Article

HEALTH EDUCATION & BEHAVIOR

Health Education & Behavior
2015, Vol. 42(2) 240–248

DOI: 10.1177/1090198114550823
heb.sagepub.com
SAGE

Outcome of a Food Observational Study Among Low-Income Preschool Children Participating in a Family-Style Meal Setting

Roberto P. Treviño, MD[1], Liset Vasquez, PhD, RD, LD, CHES[1], Mary Shaw-Ridley, PhD, MCHES[1,2], Desiree Mosley, MPH[1], Katherine Jechow, RD, LD[1], and Christina Piña, BS[1]

Abstract

Introduction. In the United States, one out of every seven low-income children between the ages of 2 and 5 years is at risk for overweight and obesity. Formative research was conducted to determine if preschool children participating in family-style meals consumed the minimum food servings according to U.S. Department of Agriculture dietary guidelines. *Method*. Participants were 135 low-income children aged 3 to 4 years who attended an urban child care center. Participant's parents completed a Family Demographic Questionnaire to provide information on race/ethnicity, parent's level of education, and household income. Direct observation of children's food and beverage consumption during school breakfast and lunch was collected over 3 consecutive days. Dietary data were assessed using the Nutrition Data System for Research software. Height and weight measurements were obtained to determine risk for obesity. Descriptive statistics were reported by using the Statistical Package for the Social Sciences Version 16. *Results*. Among 135 participants, 98% identified as Mexican American, 75% lived at or below poverty level, and 24% reported a family history of diabetes. Children consumed less than half of the calories provided between breakfast and lunch and did not consume the minimum recommended dietary food servings. Despite the poor dietary intake, physical measurement findings showed 25% obesity prevalence among study participants. *Conclusions*. Findings support the need for evidenced-based early childhood obesity prevention programs that provide behavior change opportunities for children, their families, teachers, and menu planners. Family-style meal settings are ideal opportunities for implementing nutrition education strategies to prevent early childhood obesity.

Keywords

early childhood, family-style meals, obesity

In the United States, one out of every seven low-income children between the ages of 2 and 5 years is at risk of being overweight and obese (body mass index [BMI] ≥85th percentile; Centers for Disease Control and Prevention [CDC], 2013; Taveras, Matthew, Kleinman, Rich-Edwards, & Rifas-Shiman, 2010). Poor diets, sedentary lifestyles, and unhealthy behaviors are associated with the childhood obesity epidemic, which has nearly tripled over the past 30 years (CDC, 2012a; Wang & Dietz, 2002). Among ethnic minorities, Hispanic children aged 2 to 4 years have the highest obesity rates (17.9%) after American Indian and Alaska Native (20.7%; CDC, 2013). Previous studies suggest that childhood obesity increases a child's risk for poor school performance, social isolation, and illnesses such as hypertension, dyslipidemia, atherosclerosis, metabolic syndrome, Type 2 diabetes, sleep apnea, and fatty liver (CDC, 2012a; Daniels et al., 2005; Dietz, 1998; Pratt, Stevens, & Daniels, 2008). Additionally, overweight children have a greater chance of becoming overweight or obese adults (Braveman & Egerter, 2008; Serdula et al., 1993; U.S. Department of Health and Human Services [USDHHS], 2013).

Interestingly, more than 3.5 million children spend on average greater than 30 hours per week in early child care centers (ECCCs) outside of their home (White House Task Force on Childhood Obesity, 2010). Children attending

[1]Social & Health Research Center (SAHRC), San Antonio, TX, USA
[2]Florida International University, Miami, FL, USA

Corresponding Author:
Roberto P. Treviño, Social & Health Research Center, 1302 S. St. Mary's, San Antonio, TX 78210, USA.
Email: rtrevino@sahrc.org

ECCCs often receive one half to two thirds of their calorie intake from the provided daily meals. Thus, ECCCs could potentially play a key role in preventing childhood obesity by providing healthier meal options and teaching nutrition education to 3- and 4-year olds.

Nutrient dense and balanced diets have been shown to promote healthy body weight as defined by BMI and reduce risk for chronic disease (CDC, 2011a; USDHHS, 2012). Children should consume an adequate amount of calories and maintain a balanced healthy diet for proper growth and development (Academy of Nutrition and Dietetics, 2013; USDHHS, 2013). Good eating habits and food attitudes are formed in the early years and can last a lifetime (U.S. Department of Health and Human Services Administration for Children and Families Office of Head Start, 2009). However, many children fall short of meeting the Dietary Guidelines for Americans (CDC, 2012b; Reedy & Krebs-Smith, 2010). The marketing of unhealthy foods and limited access to healthy foods make it more difficult for parents to serve healthier foods, especially among low-income families (Benjamin, 2007; CDC, 2012a; USDHHS, 2013).

