Research Article

Predictors of Nutrition Quality in Early Child Education Settings in Connecticut

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ABSTRACT

Objective: This study assessed the dietary quality of lunches and feeding practices (family-style service, teacher role modeling) in Connecticut child care centers and made comparisons by center participation in the federal *Child and Adult Care Food Program* (CACFP).

Design: Plate waste methods and visual observation of lunches served and consumed.

Setting: A total of 97 randomly selected licensed Connecticut child care centers (53 CACFP and 44 non-CACFP).

Participants: A total of 838 preschool-aged children.

Main Outcome Measures: Total energy intake, macronutrient intake, and intake by CACFP meal component as well as use of family-style dining, management of additional helpings, and whether and what teachers consumed in view of children.

Analysis: Child dietary intake at lunch was compared with dietary and CACFP recommendations using a mixed linear regression model.

Results: The CACFP centers were more likely to offer family-style service and have staff eat the same foods as the children. Children in non-CACFP centers consumed more saturated fat (4.1 vs 2.7 g; $P < .001$) and trans fats (0.1 vs 0.1 g; $P = .02$) and less milk (3.5 vs 2.7 oz; $P < .001$) than did children in CACFP centers. Caloric intake and dietary fiber were below recommendations in both groups. Participation in CACFP was a significant predictor of low-fat milk consumption.

Conclusions and Implications: The CACFP-participating centers confer some nutritional advantages in terms of provider behavior during meals, characteristics of food offerings, and child intake. Current feeding practices in child care settings require further exploration in the context of serving children at risk for food insecurity and in light of recent work on responsive feeding.

Key Words: CACFP, child care, dietary intake, ECE, preschool-aged children (*J Nutr Educ Behav.* 2018;50:458–467.)

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INTRODUCTION

The diets of most children in the US fail to meet dietary recommendations,[1,2] which places children at risk for developing obesity and diet-related noncommunicable diseases.[3] Early child education (ECE) settings provide an important opportunity to influence children's eating habits and health; 64% of preschool-aged children (3- to 5-year-olds) receive nonrelative care outside their homes.[4] Such ECE settings may influence children's diets by providing healthy food and beverages, nutrition education, and feeding practices and teacher role modeling that encourage healthy food choices.[5,6]

The federal *Child and Adult Care Food Program* (CACFP) provides financial support for food service in ECE settings, including child care centers and family day care homes. The program has become an important policy lever in addressing food security and improving nutrition in young children because it targets benefits to children from low-income families. Specifically, CACFP eligibility for free meals is set at 130% of the federal poverty line, which translates to an

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annual income of ≤$31,980 for a family of 4 in US contiguous states for fiscal year 2017–2018.[7] The program regulates the types and quantity of foods served,[8] and many states require (but may not enforce) compliance with CACFP nutrition standards in all licensed child care centers.[9] In addition, CACFP subsidizes meals and snacks for 4 million children daily[8] and has been associated with positive nutritional outcomes, including higher fruit and vegetable consumption and recommended energy intake.[10-12]

Little is known about meals served in child care centers that do not participate in CACFP and how they compare with CACFP meals and CACFP nutrition standards. Survey data from California showed a significantly greater number of CACFP centers reporting nutritionally superior food offerings than in non-CACFP centers.[10] In a nationally representative sample, CACFP participation was associated with higher parent-reported milk and vegetable intake among attendant children.[11] A small study compared dietary intake among children attending 1 CACFP and 1 non-CACFP center, and reported higher intake of milk and vegetables and lower consumption of fatty and sweet food for CACFP.[13] Comparison of objectively measured nutrient intake data in large-scale studies is needed to understand fully how CACFP participation is related to diet.

Beyond the specific foods offered in child care, how foods are served and the environment created by caregivers can also have an important role in determining children's food intake. For example, family-style (defined as having children help themselves to food from communal serving dishes) and caregiver modeling of positive mealtime behaviors are considered reference standard feeding practices in early care.[5,6] Family-style service in particular is championed as a means to improving motor skills, social skills, and attendance to hunger and satiety cues.[5,6] Harnack et al[14] compared pre-plated portions (portioned by providers) with family-style service and found that children consumed more calories with provider-portioned plates than when they served their own portions.

