

Original Article

Feeding problems reported by parents of young children with type 1 diabetes on insulin pump therapy and their associations with children's glycemic control

Patton SR, Williams LB, Dolan LM, Chen M, Powers SW. Feeding problems reported by parents of young children with type 1 diabetes on insulin pump therapy and their associations with children's glycemic control.

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Objective: Previous research demonstrated high rates of perceived mealtime behavior problems in families of young children with type 1 diabetes who were managed with conventional therapy. Because of new insulin regimens that offer greater flexibility, reexamination of mealtime behaviors is required. We assessed parent-reported mealtime behaviors in a sample of young children using an insulin pump. An additional aim was to evaluate the associations of two measures of parental feeding behavior with children's glycemic control.

Methods: Primary caregivers of 31 young children (mean age = 5.0 ± 1.3 yr) completed the Child Feeding Questionnaire (CFQ) and the Behavioral Pediatric Feeding Assessment Scale (BPFAS). Hemoglobin A1c (HbA1c) was used as a surrogate marker for children's glycemic control.

Results: Children had a mean HbA1c of $7.8 \pm 0.64\%$. Mean CFQ – Restriction and Pressure to Eat scores were 3.1 ± 0.94 and 2.0 ± 0.88 , respectively (range = 1–5). Mean BPFAS – Parent and Child scores were 16.0 ± 4.3 (range = 10–50) and 44.9 ± 9.3 (range = 25–125), respectively. Positive correlations were found between children's HbA1c levels and caregivers' reporting of frequency of child mealtime behavior problems.

Conclusions: Caregivers of young children on pump therapy report relatively low rates of mealtime behavior problems. However, correlations with children's HbA1c suggest that parent–child mealtime behaviors continue to relate to children's health outcomes. Research is needed to determine if changing mealtime interactions can improve children's glycemic control; items from the BPFAS and CFQ can offer targets to guide interventions.

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Managing diabetes in young children presents many challenges. From a physiological perspective, reports demonstrate that young children with type 1 diabetes are often highly insulin sensitive, potentially complicating the regulation of children's blood glucose levels (1). Moreover, developmentally, young children with type 1 diabetes often demonstrate increased independence seeking, transient food preferences, behavioral resistance, and volatile emotions, which can affect adherence to treatment (2, 3). Parents bear the primary responsibility for managing diabetes in a young child, including monitoring children's blood glucose levels, administering insulin, and guiding children's diet and food intake (1). Thus, research examining parent-child behaviors may offer important information for targeting interventions to achieve optimal diabetes management in young children with type 1 diabetes.

Most of the research examining parent-child behaviors at mealtimes have primarily recruited young children on a conventional insulin regimen. These studies have shown that parents of young children frequently report problems with mealtimes and adherence to a strict daily diet plan for carbohydrate intake (2, 4). Moreover, these studies have found associations between poor parent-child mealtime behaviors and poor dietary adherence and glycemic control in these children (5, 6). Recently, intensive insulin management has become more popular for young children with type 1 diabetes (1, 7, 8). Because of the greater frequency of insulin injections and the ability to titrate insulin doses to children's actual carbohydrate intake, intensive insulin management is hypothesized to more closely mimic normal pancreatic function and to simplify diabetes management for families (9). Children no longer have to follow a strict diet plan for the timing of meals and carbohydrate intake. Moreover, for young children using an insulin pump, extra doses of insulin do not require additional injections. It is expected that intensive insulin therapy allows for the young child with type 1 diabetes to eat more normally, which may reduce the burden on parents to impose structure at mealtimes to ensure adequate carbohydrate intake. However, there is no research examining mealtime behaviors and parent feeding strategies in families of children with type 1 diabetes who are intensively managed. This study examined parent report of mealtime behaviors in a sample of young children with type 1 diabetes on insulin pump therapy and compared them with published data of young children on a conventional regimen and children without diabetes (2). In addition, the current study examined the associations of two valid parent report measures of child feeding behavior with children's average glycemic control. This study tested the following hypotheses:

- (i) Caregivers of young children with type 1 diabetes using an insulin pump would report lower rates

of child mealtime behavior problems and parental difficulties with mealtime management compared with published data from caregivers of conventionally managed young children.