Though the home environment strongly influences food intake, ECCCs can play a vital role in teaching young children about nutrition and age-appropriate serving sizes (Erinosho, Hale, McWilliams, Emunah, & Ward, 2012; Sisson et al., 2012). Mealtime, in particular, is a teachable opportunity as many ECCCs have family-style meal (FSM) settings (Erinosho et al., 2012; Sisson et al., 2012). FSMs are set up by placing food items in containers or bowls in the middle of the table, enabling children to serve themselves with limited assistance (USDHHS & Human Services Administration for Children and Families Office of Head Start, 2009). FSMs allow children the freedom to make decisions about a variety of foods, eat at a slow pace, and stop eating when full (Donnelly, Jacobsen, Legowskip, Johnson, & McCoy, 2000; USDHHS & Human Services Administration for Children and Families Office of Head Start, 2009). Children may be reluctant to eat unfamiliar or less favorite food items, but the exposure and observational learning encourages change in their eating behaviors.

Since there are serious health consequences associated with malnutrition and childhood obesity, healthy eating interventions to prevent early age obesity and chronic illness should be explored. This article presents findings from an exploratory food observation study with children from low-income households attending ECCCs in an urban setting. The purpose of this formative research was to visually determine if children participating in a FSM setting consumed the minimum recommended amount of various food groups and servings according to dietary guidelines set forth by the United States Department of Agriculture and the Department of Health and Human Services (USDHHS, 2013). Anthropometric values were also collected to assess risk among preschoolers as measured by obesity prevalence. The findings will inform the design of ECCCs obesity-prevention programs aimed at improving mealtime nutrition and eating behaviors.

Method

Participants

The host site was an inner city school district in San Antonio, Texas. The district partners with the Head Start program to operate ECCCs. In 2009, the district had 55,000 students, of which 1, 934 were enrolled in ECCCs. During fall 2009, the food observation study was conducted at one of the school-based ECCCs with an enrollment of 200 students, 3 and 4 years of age.

Recruitment Strategy

All parents of children that attended the ECCCs were encouraged to participate in the study. At the beginning of the school year, the research team held a parent informational session to discuss the study and mailed brochures to parents. Consent forms were provided at parent–teacher meetings, inserted in the children's take-home folders, or mailed via U.S. Postal Service to each student's home.

Consent Process

Consent forms were written in English and Spanish. Bilingual staff was available in person or by phone to answer questions. Consented forms were returned to school via children's take-home folders. Only consented students participated in data collection. The Institutional Review Board of the University of Texas Health Science Center at San Antonio approved the study protocol.

Questionnaire

The Family Demographic Questionnaire (FDQ) is a researcher developed instrument used to collect data on family characteristics: age of child, race/ethnicity, parent's age and level of education, household income, number of persons living per household, and history of diabetes among first- and second-degree family members of the child. The instrument has been used in our previous studies. Validity was originally established through a panel of experts familiar with childhood obesity and diabetes prevention research (Treviño et al., 2004; Treviño et al., 2008).

The FDQ was sent home with students in a parent take-home folder a week after consent forms were returned to school. Parents were encouraged to complete and return the questionnaires. Completed questionnaires were returned to school via the child's backpack. At school, the project coordinator collected the questionnaires from a designated box in the classroom. No incentives were offered for completing the FDQ.

Table 1. Three-Day Breakfast and Lunch School Menus With Nutrition Facts.

Breakfast menu	Nutritional levels	Lunch menu	Nutritional levels
Day 1			
Fresh orange (with skin) Bean and cheese taco (refried beans, cheddar cheese in flour tortilla) Milk 1%	Total energy (kcal) 401 Carbohydrates (%) 62 Fat (%) 22 Protein (%) 16 Dietary Fiber (g) 4.5	Pizzatta (Reduced fat mozzarella cheese and turkey pepperoni folded over in pizzeria crust) Baby carrots (raw) Chilled peaches (Canned in light syrup) Ranch dressing cup (Light) Milk 1%	Total energy (kcal) 549 Carbohydrates (%) 49 Fat (%) 26 Protein (%) 25 Dietary fiber (g) 11
Day 2			
Apple/cherry juice (fortified with vitamin C) Buttered wheat toast (honey wheat bread, margarine) Turkey sausage (patty fully cooked) Milk 1%	Total energy (kcal) 324 Carbohydrates (%) 52 Fat (%) 26 Protein (%) 23 Dietary fiber (g) 1.7	Chicken quesadilla (enriched wheat flour tortillas filled with mozzarella cheese and fully cooked chicken breast) Whole kernel corn (canned, drained) Tropical fruit (canned in light syrup) Milk 1%	Total energy (kcal) 578 Carbohydrates (%) 58 Fat (%) 16 Protein (%) 26 Dietary fiber (g) 7.7
Day 3			
Chilled peaches (canned peaches in light syrup) Cheese tortilla roll (American cheese reduced fat rolled in flour tortilla) Milk 1%	Total energy (kcal) 348 Carbohydrates (%) 66 Fat (%) 20 Protein (%) 15 Dietary fiber (g) 2.3	Toasted cheese sandwich (honey wheat bread, American cheese processed, reduced fat) Beets (canned, drained) Chilled pears (canned in light syrup) Milk 1%	Total energy (kcal) 378 Carbohydrates (%) 68 Fat (%) 19 Protein (%) 13 Dietary fiber (g) 4.4

Dietary Assessment

Prior to dietary collection, school menus, recipes, and nutritional labels were collected and entered in Nutrition Data System for Research software (NDSR; Version 4.04, 1998-2001, University of Minnesota Nutrition Coordinating Center, Minneapolis) as user recipes to match all the nutrition information of the foods offered in the school. The menus for 3 days are reflected in Table 1.

