

Caregiver food behaviours are associated with dietary intakes of children outside the child-care setting

Temitope O Erinoshon^{1,*}, L Beth Dixon², Candace Young³, Laurie Miller Brotman⁴ and Laura L Hayman⁵

¹Department of Nutrition/Center for Health Promotion and Disease Prevention, University of North Carolina, 700 Martin Luther King Jr. Blvd, 2nd Floor, Campus Box 7426, Chapel Hill, NC 27599-7426, USA:

²Department of Nutrition, Food Studies and Public Health, New York University, New York, NY, USA: ³The Food Trust, Philadelphia, PA, USA: ⁴School of Medicine, New York University, New York, NY, USA: ⁵Department of Nursing, University of Massachusetts, Boston, MA, USA

Submitted 27 May 2011: Final revision received 29 February 2012: Accepted 20 April 2012: First published online 10 August 2012

Abstract

Objective: To evaluate whether food behaviours of parents are associated with children's dietary intakes outside the child-care setting, and to compare children's dietary intakes at home with foods and beverages consumed when they are at child-care centres.

Design: In 2005–2006, a survey was completed by parents of at least one child between 3 and 5 years old who attended group child-care centres. Surveys about nutrition practices were completed by centre directors. Research assistants observed foods and beverages consumed by children at lunchtime at the centres.

Setting: Sixteen licensed group child-care centres in three underserved New York City communities (South Bronx, East/Central Harlem, Central Brooklyn) and the Lower East Side of Manhattan.

Subjects: Two hundred parents.

Results: Children were more likely to consume healthful foods including fruits or vegetables if parents reported purchasing food from produce stands/farmers' markets, shopped for frozen or canned fruits frequently and ate family meals or meals prepared at home daily. Children were more likely to consume less healthful foods such as French fries, or fruit drinks, more frequently if parents reported eating meals from fast-food or other restaurants at least once weekly, or if children ate while watching television. Types of foods and beverages offered to children at home (e.g. higher-fat milk, soft drinks and desserts) were less healthful than those offered at child-care centres.

Conclusions: Children's dietary intakes at home need to be improved. Parents need to understand the importance of providing home environments that support healthful food behaviours in children.

Keywords
Child care
Dietary intake
Household survey
Pre-school children

Children's dietary behaviours are established in early childhood⁽¹⁾. During this critical stage of development, the majority of children under 6 years old (approximately 61%) in the USA share their time between the home and child-care settings⁽²⁾. Foods and beverages offered to and consumed by children in these settings play a significant role in children's overall health^(3–6).

At home, parents' food practices and family characteristics contribute to children's dietary intakes⁽⁷⁾. Studies of children and adolescents report that availability and accessibility of healthful foods such as fruits and vegetables at home is associated with greater consumption of these foods^(8–10). Frequent consumption of family meals at home is associated with higher intake of healthful foods in children^(11–14). In contrast, increased frequency

of eating out, especially at fast-food restaurants, in children and adolescents is associated with higher intakes of sugar-sweetened beverages and unhealthy foods such as full-fat dairy foods, red/processed meats and fried potatoes^(15–18). Eating food while watching the television (TV) is also associated with higher intakes of sugar-sweetened beverages and unhealthy foods such as pizza, salty snacks, chips and processed meats in children^(19–22).

Research studies about parents and children's dietary intakes have focused largely on school-aged children and adolescents^(23,24). Few studies have examined the influence of parents' food behaviours on the dietary intakes of young children outside structured settings like child-care centres, particularly in New York City (NYC). Further research on this topic is needed to develop effective

education campaigns and interventions to improve children's dietary intakes and reduce or prevent childhood obesity⁽²⁵⁾.

The primary objective of the present study was to evaluate whether food behaviours of parents are associated with children's dietary intakes when they are not attending group child-care centres in NYC. Specifically, parents were asked about food purchasing behaviours (e.g. stores where household foods are purchased, ease and frequency of purchasing fruits and vegetables), food consumption behaviours (e.g. frequency of consuming family meals, meals prepared at home, meals from fast-food and other restaurants, eating while watching TV) and children's consumption of fruit, 100% fruit juice, vegetables, French fries, fruit drinks, soft drinks, desserts and snacks while in the presence of the caregiver. A secondary objective of the study was to determine whether children's intakes at home were more healthful than their intakes at the group child-care centres in NYC.

Methods

Study design

In 2005–2006, the NYC Department of Health and Mental Hygiene contracted with members of the research team to develop a survey on household food behaviours of parents of at least one child between 3 and 5 years old who attend child-care centres in NYC. In the study, the term 'parents' included biological parents and non-biological primary caregivers. This research was included as part of a larger study on the nutrition practices of forty licensed group child-care centres in NYC and in response to feedback from the directors stating that parents and caregivers of the children needed education about nutrition, especially with regard to what foods and beverages to feed their child. Details about the study methodology can be found elsewhere^(26,27). Approval for the study procedures was obtained from the University Committee on Activities Involving Human Subjects at New York University.

