

Implementation of Minimum Nutrition Standards and Best Practices in Childcare Centers

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ABSTRACT

Background The federal Child and Adult Care Food Program (CACFP) provides reimbursable meals to 4.6 million children annually and sets nutrition standards for foods served. Licensing regulations in many states extend these rules to nonparticipating programs.

Objective To evaluate the quality of meals and snacks served in Connecticut licensed childcare centers in 2019 and assess implementation of a state licensing requirement to adhere to CACFP minimum nutrition standards in all centers.

Design Cross-sectional survey.

Participants/setting Two hundred licensed childcare centers in Connecticut in 2019.

Main outcome measures Meal/snack quality was assessed based on menus. Foods/beverages listed were compared to the minimum CACFP nutrition standards and optional best practices. Surveys completed by center directors measured center characteristics.

Statistical analysis Logistic and linear multivariable regression models tested differences in centers' adherence to nutrition standards and best practices by CACFP participation status.

Results CACFP centers complied with more required nutrition standards than non-CACFP centers (an adjusted mean of 4.7 vs 3.4 standards among programs serving meals, $P < 0.001$), with particularly large mean differences for whole grains and low-fat milk. Implementation of optional best practices, except for beverages, was relatively low among all centers, especially for snacks. Compliance (adjusted mean number of minimum nutrition standards met) was greater among centers accredited by the National Association for the Education of Young Children and those using a registered dietitian or a sponsoring agency to prepare menus and receiving food from a vendor. Recent completion of nutrition training was associated with greater mean implementation of best practices.

Conclusions and implications Better adherence to minimum nutrition standards and best practices among CACFP-participating childcare centers contributed to higher nutritional quality of meals and snacks offered. Snack quality would benefit most from greater compliance with nutrition standards. Providers outside of CACFP need additional supports in the implementation of licensing regulations to improve the food environment for young children.

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IMPROVING CHILD NUTRITION AND REDUCING THE burden of obesity and related chronic disease has been a major public health challenge for at least 20 years. A quarter of American preschool-aged children are classified as overweight or obese,^{1,2} and many more have poor diets and insufficient physical activity.³ From a very young age, children are consuming foods high in added sugar, sodium, and saturated fats and low in fiber, which puts them at risk for developing unhealthy lifelong habits.⁴⁻⁶ Early care and education (ECE) settings can help reshape food choices for over 60% of young American children in regular non-parental care by providing nutritious foods and beverages

and implementing feeding practices that encourage healthy choices.^{7,8} The food environment in childcare is particularly influential for children from low-income families who often lack resources for adequate nutrition at home.

Federal and state policies play an important role in supporting nutrition in ECE settings. At the federal level, about 4.6 million children receive meals and snacks in childcare settings through the federal Child and Adult Care Food Program (CACFP). Targeting benefits to children at risk for food insecurity and poor diet, CACFP reimburses participating facilities at free, reduced-price, or paid rates depending on the enrolled children's family income.⁹ Foods provided to

children in CACFP-participating programs have to meet nutrition standards to be reimbursed, and CACFP participation has been associated with higher dietary quality of meals served and improved children's dietary intake.^{10–14} CACFP-participating programs are also more likely to use feeding practices that support child nutrition and development, such as family-style serving and positive mealtime teacher behaviors.^{12,13,15,16}

In 2017, CACFP updated its nutrition standards to bring the program more in line with current dietary guidance, including increased servings of whole grains and reduced sugar content of yogurts and cereals, among other changes.^{17,18} Along with revisions to the minimum standards, CACFP also encouraged providers to follow a more stringent set of “best practice” standards, which promote further improvements in the nutritional quality of foods, including additional servings of whole grains, increases in fruit and vegetable servings, and reductions in red or processed meat servings.¹⁹ These recommendations are optional practices that receive no additional funding from CACFP.

At the state level, licensing regulations play a role in determining food policies for ECE programs. Many states require adherence to CACFP nutrition standards in *all* licensed childcare centers and group homes as a condition for licensure, regardless of whether they participate in CACFP.^{20,21} This requirement could expand the benefits of CACFP standards to all licensed childcare programs. However, it is unclear how stringently these requirements are enforced in nonparticipating programs. For example, in Connecticut (CT), which requires compliance with CACFP nutrition standards in all licensed center-based programs, 52% of non-CACFP childcare centers reported never hearing about CACFP.¹³ Not surprisingly, non-CACFP programs had frequent deviations from CACFP nutrition standards.^{12,13} Without federal meal reimbursements, required nutrition training, and program oversight in place for CACFP-participating programs, it is unclear how closely non-CACFP programs can adhere to licensing regulations and CACFP nutrition standards.

