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Does Eating During Television Viewing Affect Mealtimes in Young Children with Type 1 Diabetes Mellitus

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Abstract

This study looks for differences in mealtime characteristics and glycemic control for young children with type 1 diabetes who either eat with television (TV) viewing or without TV viewing. Sample size is 24 families (M child age= 5.2, SD=1.0 years). Meals with TV lasted six minutes longer than meals without TV. Meals with TV were associated with greater fat intake and higher average glucose levels, but not with greater intake of calories, carbohydrates, or more child bites. This study suggests relations between TV viewing and some negative outcomes for young children, but more research is needed to determine causation.

Introduction

Research has demonstrated that mealtime behavior problems are common in young children with type 1 diabetes and related to higher average daily blood glucose levels (Patton, Dolan, & Powers, 2006a; Patton, Williams, Dolan, Chen, & Powers, 2009). To date, no one has studied other potentially modifiable mealtime behaviors in these families, such as watching television (TV) during meals, to determine if it is related to negative outcomes. It is estimated that young children in the United States spend nearly 32 hours per week watching TV (McDonough, 2009) and that in about two-thirds of American households, families eat while watching TV (Matheson, Killen, Wang, Varady, & Robinson, 2004; Matheson, Wang, et al., 2004). Parents may elect to put on the TV during meals if they believe that watching TV will lead to more food intake by keeping their child at the table longer and/or by distracting him/her. However, in children without type 1 diabetes, watching TV during meals has been correlated to negative outcomes including child overweight and less nutritious food intake (Coon, Goldberg, Rogers, & Tucker, 2001; Dubois, Farmer, Girard, & Peterson, 2008; Francis & Birch, 2006; Hare-Bruun et al., 2011). Likewise, in two studies recruiting adolescents with type 1 diabetes, the researchers found a positive association between overall TV viewing (i.e., not specific to mealtimes) and average glucose control

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(Galler, Lindau, Ernert, Thalemann, & Raile, 2011; Margeisdottir, Larsen, Brunborg, Sandvik, & Dahl-Jorgensen, 2007). The purpose of this study was to examine for differences in mealtime characteristics and glycemic control for young children with type 1 diabetes (age <7 years) who either eat with TV viewing or eat without TV viewing. Observational data of home-based family meals of young children with type 1 diabetes were used for the analyses. Based on the existing literature, the following hypotheses were tested:

1. Meals with TV viewing will last longer than meals without TV viewing.
2. Meals with TV viewing will be characterized by greater child intake of calories, carbohydrate, and fat than meals without TV viewing.
3. Meals with TV viewing will be characterized by greater child bites than meals without TV viewing.
4. Children who eat with TV viewing will have higher mean blood glucose levels than children who eat without TV viewing.

Patients and Methods

Data for this study were extracted from a larger project which recruited families of young children with type 1 diabetes to complete an ethnographic study of family mealtimes. Families were recruited from two Pediatric Diabetes Centers in the mid-Western United States. Eligibility criteria were: child age between 2–7 years old, time since diabetes diagnosis of at least one year, intensive insulin management only (e.g., pump or multiple daily injection), and the family needed to speak English. The larger project had a recruitment rate of 51%. Families who declined participating cited the videotaping of meals or the continuous glucose monitoring as their main reasons for refusal.

Institutional approval was obtained prior to subject recruitment. The study procedure followed a standardized protocol for gathering the mealtime behavior data based on at least three typical home meals (Patton et al., 2006a; Powers et al., 2002; Stark et al., 1995). Meals were judged as “typical” if the meal length, location (i.e., table or other), number of people present, and children’s food intake and behavior were consistent with families’ normal mealtime patterns. At the first home visit, a trained research assistant taught parents how to operate the camera and tripod and instructed parents to move the camera, if needed, to record their child’s meals. Parents were taught how to keep a food record for all videotaped meals and they were given a digital scale to facilitate a more accurate measure. Finally, a continuous glucose monitor (CGM) was inserted into the child by a trained member of the research team. Families were instructed to videotape home meals and record their child’s food intake while their child wore the CGM. Families were paid \$50 for participating and children received a \$20 gift card to a national toy store for wearing the CGM. A medical chart review was conducted to obtain a value for children’s most recent (within 12 weeks) glycated hemoglobin A1c (HbA1c) as a descriptive measure of children’s average glycemic control.

