versus the first half of the meal ($\eta^2 = 0.06$ and $p = 0.09$, respectively). Likewise, parents used more coaxes ($\eta^2 = 0.03$) and offered more reinforcement ($\eta^2 = 0.03$) to encourage child eating in the second half versus the first half of the meal (Table IV).

Discussion

We examined parent–child mealtime interactions in a sample of families of young children with T1DM and matched controls. The findings of this study are partially consistent with the extant literature upon which it was based. Mealtime observation studies in families of young children with cystic fibrosis revealed that parents issued a higher frequency of commands and used more ineffective strategies such as coaxing and using physical prompts at mealtimes (Powers et al., 2005b; Stark et al., 2000). This research also found that young children with cystic fibrosis engaged in a higher frequency of mealtime behaviors incompatible with eating than control children (Stark et al., 2000). In the current study, we found that parents of young children with T1DM issued more direct and indirect commands to eat than parents of controls. However, we found no differences in child behavior at mealtimes, suggesting that T1DM in young children is not a risk factor for more disruptive child behavior at mealtimes.

While no differences were found in behaviors for young children with T1DM and controls, children with T1DM did engage in behaviors incompatible with eating which may be problematic for their diabetes. Young children with T1DM left the table, refused offers of food, brought toys to the meal or played with their food, and talked instead of eating during meals. All told, our data suggest that young children with T1DM engaged in these behaviors an average of 9 min/meal (mean meal duration = 19.6 min). Our previous report demonstrated associations between children's disruptive mealtime behaviors and their dietary adherence and average daily blood glucose control, findings which suggest that even typical mealtime behaviors for young children may have very different functional consequences when examined within the context of T1DM (Patton et al., 2006). Thus, clinical attention may be needed to address these developmentally normal mealtime behaviors in order to aide in improving dietary adherence and glycemic control in young children with T1DM.

While the present study identified few group differences in mealtime behaviors and primarily differences with only small to medium effect sizes, it has implications for the clinical management of young children with T1DM. From an assessment standpoint, the findings underscore the importance of asking families directly about their mealtime management and the occurrence of disruptive child mealtime behaviors during regular diabetes appointments. Moreover, because child behaviors appear to be similar across groups, parents of young children with T1DM may benefit from information that normalizes their experiences among families of young children, while also providing them with tools to influence behaviors that are related to less than adequate dietary adherence for this illness. With respect to intervention, this study identified differences in parent behaviors that are potentially modifiable and could affect modest changes in health outcomes for young children. Specifically, behavioral interventions exist for other chronic illness populations (e.g., cystic fibrosis) that teach parents how to give effective commands and how to pair short, direct commands with contingent attention (Powers et al., 2005a; Stark et al., 1996; Stark, Powers, Jelalian, Rape, & Miller, 1994). Direct commands (vs. a combination of direct and indirect instructions without predictable consequences) provide children with a clear message of the behaviors that are expected and thus can reduce problems with noncompliance due to misunderstanding. In addition, when paired with contingent attention, children are able to receive immediate, predictable feedback for their behavior, which can help them to comply with future directives (Stark et al., 1994, 1996). It is possible that these interventions could serve as a model for developing an intervention that is specific to teaching parents strategies for managing mealtimes for young children with T1DM. As another strategy, it may be helpful to target shorter and more structured mealtimes for young children with T1DM. Providing more structure at meals by having a parent sit with the child while he/she eats, establishing family rules for bringing toys to the table or getting up from the table, and establishing specific goals for child behavior (i.e., eating before talking, trying foods) may help children to self-manage their behavior more effectively and reduce the need for parents to intervene (Stark et al., 1994). Finally, teaching parents to target short, efficient meals and not to keep children at the table as a strategy for achieving greater food intake may also help to prevent an escalation in disruptive child behaviors (Stark et al., 1994).