This study measures adherence of the foods and beverages on menus of 200 CT licensed childcare centers to the CACFP minimum nutrition standards and best practices, assesses the difference in compliance by CACFP participation status, identifies potential implementation factors, and suggests additional support structure to inform specific areas for improvement in ECE child nutrition.

METHODS

Sample Selection

The sample was CT-based licensed childcare centers that served meals and/or snacks to children 0 to 5 years of age. Family day care homes were not assessed as licensing regulations to follow CACFP nutrition standards do not apply to them in CT. After-school programs (for children aged 5–12 years) were excluded due to the study's focus on young children. Administrative records were obtained from the CT Office of Early Childhood on licensed centers and from the State Department of Education on CACFP participation. Data on meal/snack service was collected through telephone calls to providers. The study recruited all CACFP-participating centers ($n = 176$) and a sample of non-CACFP centers

RESEARCH SNAPSHOT

Research Question: What is adherence to required nutrition standards and optional best practices of the federal Child and Adult Care Food Program (CACFP)?

Key Findings: Based on center menus, CACFP-participating centers had greater adherence to minimum nutrition standards than non-CACFP centers (a mean difference of 1.4 [95% CI: 1–1.8] standards among programs serving meals), offering higher menu quality and better nutrition for young children. Centers followed best practices for beverages by not serving sugary drinks, but implementation of other best practices was less consistent, especially for snacks. Implementation supports, such as having a registered dietitian develop menus, and nutrition training of providers can help improve compliance with minimum nutrition standards and best practices that encourage healthy food habits in childcare settings.

serving children aged 0 to 5 ($n = 391$ selected from 733 non-CACFP centers serving young children and known to provide food). Non-CACFP centers located in low-income communities were oversampled.

Center directors were contacted by e-mail to participate in an online survey about food service practices affecting young children and center experience with CACFP. This initial e-mail requested that the survey be completed by the person most familiar with the food service at the childcare center (eg, center director). As part of the survey, participants were asked to submit a copy of their current menu to show food selections of children in their care. Centers could submit the menu by attaching it to the online survey, faxing, mailing, or e-mailing to the research team. All participants consenting into the study and completing the survey received a monetary incentive (a \$20 gift card) for their center or personal use. The study was approved by the institutional review board at the University of Connecticut and the CT Office of Early Childhood in December 2018.

Measures

Menu Quality. For each center, all food and beverage items listed on the menu were entered for 1 week (randomly selected if a monthly menu). Data entry was completed by researchers with background in public health and nutrition who were trained to use a data entry protocol developed for this project. When available, substitutions were noted in the menu assessment. Data entry was cross-checked by 2 researchers for about 20% of the menus. Menu coding was conducted by a registered dietitian based on the protocol and verified by a senior researcher. The protocol defined food items according to a list of 44 categories relevant to CACFP standards (eg, whole grains); items could be coded as crossing several categories. The protocol for coding food and beverage items on the menu is available from authors upon request.

To assess the extent to which centers' menus met the minimum CACFP nutrition standards, 2 dimensions of the meal patterns were evaluated. First, a center was coded as in compliance if it served a minimum number of required

components for a reimbursable meal/snack, including 3 components for breakfast (fruit/vegetables, grain/protein, dairy), 5 components for lunch (fruit, vegetables, grain, dairy, protein), and 2 components for a snack (any of the 5 lunch components). A center was coded as not in compliance if it failed to serve all required components at least once during the examined week.

Second, all listed food and beverage items were examined to measure each center's compliance with 6 minimum CACFP nutrition standards for child meals: (1) unflavored nonfat/low-fat milk served to children aged 2 to 5 years; (2) at least 1 serving of whole grains per day; (3) fruit and vegetables as 2 separate components at lunch; (4) 100% fruit/vegetable juice limited to 1 serving per day; (5) no grain-based dessert; and (6) breakfast cereal of <6 g of sugar per ounce. If food specific items were not served, the required item could not be assessed and was coded as missing. If the menu did not provide information on the item's fat/sugar content, that item was coded as noncompliant (eg, if only "milk" was listed, the low-fat/nonfat milk requirement would not be met). As with the minimum number of meal components, failure to comply at least once during the week was coded as noncompliance for a standard for the week. Due to low prevalence of serving any yogurt, availability of low-fat yogurt was not assessed.