The dietary observation method used in our study was modeled after the Dietary Observation for Child Care system (Ball, Benjamin, & Ward, 2007, 2008). This method has been tested and shown to be a reliable method. Following the protocol modeled after Ball et al. (2007), 10 nutritionists were trained as observers to record the dietary information. In the first phase of the training, observers practiced measuring and observing different amounts of food. In Phase 2, they were asked to visually identify serving sizes from various food items using standard food models and pictures. In the last phase, observers had to demonstrate accuracy and competency on visually recording the amount of food served and consumed as well as measuring liquids by role-play and mock observation. The Food Observation Monitoring (FOM) form in the present study was used just to record the amount of food served and consumed by students. The FOM has three columns: (a) amount served, (b) amount consumed, and (c) meal descriptions or comments (see Table 2).

Consented preschool children were observed for both breakfast and lunch on 3 consecutive days. The tools required to perform the direct food observation were measuring cups and the FOM form. Food portions were served in a ¼ cup serving spoon that had a capacity of 2 ounces. The dietary collection protocol included the following steps: (a) place prelabeled student trays on the designated table once they were ready to discard; (b) document the amount of food that was consumed by either: all eaten, ¾ eaten, ½ eaten, ¼ eaten, or none eaten; (c) use measuring cups to convert food portion sizes to ounces; and (d) for liquids, such as milk and juice, pour separately into measuring cups to measure the amount of liquid consumed by subtracting the amount left over from the amount served. FOM forms were returned back to the Social and Health Research Center office and entered into the NDSR.

Physical Measures

Children's height was measured with his or her shoes and socks removed using a wall-mounted stadiometer (Seca Bodymeter 206, Seca Corporation, Hanover, MD). Their body weight was measured using a Tanita weight scale (BF-2000 Iron Kids, Tanita Corporation, Arlington Heights, IL). BMI was calculated using the following formula: BMI = weight in kilograms divided by the square of height in meters. Obesity was considered if children's BMI was ≥95th

Table 2. Food Observation Monitoring Form.

School Name: _____ Study ID: _____ Date: _____

Student ID: 24-04-_____ Teacher: _____ Evaluator: _____

Instructions: This form is filled out by a trained SHRC staff member to observe plate waste data. Fill out all header information above before beginning the observation. Begin observation by identifying food items being served for the day in appropriate spaces provided. Check off food items in boxes below. Once student is ready to discard tray, label the tray and carton of milk for each student, then observe remains of tray and fill in form. Record what was consumed in fruit, vegetables, whole grains, and milk consumption. Measure remains of milk by pouring into a liquid measuring cup and record amount.

All Eaten 7/8 3/4 2/3 1/2 1/3 1/4 1/8 1/16 None Eaten

Breakfast menu—Tuesday	Amount served	Description or comments	Amount consumed (all, 7/8, 3/4, 2/3, 1/2, 1/3, 1/4, 1/8, 1/16, none eaten)
Orange juice	4 oz		
Buttered biscuit	1each		
Sausage patty	1 each		
Fresh banana	1/2		
Cold cereal (list brand name)	3/4oz		
Milk (circle milk option)	8oz	Skim white, 1% white, or nonfat chocolate	
Extra item(s) (brand name, description, and size)			

percentile and BMI percentile for age and gender was calculated using CDC data tables (CDC, 2011b).

Data Analysis

Dietary data collected and recorded on the FOM were analyzed to determine the mean quantity of food consumed for each food group. The analysis of the recorded dietary data was conducted in three phases. The first phase was to record the amount of food served minus the amount of food wasted to calculate food consumed at breakfast and lunch. The second phase involved averaging the nutrient analysis of both meals. The third phase involved averaging the 3 days of food observation to determine the meal's composite nutritional value. Analyses were performed using the Statistical Package for the Social Sciences Version 16 (SPSS Inc., Chicago IL). Descriptive statistics are presented as means and standard deviations.

Results

Student and Household Characteristics

Of the 200 eligible children, 135 parents signed a consent form for their children to participate. Additionally, the 135 parents completed and returned the FDQ. The average age of the students participating in the study was 4.56 ± 0.497 years. Students and household characteristics are summarized in Table 3. According to household income and persons per household, 75.8% of the respondents were living in poverty.

Table 3. Student and Family Household Characteristics.