There are limitations to report for this study. First, the majority of families who participated in this study were from two parent households and the middle to upper middle class. While the families of the young children in this study were representative of the patients served by the PDC at CCHMC and the communities from which they were recruited, the absence of a more diverse sample with respect to ethnicity and family SES is a limitation. Second, most of the children were managed by the conventional two-injections per day insulin therapy. At many institutions, a number of young children with T1DM are now managed according to an intensive insulin regimen, involving an insulin pump or three or more insulin injections per day. Thus, the findings of this study may not generalize to families using an intensified insulin therapy regimen. Third, our recruitment rate of 45% of families of young children with T1DM is relatively low and a comparison of the data collected from the two samples suggests greater variability for some of the behaviors among families of young children with T1DM when compared to controls. Because of our low recruitment rate among diabetes families, it is possible our data are not representative of mealtime behaviors of all children with T1DM. Related, the lack of variability in our control sample may suggest that a selection bias occurred in our control recruitment resulting in a final control sample that was more similar within group. Because of these limitations related to sampling, we caution the reader against over interpreting our findings. Additional studies are required to address each of these limitations.

With respect to power, our sample of 59 families of young children with T1DM and 59 control families was adequate to detect differences with at least medium effect sizes, but not sufficient to detect differences with small effect sizes. In weighing the clinical significance of this study, we decided the power to detect at least medium effect sizes would be adequate to identify potentially meaningful group differences and thus would improve upon our previous reports pertaining to mealtime interaction.

The outcomes of this study are significant because they provide a replication and extension of our previous results and can inform clinical practice and the development of a specific behavioral intervention for mealtimes in young children with T1DM. With respect to future research the present study offers several areas for further investigation. First, research is needed examining the mealtime interactions of families of young children with T1DM who are managed intensively. Intuitively, it would seem that parents of young children who are intensively managed may perceive meals as less challenging because they do not need to adhere to a specific carbohydrate amount per meal, but this has yet to be tested. Second, research is needed testing whether parents of young children with T1DM report less stress and improved mealtime functioning if they are taught specific behavioral strategies for mealtimes. Behavioral mealtime interventions have been successful in improving the functioning of families of young children with cystic fibrosis, suggesting a good theoretical foundation for these interventions in T1DM. Third, we need research in families of young children with T1DM investigating parent and child-based factors that may moderate parents' perceptions of mealtimes, such as parental/child mental health status, parenting skills and knowledge, parents' self-efficacy, family social support, and parents' diabetes knowledge in order to identify other targets for behavioral intervention. Finally, we need to conduct research to examine parent–child mealtime interactions in families of young children with T1DM who come from diverse ethnic and socioeconomic backgrounds.

Acknowledgments

We thank the following individuals for assisting with subject recruitment and data management: Alex Castator, Molly Heidemann, Racquel Henry, and Debbie Standiford, RN, (Cincinnati Children's Hospital Medical Center), Drs Steve Muething, Andy Zupan, and Deborah Mack, Children's Health Care; Dr Elizabeth Brown, Hyde Park Pediatrics; Drs Chris Boling and Chris Cunha, Pediatric Associates; and members of the Cincinnati Pediatric Research Group (CPRG, Cincinnati Children's Hospital Medical Center). Finally, we thank the families who participated in this research project. This research was supported in part by grants R01 DK54915 and K24 DK59973 from the National Institutes of Health/National Institute of Diabetes and Digestive and Kidney Diseases (to S.W.P.) and grant F32 DK61121 from the National Institutes of Health/National Institute of Diabetes and Digestive and Kidney Diseases (to S.R.P.). Additional support was provided by USPHS Grant No. M01 RR 08084 from the National Center for Research Resources of the NIH.

Conflicts of interest: None declared.

Received March 12, 2007; revisions received February 29, 2008; accepted March 3, 2008

References

Cohen, J. (1960). A coefficient of agreement of nominal scales. *American Journal of Public Health, 71*, 15–23.

Fertig, B., Simmons, D., & Martin, D. (1995). Therapy for diabetes. In M. I. Harris, C. C. Cowie, P. P. Stern, E. J. Boyko, G. E. Reiber, & P. H. Bennett (Eds.), *Diabetes in America* (2nd ed., pp. 519). Bethesda, MD: National Diabetes Data Group of the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health.

Golden, M. P., Russell, B. P., Ingersoll, G. M., Gray, D. L., & Hummer, K. M. (1985). Management of diabetes mellitus in children younger than 5 years of age. *American Journal of Diseases of Children, 139*(5), 448–452.

Hartman, D. (1977). Consideration in the choice of interobserver reliability estimates. *Journal of Applied Behavioral Analysis, 10*, 103–116.