Best practices for child meals were evaluated in a similar fashion using a week's worth of menu data. Each center was assessed if it served: (1) fruit or vegetable as 1 of the 2 components at every snack; (2) whole fruit more often than juice; (3) dark green vegetables at least weekly; (4) red and orange vegetables at least weekly; (5) bean and legumes at least weekly; (6) starchy vegetables at least weekly; (7) other vegetables at least weekly; (8) at least 2 servings of whole grains daily; (9) lean meats, nuts, and legumes only; (10) 1 serving or less of processed meats weekly; (11) natural cheese only; (12) 1 serving or less of pre-fried food weekly; and (13) no noncreditable foods with added sugars, such as sweet toppings, candy, and sugary drinks.

Center-Level Characteristics. Providers self-reported, via a survey, information about their center's CACFP participation, Early Head Start/Head Start status, accreditation with the National Association for the Education of Young Children (NAEYC), acceptance of childcare subsidies, for-profit/nonprofit status, and receipt of state funding for the School Readiness program. Providers also reported on typical meal preparation methods (eg, on site, vendor), who in the center was responsible for menu development, access to food service facilities and equipment (eg, full kitchen, partial kitchen), and nutrition training received. Center capacity was available in the administrative data. Census-block data on household income, education, and poverty from the 2013-2017 American Community Survey²² was used to approximate the socioeconomic makeup of the children enrolled in the surveyed centers.

Analyses

Survey weights were calculated to adjust for the differential probability by CACFP status to receive the survey (ie, design weight) and nonresponse. The nonresponse weights were based on propensity weights developed from a logistic

regression model of the survey response on a set of observed covariates (CACFP status, licensed capacity, acceptance of childcare subsidies, serving infants/preschool children, and census tract income/education/racial composition). All analyses were weighted.

Logistic regression models generated outcomes that estimated the centers' adherence to minimum standards and best practices, stratifying by CACFP participation status. In addition, linear regression models were used for a total count of minimum standards and best practices met (normal distribution). Based on prior research that suggested the importance of center-level characteristics, the following variables were included as covariates: NAEYC accreditation, kitchen facilities, receipt of state funding, nutrition training, menu development, and sociodemographic composition of the center neighborhood, these were included as covariates.^{13,23} As many non-CACFP centers served snacks only, analyses were completed separately for centers serving meals and centers serving snacks. Statistical significance was set at $\alpha < .05$. All analyses were conducted in Stata 15.0.²⁴

RESULTS

The response rate was 35% for the survey and menu submission, including 49% for CACFP and 29% for non-CACFP centers. Centers that did not respond to the survey were not significantly different at the 5% level from respondents based on capacity, neighborhood sociodemographics (eg, census block household median income, racial/ethnic composition) and acceptance of childcare subsidies. The survey and menus were completed through January to October 2019 by 200 centers, including 86 CACFP and 114 non-CACFP centers.

Center Characteristics

The CACFP and non-CACFP centers had statistically significant differences across multiple measures (Table 1). Although almost all CACFP centers served meals and snacks, this was true for about a quarter of non-CACFP centers ($n = 28$), with parents providing lunch in the majority of non-CACFP centers. Most non-CACFP centers only served snacks. CACFP centers had higher rates of NAEYC accreditation, receipt of state School Readiness funding, acceptance of childcare subsidies, Head Start affiliation, nonprofit status, and location in the areas with lower median household income and educational achievement.

Differences in Meal Service Implementation by CACFP Status

There were also important differences by CACFP participation in the implementation processes that centers used for providing meals, with CACFP centers generally having more robust supports in place. Non-CACFP centers reported either a center director (71.7%) or teachers (23.2%) overseeing menu preparation. In contrast, CACFP programs most often reported a food manager/chef (39.3%), a registered dietitian (30.0%), or a sponsoring agency (19.4%) responsible for menu preparation. Food was more likely to be cooked on site from scratch at CACFP centers (40.2% vs 17.8%, $P < 0.001$) even though both groups had similar access to kitchen facilities. Almost all CACFP centers reported that they received nutrition training within the last 12 months, usually through required CACFP

Table 1. Characteristics of 200 licensed child care centers in Connecticut by participation in the CACFP^a, 2019^b