Over the past several years, research on responsive feeding has shown this paradigm to produce desirable weight trajectories and eating behaviors in early childhood.[15-21] Responsive feeding involves attention to the child's verbal or other signals of hunger and satiety, and responding with food only when the child communicates food needs. In other cases (a need for sleep, attention, or affection), caregivers are encouraged not to respond with food but rather address the nonfood issue.

This study assessed predictors of dietary intake at lunch among preschool-aged children in Connecticut child care centers. Specifically, overall energy, macronutrient intake, and intake by CACFP meal component were compared with CACFP requirements and recommendations from the Institute of Medicine (IOM). It was hypothesized that the dietary quality of food consumed would be better aligned with dietary recommendations in CACFP centers. The researchers also assessed the frequency of family-style service, along with its relationship to dietary intake outcomes. Because little is known about this relationship, no *a priori* hypotheses are offered. Results are discussed in the context of recent work on responsive feeding.

METHODS

Sample

The study sample was drawn from licensed child care centers in Connecticut in 2015 that served at least 13 preschool-aged children and were not part of the public-school system. From 1,447 centers, 924 were identified as meeting these criteria and not participating in CACFP; an additional 181 were CACFP centers. To be eligible, centers had to provide lunch rather than serve parent-made meals. Information on whether centers provided lunch and/or snacks was collected via phone calls to child care centers and website searches. From the sample of 924 non-CACFP centers, only 76 (8%) reported providing lunch. The majority of non-CACFP centers served only snacks; parents had to provide lunch (42%) or provided both lunch and snacks (38%). About 12% of centers could not be identified. In contrast, most CACFP centers served lunch: 5 of 181 CACFP centers served only snacks.

All 76 non-CACFP centers that reported serving lunch were recruited; 44 agreed to participate (58%). For CACFP, 92 centers were randomly selected, 53 of which agreed to participate (58%). Randomization was completed by assigning a random number between 0 and 1, and recruiting centers with a random number ≥ 0.66. Certain CACFP centers (n = 22) were oversampled for the purpose of another longitudinal study. Centers were assessed between June, 2015 and July, 2016. A total of 370 preschool-aged children in non-CACFP centers and 468 in CACFP centers participated in the lunch observation.

Procedures

The University of Connecticut Institutional Review Board approved study procedures. Directors distributed parental passive consent forms (in English and Spanish) to families in advance of the research team's visit. Children whose parents opted out were not observed. Directors reported the age range of children in participating classrooms; researchers recorded the gender of children. No other identifying information was recorded. All data collection for each center occurred within a single day and in 1 classroom of preschool-aged children per site.

Seven researchers with a background in public health nutrition or dietetics were trained to estimate visually the quantity of foods served (self-served by the child or served by the teacher) and consumed. Training involved 8 hours of practice using a method of visual estimation developed by Ball and colleagues,[22] in which observers estimate quantities for each food item to the nearest tablespoon, ounce, or number. In addition to using visual estimation methods, the study team arranged to receive a sample meal before lunch in centers that served pre-plated individual meals. This allowed researchers to visually estimate each meal component and check the accuracy of their estimation by weighing each food. Sample

meals were also helpful for the measurement of meal components that were served family style in standard portions (for example, a bread roll or meatball), reducing the need to estimate visually the serving size of some items. Specifically, of 2,073 estimations of food and beverage items for the 370 children observed in non-CACFP centers, plate waste weighing was used for 1,276 estimations (61.5%) and plate waste visual estimation was used for the remaining 38.5% of food-level consumption estimations. All leftovers were weighed.