Assessment of parents' behaviours and children's dietary intakes at home

Health professionals at the NYC Department of Health and Mental Hygiene and researchers at New York University developed survey questions about food purchasing and food consumption behaviours of parents and their families. Food purchasing behaviours included types of stores where household foods were purchased (supermarkets, small corner store/bodega, restaurants, discount stores, produce stand/farmers' market, other), ease of purchasing fruits and vegetables (very difficult, somewhat difficult, not very difficult) and frequency of purchasing fresh, frozen or canned fruits and vegetables (every day, a few times/week, 1 time/week, never). Food consumption behaviours included frequency of consuming

family meals, meals prepared at home, meals from fast-food restaurants such as McDonalds or Wendy's and meals from other types of restaurants such as Italian, Chinese buffet, Mexican or Caribbean (every day, 4–6 d/week, 2–3 d/week, only on Sundays or 1 d/week, never). Parents were also asked about whether their children ate food while watching TV (yes, no).

To assess children's dietary intakes at home, parents were asked about their children's frequency of consuming fresh, canned or frozen fruits, 100% fruit juice (e.g. orange, apple, grapefruit juice), fresh, canned or frozen vegetables, fried potatoes (i.e. French fries, hash brown potatoes, tater tots), fruit drinks (e.g. Koolaid, Hi-C, Tang, Lemonade), non-diet soft drinks (e.g. Coke, Sprite, Pepsi), desserts (e.g. candy, cookies, ice cream, cake) and snacks (e.g. potato chips, Doritos, crackers) at home. Response categories were never, 1–2 times/week, 3–4 times/week, 5–6 times/week, 1 time/d and >1 time/d.

The Household Survey was developed in English and translated into Spanish. A graduate research assistant whose primary language was Spanish, and who was familiar with the target population, back-translated the Spanish survey to English to ensure that the Spanish translations were accurate and easy to understand. Content validity of both the English and Spanish versions of the survey was confirmed by nutrition faculty members and students at New York University's Department of Nutrition, Food Studies and Public Health.

Assessment of children's dietary intakes at the child-care centre

Two research assistants conducted site visits on a scheduled day that was convenient for child-care centres to administer a Director Survey and observe children's dietary intakes at the centres. The Director Survey was used to collect data about nutrition practices at child-care centres. The survey included questions about demographic characteristics of the centres; types of meals provided to children, places where foods and beverages are purchased and people in charge of purchasing foods and beverages; on-site food sources, such as availability of vending machines, kitchen and kitchen equipment, and cooks at the centres; and nutrition practices such as menu planning, selection of foods and beverages offered to children, availability of a health committee and person in charge of nutrition issues, and availability of nutrition-related activities for parents and children at the centres. Centre directors completed the Director Survey during face-to-face interviews with one research assistant. The current study analyses directors' responses about the selection of foods (e.g. fruits, vegetables, French fries) and beverages (e.g. milk, fruit juice) usually offered to children at the centres.

Dietary observations were conducted to assess children's dietary intakes at the child-care centres. In one pre-school classroom (3–4-year-olds) at each centre, the two research assistants selected six children at random to observe.

Between 08.00 and 14.00 hours, the research assistants recorded all types and amounts of foods and beverages consumed by the children. In general, children ate two meals during this period: breakfast or morning snack (referred to as 'breakfast' hereafter because the foods and amounts served were very similar) and lunch. If types of beverages or foods were not obvious, teachers or food service staff members were asked to clarify. Data from the dietary observations were analysed to determine the actual selection of foods and beverages consumed by children during mealtimes at the centres.

Study sample

Directors of sixteen licensed child-care centres located in three District Public Health Office regions (four centres in the South Bronx, four centres in East and Central Harlem, five centres in Central Brooklyn) and in the Lower East Side of Manhattan (three centres) were contacted to participate in the study. These centres were selected because their directors had indicated interest in assisting with administering a survey to parents to assess caregiver behaviours during the initial phase of the larger study assessing nutrition practices at the forty child-care centres⁽²⁷⁾. After obtaining written consent from the centre directors, the project coordinator explained the survey and obtained written consent from parents when they dropped off their child in the morning or when they arrived to pick up their child at the end of the day. Parents were asked to complete and return the Household Survey within a week to a box in a central location designated by directors of the centres. The Household Survey was distributed to 253 parents at the sixteen centres; 86% (n 218) of the parents completed and returned the survey. Surveys with missing responses to at least eight questions, out of a total of thirty-four questions, were excluded. In all, 200 surveys (i.e. fifty surveys per geographic region – South Bronx, Harlem, Brooklyn, Lower East Side of Manhattan) were analysed. Parents who returned the Household Survey received a \$US 5 Pathmark gift certificate by mail as a thank you gift.

The Director Survey was administered to all centre directors. For the dietary observations, six children were selected at random in a classroom at each centre and observed during mealtimes. In all, dietary observation data were collected from ninety-six children who attended the sixteen child-care centres.

