Research report

Associations of food preferences and household food availability with dietary intake and quality in youth with type 1 diabetes ☆

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ABSTRACT

The objective of this study was to examine associations of food preferences and availability with dietary intake in youth with type 1 diabetes, for whom dietary intake and quality are essential to disease management. Youth (n = 252, age 13.2 ± 2.8 y, diabetes duration 6.3 ± 3.4 y) reported preferences and parents reported household availability for 61 food items categorized as fruit, vegetables, whole grains, refined grains and fats/sweets. Youth energy-adjusted daily servings of food groups, Healthy Eating Index-2005 and Nutrient Rich Foods 9.3 scores were calculated from 3-day diet records. Associations of dietary intake and quality variables with preference and availability of all food groups were evaluated by linear regressions adjusted for sociodemographic characteristics. Fruit and whole grain intake were positively related to corresponding preference and availability; whole grain intake and refined grain availability were inversely related. Vegetable, refined grain and fats/sweets intake were unrelated to preference and availability. Diet quality measures were related positively to fruit preference and whole grain availability and inversely to refined grains availability. Findings indicate associations of dietary intake with food preference and availability vary by food group in youth with type 1 diabetes. Measures of overall dietary quality were more consistently associated with food group availability than preferences.

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Introduction

In youth with type 1 diabetes, dietary quality is of primary importance for optimizing glycemic control to support normal growth and development while minimizing glycemic excursions and adverse medical complications (American Diabetes Association, 2011; Bantle et al., 2008; Silverstein et al., 2005; Smart, slander-van, & Waldron, 2009). Dietary guidance for this population is based on that for healthy children and adolescents (Bantle et al., 2008), with a focus on integrating the monitoring of blood glucose and dietary carbohydrate with individualized considerations for aspects of nutritional requirements, meal planning and insulin regimens (Bantle et al., 2008).

Despite the emphasis on nutrition in the management of type 1 diabetes, research suggests suboptimal diet quality in this population that is comparable to, if not poorer than, the general youth population (Rovner & Nansel, 2009). These eating behaviors may contribute to increased cardiovascular risk (Gunther et al., 2009; Liese et al., 2011), and may track into adulthood (Larson et al., 2008; te Velde, Twisk, & Brug, 2007), impacting health outcomes throughout the lifespan. Focus on matching insulin dose with the amount of carbohydrate intake may lead to avoidance of nutrient-rich foods such as fruit, whose carbohydrate content can be difficult to estimate, and preference for packaged, processed foods with nutrition labels or carbohydrate-free food products not requiring insulin administration (Bantle et al., 2008; Gellar, Schrader, & Nansel, 2007; Mehta, Haynie, et al., 2009). Insulin regimen (Mehta, Haynie, et al., 2009), sociodemographic factors (Bortsov et al., 2011) and adherence to diabetes self-management (Mehta, Quinn, Volkening, & Laffel, 2009) have also been associated with dietary behaviors in youth with type 1 diabetes. However, further research is needed to identify modifiable influences on eating behaviors in this population in order to support efforts to improve dietary quality and related health outcomes (Patton, 2011).

Previous research of modifiable influences on eating behaviors in the general youth population has identified food preferences and household availability as important determinants of dietary intake and quality. Studies have consistently demonstrated positive relationships between preferences and intakes of specific

foods or food groups (Bere & Klepp, 2004; Brug, Tak, te Velde, Bere, & de Bourdeaudhuij, 2008; Cullen et al., 2003). Evidence for a similar relationship of food availability and intake is conflicting (Arcan et al., 2007; Befort et al., 2006; Blanchette & Brug, 2005; Brug et al., 2008; Cullen et al., 2003; Gallaway, Jago, Baranowski, Baranowski, & Diamond, 2007; Horst et al., 2007; Koui & Jago, 2008; Kristjans-dottir et al., 2006; McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009), suggesting that in the context of an abundant food environment, household availability may be a relatively unimportant influence on eating behavior.

Research on the role of food preferences and availability has primarily focused on these characteristics for fruit and vegetables, and their impact on intake of corresponding food groups. However, dietary choices may result from selecting preferred foods from among all available foods, and as such, may lead to unhealthy food choices if preferences for available nutrient-poor foods are higher than preferences for healthier alternatives. Scant research has examined the relationship of whole grain, fruit and vegetable intake with preference and availability of refined foods, such as refined grains, snacks and sweets; one previous study in the general youth population showed an inverse relationship between fruit and vegetable intake and home availability of unhealthy foods (Cutler, Flood, Hannan, & Neumark-Sztainer, 2011). Moreover, the influence of child food preferences and home food availability on measures of overall dietary quality has not been previously examined. Such measures of dietary exposure provide a more realistic reflection of the nutritional characteristics of the diet as a whole, and may better represent interrelationships among dietary components (Arvaniti & Panagiotakos, 2008; Messina et al., 2001).