Two to 3 trained researchers observed lunch in each center. Before children were seated, each researcher chose 3–6 chairs for observation across 1 or 2 neighboring tables. The number of children who were observed was determined by the complexity of each meal, depending on whether starting portions came in a unit (eg, half a sandwich) or varied widely (eg, pasta). To assess interrater reliability for each visit, researchers overlapped on at least 1 child. Of the total sample of 468 children in CACFP centers, 55 children's meals were double-coded: 2 observers estimated amounts served and remaining of all foods for a child. In non-CACFP centers, 66 children were double-coded (18%). In CACFP centers, 11 unique rater pairs were tested; the number of items observed ranged from 10 to 301 within a set. Intraclass correlation coefficients were computed for each set of double-coded meal observations. Intraclass correlation coefficient values ranged from 0.82 to 1.0 (mean, 0.95; SD, 0.06), indicating high agreement across raters, because all values were considered good or excellent.[23]

Observers adapted the Rudd Center Child Care Meal Observation Tool[24] to collect data on whether family-style or pre-plated service was used, how requests for extra servings were handled, and food restrictions. Items also addressed teacher role modeling, including the types of foods that teachers consumed in view of children. When available, an onsite cook was consulted to acquire the level of detail needed (eg, type of fat used in cooking). Some validity data have been published[25] on the concordance among survey, observation, and interview responses for this tool. The complete measure is available upon request.

Nutrition Analysis

Nutrient information. For each food and beverage observed, nutrient information was retrieved from the US Department of Agriculture's (USDA's) National Nutrient Database for Standard Reference,[26] including total energy, total fat, saturated fat, trans fat, carbohydrates, sugars, dietary fiber, calcium, and sodium. Each food and beverage was also categorized as a fruit, vegetable, grain, meat/meat alternative, or milk; and grains were classified as whole (whole grain is the first ingredient) or refined. Beverages included whole milk, 1% milk, 2% milk, skim milk, nondairy milk, flavored milk, 100% juice, sugar-sweetened beverages, or water.

The researchers calculated both macronutrients and micronutrients per ounce of each food and beverage item and the amount of fruits, vegetables (by cup), grains, and meat/meat alternates (by ounce) to compare them with CACFP recommendations. All beverages were measured in fluid ounces.

Dietary intake. Children's macronutrient and micronutrient intake during the lunch period and intake across types of foods and beverages was estimated via plate waste weighing and visual observation. Consumption estimates (postconsumption weights of each food and beverage compared with standard baseline weights estimated from a sample meal) were used as the default method for estimating amounts consumed; visual estimations were used only when weighed estimates were not available.

Data Analysis

The researchers used *t* tests (for means) and chi-square tests of independence (for frequencies) to compare CACFP-participating and nonparticipating centers on center-level measures, including center characteristics, the food environment (eg, access to water), provider behaviors, and characteristics and amounts of food served. Center-level analyses were carried out on unadjusted means. Because of the clustering of child data within a center, all child-level analyses were run as mixed linear regression models, allowing the intercept to vary across centers. This included comparisons of means for CACFP and non-participating centers; thus, means are adjusted for center clustering by including center as a variable in the model. Outcomes included child's lunch intake by CACFP meal component, energy and macronutrients, important micronutrients, and percentage of total energy from each macronutrient.

Primary predictors of interest in mixed linear regression models were CACFP participation and family-style service. Covariates included child gender; an indicator for water served on the table; teacher role modeling (including indicators for whether children were denied seconds, whether teachers consumed the same foods as children, and whether teachers asked children if they wanted seconds); day of observation; *Head Start* participation; center accreditation by the National Association for the Education of Young Children; onsite meal preparation (prepared on premises or brought in by vendors); and medium income of the center census tract location. All analyses were conducted in Stata software (version 14.0, Stata Corp LP, College Station, TX, 2015) and SPSS software (version 23.0, IBM Corp, Armonk, NY, 2015).