Data analysis

All data were coded and entered into the SPSS statistical software package version 16.0 (SPSS Inc.). Descriptive statistics were calculated for demographic characteristics, food behaviours of parents, parent-reported dietary intakes of children at home and observed dietary intakes of children at the child-care centre. Because of the small sample sizes for some of the categorical responses, parents' responses for food behaviours and children's

dietary intakes at home were re-coded into two categories and cut-off points were selected according to the distribution of data across response categories and dietary recommendations⁽²⁸⁾. Binary logistic regression models were created, and odds ratios and 95% confidence intervals were calculated to evaluate associations between parents' food behaviours and children's dietary intakes, controlling for parents' ethnicity and highest level of education completed. Two-sided P values < 0.05 were used to determine statistical significance.

The types of foods and beverages offered to children at home and at the child-care centres were also compared descriptively using data collected from the Household Survey, data collected from a survey of directors previously administered at the sixteen child-care centres as part of the larger study⁽²⁷⁾, as well as 1 d of direct observation of ninety-six children's dietary intakes at lunchtime at all sixteen centres.

Results

Demographic characteristics of parents

Ninety-five per cent of the parents were women, 77% were 20 to 39 years old, and 54% were married or living with a partner (Table 1). The majority of parents were black or African-American (32%) and Hispanic or Latino (55%). About half (51%) of parents reported that they had attended high school, 22% had received some

Table 1 Demographic characteristics of 200 parents of young children who attended sixteen group child-care centres in New York City, 2005–2006

Characteristic	Parents (n 200)	
	n	%
Gender		
Female	188	94.5
Age (years)		
20–29	71	35.9
30–39	82	41.4
40–49	31	15.7
≥ 50	14	7.1
Marital status		
Single parent	91	46.0
Married/living with partner	107	54.0
Race/ethnicity		
White	1	0.5
Black/African-American	63	31.7
Hispanic/Latino	109	54.8
Asian	23	11.6
Other	3	1.5
Highest level of education completed		
High school	96	50.5
Some college	41	21.6
College degree/graduate school	53	27.9
	Mean	SD
Number of persons residing in the household	4.18	1.19
Number of children residing in the household	2.12	1.02

college education and 28% had completed a college degree. Parents reported an average of four persons residing in each household.

Food behaviours of parents

All parents reported that they purchased food for their household from supermarkets, 68% also purchased food from corner stores or bodegas, and about half of caregivers purchased food from produce stands or farmers' markets (Table 2). Approximately one-third of parents also reported purchasing food for their household from restaurants and discount stores. The majority of parents reported that they did not find it very difficult to purchase

fresh fruits and vegetables for their household. Two-thirds of parents said that they purchased fresh fruits and vegetables daily or a few times weekly, and half reported that they also purchased frozen or canned vegetables once weekly or more frequently.

Two-thirds of parents reported that their families usually ate meals together every day (Table 2). Thirty-nine per cent reported that their families usually ate meals prepared at home every day, but at least 70% of parents reported that their families ate meals from fast-food or other restaurants once weekly. About half of parents reported that their children ate food while watching TV.

Table 2 Food behaviours of 200 parents of young children who attended sixteen group child-care centres in New York City, 2005–2006

	Parents (<i>n</i> 200)	
	<i>n</i>	%
Do you buy food for your household at ('yes' responses)*		
Supermarket	199	100.0
Bodega/corner store	135	67.8
Restaurant	72	36.2
Produce stand/farmers' market	97	48.5
Discount store	74	37.2
Other	14	7.0
How difficult is it to purchase fresh fruits and vegetables		
Very difficult	7	3.6
Somewhat difficult	40	20.3
Not very difficult	150	76.1
Frequency of purchasing fresh fruits and vegetables		
Daily	29	14.9
A few times/week	97	49.7
1 time/week	59	30.3
<1 time/week	10	5.1
Frequency of purchasing frozen or canned fruits and vegetables		
Daily	2	1.0
A few times/week	40	20.4
1 time/week	59	30.1
<1 time/week	69	35.2
Never	26	13.3
Frequency of consuming family meals		
Every day	134	67.0
4–6 d/week	33	16.5
2–3 d/week	28	14.0
Only on Sundays	4	2.0
Never	1	0.5
Frequency of consuming meals prepared at home		
Every day	76	38.8
4–6 d/week	44	22.4
2–3 d/week	22	11.2
Only on Sundays	22	11.2
Never	32	16.3
Frequency of consuming meals from fast-food restaurants		
Every day	1	0.5
4–6 d/week	3	1.5
2–3 d/week	22	11.1
1 d/week	142	71.4
<1 d or never	31	15.6
Frequency of consuming meals from other restaurants		
Every day	1	0.5
4–6 d/week	3	1.5
2–3 d/week	19	9.7
1 d/week	137	70.3
<1 d or never	35	17.9

*A farmers' market is an outdoor food market where local farmers sell their produce directly to the public. Compared with small corner stores/bodegas, produce stands and farmers' markets are known for carrying fresh, locally grown produce, especially fruits and vegetables.