Characteristic	*M* ± *SD* or %
Students (*n* = 135)	
Age (years)	4.56 ± 0.497
Gender (% male)	50
Ethnicity (% Hispanic)	98
Family household (*n* = 123)	
Maternal age (years)	29.34 ± 7.76
Maternal education (years)	11.08 ± 2.03
Paternal education (years)	10.82 ± 2.82
Income per month	1337.84 ± 846.03
Persons per household	4.77 ± 1.88
Living in poverty (%)[a]	75.8
Economic disadvantage (%)[b]	81.6 ± 1.5
Family history of diabetes (%)[c]	24

[a]Based on U.S. Census Bureau's (2007) poverty threshold. [b]Based on the number of eligible student in the free and reduced sectional–school lunch program. [c]Based on first- and second-degree relatives.

School Food Servings and Children Consumption

Table 1 shows the school menus, which represent what was offered to children. The food placed on the plate represents what was served. After the child ate, the portion of the food that was actually eaten per food item was considered the "consumed." Table 4 shows the 3-day school breakfast and lunch observation results of what the children were served and what they consumed. Mean 3-day total kilocalories

Table 4. Breakfast and Lunch Nutritional Analysis of Food Served and Consumed by Preschoolers Measured in 3-Day Food Observation Study (n = 135).

	Breakfast		Lunch		Total	
Energy and nutritional levels	Served	Consumed	Served	Consumed	Served	Consumed
Primary energy source						
Energy (kcal)	358.33 ± 8.74	155.11 ± 66.82	501.00 ± 172.87	324.32 ± 100.40	859.33 ± 166.36	479.44 ± 147.76
Total carbohydrate (g)	46.667 ± 10.8	24.3 ± 8.61	55.1 ± 62.17	36.91 ± 13.06	108.83 ± 5.05	60.60 ± 19.42
Total carbohydrate (%)	60 ± 7.21	64.55 ± 11.65	58.33 ± 9.50	46.05 ± 8.53	59.17 ± 6.79	55.3 ± 7.88
Total fat (g)	10.97 ± 0.95	3.71 ± 2.47	12.11 ± 3.92	9.40 ± 16.90	27.87 ± 0.15	15.66 ± 5.38
Total fat (%)	22.67 ± 3.06	17.59 ± 7.37	20.33 ± 5.13	30.85 ± 7.59	21.5 ± 2.29	24.46 ± 4.33
Total protein (g)	18.80 ± 1.55	7.09 ± 3.73	19.80 ± 29.27	18.78 ± 7.15	48.07 ± 11.83	25.52 ± 10.6
Total protein (%)	18 ± 4.36	16.86 ± 5.17	21.33 ± 7.23	22.28 ± 3.78	19.67 ± 5.30	19.57 ± 3.88
Fats and lipids						
Cholesterol (mg)	35.333 ± 13.6	17.92 ± 10.77	47.00 ± 21.28	32.75 ± 11.50	82.33 ± 34.43	50.67 ± 9.59
Total saturated fat (g)	4.6333 ± 1.22	1.41 ± 1.08	6.50 ± 1.75	4.15 ± 1.67	11.13 ± 2.48	5.56 ± 1.26
Fiber						
Total dietary fiber (g)	2.9667 ± 2.67	1.95 ± 0.78	7.70 ± 3.30	3.76 ± 1.74	10.53 ± 4.51	5.80 ± 2.09
Vitamins						
Vitamin A (µg)	214.33 ± 22.2	76.35 ± 41.08	554.00 ± 560.32	104.21 ± 47.08	768.33 ± 557.89	180.56 ± 72.20
Thiamin, B1 (mg)	0.3167 ± 0.14	0.14 ± 0.07	1.36 ± 1.86	0.28 ± 0.15	1.67 ± 1.97	0.41 ± 0.18
Niacin, B3 (mg)	2.8 ± 0.78	1.41 ± 0.07	5.07 ± 2.24	4.34 ± 1.94	7.87 ± 3.00	5.75 ± 2.11
Vitamin B_6 (mg)	0.2233 ± 0.06	0.12 ± 0.06	0.41 ± 0.16	0.29 ± 0.12	0.64 ± 0.22	0.41 ± 0.13
Vitamin B_{12} (µg)	1.4567 ± 0.24	0.53 ± 0.33	1.83 ± 0.31	1.11 ± 0.55	3.29 ± 0.29	1.64 ± 0.67
Minerals						
Calcium (mg)	457.67 ± 90.8	144.23 ± 83.71	585.67 ± 65.25	293.21 ± 142.52	1043.33 ± 133.82	436.67 ± 185.65
Iron (mg)	1.89 ± 0.39	1.43 ± 0.84	3.13 ± 0.74	2.20 ± 0.76	5.02 ± 0.53	3.61 ± 1.12
Magnesium (mg)	54.333 ± 9.24	20.28 ± 10.18	96.67 ± 23.25	55.85 ± 23.86	151.00 ± 22.07	76.56 ± 28.73
Potassium (mg)	645.33 ± 117	208.16 ± 115.24	875.33 ± 125.72	493.85 ± 183.11	1520.67 ± 209.34	702.57 ± 241.61
Phosphorus (mg)	428 ± 92.5	141.24 ± 80.96	619.33 ± 47.54	347.13 ± 153.73	1047.33 ± 49.08	488.93 ± 202.61
Sodium (mg)	647 ± 179	263.90 ± 146.12	1093.67 ± 247.41	756.15 ± 255.16	1740.67 ± 248.46	1020.67 ± 327.27
Zinc (mg)	2.3067 ± 0.51	1.15 ± 0.52	3.50 ± 0.79	2.12 ± 0.10	5.81 ± 1.20	3.27 ± 1.16
Food group consumption						
Fruits (servings)	1 ± 0	0.76 ± 0.08	1 ± 0	0.49 ± 0.13	2 ± 0	1.25 ± 0.11
Vegetables (servings)	1 ± 0	0.05 ± 0.08	1 ± 0	0.65 ± 0.32	2 ± 0	0.70 ± 0.20
Grains (servings)	1 ± 0	0.63 ± 0.07	1 ± 0	1 ± 0	2 ± 0	1.63 ± 0.13
Protein (servings)	0.67 ± 0.57	0.24 ± 0.42	1 ± 0.57	1.34 ± 0.48	1.67 ± 0.57	1.59 ± 0.45
Dairy (servings)	2 ± 0	0.41 ± 0.09	2 ± 0	0.84 ± 0.24	4 ± 0	1.25 ± 0.17
Fats (servings)	0.67 ± 0.57	0.50 ± 0.55	1 ± 0.57	0.92 ± 0.61	1.67 ± 0.57	1.42 ± 0.58