RESULTS

Significant differences were found between CACFP and non-CACFP centers (all center characteristics are found in Table 1), including center location, feeding practices (family-style service or staff consuming the same foods as the children), and food preparation. There was no difference in how children were able to access drinking water. There were significant differences in the types of foods and beverages served at lunch, including serving of both a fruit and vegetable, milk overall, and low-fat milk (more frequently in CACFP centers) and water (more frequently in non-CACFP centers). Groups did not differ in the frequency of serving vegetable subcategories, red and/or processed meats, full-fat cheese and yogurt, and refined and whole grains. Sweets, flavored milk,

Table 1. Food Environment and Foods Served at Lunch in Child Care Centers

Center Characteristic	CACFP (n = 53)	Non-CACFP (n = 44)
Center characteristics		
Accredited by NAEYC, n (%)	45 (85)	17 (39)***
Participating in *Head Start*, n (%)	7 (13)	0*
Total center capacity, children (mean [SD])	106 (92)	111 (66)
Household median income census tract ($) (mean [SD])	44,735 (23,040)	82,111 (33,418)***
Non-Hispanic black race (%) (mean [SD])	21.2 (23)	8.3 (11)**
Hispanic ethnicity (%) (mean [SD])	27.3 (21)	13.3 (15)***
Center food environment, n (%)		
Meal served family style	41 (77)	14 (32)***
Meal was cooked onsite	29 (55)	33 (75)*
Staff ate same food as children	38 (72)	16 (36)***
Staff ate less healthy food in child's view	2 (4)	3 (7)
Staff ate branded food in child's view	7 (13)	4 (9)
Water access, n (%)[a]		
No child access to drinking water	6 (12)	2 (5)
Sink/fountain, require adult assistance	17 (33)	12 (27)
Child-level sink	29 (56)	27 (61)
Foods/beverages served, n (%)		
Any fruits or vegetables	53 (100)	42 (95)
Any fruit	51 (96)	33 (75)**
Any vegetable	50 (94)	34 (77)*
Dark green vegetable	14 (26)	14 (32)
Orange vegetable	15 (28)	10 (23)
Potatoes	4 (8)	6 (14)
Both fruit and vegetable	48 (91)	25 (57)***
Any meat/meat alternate	53 (100)	42 (96)
Lean meat/fish	20 (38)	13 (30)
Red/processed meat	23 (43)	18 (41)
Beans/nuts/legumes	3 (6)	6 (14)
Regular cheese or yogurt	21 (40)	19 (43)
Low-fat cheese or yogurt	2 (4)	1 (2)
Any grain products	50 (94)	39 (89)
Refined grain products	28 (53)	26 (59)
Whole-grain products	29 (55)	17 (39)
Salty snacks	0	2 (5)
Sweets	0	0
Water	13 (25)	24 (55)**

(continued)

Table 1. Continued

Center Characteristic	CACFP (n = 53)	Non-CACFP (n = 44)
Any milk	53 (100)	35 (80)***
Skim	2 (4)	1 (2)
1% low-fat	50 (94)	14 (32)***
2% reduced-fat	0	12 (27)***
Whole milk	1 (2)	7 (16)*
Flavored milk	0	0
Non-dairy milk	9 (17)	2 (5)
100% fruit juice	1 (2)	0
Fruit drinks	0	2 (5)
CACFP standards compliance, n (%)		
Serving all CACFP meal components (grains, meat/meat alternate, fruit OR vegetable and ANY milk)	50 (94)	30 (68)***
Serving all CACFP meal components (grains, meat/meat alternate, fruit OR vegetable and low-fat/skim milk), as required by CACFP and state licensing before October 1, 2017	50 (94)	13 (30)***
Serving all meal components (grains, meat, fruit AND vegetable and low-fat/skim milk), as required by CACFP and state licensing after October 1, 2017	45 (85)	11 (25)***

CACFP indicates *Child and Adult Care Food Program*; NAEYC, National Association for the Education of Young Children. Note: Group means were compared with independent *t* tests and group frequencies were compared with chi-square tests. [a]Data on this variable were missing for 1 CACFP center. Two-sided *P*: ***$P < .001$; **$P < .01$; *$P < .05$.

and soda were not served, and salty snacks, 100% juice, and fruit drinks (with added sugar) were rarely served.