Characteristic	All centers (n = 200)	Non-CACFP centers(n = 114)	CACFP centers(n = 86)	CACFP vs non-CACFP ^c
Meals and/or snacks provided, %	<i>← adjusted mean (SE) →</i>			<i>mean difference (95% CI)</i>
Meals (breakfast/lunch)	39.1 (3.7)	23.7 (4.0)	94.7 (4.2)	71 (59.6 to 82.4) ^{***}
Snacks	91.3 (2.2)	92.0 (2.6)	88.8 (3.8)	−3.1 (−12.2 to 6)
Program participation, %				
NAYEC ^d accreditation	56.3 (4.0)	47.9 (4.7)	86.9 (4.8)	39.1 (25.7 to 52.5) ^{***}
School readiness ^e	36.5 (3.8)	27.2 (4.4)	69.7 (5.7)	42.4 (28.3 to 56.6) ^{***}
Head Start/Early Head Start ^f	5 (1.3)	0	23.1 (5.3)	23.1 (12.6 to 33.6) ^{***}
Acceptance of child care subsidies	74.8 (3.6)	69.6 (4.4)	93.7 (2.5)	24.1 (14 to 34.2) ^{***}
% of children with child care subsidies	17.2 (2)	13.7 (2.3)	28.4 (4.0)	14.7 (5.5 to 23.9) ^{***}
Nonprofit center, %	53.4 (4.0)	44.4 (4.8)	86.1 (5.2)	41.7 (27.7 to 55.6) ^{***}
CACFP guidelines posted on menus, %	18.9 (2.4)	4.7 (1.9)	69.8 (6.2)	65 (52.2 to 77.9) ^{***}
Menus prepared by, %				
Center director	60.3 (3.7)	71.7 (4.2)	19.3 (5.1)	−52.4 (−65.5 to −39.3) ^{***}
Corporate office	2.9 (1.2)	3.0 (1.5)	2.3 (1.7)	−0.7 (−5.1 to 3.8)
CACFP sponsor	4.2 (1.4)	0	19.4 (5.4)	19.4 (8.6 to 30.2) ^{***}
Kitchen/food manager/cook	18.9 (2.8)	13.3 (3.2)	39.3 (5.5)	26 (13.5 to 38.6) ^{***}
Meal planning service	1 (0.5)	0	4.5 (2.2)	4.5 (0.1 to 9) [*]
Dietitian	7.8 (1.5)	1.6 (1.1)	30.0 (5.1)	28.4 (18.1 to 38.7) ^{***}
Teachers/staff	18.7 (3.2)	23.2 (4)	2.5 (1.7)	−20.7 (−29.5 to −12) ^{***}
Meal preparation method, %				
On site from scratch	22.6 (3.2)	17.8 (3.6)	40.2 (5.9)	22.4 (8.7 to 36.1) ^{***}
Cooked at another site and delivered	3 (1.2)	1.8 (1.3)	7.3 (2.9)	5.5 (−0.8 to 11.8)
Vendor/catering company; heating	8.5 (2.1)	7.5 (2.4)	12 (3.5)	4.4 (−4 to 12.9)
Vendor/catering company; no heating	11.8 (2.5)	10.1 (2.9)	17.9 (4.2)	7.8 (−2.3 to 17.9)
Food service facilities, %				
Full kitchen	42.6 (3.9)	40.4 (4.6)	50.6 (5.9)	10.2 (−4.7 to 25)
Partial kitchen	40.5 (3.9)	43.2 (4.7)	30.9 (5.2)	−12.3 (−26.2 to 1.5)
Having a microwave	34.2 (3.8)	39.5 (4.7)	15.1 (4.9)	−24.4 (−37.8 to −11) ^{***}
Nutrition training, %				
Annual professional development	34.1 (3.7)	30.6 (4.4)	46.9 (5.9)	16.3 (1.8 to 30.8) [*]
CACFP training	21.7 (2.6)	3 (1.7)	89 (4.9)	86 (75.7 to 96.3) ^{***}
Child care subsidies Care4Kids ^g training	20.6 (3.2)	20.9 (3.9)	19.7 (4.3)	−1.2 (−12.6 to 10.3)
NAPSACC ^h	5.8 (1.9)	6.3 (2.3)	4.3 (2.1)	−1.9 (−8.1 to 4.3)
State quality improvement system	12.1 (2.5)	12 (3)	12.5 (3.5)	0.5 (−8.7 to 9.7)
Census tract of center location				
% of population with income below poverty line	11.3 (0.9)	8.8 (1.1)	20.5 (1.4)	11.7 (8.3 to 15.1) ^{***}

(continued on next page)

Table 1. Characteristics of 200 licensed child care centers in Connecticut by participation in the CACFP^a, 2019^b (continued)

Characteristic	All centers (n = 200)	Non-CACFP centers(n = 114)	CACFP centers(n = 86)	CACFP vs non-CACFP ^c
Median household income, \$	81,829 (3539)	90,465 (4315)	50,699 (2257)	−39,766 (−49,394 to −30,138)***
% of population with bachelor's degree or higher	40.2 (1.5)	43.8 (1.8)	26.9 (2)	−16.9 (−22.2 to −11.5)***

^aCACFP = Child and Adult Care Food Program.