Note. Values are given as mean ± standard deviation (M ± SD).

(kcal) served for both breakfast and lunch was 859.33 ± 166.36 kcal/day of carbohydrates (59%), proteins (19%), and fats (24%); children, however, only consumed 479.44 ± 147.76 kcal of those servings.

Dietary recommendations suggest that preschool children should consume an average range of 1,200 to 1,400 calories per day for females and 1,200 to 1,600 calories per day for males (U.S. Department of Agriculture [USDA], 2013a). ECCCs often provide one half to two thirds of the caloric dietary needs for young children. Preschool children should consume 1 to 1.5 cups of fruit, 1.5 cups of vegetables, 2 cups of dairy, and 4 to 5 ounces of grains per day in smaller portions to meet the MyPyramid dietary recommendations (USDA, 2013a, 2013b). However, according to study results, participants consumed only 1 serving of fruit and less than 1 full serving of vegetables for breakfast and lunch. Mean total dietary fiber intake was 5 ± 2.09 grams/day, significantly below the dietary recommendation of 19 to 25 grams for girls and boys, respectively (USDA, 2013a). Children should consume 2 cups of dairy per day; however, in school they only consumed 1 serving. Mean daily calcium intake was 436 ± 185 mg/day and 45% did not meet the dietary reference intake of 800 mg/day (USDA, 2013a).

Student's Anthropometric Measures

Table 5 provides a summary of the height, weight, and BMI of the student participants. The obesity prevalence for girls and boys was 25.4% and 25%, respectively (see Table 5).

Discussion

Overall, our research illustrates the importance of a bottom-up approach to understanding early childhood-eating behaviors. Preschool children who participated in a FSM did not meet the minimum dietary intake recommendations, and

Table 5. Student's Anthropometric Measures.

Characteristic	*M* ± *SD*	Percentile[a]
Girls (*n* = 67)		
Height (cm)	105.72 ± 4.58	75th
Weight (kg)	19.16 ± 4.177	80th
Body mass index (kg/m^2)	17.03 ± 2.28	80th
Obesity prevalence (≥95th percentile)	25.4	
Boys (*n* = 68)		
Height (cm)	106.41 ± 4.49	60th
Weight (kg)	19.20 ± 3.29	80th
Body mass index (kg/m^2)	16.87 ± 1.99	80th
Obesity prevalence (≥95th percentile)	25	

[a]Centers for Disease Control and Prevention (2000; http://www.cdc.gov/growthcharts/charts.htm) growth chart percentile (gender and age adjusted).

physical measures indicated that one in four were obese. Ninety-eight percent of the participants self-identified as Mexican American, 75% came from families that reported living at or below the poverty level, and 24% reported a family history of diabetes. These findings corroborate other research showing that low-income minorities, particularly Mexican American children are at higher risk for obesity and chronic illness, such as Type 2 diabetes (CDC, 2013; Copeland, Becker, Gottschalk, & Hale, 2005). The problem is exacerbated in that the children are at risk for obesity later in life (Lee, Mullan-Harris, & Gordon-Larsen, 2009).

Obesity is usually associated with high energy intake and low energy expenditure. Children in the age group of our participants are expected to consume at school approximately two thirds of the average kilocalories required per day (1200-1600 kcal) for breakfast and lunch. However, our participants consumed less than half of the calories offered at the ECCCs. Yet their obesity rate is more than twice the national average (Ogden, Carroll, Kit, & Flegal, 2014). What could account for the discrepancy in the children's low calorie consumption on the one hand and their high obesity rate on the other? Treviño et al. (2008) found this low-calorie intake–high obesity rate paradox among low-income fourth-grade Mexican American children. They determined that low-income families may have had food insufficiency and that this condition is associated with periods of binge eating and compromised food quality causing obesity.