With a few exceptions, CACFP centers complied with the CACFP meal patterns in effect at the time of data collection and served all 4 required meal components (grain, meat/meat alternate, fruit or vegetable, and milk), and milk was low-fat or skim. Although non-CACFP centers were supposed to follow the same CACFP standards according to the state licensing regulations, only 68% of the observed centers served all 4 meal components ($P < .01$). Even fewer centers served all meal components and had low-fat/skim milk (30%; $P < .01$). The most frequent violation of CACFP nutrition standards in non-CACFP centers was not serving milk entirely at lunch and serving whole or reduced-fat milk.

Child Dietary Intake

Table 2 lists foods consumed by children. There was no difference by CACFP status in the average consumption of meat/meat alternates, grains, or fruits/vegetables. Children in CACFP centers consumed more milk. Mean calories consumed across both groups fell below the 338-cal target for lunch for this age group recommended by the IOM.[26,27] The range of calories consumed was large: 0–1,073 cal in non-CACFP centers and 0–839 cal in CACFP centers.

Children at CACFP centers consumed more of calories in protein than did their non-CACFP counterparts ($P = .05$). The primary macronutrient differences occurred with respect to fats. Overall, children in CACFP centers consumed less total fat, saturated fat, and trans fats. Similarly, total fat ($P < .001$) and saturated fat ($P < .001$) made up significantly lower percentages of total caloric intake in CACFP centers. Dietary fiber did not differ across groups, but mean intake was well below the recommended target (5.5 g for lunch) in both groups. Children in CACFP centers consumed more calcium. Both groups met and surpassed the recommended calcium intake, and exceeded recommended limits on sodium.

Table 3 presents results of mixed linear regression analyses, with total calories, amount of low-fat milk, fruit, and vegetables consumed and the proportion of calories consumed from protein, fat, and saturated fat. Additional models were estimated for all other outcomes presented in Table 2 (results not shown; available upon request). Taken together, CACFP status was a significant predictor of higher intake of low-fat milk but no other meal components. Despite the higher probability of serving both fruit and vegetables in CACFP centers, there was no difference in children's consumption of fruit and vegetables by CACFP status (or other examined variables).

Another important predictor of several dietary outcomes was family-style service, which had a significant negative association with percent calories consumed from saturated fat. Furthermore, when water was served on the table, children consumed fewer

Table 2. Children's Food Intake at Lunch in Child Care Centers: Estimated Marginal Means (SEs)[a]

Outcome	Requirements/ Recommendations	CACFP Centers (n = 468)	Non-CACFP Centers (n = 370)
Meal component	CACFP		
Meat/meat alternate, oz	1.5 oz	1.9 (0.14)	1.7 (0.16)
Grain, oz	0.5 oz	0.9 (0.09)	0.7 (0.09)
Fruit, cups	n/a	0.2 (0.02)	0.2 (0.02)
Vegetables, cups	n/a	0.2 (0.04)	0.2 (0.04)
Fruit/vegetables, cups	0.5 cup	0.4 (0.04)	0.4 (0.04)
Milk, fl oz	6 fl oz	3.5 (0.22)	2.7 (0.24)**
Macronutrients and micronutrients per lunch	IOM ages 3–5		
Energy, kcal	338	246.5 (11.78)	277.9 (13.08)
Protein, g	10	14.6 (0.83)	14.3 (0.92)
Total fat, g		7.4 (0.60)	10.3 (0.67)**
Saturated fat, g		2.7 (0.25)	4.1 (0.28)***
Trans fat, g		0.1 (0.02)	0.1 (0.02)*
Carbohydrates, g		31.4 (1.65)	33.0 (1.83)
Sugar, g		13.2 (0.72)	12.5 (0.80)
Dietary fiber, g	5.5	2.7 (0.17)	2.9 (0.19)
Calcium, mg	156	212.0 (11.53)	177.9 (12.79)
Sodium, mg	< 425	436.2 (31.51)	464.0 (34.86)
Macronutrients, % energy consumed	IOM		
Protein, %	10–30	24.0 (1.0)	20.9 (1.1)*
Total fat, %	25–35	25.4 (1.3)	32.5 (1.4)***
Saturated fat, %	<10	9.5 (0.6)	13.2 (0.7)***
Carbohydrates, %	45–65	52.3 (1.5)	48.8 (1.7)