- (ii) Caregivers of young children with type 1 diabetes using an insulin pump would report low rates of parental restriction and pressuring children to eat.
- (iii) Among caregivers of young children who report parental restriction of child feeding and problems with mealtime behavior, there will be positive associations between these variables and children's average glycemic control.

Methods

Participants

The study recruited young children and their primary caregiver (96% mothers) from two Pediatric Diabetes Centers in the mid-western USA. Families were eligible to participate if they had a child less than 7 yr old who had been diagnosed with type 1 diabetes for at least 1 yr and had been using a continuous insulin infusion pump for at least 3 months before study enrollment. Families were excluded if a medical chart review suggested concurrent developmental/psychiatric problem or that the child suffered from another disease/condition known to affect growth (e.g. celiac). A total of 47 eligible families were approached for the study and 37 agreed to participate (79% recruitment rate). The most common reasons that caregivers declined to participate related to transportation/scheduling concerns. In addition, six families were not enrolled because the child was aged out of eligibility before the family was able to begin the study or because the research team was unable to reach the family by telephone to schedule the first study visit.

Procedure

Institutional review board approval was obtained by both participating institutions before enrollment. Families eligible for this study were identified through a database review and contacted by a member of the research team. Primary caregivers completed a written informed consent before completing all study activities. Caregivers completed two self-report questionnaires that assessed parents' perceptions of mealtimes and parental feeding behaviors. Children's glycemic control was examined using glycosylated hemoglobin A1c (HbA1c) levels, which were gathered through medical chart review at the time of enrollment. Children had a mean HbA1c of $7.8 \pm 0.64\%$, which was within the age-based target of American Diabetes Association of less than 8.5% for young children with type 1 diabetes (1).

Dependent measures

Parents’ perceptions of mealtime behaviors were examined using the Behavioral Pediatrics Feeding Assessment Scale (BPFAS) (10). The BPFAS is a valid 35-item parent report questionnaire that examines child and parent behavior at mealtimes. For each item, parents reported how often the particular behavior occurred using a 5-point Likert scale (1 = never to 5 = always) and then endorsed if the behavior was problematic (yes/no). The BPFAS generates four scores: (i) Child Behavior – Frequency and (ii) Parent Behavior – Frequency, which reflect how often the behaviors occur, (iii) Child Behavior – Problems, and (iv) Parent Behavior – Problems, which reflect the number of problematic behaviors. For all these scales, higher values represent poorer mealtime functioning.

Parents’ feeding behaviors were examined using the 12 items comprising the Restriction and Pressure to Eat factor scores from the Child Feeding Questionnaire (CFQ) (11). The CFQ is a valid parent report questionnaire that examines parental eating attitudes and feeding behaviors. For each item, parents responded using a 5-point scale ranging from ‘disagree’ to ‘agree’. Factor scores were determined by calculating the mean of the items within each factor, with higher values reflecting greater agreement with items within each factor score.

Data analyses

All data were analyzed using spss statistical software (12). To examine sample characteristics, means, standard deviations, and frequencies were calculated for variables. To examine hypotheses 1 and 2, means and standard deviations of caregivers’ scores on the BPFAS and the CFQ – Restriction and Pressure to Eat were calculated. One-sample *t*-tests were used to compare caregivers’ BPFAS scores with published scores for young children on a conventional insulin regimen and

a comparable sample of control children (2). In addition, caregivers’ scores on the CFQ – Restriction and Pressure to Eat factors were compared with published scores for children without type 1 diabetes using one-sample *t*-tests (13). To test hypothesis 3, caregivers’ scores on the BPFAS and the CFQ – Restriction and Pressure to Eat factors were correlated with children’s HbA1c using Pearson product–moment correlations. For hypothesis 3, two-tailed tests of significance were used with an alpha level set at 0.01 to control for multiple tests.