Other research also suggests children and youth are not meeting the recommended dietary guidelines (Briefel & Johnson, 2004; Reedy & Krebs-Smith, 2010; USDHHS, 2012). The MyPlate, Dietary Recommendations for Americans older than 2 years, promotes a diet that is rich with fruits, vegetables, whole grains, and low-fat and fat-free milk (USDA, 2013a, 2013b). Although it is unclear why preschool children in this study did not consume most of the calories offered, research does suggest that children's eating habits and food preferences are shaped by parents early on in life (Saunders, 2007). Additionally, home environment factors, such as food knowledge, attitudes, preferences, cultural norms, social support, food assistance programs, and economics can have an effect on food consumption at school (USDA, 2013b).

The research team made several other noteworthy observations during the study. First, the children seemed to be too sleepy to eat all of their breakfast on several mornings during the study period. This is important because breakfast provided more than 350 kcal and is considered the most important meal of the day to fuel their mind and body. Second, during the 3-day observation period, the FSM basic protocol (Contra Costa Child Care Council, n.d.) of allowing the children to take ownership and serve themselves the food selections was not fully implemented. Teachers frequently were observed serving meals to the children. This may have been due to time constraints. Nonetheless, teachers serving the food rather than allowing the children to serve themselves may have influenced the amount and frequency of the food children consumed. Ownership as determined by self-serving may encourage greater consumption and eating new foods. Additionally, the children may not have consumed most of their food because of preexisting food preferences, taste, and appearance of the food. Thus, study findings could also be important to meal planners as they seek to better understand the child's food preferences and eating patterns to reduce food waste.

Limitations

The limitations of the study are associated with dietary measurement. First, observations were of two meals a day at school, breakfast and lunch, and did not include home meals. Another study our center conducted showed that children living in poverty were still energy insufficient despite using 24-hour dietary recalls to collect dietary intake at school and home (Treviño et al., 2008). Second, direct observation was based on human interpretation of portions consumed. Direct observation has been successfully used with similar age groups in other studies (Ball et al., 2008). Self-reported and recall may not have yielded an accurate dietary assessment for this young age group. Third, the study did not include interviews with teachers to discuss children's food consumption behaviors prior to and after the observation study. Fourth, lack of assessment of students' food preferences prevented comparison with school menus. Food preferences can influence consumption. Fifth, we did not collect data on known food allergies of the children. Allergies may have been a factor in consumption behavior. Typically, children with food allergies and/or special needs are identified as "dietary restrictions" and food service staff makes the necessary adjustments prior to serving the child. Finally, because this was a convenience sample with mostly low-income

Mexican American children, results cannot be generalized to all preschool/early childcare center children.

Conclusions

This formative study indicates a need to understand the eating behaviors among mostly preschool children living in poverty. The school menu offerings in this study provided the appropriate calories, servings of fruits, vegetables, and dairy sources but children nonetheless wasted nearly half of the kcal and the healthier food items offered and served. Preschool children, families, teachers, and food service staff need culturally relevant nutrition education to improve health knowledge and eating behaviors that comply with dietary recommendations.

Lessons learned from the study include (a) preschool children wasted near half of the food served and most were the healthier food options; (b) teachers and providers could serve as role models to positively affect healthy eating, but may need training to better serve in this capacity; and (c) parents must be informed of their child's eating behaviors and be part of the process to improve healthy eating.

Future research should investigate the effectiveness of incorporating nutrition education during FSM time as a strategy to prevent childhood obesity. Researchers and practitioners should also explore multilevel approaches that include school environmental strategies and interventions for families to improve healthy eating habits to start at home.

Implications for Practice

The study findings have several important implications for using FSMs to promote nutrition education in early childhood (prekindergarten) settings. A FSM setting provides teachers the opportunity to model healthy eating behaviors, share nutrition messages, and allows children to try new foods, which could promote self-efficacy for lifelong healthier nutrition practices. Our recommendations for health education practice include the following.

Early childhood classroom teachers and staff should be encouraged to

1. participate in annual training/continuing education to learn more about the benefits of healthy eating and good nutrition
2. include nutrition education within the science component of a Pre-K curriculum
3. offer nutrition education classes for parents
4. serve as role models during mealtimes to encourage consumption of all food groups
5. introduce MyPlate as a teaching tool during classroom instruction and the FSM setting
6. use FSM settings to broaden children's palates by introducing them to fruits and vegetables beyond their comfort zones
7. provide "healthy" incentives to try a fruit and/or vegetable (extra time in a learning center, an extra trip to the library, or serve as line leader).

School menu planners/cafeteria services should be encouraged to

1. increase the diversity of the food offerings (include food preferences expressed by children and their parents) to increase consumption and decrease waste
2. use MyPlate as a teaching tool to feature weekly healthy foods such as fruits, vegetables, whole grains and dairy in a fun and educational format
3. provide a variety of whole grain sources for both breakfast and lunch.