CACFP indicates *Child and Adult Care Food Program*; IOM, Institute of Medicine; n/a, not applicable.
[a]Because of clustering of child data within a center, these comparisons were run as mixed linear regression models with CACFP as the sole predictor, and inclusion of a random intercept (that is, allowing the intercept to vary across centers). Means reported are the resulting estimated marginal means. Two-sided *P*: ***$P < .001$, **$P < .01$, *$P < .05$.

calories from fat and saturated fat. Compared with Monday as a reference, the day of observation had no association with the food consumed, with the exception of Friday (lower intake of low-fat milk and calories from protein) and Wednesday (lower calories from fat). Finally, of the 3 teacher behaviors examined, only consuming the same food as children significantly predicted dietary outcomes; this suggested lower consumption of calories from fat (Table 3) (full results available upon request).

Of note were the large proportions of variance caused by nesting within classrooms, which were unexplained by variables included. Random intercepts were significant across all regression models ($P < .001$ for all) and the proportion of variance resulting from clustering within site was high (intraclass correlations, 0.33–0.68).

DISCUSSION

Overall, CACFP-participating centers were shown to confer some nutritional advantages in terms of provider behavior during the meal, characteristics of food offerings, and child intake. The CACFP centers were more likely to embrace reference standard practices of feeding young children in ECE settings, such as family-style service and having staff consume the same foods as the children.[5] Previous research showed that family-style food service was more prevalent in CACFP than non-CACFP centers based on self-reported data on feeding practices.[28,29] In the current study, CACFP centers were more likely to provide both a fruit and a vegetable at lunch and to serve milk of a low-fat/skim variety, as required by CACFP.[30] Compliance with the low-fat milk rule may explain why children in CACFP centers consumed less saturated fat and total fat; there was no significant difference by CACFP status in the serving of red meat and cheese. In contrast, children in non-CACFP centers, where low-fat/skim milk was notably less prevalent,

Table 3. Predictors of Food Consumed at Lunch in Child Care Centers: Results of Multilevel Regression Analyses**

	Child Dietary Outcomes													
	Energy Consumed, kcal		Low-Fat Milk Consumed, oz		Fruit Consumed, Cups		Vegetables Consumed, Cups		Calories From Protein (%)		Calories From Fat (%)		Calories From Saturated Fat (%)	
Predictors	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**
Child and Adult Care Food Program	–20.28	28.12	1.97***	0.54	0.07	0.54	–0.07	0.09	–1.48	2.32	–2.94	2.72	–1.96	1.46
Family-style service	–35.79	21.57	0.30	0.41	0.04	0.04	0.02	0.07	3.47	1.78	–3.47	2.08	–2.74*	1.12
Water on table	35.72	41.06	–0.02	0.78	0.08	0.08	–0.18	0.12	–4.31	3.35	–9.67*	3.92	–4.69*	2.10
Teacher role model variables														
Teachers asked children whether they wanted to eat more.	2.46	20.07	0.33	0.38	–0.01	0.04	0.01	0.06	2.25	1.65	–3.02	1.94	–0.17	1.04
Teachers consumed the same foods as children.	4.94	20.57	–0.13	0.39	–0.04	0.04	–.010	0.06	–1.93	1.70	–5.10*	1.99	–1.43	1.07
Children were denied seconds.	–15.64	22.58	0.26	0.43	–0.005	0.04	0.06	0.07	1.10	1.86	–1.48	2.19	0.30	1.17
Day of week observation														
Tuesday	20.54	29.07	0.07	0.55	0.03	0.05	0.09	0.09	–2.14	2.39	–2.53	2.81	–0.75	1.51
Wednesday	–4.76	33.93	0.08	0.65	0.004	0.06	–0.09	0.10	–1.76	2.80	–7.50*	3.28	–1.71	1.76
Thursday	16.28	28.11	0.31	0.53	0.04	0.05	0.01	0.09	0.25	2.31	–3.03	2.71	–1.03	1.45
Friday	–15.13	26.51	–1.18*	0.50	–0.001	0.05	–0.03	0.08	–5.44*	2.16	–4.98	2.53	–1.69	1.36
Random effects														
Intercept	6,067***	1,199.53	2.26***	0.43	0.02***	0.004	0.07***	0.01	47.31***	8.09	65.99***	11.15	19.35***	3.20
Residual	12,128***	630.54	3.88***	0.20	0.04***	0.002	0.04***	0.002	34.95***	1.82	40.66***	2.12	8.94***	0.47