The primary objective of this paper is to examine the associations of food preference and availability with dietary intake and quality in a sample of youth with type 1 diabetes. This study extends previous findings by assessing preference and availability of a broader range of food groups including refined foods, and exploring whether food group preference and home availability are associated with intakes of both corresponding and non-corresponding food groups. The study further investigates the associations of food preferences and availability with measures of overall diet quality.

Methods

Subjects and setting

Subjects were recruited in a cross-sectional study of diet and diabetes-related health outcomes from a pediatric diabetes center in Boston, MA. Families with eligible participants age 8–18 years inclusive, with a type 1 diabetes diagnosis for at least 1 year were approached. Of the 455 eligible subjects, 302 (66%) enrolled in the study. Eleven subjects were eliminated due to having a sibling enrolled in the study with longer diabetes duration or more complete data. Of the remaining 291 subjects, 252 with diet records comprise the sample for analysis in this study. The primary reason

given for non- participation was time constraints. Child age did not differ according to participation status.

Data collection

Child age, sex, height, weight, and insulin regimen were extracted from medical records. Age- and sex-adjusted BMI percentile were calculated. Household income and size were obtained from parent surveys, and used to calculate the income-to-poverty ratio, a measure of income relative to the poverty level adjusted for inflation and household size (higher ratio corresponds to higher income relative to the poverty threshold) (Bishaw & Macartney, 2010; US Census, 2011).

Child food preferences and parent-reported availability were assessed in surveys administered separately to children and parents based on measures with demonstrated reliability and validity (Cullen et al., 2000, 2001; Hearn et al., 1998; Marsh, Cullen, & Baranowski, 2003). Youth reported preference ratings for each of 61 food items they reported as having tried (0 = do not like/1 = like a little/2 = like a lot) (Cullen et al., 2000). Parents reported household availability (yes/no) of each food item over the past 7 days, a measure with demonstrated correlation to observed household food group availability (Marsh et al., 2003). Food items on the questionnaires were expanded to include additional fruit and vegetable items as well as whole grains, refined grains and fats/sweets. Responses for food items were grouped by fruit (18 items), vegetables (26 items), whole grains (8 items), refined grains (4 items) and fats/sweets (5 items). Food items and groups are given in Table 1. For each food group, preference reflects the mean preference rating for all eaten foods within each food group, and availability reflects the total number of foods within each food group available in the home over the past 7 days.

Dietary intake was assessed using three-day diet records completed within approximately 1 week after survey administration. Research assistants reviewed instructions, including a sample diet record, with families. Families were instructed to keep records on three consecutive days in one week, including two weekdays and one weekend day, and were asked to use measuring utensils (cups, spoons, food scales) at home if available or, if unavailable, to provide their best estimate of portion size. Families were reminded to provide all specific details for each food item, including names of brands or restaurants, whether the item was labeled as low fat/low sugar/1% milk/etc., and to leave no blank fields on the form.

Nutrition Data System for Research (NDS-R, Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN) was used to analyze food records for calculating mean daily servings for fruit, vegetables, whole grains, refined grains, and fats/sweets standardized per 4184 kJ in order to simplify comparability of intake across all food groups and to account for differences in total energy requirements. Overall dietary quality was assessed by calculating the Healthy Eating Index-2005 (HEI-2005) (Guenther, Reedy, & Krebs-Smith, 2008), as well as the Nutrient Rich Foods 9.3 score (NRF 9.3) (Fulgoni, Keast, & Drewnowski, 2009). The

Table 1
List of food items in exposure, preference, and availability questions.

Food groups	Items (#)	Foods
Fruit	18	Apples, pears, bananas, cherries, strawberries, blueberries, other berries, grapes, peaches/nectarines, plums, apricots (fresh), oranges, grapefruit, pineapple, other tropical fruit, melons, dried fruit, fruit salad
Vegetables	26	Tomatoes, asparagus, beets, broccoli, cauliflower, green peas, green beans, corn, carrots, celery, lettuce, spinach, greens, cabbage, onions, sweet pepper, cucumber, zucchini, winter squash, eggplant, mixed vegetables, okra, fries, potatoes (not fried), sweet potatoes, beans
Whole grains	8	Brown/wild rice, wheat pasta, instant oatmeal, old-fashioned oatmeal, steel cut oats, whole grain bread, whole grain crackers, barley/quinoa
Refined grains	4	White rice, white pasta, white bread, crackers (not whole grain)
Fats/sweets	5	Chips, popcorn, cakes, cookies, candy