Results

Participants

Participants were primary caregivers of 31 young children with type 1 diabetes. Young children had a mean age of 5.0 ± 1.3 yr. There were 17 boys and 14 girls in the child sample, and 97% of caregivers identified their child as White.

Parental feeding scales

Table 1 summarizes descriptive statistics for the BPFAS and CFQ scales. Cronbach’s alpha scores for each scale were adequate ranging from 0.61 for CFQ – Pressure to Eat to 0.87 for BPFAS – Child Problem. In addition, individual scales for the BPFAS and CFQ demonstrated normal distributions in this sample.

One-sample comparisons of parental feeding scales

Consistent with hypothesis 1, BPFAS scores suggested that caregivers of young children using an insulin pump reported relatively low rates of parent and child mealtime behavior problems (Table 1). For hypothesis 2, we found caregivers reporting moderate scores on the CFQ – Restriction scale and relatively low scores on the

Table 1. Parental feeding scales and comparisons with published scores*

Variable	Cronbach’s α	Current DM sample (n = 31)	Powers et al. (2) DM sample (n = 40)	Powers et al. (2) non-DM sample (n = 40)	Carnell and Wardle (13) non-DM sample (n = 439)
BPFAS					
Parent Frequency	0.72	16.0 (4.29)	20.6 (5.4)†	16.6 (3.6)	—
Parent Problem	0.73	0.73 (1.41)	1.8 (2.4)†	0.6 (1.6)	—
Child Frequency	0.82	44.9 (9.3)	50.0 (11.0)†	45.8 (7.7)	—
Child Problem	0.87	2.0 (3.3)	3.8 (4.0)†	1.8 (2.3)	—
CFQ					
Restriction	0.81	3.07 (0.94)	—	—	2.4 (0.9)†
Pressure to Eat	0.61	2.05 (0.88)	—	—	2.0 (1.1)

BPFAS, Behavioral Pediatric Feeding Assessment Scale; CFQ, Child Feeding Questionnaire; DM, diabetes mellitus. *Data are mean (SD).

†p < 0.01 using one-sample *t*-tests comparing current DM sample data with published data.

CFQ – Pressure to Eat scale. One-sample *t*-tests comparing parents’ scores on the BPFAS – Parent Problem and Parent Frequency scales with published scores for caregivers of young children using conventional insulin therapy revealed significantly lower scores for caregivers of young children using an insulin pump, suggesting that these caregivers perceived fewer problems with mealtimes than those of conventionally managed children. Similarly, there were significant differences when comparing the BPFAS – Child Problem and Child Frequency scales with published scores for caregivers of conventionally managed children, with caregivers in the current sample reporting fewer child mealtime behavior problems. No differences were observed when BPFAS scores from the current sample were compared with those from caregivers of children without diabetes. With respect to the CFQ, caregivers in the current sample endorsed significantly higher Restriction scores than those of young children without type 1 diabetes. There were no differences observed for the CFQ – Pressure to Eat scale for the samples.

Associations between caregiver feeding scales and child glycemic control

Table 2 shows Pearson product–moment correlations for caregiver feeding scores and children’s HbA1c levels. Hypothesis 3 predicted positive associations between children’s glycemic control and caregivers’ report of restriction of child feeding and problematic mealtime behaviors. As hypothesized, we found positive associations between caregivers’ reporting of the number ($r = 0.42, p = 0.01$) and frequency of child behavior problems ($r = 0.48, p = 0.007$) with children’s HbA1c. Contrary to hypothesis 3, no relation was found between the CFQ – Restriction scale and children’s HbA1c values, suggesting that restriction of child to eat may not be a feeding strategy used by caregivers of children with higher average blood glucose levels. Table 2 also shows significant positive

associations between caregivers’ CFQ – Restriction and BPFAS – Parent Frequency scales and CFQ – Pressure to Eat and BPFAS – Parent Frequency and Parent Problem scales, suggesting a correspondence between the two measures. The correspondence between the BPFAS and factors of the CFQ offers some evidence of concurrent validity for using the CFQ in families of young children with type 1 diabetes.