Measures

Mealtime observations—Videotaped meals were coded for TV viewing and child eating using the Dyadic Interaction Nomenclature for Eating (DINE) (Stark et al., 2000) a valid behavioral coding system which has been used extensively in young children (Patton et al., 2004; Patton et al., 2006a; Stark et al., 1995). TV viewing was coded on an occurrence/nonoccurrence basis within 10 second intervals. TV viewing was present if the TV was on and the child was clearly engaged in watching the TV (e.g., laughing, talking about the TV program). A frequency count was obtained for bites within 10 second intervals. Consistent

with the DINE procedure, each meal was viewed a minimum of three times. Based on a random subset of videotaped meals (33%) independently coded for reliability purposes, the Kappa coefficient was 0.77 for Bites and 0.92 for TV viewing, which exceeded the minimum considered acceptable for inter-rater reliability (Cohen, 1960).

Food Records—Children's food and beverage intake during each of the videotaped meals was captured via parent-report food records. These records were later analyzed by a research dietitian using the Nutrition Data System for Research software version 2009, (Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN).

Continuous Glucose Monitoring—To measure mean glucose two hours after the meal and mean daily glucose, the Minimed Continuous Glucose Monitoring System Gold® (CGM) was used (Medtronic, Northridge, CA). This is a retrospective CGM monitor. Consistent with manufacturer's instructions, the sensors were placed just under the skin on children's buttocks or abdomen using a spring-loaded insertion device. The CGM reported an average of children's glucose concentrations every five minutes. For the current analyses, young children's mean hours of use for the CGM was 54 ± 18.7 and they had an average of 654 ± 223 (range: 291–1081) separate glucose measurements.

Statistical Analysis

TV viewing was present in all three meals for 10 children and absent from all three meals for 14 children. Mealtime characteristics were averaged within child for the main study analyses. To describe sample characteristics means, standard deviations (SD), and frequency counts were calculated. Study hypotheses were tested using a series of independent sample t-tests with TV viewing (yes or no) as the independent variable.

One-sided tests of significance were used for the comparisons to reflect the directional nature of all of the hypotheses. The use of one-sided tests in this small sample also had the advantage of decreasing the risk of a Type 2 Error without changing the risk of a Type 1 Error (Howell, 1992). In statistics, Type 1 Error refers to the risk of incorrectly rejecting a true null hypothesis or reporting a study result that is not really true. The risk of committing a Type 1 Error is reflected by the p-value or α . In contrast, Type 2 Error, refers to the risk of failing to reject the null hypothesis when it is false or failing to report a true study result. The risk of committing a Type 2 Error is reflected by β and $1 - \beta$ is a measure of the power of the test to detect significance (Howell, 1992). By using one-sided tests for all of the comparisons, we were able to increase the power of the tests to detect significance, but we did not alter the p-value, which would increase the risk of a Type 1 Error. Rather, we forced our analyses to only allow for a significant difference if that difference was consistent with the direction of each hypothesis; if contrary to the direction of our hypothesis, the result was not significant regardless of the p-value. Second, because this is the first study to examine the impact of TV viewing on mealtime characteristics in young children with type 1 diabetes, we applied no correction to the analyses. A statistical correction may be warranted in cases where multiple comparisons are performed to further protect against Type 1 Error. However, these corrections have the disadvantage of increasing the risk of Type 2 Error which is already higher in small samples because power is reduced. P-values for all comparisons are reported. The decision not to correct for multiple tests is also included as a potential study limitation.

Results

Young children had a mean age 5.2 ± 1.0 years (range: 2–7 years) and a mean HbA1c level of $8.5 \pm 1.2\%$. There were 13 boys and 11 girls in the sample. The sample included 50% of

children using an insulin pump and 50% of children on multiple daily injections. There were no differences by TV viewing for sample characteristics.

Table 1 provides a summary of the means and standard deviations for all of the demographic and dependent measures. Specific to hypothesis 1, there was a significant difference in meal duration by TV viewing [$t(22)=2.27$, $p=0.01$]. In partial support of hypothesis 2, the analyses showed that young children consumed more grams of fat [$t(22)=1.67$, $p=0.05$] during meals with TV viewing versus meals without TV viewing. However, no differences were found for children's calorie [$t(22)=0.69$, $p=0.49$] or carbohydrate [$t(22)=-0.95$, $p=0.35$] intake based on TV viewing. Contrary to hypothesis 3, no difference was found in the average frequency of bites taken for meals with TV viewing and meals without TV viewing [$t(22)=0.53$, $p=0.30$]. Finally, for hypothesis 4, a statistical difference based on TV viewing was found for mean glucose level two hours after the meal [$t(22)=1.98$, $p=0.03$] and for mean daily glucose level [$t(22)=1.72$, $p=0.05$].