Food behaviours of parents associated with children's dietary intakes

Purchasing food from produce stands or farmers' markets and frequency of purchasing frozen or canned fruits and vegetables were associated with children's consumption of fruits and vegetables. The odds of children consuming fruits (OR = 2.32, 95% CI 1.24, 4.35) and vegetables (OR = 2.52, 95% CI 1.31, 4.86) at least once daily was more than twice as high if parents reported purchasing food from produce stands or farmers' markets, compared with children whose parents did not purchase food from produce stands or farmers markets. On the other hand, the odds of children consuming fruits at least once daily decreased by 61% (OR = 0.39, 95% CI 0.18, 0.85) if parents reported that they purchased frozen or canned fruits and vegetables for their household ≤ 1 time/week, compared with children whose parents purchased frozen or canned fruits and vegetables a few times per week or daily. Purchasing food from corner stores or bodegas and restaurants, and self-reported ease of purchasing fruits and vegetables were not associated with children's intake of fruits and vegetables.

Consumption of meals prepared at home was associated with children's intakes of fruits and vegetables (Table 3). The odds of children consuming fruits and vegetables decreased by 61% and 67%, respectively, if parents reported that their families ate meals prepared at home ≤ 6 d/week, compared with children whose parents reported eating meals prepared at home daily. Also, the odds of children consuming 100% fruit juice at least once daily decreased by 48% if parents reported eating family meals ≤ 6 d/week compared with children whose families ate meals together on a daily basis.

Consumption of meals from fast-food and other restaurants was associated with children's intake of French fries. The odds of children consuming French fries at least once weekly decreased by 76% and 69%, respectively, if parents reported that their families never ate meals from fast-food and other restaurants, compared with children whose parents reported eating meals from fast-food and other restaurants ≥ 1 time/week. The odds of children consuming 100% fruit juice at least once daily decreased by 53% if parents reported that their children ate while watching TV. The odds of children consuming fruit drinks, desserts and snacks ≥ 3 times/week increased by more than 100 to 200% if parents reported that their children ate while watching TV.

Children's dietary intakes at home v. at group child-care centres

The majority of parents reported that children consumed high-fat milk such as whole or 2% milk at home whereas most child-care centres offered low-fat milk such as 1% or skimmed milk to children (Table 4). Almost all parents and all child-care centres offered fruits, 100% fruit juice and vegetables to children. Seventy-seven per cent of

parents reported that children consumed fruit drinks at home, and 23% said their children consumed fruit drinks ≥ 5 times/week. In contrast, none of the centres reported providing fruit drinks to children. Half of the parents reported children consumed soft drinks at home, and 11% reported that their children drank soft drinks ≥ 5 times/week. None of the child-care centres provided soft drinks to children. The majority of parents reported that children consumed French fries, desserts and snacks at home, but only a few said their children ate these foods ≥ 5 times/week. Only one centre offered French fries to children for lunch on the day of dietary observations; although none of the centres offered desserts or snacks for lunch, a few centres offered these foods at the morning meal (two centres offered desserts like pudding, three centres offered snacks like crackers).

Discussion

In the present study, parents' behaviours related to food purchasing and food consumption were associated with reported dietary intakes of young children outside group child-care centres in NYC. First, children were more likely to consume healthful foods and beverages (e.g. fruits, vegetables, 100% fruit juice) if parents reported that they purchased food from produce stands or farmers' markets, shopped for frozen or canned fruits and vegetables frequently and ate family meals or meals prepared at home daily. These findings are consistent with prior studies of older children and adults that showed higher intakes of fruits and vegetables were associated with easy access to food outlets, including farmers' markets that carry large selections of fresh fruits and vegetables⁽²⁹⁻³⁵⁾, availability of fruits and vegetables at home^(8-10,17) and regular consumption of family meals^(12,14) and meals prepared at home⁽³⁶⁾.

Second, children were more likely to consume unhealthful foods and sugar-sweetened beverages (e.g. French fries, desserts, sweet and salty snacks, fruit drinks) if parents reported their families ate meals from fast-food or other restaurants at least once weekly or if children ate food while watching TV. Eating out at fast-food or other restaurants is prevalent among young children in the USA⁽³⁷⁻³⁹⁾. Meals and snacks based on foods prepared away from home tend to be higher in energy, total fat and saturated fat than foods prepared at home^(40,41). Studies show that eating out, especially at fast-food restaurants, is associated with decreased intakes of healthful foods, including fruits, vegetables and low-fat dairy foods, and increased intakes of unhealthful foods such as hamburgers, fried potatoes, soft drinks and sugar-sweetened beverages^(15,16,18,42). Similarly, eating while watching TV is associated with eating less healthful foods like pizza, salty snacks, soda, red and processed meat, lower intakes of fruit, vegetables, grains and Ca-rich foods^(21,22) and decreased sensitivity to internal cues of satiety⁽⁴³⁾.