In the home environment, parents should be encouraged to

1. introduce new foods during mealtime, especially fruits, vegetables, and whole grains to boost fiber intake
2. serve mandatory daily breakfast to fuel children's mind and body
3. provide low-fat and fat-free milk to meet the calcium needs of children
4. serve FSM at home to model ECCCs family style meals.

Finally, policymakers may find these study findings useful to improve the Child and Adult Care Food Program (CACFP) nutrition standards, programs, and policies in child care centers, especially in view of recent national initiatives, such as Let's Move! Child Care (2012) and legislation—Healthy, Hunger-Free Kids Act (Food Research and Action Center, 2010; USDA, 2013c, 2013d).

If we hope to design early childhood obesity prevention interventions for high-risk children, we must understand the nutrition knowledge, attitudes, and behaviors of these children in ECCCs. Early childhood obesity prevention programs must be evidence-based and provide learning opportunities for children, their families, teachers/providers, and menu planners/cafeteria services. All stakeholders must be engaged in transforming the ECCCs culture to develop new generations of "nutrition wise" and physically active children. The Whole School, Whole Community, Whole Child (WSCC) model (Association for Supervision and Curriculum Development, 2014) represents a collaborative approach to learning and health that will facilitate our efforts to achieve this goal.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was completed with funding from the Medtronic Foundation. Funding was provided to the Social & Health Research Center of which Dr. Roberto Trevino is the Director. He is the senior author on this article.

References

Academy of Nutrition and Dietetics. (2013). *Size-wise nutrition for preschool age children*. Retrieved from http://www.eatright.org/Public/content.aspx?id=8055

Association for Supervision and Curriculum Development. (2014). *The whole school, whole community, whole child*. Retrieved from http://www.ascd.org/programs/learning-and-health/wscc-model.aspx

Ball, S. C., Benjamin, S. E, & Ward, D. S. (2007). Development and reliability of an observation method to assess food intake of young children in child care. *Journal of the American Dietetic Association*, *107*, 656-661.

Ball, S. C., Benjamin, S. E., & Ward, D. S. (2008). Dietary intakes in North Carolina child-care centers: Are children meeting current recommendations. *Journal of the American Dietetic Association*, *108*, 718-721.

Benjamin, S. E. (2007). *Making food healthy and safe for children: How to meet the national health and safety performance standards—Guidelines for out of home child care programs* (2nd ed.). Chapel Hill, NC: National Training Institute for Child Care Health Consultants. Retrieved from http://nti.unc.edu/course_files/curriculum/nutrition/making_food_healthy_and_safe.pdf

Braveman, P., & Egerter, S. (2008). *Overcoming obstacles to health: Report from the Robert Wood Johnson Foundation to the commission to build a healthier America*. Princeton, NJ: Robert Wood Johnson Foundation.

Briefel, R. R., & Johnson, C. L. (2004). Secular trends in dietary intake in the United States. *Annual Review of Nutrition*, *24*, 401-431. doi:10.1146/annurev.nutr.23.011702.073349

Centers for Disease Control and Prevention. (2011a). *Tips for parents-Ideas to children maintain their weight*. Retrieved from http://www.cdc.gov/healthyweight/children/index.html#prevention

Centers for Disease Control and Prevention. (2011b). *About BMI for children and teens*. Retrieved from http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Centers for Disease Control and Prevention. (2012a). *Childhood overweight and obesity*. Retrieved from http://www.cdc.gov/obesity/childhood/index.html

Centers for Disease Control and Prevention. (2012b). Youth risk behavioral surveillance-United States, 2011. *MMWR Morbidly and Morality Weekly Report*, *61*(4), 1-162.

Centers for Disease Control and Prevention. (2013). *Obesity rates among low-income pre-school children*. Retrieved from http://www.cdc.gov/obesity/downloads/pednssfactsheet.pdf

Contra Costa Child Care Council. (n.d). *Best practices for child care nutrition and physical activity environments. A guide for self-assessment and policy development*. Retrieved from http://www.healthybeveragesinchildcare.org/bestpractices/BestPracticesHandbook.pdf

Copeland, K. C., Becker, D., Gottschalk, M., & Hale, D. (2005). Type 2 diabetes in children and adolescents: Risk factors, diagnosis, and treatment. *Clinical Diabetes*, *23*, 181-185.

Daniels, S. R., Arnett, D. K., Eckel, R. H., Gidding, S. S., Hayman, L. L., Kumanyika, S., . . .Williams, C. L. (2005). Overweight in children and adolescents: Pathophysiology, consequences, prevention, and treatment. *Circulation*, *111*, 1999-2012.

Dietz, W. H. (1998). Health consequences of obesity in youth: Childhood predictors of adult disease. *Pediatrics*, *101*(3 Pt. 2), 518-525.

Donnelly, J. E., Jacobsen, D. J., Legowskip, P., Johnson, S., & McCoy, P. (2000). Family-style foodservice can meet US dietary guidelines for elementary school children. *Journal of the American Dietetic Association*, *100*, 103-105.