Kaufman, F. R., Halvorson, M., Fisher, L., & Pitukcheewanont, P. (1999). Insulin pump therapy in type 1 pediatric patients. *Journal of Pediatric Endocrinology & Metabolism, 12*(Suppl 3), 759–764.

Linscheid, T., Budd, K., & Rasnake, L. (2003). Pediatric feeding disorders. In M. Roberts (Ed.), *Handbook of pediatric psychology* (3rd ed., pp. 481–498). New York: The Guilford Press.

Mackner, L. M., McGrath, A. M., & Stark, L. J. (2001). Dietary recommendations to prevent and manage chronic pediatric health conditions: Adherence, intervention, and future directions. *Journal of*

Developmental and Behavioral Pediatrics, 22(2), 130–143.

Patton, S. R., Dolan, L. M., Mitchell, M. J., Byars, K. C., Standiford, D., & Powers, S. W. (2004). Mealtime interactions in families of pre-schoolers with type 1 diabetes. *Pediatric Diabetes, 5*(4), 190–198.

Patton, S. R., Dolan, L. M., & Powers, S. W. (2006). Mealtime interactions relate to dietary adherence and glycemic control in young children with type 1 diabetes. *Diabetes Care, 29*(5), 1002–1006.

Powers, S. W., Byars, K. C., Mitchell, M. J., Patton, S. R., Standiford, D. A., & Dolan, L. M. (2002a). Parent report of mealtime behavior and parenting stress in young children with type 1 diabetes and in healthy control subjects. *Diabetes Care, 25*(2), 313–318.

Powers, S. W., Jones, J. S., Ferguson, K. S., Piazza-Waggoner, C., Daines, C., & Acton, J. D. (2005a). Randomized clinical trial of behavioral and nutrition treatment to improve energy intake and growth in toddlers and preschoolers with cystic fibrosis. *Pediatrics, 116*(6), 1442–1450.

Powers, S. W., Mitchell, M. J., Patton, S. R., Byars, K. C., Jelalian, E., Mulvihill, M. M., et al. (2005b). Mealtime behaviors in families of infants and toddlers with cystic fibrosis. *Journal of Cystic Fibrosis, 4*(3), 175–182.

Powers, S. W., Patton, S. R., Byars, K. C., Mitchell, M. J., Jelalian, E., Mulvihill, M. M., et al. (2002b). Caloric intake and eating behavior in infants and toddlers with cystic fibrosis [electronic version]. *Pediatrics, 109*(5), E75.

Powers, S. W., Patton, S. R., Byars, K. C., Mitchell, M. J., Maynard, M. K., McAfee, C. C., et al. (2002c). Parent and child mealtime behaviors in families of toddlers with cystic fibrosis. *Pediatric Pulmonolology, 33*(Suppl), 483.

Sperling, M. (1996). Diabetes mellitus. In M. Sperling (Ed.), *Pediatric endocrinology* (pp. 229–264). Philadelphia, PA: WB Saunders.

Stark, L. J., Jelalian, E., Mulvihill, M. M., Powers, S. W., Bowen, A. M., Spieth, L. E., et al. (1995). Eating in preschool children with cystic fibrosis and healthy peers: Behavioral analysis. *Pediatrics, 95*(2), 210–215.

Stark, L. J., Jelalian, E., Powers, S. W., Mulvihill, M. M., Opipari, L. C., Bowen, A., et al. (2000). Parent and child mealtime behavior in families of children with cystic fibrosis. *Journal of Pediatrics, 136*(2), 195–200.

Stark, L. J., Mulvihill, M. M., Powers, S. W., Jelalian, E., Keating, K., Creveling, S., et al. (1996). Behavioral intervention to improve calorie intake of children with cystic fibrosis: Treatment versus wait list control. *Journal of Pediatric Gastroenterology and Nutrition, 22*(3), 240–253.

Stark, L. J., Powers, S. W., Jelalian, E., Rape, R. N., & Miller, D. L. (1994). Modifying problematic mealtime interactions of children with cystic fibrosis and their parents via behavioral parent training. *Journal of Pediatric Psychology, 19*(6), 751–768.

Wysocki, T., Huxtable, K., Linscheid, T. R., & Wayne, W. (1989). Adjustment to diabetes mellitus in pre-schoolers and their mothers. *Diabetes Care, 12*(8), 524–529.