Table 3 Associations between children's dietary intakes at home and selected food behaviours, New York City, 2005–2006

Children's dietary intakes	Family meals: ≤6 d/week*		Home-prepared meals: ≤6 d/week†		Meals at fast-food restaurants: never‡		Meals at other types of restaurants: never§		Eating while watching TV	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Fruit										
<1 time/d	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥1 time/d	0.62	0.32, 1.18	0.39	0.21, 0.72	0.83	0.36, 1.88	1.98	0.90, 4.36	0.89	0.49, 1.63
100% fruit juice										
<1 time/d	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥1 time/d	0.52	0.28, 0.97	0.65	0.35, 1.20	1.01	0.46, 2.24	1.93	0.85, 4.40	0.47	0.25, 0.85
Vegetables										
<1 time/d	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥1 time/d	0.60	0.30, 1.20	0.33	0.17, 0.62	0.91	0.39, 2.12	1.65	0.76, 3.62	0.72	0.39, 1.34
French fries										
Never	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥1 time/week	1.19	0.48, 2.95	1.46	0.62, 3.41	0.24	0.09, 0.60	0.31	0.12, 0.81	1.49	0.65, 3.42
Fruit drinks										
≤2 times/week	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥3 times/week	0.73	0.37, 1.45	0.92	0.48, 1.78	0.42	0.16, 1.12	1.28	0.55, 3.00	2.33	1.20, 4.51
Soft drinks										
Never	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥1 time/week	1.03	0.55, 1.94	1.54	0.82, 2.88	0.50	0.22, 1.16	0.94	0.42, 2.07	0.72	0.39, 1.30
Desserts										
≤2 times/week	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥3 times/week	1.32	0.70, 2.45	1.26	0.67, 2.35	0.68	0.30, 1.55	1.20	0.54, 2.66	2.84	1.52, 5.30
Snacks										
≤2 times/week	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
≥3 times/week	0.84	0.42, 1.68	2.02	1.00, 4.07	0.76	0.32, 1.84	0.88	0.37, 2.11	3.20	1.59, 6.41

TV, television.

*Reference category: frequency of consuming family meals daily.

†Reference category: frequency of consuming meals prepared at home daily.

‡Reference category: frequency of consuming meals from fast-food restaurants ≥1 d/week.

§Reference category: frequency of consuming meals from other restaurants ≥1 d/week.

||Reference category: 'no' responses to the question on eating during TV viewing.

Table 4 Results from parent reports, child-care centre director reports and direct observations of children's dietary intakes at sixteen child-care centres in New York City, 2005–2006

Food group	Household Survey (200 parents)*		Household Survey, intake ≥ 5 times/week (200 parents)†		Director Survey (16 centres)‡		Direct observations at lunchtime (16 centres, 96 children observed)§	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Milk								
1%, skimmed	97	57.4	58	34.3	13	81.3	13	81.3
Whole, 2%	163	88.6	114	62.0	6	37.5	3	18.7
Fruits	186	93.9	119	60.1	16	100.0	16	100.0
100% fruit juice	194	98.5	145	73.7	15	93.8		–
Vegetables	188	95.4	103	52.3	16	100.0	16	100.0
French fries	169	85.4	15	7.5		–	1	6.3
Fruit drinks	150	77.2	45	23.1	1	6.3		–
Soft drinks	95	49.7	21	11.0	0	0.0	0	0.0
Desserts	186	94.9	48	24.5		–	0	0.0
Snacks	183	92.9	33	16.7		–	0	0.0

Centre directors were asked about the types of milk provided to children at their centres (not 3–5-year-olds, specifically). Some directors reported more than one milk type. Fruit juice consumption was observed at one centre (two children drank); however, the observers were unable to decipher whether it was 100% fruit juice or <100% fruit juice.

*Parents who reported on the Household Survey that their children ate the foods at least once weekly.

†Parents who reported that their children ate the foods ≥ 5 times/week.

‡Reports from directors at the sixteen child-care centres where the Household Survey was administered.

§Proportion of centres that provided the selection of foods and beverages based on 1 d of direct observations of the lunch meal at each child-care centre.

||Data were not collected or observed.

Third, beverages and foods offered to children at home were less healthful than beverages and foods offered to children at group child-care centres in NYC. In the present study, most parents reported that children drank high-fat milk (whole or 2%) at home whereas low-fat milk (1% or skimmed) was offered at most child-care centres, as stated in formal nutrition policies in Article 47 of the NYC Health Code⁽⁴⁴⁾. Other studies show that children of pre-school age tend to consume more high-fat than low-fat milk at home^(45,46), with factors such as low parental education, belief that high-fat milk is higher in Ca and healthier for pre-school children and parents not having tried low-fat milk contributing to this trend⁽⁴⁵⁾. For pre-school children, low-fat milk is recommended because it contributes less fat, cholesterol and energy to the diet than whole or 2% milk^(46,47). Children also drank fruit drinks and soft drinks and ate more desserts and sweet and salty snacks at home as opposed to consumption within the child-care setting. Fruit drinks and soft drinks have added sweeteners but provide little or no nutritional benefits⁽⁴⁸⁾. Moreover, excessive consumption of these beverages, as well as foods with high amounts of added sugars, is associated with increased risk of obesity^(48–50).