Discussion

This is the first time mealtimes have been studied in families of young children with type 1 diabetes based on TV viewing. The results show that TV viewing during mealtimes is related to longer meal duration, intake of foods higher in fat, and higher mean glucose levels two hours after the meal and for the day. However, TV viewing did not relate to greater carbohydrate or calorie intake or a greater number of bites per meal for children.

Several studies suggest that longer meal durations are problematic because they can lead to greater child disruptive behaviors (Patton, Dolan, & Powers, 2006b; Powers et al., 2002; Stark et al., 1995). In addition, longer meal duration could be clinically significant in children with type 1 diabetes if parents delay insulin administration until the end of the meal. Parents may delay insulin until the end of the meal if they are not sure how much food their child is going to consume (Silverstein et al., 2005). In the current study, TV viewing resulted in meals that lasted on average 6 minutes longer than meals without TV viewing. Notably, this difference in meal duration translated into a mean duration of greater than 20 minutes for meals with TV viewing and less than 20 minutes for meals without TV viewing. While the timing of mealtime insulin administration is not known for every meal in the current study, past research has shown that delaying insulin administration by 20 minutes can lead to a period of significantly higher and longer post-prandial excursion than when insulin is administered at the start of the meal (Cobry et al., 2010). Thus, in general, longer meal duration in type 1 diabetes could be potentially problematic if parents are also delaying insulin administration. Minimizing distractions, such as turning off the TV during meals, and contingent attention (e.g., praising child eating) have been shown to lead to greater child eating and shorter meal durations and may be important strategies to teach parents to use in mealtime management (Powers et al., 2005; Stark, Powers, Jelalian, Rape, & Miller, 1994).

The difference found in the children's food intake for meals with TV viewing in part mirrors the existing literature. Studies in children without type 1 diabetes have found eating with TV viewing to correlate with higher energy intake and child overweight (Coon et al., 2001; Dubois et al., 2008; Francis & Birch, 2006; Hare-Bruun et al., 2011; Matheson, Killen, et al., 2004; Matheson, Wang, et al., 2004). In this study, a small (5 gram), but significant difference was found for children's fat intake in meals with TV viewing versus meals without TV viewing. While five grams is only a small difference, across the day, this difference has the potential to lead to long term weight gain if parents are not making adjustments in the fat content of other meals. Moreover, the difference has the potential to be clinically meaningful for a child with type 1 diabetes, where lower fat intake overall is recommended to reduce the risk for cardiovascular complications (Silverstein et al., 2005).

Contrary to expectations, no difference was found in children's intake of calories or carbohydrates based on TV viewing. Also, no difference was found in child eating, as measured by average frequency of bites.

The associations between TV viewing during mealtimes and young children's mean daily glucose level and mean glucose level two hours post-prandial are consistent with the extant literature (Galler et al., 2011; Margeirsdottir et al., 2007). However, the results do not support a causal relation between TV viewing during mealtimes and higher glucose levels in children. To explore more completely the possible relation between TV viewing while eating and child glucose levels, a controlled laboratory would be needed wherein the effects of potential confounds related to general diabetes management behavior can be minimized.