*$P < .05$; **$P < .01$; ***$P < .001$.

Note: Additional covariates include child's gender, center's *Head Start* participation, National Association for the Education of Young Children accreditation, onsite meal preparation, and center's census tract medium income.

consumed saturated fat in excess of the IOM recommendations (13.2% vs <10%), which was the only result outside the IOM range. Non-CACFP centers could address this outlier by a simple switch to low-fat or skim milk, which would not require additional funds (because milk prices are typically the same across milks of different fat content) and would ensure compliance with state licensing regulations.

For the most part, the sample in the current study (both CACFP-participating and nonparticipating centers) appeared to be comparable to those in previous research. Another study on Connecticut CACFP child care centers found that children's dietary intake exceeded recommended limits for saturated fat, sodium, and protein, and failed to meet fiber recommendations.[12] A North Carolina–based study of CACFP and non-CACFP centers showed that the majority of centers served whole milk, high-sugar or high-sodium foods and few foods of whole grain and low fiber, and overserved juice,[31] with similar results from a study in Georgia.[32] The current study also found that children in CACFP and non-CACFP centers had a low intake of fruit and vegetables: < 0.5 cup of fruit and vegetables per lunch and much lower dietary fiber than recommended. An increase in fruit and vegetable consumption remains an important goal across the child care settings.

Total energy consumption during lunch was lower than the IOM-recommended 338-cal target regardless of CACFP participation. Although this finding was consistent with other results reported in recent literature,[12,31] it is unclear why intake is low, particularly in populations at risk for food insecurity who likely arrive hungry. Provider behaviors may have a role,[28,33] although these did not appear to be significant in the current study. Timing of previous meals or snacks (breakfast or morning snack) could also affect hunger levels and caloric intake at lunch. Information on the timing and amount of food consumed at prior meals and snacks as well as the activity level of children before lunch was not collected in this study.

For children at risk for food insecurity, low caloric intake during care hours may contribute to subpar caloric intake overall, which in turn may affect their development and growth. For all children, the meals served in care are required to comply with CACFP nutrition standards, which could be the healthiest foods offered in a child's day in some families. Children with access to more food outside the center environment may compensate for undereating in care by overeating less healthy items later in the day. Some research supports the assertion of overconsumption in out-of-care hours,[34] which could contribute to both overweight and long-term outcomes associated with poor nutrition.

However, an important question is whether children are actually undereating. Consideration of a responsive feeding paradigm raises the possibility that children may be taking in sufficient calories, and cautions encouragement to eat beyond satiety. In addition, research suggests that current caloric targets may overestimate caloric needs for preschoolers because of the erroneous assumption that all or most young children are very active.[35] Data are currently insufficient to conclude that children are undereating, or that encouragement to eat beyond the point at which they naturally stop is beneficial. More research is needed into the caloric needs of young children and how best to encourage them to eat sufficient amounts of nutritious food.

In this study, teacher role modeling, which is a recommended practice in ECE settings,[5] had little impact on child intake. Parent behaviors were found to influence child intake, but teacher role modeling behaviors did not.[36] Hendy and Raudenbush[37] found a positive effect of enthusiastic teacher modeling (ie, eating the target food and speaking positively about it) on child food acceptance, but no effect of silent modeling. Furthermore, competing peer modeling was found to negate the positive effect of any teacher modeling. These studies suggested that teacher behaviors must be considered within the context of other child and teacher behaviors, and that the operationalization of modeling is important.