Children in the current study spent at least 8h/d in child-care centres. To meet daily nutrition needs, foods and beverages provided in both the home and child-care environment should be in accordance with current dietary guidelines⁽⁵¹⁾. Although most parents reported providing fruits and vegetables to children frequently, they also provided less healthful foods such as fruit drinks, soft drinks, desserts and sweet and salty snacks. On average, the selection of foods and beverages provided at child-care centres appeared to be more healthful than those

provided at home, although results from the larger study of forty child-care centres showed that most children's actual consumption at child-care centres was less than half of the daily food group recommendations, especially for vegetables, and was low for some nutrients, most notably vitamin E⁽²⁷⁾. These findings underscore the need for nutrition policies and intervention strategies that promote healthy eating in children in both the home and child-care environment.

Although the current cross-sectional study provides data from a sizeable convenience sample, it is important to note that these findings may not be generalizable to or representative of all children and caregivers in NYC or elsewhere in the USA. Self-reported information from caregivers may not be accurate; however, prior studies report that parents tend to provide reliable information about their children's dietary intake at home^(52–54). Dietary data from 1 d site visits may not represent types or amounts of foods served to children every day, but the observed dietary intakes at the child-care centres were generally consistent with the reports from the directors. The Household Survey was not tested for reliability, but content validity was confirmed by a group of nutrition and public health experts. A complete 24 h record of children's dietary intakes was not possible because of expense. Also, the Household Survey may not have been completed by caregivers whose children were observed during mealtime in centre classrooms in the larger study. However, data were collected from multiple sources (i.e. surveys to parents and centre directors, and direct observation of lunch at centres). In addition, the sample of parents consisted of low- and middle-income families from diverse ethnic backgrounds.

Building on the results of the study, and with consideration of the generalizability of results, future research in this area should include child-care centres in other geographic regions of NYC, dietary data from more than 1 d of observations at child-care centres, dietary observations to validate food consumption within child-care centres and home observations to validate parental self-report.

Conclusions

Findings from the present study suggest that children's dietary intakes at home, especially with regard to beverages, need to be improved. Policy changes to child-care centres alone are not enough to alter the nutritional intake of young children. Given new nutrition standards across NYC child-care centres and the implementation of practices consistent with these standards (as evidenced in the larger study), there are opportunities for child-care centres to help alter caregiver purchasing and meal planning behaviours. For example, parents may be more likely to purchase and serve low-fat or non-fat milk if they understand that this is what their children are drinking every day at child care. Incorporating nutrition as part of regular classroom activities, using mealtimes to encourage children to try new foods and teach children about healthful eating habits, and organizing age-appropriate cooking activities at child-care centres may encourage children to adopt healthy eating behaviours. Families may also benefit from receiving education from nutrition professionals about the health risks and benefits of foods and the implications of food purchasing and consumption behaviours on children's dietary intakes and nutritional status. Although efforts such as the Let's Move! initiative, launched by the White House in 2010⁽⁵⁵⁾, encourage parents to provide healthful foods and beverages to children at home, parents are likely to require more direct support for changing their daily interactions with their children at home. Information alone is unlikely to alter parenting behaviours that are related to unhealthful eating patterns, especially for caregivers living in stressful environments with limited resources. Programmes that support parenting behaviours and community efforts that encourage specific time- and cost-saving techniques for shopping, food preparation and storage of healthful foods and beverages that appeal to young children, as well as to the rest of the family, are required for lasting changes.

Acknowledgements

Funding for the study was provided from two contracts from the New York City Department of Health and Mental Hygiene. The project was carried out while T.O.E. was a doctoral candidate in the Department of Nutrition, Food

Studies and Public Health at New York University. The authors do not have any conflicts of interest to disclose. T.O.E. was the project coordinator for the larger project on nutrition practices at NYC child-care centres which housed the present study. She participated in the development of the Household Survey, data collection, data analysis and manuscript development. L.B.D. was the principal investigator for the larger project on nutrition practices at NYC child-care centres which housed the present study. She led the conceptualization of the study purpose and design, data collection and analysis, and provided guidance in developing the manuscript. She has seen and approved the contents of the submitted manuscript. C.Y. participated in the conceptualization of the study purpose, design and data collection. She has seen and approved the contents of the submitted manuscript. L.M.B. provided guidance during the various phases of the study, including development of the study purpose, data analysis and manuscript development. She has seen and approved the contents of the submitted manuscript. L.L.H. provided guidance during the various phases of the study, including development of the study purpose, data analysis and manuscript development. She has seen and approved the contents of the submitted manuscript. The authors would like to thank the parents and caregivers who completed the Household Survey; the directors and staff of the participating child-care centres; the colleagues who provided feedback on the materials; and the New York City Department of Health and Mental Hygiene who provided funding support for the study.