Conclusions

Insulin pump therapy offers a flexible approach to diabetes management in young children, which may not be duplicated by injection therapies (14, 15). Because of the placement of a flexible catheter, insulin pump therapy requires fewer needle sticks to administer insulin than injection therapies (1, 14, 15). Pumps are able to dispense very small doses of insulin, which can be important in young children given their tendency to be more insulin sensitive than older children (1, 14, 15). Moreover, children and families do not need to adhere to a strict diet plan because insulin can be administered with meals and titrated to children’s carbohydrate intake without requiring additional injections (1, 14, 15). In the past, research in young children on conventional insulin therapy has found problems in mealtime behaviors and increased parental stress related to mealtimes (2). Presumably, these problems may have been exacerbated by the carbohydrate intake requirements dictated by children’s insulin regimens, which limited the frequency and timing of meals and the selection and quantity of foods offered (1, 2). With the greater flexibility in mealtimes now offered by insulin pump therapy, research is needed to examine mealtime behaviors in families of young children managed by pump therapy.

Findings suggest that caregivers of young children on an insulin pump report significantly fewer mealtime behavior problems than those of children who are managed conventionally. However, the results also demonstrate associations between caregivers’ perceptions of child mealtime behavior problems and higher

Table 2. Correlations between parental feeding scales and child HbA1c*

Factor	1	2	3	4	5	6	7
HbA1c	1	0.34 (0.04)	0.22 (0.22)	0.45 (0.007)	0.42 (0.01)	–0.003 (0.50)	0.38 (0.04)
BPFAS – Parent Frequency		1	0.62 (0.001)	0.77 (0.001)	0.64 (0.001)	0.42 (0.01)	0.57 (0.001)
BPFAS – Parent Problem			1	0.48 (0.007)	0.75 (0.001)	0.31 (0.05)	0.53 (0.001)
BPFAS – Child Frequency				1	0.77 (0.001)	0.32 (0.04)	0.48 (0.008)
BPFAS – Child Problem					1	0.28 (0.06)	0.58 (0.001)
CFQ – Restriction						1	0.42 (0.01)
CFQ – Pressure to Eat							1

BPFAS, Behavioral Pediatric Feeding Assessment Scale; CFQ, Child Feeding Questionnaire; HbA1c, hemoglobin A1c. *Data are *r*(*p*)

child average blood glucose control, a finding that is consistent with past research in children on conventional therapy (6). In type 1 diabetes, HbA1c is the most common measure of patient health status and has been linked to the development of diabetes-related complications in adolescents and adults (1, 16, 17). While the results of this study do not explain a causal relation between child mealtime behavior problems and children's HbA1c levels, they do suggest a pattern of child mealtime behaviors that may have long-term negative health consequences for young children with type 1 diabetes, given the association with HbA1c. In the BPFAS, examples of child mealtime behavior problems include leaving the table during meals, problems when coming to the table for meals, poor appetite, drinking rather than eating at meals, and long meal durations (10). For young children with type 1 diabetes, these behaviors are problematic because they can delay and/or reduce the amount of carbohydrates the child consumes at meals, which could increase their risk for a hypoglycemic event. Alternatively, children could experience hyperglycemia if caregivers' give less insulin to reduce the risk of hypoglycemia. While both the risks for hypoglycemia and hyperglycemia are lower in children managed on insulin pumps than those managed conventionally because of the timing of insulin to carbohydrate intake, the associations found with HbA1c suggest that families of young children on insulin pumps might still benefit from intervention.

Research in children with cystic fibrosis may offer a direction for developing a diabetes-specific intervention for mealtimes. Similar to families of young children with type 1 diabetes, families of children with cystic fibrosis may experience problems with mealtime behaviors (18). Notably, this research has also identified and tested effective parenting strategies for managing mealtimes and improving children's behavior (19, 20). Some behavioral based strategies that may be readily applied to diabetes management include crafting rules for mealtimes and teaching caregivers to use contingent attention to reinforce eating behaviors while ignoring non-eating behaviors (20). In addition, it may be helpful to teach caregivers multiple strategies for achieving their child's dietary goals. For example, diabetes teams could work with caregivers to develop a list of preferred snacks that a child could consume to cover extra insulin if the child is not willing to finish his/her meal. Or, teams could provide caregivers a list of healthy low carbohydrate snacks that a child could eat if he/she is feeling hungry, but caregivers want to avoid giving more insulin.