The results of the multilevel regression analyses indicated large and significant variance associated with the nesting of children within centers. This variance remains largely unexplained by variables measured in this study. There are numerous possible explanations for the differences in dietary intake associated with centers, the most obvious of which is the heterogeneity of meal offerings across centers. Lunch menus were unique to each site, which may explain this finding. Whereas a primary aim of this study was to provide a snapshot of the food environment in child care by CACFP status, the naturally occurring heterogeneity of food offerings introduced analytic limitations.

Finally, it was surprising to find during the sampling stage that many Connecticut non-CACFP centers did not provide lunch or any food at all. The *Child and Adult Care Food Program* is often touted as a powerful policy tool for both participating and nonparticipating centers because states have the authority to require compliance with CACFP nutrition standards in any licensed facilities. However, if many nonparticipating licensed centers serve no food at all, these policies are impotent.

Characteristics of this study limit its conclusions. The study was observational; thus, differences between CACFP and non-CACFP centers cannot be attributed to CACFP status alone. This holds for any other group differences observed (eg, food service style). Furthermore, because the study was geographically limited, any observations may not be generalizable outside the state studied. Data were collected during a single day of observation at each site; future studies would benefit from longer-term observations.

IMPLICATIONS FOR RESEARCH AND PRACTICE

In response to the Healthy, Hunger-Free Kids Act of 2010,[30] the USDA released new regulations[38] to align CACFP meal patterns with the current Dietary Guidelines for Americans.[1] The regulations, which took effect October 1, 2017, draw upon the IOM recommendations[27] to require a greater variety of fruit and vegetables and more whole grains. Key differences between the previous and updated regulations as they apply to preschool-aged children include limits on juice

offerings, inclusion of whole grains, consideration of fruits and vegetables as separate meal components (with the intent to increase vegetable offerings), limits to added sugar, and elimination of onsite deep-fat frying as meal preparation. These changes may also affect non-CACFP centers in states such as Connecticut, which require all licensed centers to follow CACFP nutrition standards.[9] Given this study's finding that many nonparticipating centers were not meeting the previous basic requirements, especially in relation to milk, attention to both participating and nonparticipating centers is warranted during the implementation of updated, more stringent regulations.

Because many non-CACFP centers failed to meet basic CACFP standards of having 1 fruit or vegetable, 1 grain, 1 protein, and 1 milk at lunch, it is clear that participation in the program likely matters much more for promoting dietary quality than including compliance as a licensing standard (and potentially not enforcing it). At the same time, understanding barriers to providing food in child care settings is of primary importance.

One clear avenue for future research is to explore why research consistently documents what is currently considered to be low food intake for children of this age and how adequate consumption of healthful foods and beverages can be achieved. As noted earlier, caloric targets may require adjustment[35] and responsive feeding approaches must be prioritized such that children develop the capacity for attention to hunger and satiety cues. Of note, family-style service allows some children to overconsume substantially (up to >1,000 cal/lunch in the current study), and experimental data showed that overweight children may be more susceptible to serving themselves overly large portions.[39,40] Provider training is essential to educate teachers on how to help some children limit intake, while facilitating consumption that is responsive to internal cues in all children. It is concerning that some children in this study consumed 0 cal at lunch, especially in CACFP centers serving many low-income children. Interventions from the responsive feeding literature would be welcome in helping teachers navigate the complexities of feeding young children facing risks of food insecurity as well as overconsumption and obesity.

This study directly compared measured dietary intake among children in large samples of CACFP vs non-CACFP settings. These data are timely given the ongoing implementation of new CACFP standards to govern a program that particularly affects the diets of children from lower-income families. This study documented a positive association of CACFP center participation with low-fat milk intake and decreased intake of saturated fat; it also identified some concerning trends with regard to low caloric intake, findings complicated by the dual context of food insecurity and childhood obesity. Future research and practice must navigate these 2 societal problems simultaneously with careful consideration.

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