Some limitations to these analyses exist. First, the study involved secondary analyses of data pulled from a larger, ethnographic study. These data likely capture realistic mealtime behaviors of a sample of young children with type 1 diabetes, but without a controlled setting, it is impossible to rule out the impact of confounders (e.g., quality of meals, other food intake during the day) which may also directly relate to the study outcomes. Second, because the data were not collected in a controlled laboratory setting, causation cannot be confirmed. Rather, the results of this study reflect inferences related to TV viewing in young children with type 1 diabetes. It is possible differences in meal duration, fat intake, and child's blood glucose levels may reflect a broader difference in parenting style (e.g., permissive versus authoritative), one dimension of which is allowing TV viewing during meals. In the future, it may be helpful to conduct a controlled laboratory study and/or to measure parenting style and its relation to child mealtime characteristics. Third, the larger ethnographic study from which these data were extracted had a relatively low recruitment rate (51%). While the recruitment rate of the larger study is comparable to other studies which have used home videotaping (Patton et al., 2004; Patton et al., 2006a; Powers et al., 2002), it suggests that this study may have sampled from a smaller group of families than the general clinic population. Thus, caution is recommended when attempting to generalize these results. Likewise, because the sample size was small and primarily comprised of White, married, and middle to upper-middle class families who were recruited from two Pediatric Diabetes Centers located in the Mid-western United States, caution is recommended when generalizing these results to families from other ethnic, racial, or socioeconomic backgrounds. Fourth, because this study used videotaped home meals, it is impossible to rule out the existence a Hawthorne Effect, or the possibility that parent-child mealtime behaviors could have been altered as a result of the videotaping. The study procedures took steps to minimize the likelihood of a Hawthorne Effect by using only meals rated as typical by families and recording at least three meals so that families had an opportunity to adjust to the camera. However, even with these steps, it is possible that the camera may have affected family mealtime behavior and in turn, the study results. Finally, as noted previously, no correction was applied for multiple comparisons because with the small sample, this likely would have increased the risk of committing a Type 2 Error or failing to report a true finding. P-values for all of our comparisons are reported so that the reader can better appreciate the strength of the results.

In conclusion, eating with TV viewing is associated with negative outcomes for young children with type 1 diabetes including longer mealtimes, greater fat intake, and higher mean glucose levels. However, TV viewing is not associated with greater child eating. If parents are concerned about their child's food intake and mealtime behavior, better strategies exist. Research demonstrates that behavioral management strategies, such as contingent attention, response cost, and shaping can lead to more child eating and better mealtime behavior (Powers et al., 2005; Stark et al., 1996; Stark et al., 1994). Therefore, clinicians should consider referring parents for behavioral counseling if they report problems with child eating

and mealtime management. With respect to research, an important question remains in understanding the specific nature of the possible association between TV viewing and young children's glycemic control. A future study may wish to investigate this question via a controlled, laboratory-based study.

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Table 1

Demographic and dependent variables according to TV viewing for young children with type 1 diabetes

	TV viewing	no TV viewing	
<i>Demographic variables</i>	Mean $\pm$ SD	Mean $\pm$ SD	p=
Child age (years)	5.0 $\pm$ 0.82	5.3 $\pm$ 1.1	0.50
Child A1C	8.8 $\pm$ 0.76	8.4 $\pm$ 1.5	0.46
BMI	16.8 $\pm$ 1.2	17.3 $\pm$ 1.9	0.46
<i>Demographic variables (frequency)</i>	N (%)	N (%)	p=
Gender:			0.73
male	5 (39%)	8 (61%)	
female	5 (45%)	6 (55%)	
Insulin regimen:			0.10
pump	3 (25%)	9 (75%)	
multiple daily injections	5 (42%)	7 (58%)	
Parent marital status:			0.15
married	7 (29%)	12 (50%)	
not married	4 (17%)	1 (4%)	
Family SES [†] :			0.13
Class I	1 (4%)	0 (0%)	
Class II	1 (4%)	1 (4%)	
Class III	1 (4%)	7 (29%)	
Class IV	6 (25%)	3 (13%)	
Class V	1 (4%)	3 (13%)	
<i>Mealtime variables</i>	Mean $\pm$ SD	Mean $\pm$ SD	p=
Meal duration (minutes)	24.4 $\pm$ 6.8	18.8 $\pm$ 5.4	0.01
Kilocalorie	524 $\pm$ 209	462 $\pm$ 219	0.24
Carbohydrate (grams)	64 $\pm$ 17	54 $\pm$ 28	0.17
Fat (grams)	24 $\pm$ 12	17 $\pm$ 7	0.05
Child Bites	70 $\pm$ 32	65 $\pm$ 18	0.30
Mean glucose 2 hours post-prandial (mg/dl)	241 $\pm$ 73	187 $\pm$ 61	0.03

	TV viewing	no TV viewing	
<i>Demographic variables</i>	Mean $\pm$ SD	Mean $\pm$ SD	p=
Mean daily glucose level (mg/dl)	235 $\pm$ 55	201 $\pm$ 43	0.05

Note:

^{*}Hollingshead four-factor scale of socioeconomic status