Erinosho, T. O., Hale, D. P., McWilliams, C. P., Emunah, J., & Ward, D. S. (2012). Nutrition policies at child-care centers and impact on role modeling of healthy eating behaviors or caregivers. *Journal Academy of Nutrition and Dietetics*, *112*, 119-124.

Food Research and Action Center. (2010). *FRAC's child care wellness toolkit: Child and adult care food program*. Retrieved from http://frac.org/federal-foodnutrition-programs/child-and-adult-care-program/child-care-wellness-plans-and-policies/

Lee, H., Mullan-Harris, K., & Gordon-Larsen, P. (2009). Life course perspectives on the links between poverty and obesity during the transition to young adulthood. *Population Research and Policy Review*, *28*, 505-532.

Let's Move Child Care. (2012). *Strive for five: Goals for a healthier future*. Retrieved from http://www.healthykidshealthyfuture.org/welcome.html

Ogden, C. L., Carroll, M. D., Kit, B. D., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA, 311*(8), 806-814.

Pratt, C. A., Stevens, J., & Daniels, S. (2008). Childhood obesity prevention and treatment recommendations for future research. *American Journal of Preventive Medicine*, *35*, 249-252.

Reedy, J., & Krebs-Smith, S. M. (2010). Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *Journal of the American Dietetic Association*, *110*, 1477-1484.

Saunders, K. L. (2007). Preventing obesity in pre-school children: A literature review. *Journal of Public Health*, *29*, 368-375.

Serdula, M. K., Ivery, D., Coates, R. J., Freedman, D. S., Williamson, D. F., & Byers, T. (1993). Do obese children become obese adults? A review of the literature. *Preventive Medicine*, *22*, 167-177.

Sisson, S. B., Campbell, J. E., May, K. B., Brittain, D. R., Monroe, L. A., Guss, S. H., & Ladner, J. L. (2012). Assessment of food, nutrition, and physical activity practices in Oklahoma child-care centers. *Journal of the Academy of Nutrition and Dietetics*, *112*, 1230-1240.

Taveras, E. M., Matthew, W., Kleinman, K., Rich-Edwards, J. W., & Rifas-Shiman, S. L. (2010). Racial/ethnic differences in early-life risk factors for childhood obesity. *Journal of the American Academy of Pediatrics*, *125*, 686-695. doi:10.1542/peds.2009-2100

Treviño, R. P., Fogt, D. L., Wyatt, T. J., Leal-Vasquez, L., Sosa, E., & Woods, C. (2008). Diabetes risk, low fitness, and energy insufficiency levels among children from por families. *Journal of the American Dietetic Association*, *108*, 1846-1853.

Treviño, R. P., Yin, Z., Hernandez, A., Hale, D. E., Garcia, O. A., & Mobley, C. (2004). Impact of the Bienestar school-based diabetes mellitus prevention program on fasting capillary glucose levels: A randomized controlled trial. *Archives of Pediatric Adolescent Medicine*, *158*, 911-918.

U.S. Census Bureau. (2007). *Poverty thresholds*. Washington, DC: U.S. Department of Commerce.

United States Department of Agriculture (2001). Food and Nutrition Service, Nutrition Assistance Program Report Series. *The Office of Analysis, Nutrition and Evaluation: "Children's diets in the mid- 1990s: Dietary intake and its relationship with school meal participation."* Washington, DC: Special Nutrition Programs Report No. CN-01-CD1.

U.S. Department of Agriculture. (2013a). *Dietary reference intakes: Macronutrients*. Washington, DC: National Academies Press. Retrieved from http://fnic.nal.usda.gov/dietary-guidance/dietary-reference-intakes/dri-tables

U.S. Department of Agriculture. (2013b). *Dietary guidelines for Americans*. Retrieved from http://www.cnpp.usda.gov/dietaryguidelines.htm

U.S. Department of Agriculture. (2013c). *Food and nutrition service, nutrition & wellness tips for young children: Provider handbook for the child and adult care food program*. Retrieved from http://www.teamnutrition.usda.gov/Resources/nutritionandwellness.html

U.S. Department of Agriculture (2013d). *Healthy hunger-free kids act of 2010*. Retrieved from http://www.fns.usda.gov/cnd/governance/legislation/cnr_2010.htm

U.S. Department of Health and Human Services. (2012). *Healthy people 2010 final review*. Washington, DC: Author.

U.S. Department of Health and Human Services. (2013). *Healthy people 2020, Nutrition and weight status*. Retrieved from http://healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=29

U.S. Department of Health and Human Services & Administration for Children and Families Office of Head Start. (2009). *ABC's of successful menu planning: Family-style meal service*. Retrieved from http://eclkc.ohs.acf.hhs.gov/hslc/ttasystem/health/Health/nutrition/nutrition%20program%20staff/health_pub_12000_071406.html

Wang, G., & Dietz, W. H. (2002). Economic burden of obesity in youths aged 6 to 17 years: 1979-1999. *Pediatrics*, *109*(5), e81.

White House Task Force on Childhood Obesity. (2010). *Solving the problem of childhood obesity*. Retrieved from http://www.letsmove.gov/sites/letsmove.gov/files/Obesity_update_report.pdf