In addition to providing a direction for mealtime intervention, this study also offers preliminary data to support a new assessment strategy for caregiver feeding in young children with type 1 diabetes using the CFQ – Restriction and Pressure to Eat scales. As stated previously, the CFQ is a valid caregiver report measure that has been used extensively in research recruiting

young children without a chronic illness to measure parental feeding attitudes and strategies (11). For the CFQ, the Restriction and Pressure to Eat scales examine two types of parental control of child feeding, which we considered also relevant for caregivers of young children with type 1 diabetes. Findings from this study demonstrated adequate internal consistency for the CFQ – Restriction and Pressure to Eat scales when completed by caregivers of young children with type 1 diabetes. We also found associations between caregivers' CFQ and BPFAS scores, suggesting preliminary concurrent validity for portions of the CFQ scales in type 1 diabetes. There are two clinical advantages in using the CFQ – Restriction and Pressure to Eat scales and the BPFAS to examine caregiver–child mealtime behaviors. First, all these measures are relatively short and so may be easy to complete and score in the context of a busy clinic day. Second, the CFQ and BPFAS include unique items, which may provide a more thorough assessment of caregiver–child feeding interactions and specific parental behaviors to target within interventions (e.g. CFQ – 'I praise my child if he/she eats a new food' and BPFAS – 'I make alternate meals if my child does not like what is available'). However, as this is the first-time portions of the CFQ have been used in type 1 diabetes, more research is needed to establish the validity of this measure in families of young children with type 1 diabetes.

We provided an update to the literature examining mealtime behaviors in families of young children with type 1 diabetes by recruiting a new sample of young children receiving insulin pump therapy. In addition, we present preliminary psychometric data on two scales from the CFQ, a valid measure of parental feeding attitudes and behaviors that has been used extensively in families of young children without type 1 diabetes. There are some limitations to this study. First, this study recruited a relatively small sample of families of young children with type 1 diabetes who were primarily White, married, and from the middle-to-upper-middle socioeconomic class. While the samples were representative of the patient populations and communities from which they were drawn, our findings concerning mealtimes may not generalize to more diverse patient samples. Second, because of other procedures included in this study, we elected to recruit only young children who were using an insulin pump for their diabetes management. While the use of insulin pump therapy is increasing in young children with type 1 diabetes, many clinics still reserve this regimen for patients in good metabolic control and with few self-management problems. As such, it is possible that caregivers' scores on the BPFAS and CFQ were lower than what might be found in a more diverse sample of caregivers of young children with type 1 diabetes, and the reader is cautioned against overgeneralizing our results. Third, this study used published data when comparing caregivers' BPFAS scores for children on insulin pumps with those of children who were conventionally managed.

The authors decided to include these comparisons to provide a context for understanding caregivers' BPFAS scores with respect to the existing literature. In planning these comparisons, the authors took care to ensure that the published samples were comparable to the current sample with respect to child's age, ethnicity, and caregivers' socioeconomic status. In addition, because conventional therapy was the first line of insulin treatment for children who participated in the previous studies, we reasoned that the published data might provide a cleaner comparison of mealtime interactions than if a new sample was recruited as conventional therapy is no longer the first line of treatment and children now on a conventional regimen may not be typical of most children with type 1 diabetes (1, 21). Our findings imply that caregivers may perceive fewer problems with mealtimes if their child uses insulin pump therapy vs. conventional therapy. However, to test a causal relation, research would need to recruit a sample of young children who are conventionally managed and assess parent-child mealtime functioning at baseline and following transition to intensive insulin therapy. Research is also needed to examine whether intervening with caregivers and teaching them alternative strategies for managing mealtimes can improve children's mealtime behaviors, decrease caregivers' use of potentially problematic feeding strategies, and improve children's glycemic control.

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