References

1. Birch LL & Fisher JO (1998) Development of eating behaviors among children and adolescents. *Pediatrics* **101**, 539–549.
2. Federal Interagency Forum on Child and Family Statistics (2009) *America's Children: Key National Indicators of Well-being, 2009*. Washington, DC: US Government Printing Office; available at http://www.childstats.gov/pdf/ac2009/ac_09.pdf
3. Ball SC, Benjamin SE & Ward DS (2008) Dietary intakes in North Carolina child-care centers: are children meeting current recommendations? *J Am Diet Assoc* **108**, 718–721.
4. Padgett A & Briley ME (2005) Dietary intakes at child-care centers in Central Texas fail to meet Food Guide Pyramid recommendations. *J Am Diet Assoc* **105**, 790–793.
5. Bollella MC, Spark A, Boccia LA *et al.* (1999) Nutrient intake of Head Start children: home vs. school. *J Am Coll Nutr* **18**, 108–114.
6. Oakley CB, Bomba AK, Knight KB *et al.* (1995) Evaluation of menus planned in Mississippi child-care centers participating in the Child and Adult Care Food Program. *J Am Diet Assoc* **95**, 765–768.
7. Davison KK & Birch LL (2001) Childhood overweight: a contextual model and recommendations for future research. *Obes Rev* **2**, 159–171.
8. Cullen KW, Baranowski T, Owens E *et al.* (2003) Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influences children's dietary behavior. *Health Educ Behav* **30**, 615–626.

9. Haerens L, Craeynest M, Deforche B *et al.* (2008) The contribution of psychosocial and home environmental factors explaining eating behaviors in adolescents. *Eur J Clin Nutr* **62**, 51–59.
10. Hanson NI, Neumark-Sztainer D, Eisenberg ME *et al.* (2005) Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutr* **8**, 77–85.
11. Haapalahti M, Mykkanen H, Ikkanen S *et al.* (2003) Meal patterns and food use in 10- to 11-year old Finnish children. *Public Health Nutr* **6**, 363–370.
12. Neumark-Sztainer D, Hannan PJ, Story M *et al.* (2003) Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents. *J Am Diet Assoc* **103**, 317–322.
13. Videon TM & Manning CK (2003) Influences on adolescent eating patterns: the importance of family meals. *J Adol Health* **32**, 365–373.
14. Gillman MW, Rifas-Shiman SL, Frazier AL *et al.* (2000) Family dinner and diet quality among older children and adolescents. *Arch Fam Med* **9**, 235–240.
15. Taveras EM, Berkey CS, Rifas-Shiman SL *et al.* (2005) Association of consumption of fried food away from home with body mass index and diet quality in older children and adolescents. *Pediatrics* **116**, 518–524.
16. Bowman SA, Gortmaker SL, Ebbeling CB *et al.* (2004) Effects of fast food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics* **113**, 112–118.
17. Befort C, Kaur H, Nollen N *et al.* (2006) Fruit, vegetable, and fat intake among non-Hispanic black and white adolescents: associations with home food availability and food consumption settings. *J Am Diet Assoc* **106**, 367–373.
18. Paeratakul S, Ferdinand DP, Champagne CM *et al.* (2003) Fast food consumption among US adults and children: dietary and nutrient intake profile. *J Am Diet Assoc* **103**, 1332–1338.
19. Matheson DM, Wang Y, Klesges LM *et al.* (2004) African-American girls' dietary intake while watching television. *Obes Res* **12**, Suppl., 32S–37S.
20. Marquis M, Filion YP & Dagenais F (2005) Does eating while watching television influence children's food related behaviors? *Can J Diet Pract Res* **66**, 12–18.
21. Feldman S, Eisenberg ME, Neumark-Sztainer D *et al.* (2007) Associations between watching TV during family meals and dietary intake among adolescents. *J Nutr Educ Behav* **39**, 257–263.
22. Coon KA, Goldberg J, Rogers BL *et al.* (2001) Relationships between use of television during meals and children's food consumption patterns. *Pediatrics* **107**, E7.
23. Spurrier NJ, Magarey AA, Golley R *et al.* (2008) Relationships between the home environment and physical activity and dietary patterns of preschool children: a cross-sectional study. *Int J Behav Nutr Phys Act* **5**, 31.
24. Ventura AK & Birch LL (2008) Does parenting affect children's eating and weight status? *Int J Behav Nutr Phys Act* **5**, 15.
25. White House Task Force on Childhood Obesity Report to the President (2010) Solving the problem of childhood obesity within a generation. http://www.letsmove.gov/sites/letsmove.gov/files/TaskForce_on_Childhood_Obesity_May2010_FullReport.pdf (accessed April 2011).
26. Erinoshio T (2008) Nutrition policies and practices of New York City daycare centers and the dietary behaviors of children who attend the daycare centers. PhD Dissertation, New York University (publication no. AAT 3332506).
27. Erinoshio TO, Dixon LB, Young C *et al.* (2011) Nutrition practices of 40 childcare centers in New York City are positive but children's dietary intakes need improvement. *J Am Diet Assoc* **111**, 1391–1397.
28. US Department of Health and Human Services & US Department of Agriculture (2005) Dietary Guidelines for Americans, 2005. <http://www.health.gov/dietaryguidelines/> (accessed December 2010).
29. Timperio A, Ball K, Roberts R *et al.* (2008) Children's fruit and vegetable intake: associations with the neighborhood food environment. *Prev Med* **46**, 331–335.
30. Rose D & Richards R (2004) Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. *Public Health Nutr* **7**, 1081–1088.
31. Bodor JN, Rose D, Farley TA *et al.* (2008) Neighborhood fruit and vegetable availability and consumption: the role of small food stores in an urban environment. *Public Health Nutr* **11**, 413–420.
32. Pearce J, Hiscock R, Blakely T *et al.* (2008) The contextual effects of neighborhood access to supermarkets and convenience stores on individual fruit and vegetable consumption. *J Epidemiol Community Health* **62**, 198–201.
33. Herman DR, Harrison GG, Afifi AA *et al.* (2008) Effect of a targeted subsidy on intake of fruits and vegetables among low-income women in the Special Supplemental Nutrition Program for Women, Infants, and Children. *Am J Public Health* **98**, 98–105.
34. Anderson JV, Bybee DI, Brown RM *et al.* (2001) 5 A Day fruit and vegetable intervention improves consumption in a low income population. *J Am Diet Assoc* **101**, 195–202.
35. McCormack LA, Laska MN, Larson NI *et al.* (2010) Review of the nutrition implications of farmers' markets and community gardens: a call for evaluation and research efforts. *J Am Diet Assoc* **110**, 399–408.
36. Crawford D, Ball K, Mishra G *et al.* (2007) Which food-related behaviors are associated with healthier intakes of fruits and vegetables among women? *Public Health Nutr* **10**, 256–265.
37. Anderson PM & Butcher KF (2006) Childhood obesity: trends and potential causes. *Future Child* **16**, 19–45.
38. Lin B, Guthrie J & Blaylock JR (1996) The Diets of America's Children: Influence of Dining Out, Household Characteristics, and Nutrition Knowledge. <http://www.ers.usda.gov/Publications/AER746/> (accessed March 2011).
39. Adair LS & Popkin B (2005) Are child eating patterns being transformed globally? *Obes Res* **13**, 1281–1299.
40. Guthrie JF, Lin BH & Frazao E (2002) Role of food prepared away from home in the American diet, 1977–78 versus 1994–96: changes and consequences. *J Nutr Educ Behav* **34**, 140–150.
41. Poti JM & Popkin BM (2011) Trends in energy intake among US children by eating location and food source, 1977–2006. *J Am Diet Assoc* **111**, 1156–1164.
42. Jeffery RW, Baxter J, McGuire M *et al.* (2006) Are fast food restaurants an environmental risk factor for obesity? *Int J Behav Nutr Phys Act* **3**, 2.
43. Francis LA & Birch LL (2006) Does eating during television viewing affect preschool children's intake? *J Am Diet Assoc* **106**, 598–600.
44. New York City Department of Health and Mental Hygiene (2007) Notice of adoption of the repeal and reenactment of Article 47 of the New York City Health Code. <http://www.nyc.gov/html/doh/downloads/pdf/public/notice-adoption-hc-art47-0308.pdf> (accessed April 2011).
45. Dennison BA, Erb TA & Jenkins PL (2001) Predictors of dietary milk fat intake by preschool children. *Prev Med* **33**, 536–542.
46. Kranz S, Lin P & Wagstaff DA (2007) Children's dairy intake in the United States: too little, too fat? *J Pediatr* **151**, 642–646.
47. Lee HHC, Gerrior SA & Smith JA (1998) Energy, macronutrient, and food intakes in relation to energy compensation in consumers who drink different types of milk. *Am J Clin Nutr* **67**, 616–623.

48. American Academy of Pediatrics Committee on Nutrition (2001) The use and misuse of fruit juice in pediatrics. *Pediatrics* **107**, 1210–1213.
49. Dubois L, Farmer A, Girard M *et al.* (2007) Regular sugar-sweetened beverage consumption between meals increases risk of overweight among preschool-aged children. *J Am Diet Assoc* **107**, 924–934.
50. Ludwig DS, Peterson KE & Gortmaker SL (2001) Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet* **357**, 505–508.
51. US Department of Agriculture (2010) Dietary Guidelines for Americans, 2010. <http://www.cnpp.usda.gov/DGAs2010-PolicyDocument.htm> (accessed March 2011).
52. Basch CE, Shea S, Arliss R *et al.* (1990) Validation of mothers' reports of dietary intake by four to seven year-old children. *Am J Public Health* **80**, 1314–1317.
53. Eck LH, Klesges RC & Hanson CL (1989) Recall of a child's intake from one meal: are parents accurate? *J Am Diet Assoc* **89**, 784–789.
54. Klesges RC, Hanson CL, Eck LH *et al.* (1988) Accuracy of self-reports of food intake in obese and normal weight individuals: effects of parental obesity on reports of children's dietary intake. *Am J Clin Nutr* **48**, 1252–1256.
55. Let's Move! (2011) America's move to raise a healthier generation of kids. <http://www.letsmove.gov/eathealthy.php> (accessed March 2011).