^bAll analyses are adjusted by survey weight to account for the unequal probability of sample selection and nonresponse.

^cTwo-sample *t* test *P* value.

^dNAEYC = National Association for the Education of Young Children (works to promote high-quality early learning for children aged 0-8).

^eSchool readiness is a state-funded program that provides access to quality educational programs for children aged 3 and 4.

^fHead Start is a program that works to promote the school readiness of infants, toddlers, and preschool-aged children from low-income families.

^gCare4kids subsidies is the State of Connecticut's child care subsidy program that helps low- to moderate-income families pay their child care expenses.

^hNAPSACC = Nutrition and Physical Activity Self-Assessment for Child Care.

P* < 0.05, **P* < 0.001.

training (89.0%) or courses taken for professional development (46.9%). In contrast, only about half of non-CACFP centers reported any nutrition training experience, including 30.6% for professional development and 20.9% for the childcare subsidy program that required some nutrition training.

Meeting CACFP Minimum Component Standards

Compliance with requirements to have a minimum number of meal/snack components was significantly lower in the non-CACFP group, with 40% of the centers meeting breakfast requirements for a milk, grain, and fruit/vegetable and only 22% serving all 5 components for lunch every day (Table 2, adjusted weighted prevalence). The CACFP group had much higher rates of compliance, 89% and 65%, respectively (*P* < 0.001), although still below full compliance. A common omission was lack of both fruit and vegetables for lunch or not serving milk for breakfast. Snacks of at least 2 components were always served by 44% of non-CACFP centers and 88% of the CACFP centers (Table 3). A frequent compliance issue in non-CACFP centers was use of water with a grain item at snack instead of milk and grain or fruit and grain.

Meeting CACFP Nutrition Standards

For specific minimum nutrition standards in centers serving meals, compliance was significantly higher in CACFP centers as compared with the non-CACFP group for 4 out of 6 standards (Table 2). Almost all centers in both groups avoided serving 100% juice more often than daily (data not shown in Table 2) and did not serve grain-based dessert. CACFP centers were almost twice as likely as non-CACFP centers to serve low-fat/nonfat milk and daily whole grains and more often served lower-sugar breakfast cereal. Overall, the centers met on average 4.1 standards out of the 6 assessed. Non-CACFP centers met on average 1.4 (95% CI: 1-1.8) fewer standards than CACFP centers.

In the group of centers serving snacks, differences in meeting CACFP standards were more pronounced. Table 3 shows that CACFP centers were significantly more likely to adhere to regulations for 4 out of 5 nutrition standards. The largest difference in compliance of non-CACFP centers was for whole grains (63.6%, 95% CI: 56.7-70.5) and nonfat/low-fat

milk (56.5%, 95% CI: 49.6-63.3). As a result, the total count of met requirements in non-CACFP centers serving snacks was 2.2 vs 4.7 in the CACFP group (*P* < 0.001).

CACFP Best Practices

There were no significant differences for optional best practices by CACFP status in the group of centers serving meals. Implementation, however, varied widely across the best practices assessed. For example, some recommendations had almost universal compliance, such as serving whole fruit more often than juice, limiting processed meats to a weekly serving, serving red/orange vegetables and other vegetables at least weekly (Table 2). At the same time, less than one-fifth of all centers, including CACFP centers, served fruit or vegetables as 1 of the 2 components at snack, few had at least 2 whole grain servings daily, very few reported serving natural cheese, and almost none served lean meats, nuts, and legumes only (not reported due to nonconvergence). The average number of best practices met was around 7 in both CACFP and non-CACFP groups. The group of centers serving snacks showed even greater differences by CACFP, particularly for vegetable standards (Table 3). No differences were identified among CACFP centers by Head Start participation, with 1 exception of serving whole grains twice per day (results not shown).

The role of center-level meal service practices varied across measures, but several indicators stood out. For example, for centers serving meals, NAEYC accreditation was associated with a higher adjusted mean number of standards met (0.82; 95% CI: 0.14-1.50), similar to having a menu prepared by a sponsoring agency/corporate office (0.91, 95% CI: 0.08-1.73) or by a registered dietitian (0.76; 95% CI: 0.07-1.45) or receiving food from a vendor (0.84, 95% CI: 0.29-1.39). Having recent nutrition training by center directors or similar managers was linked to a higher adjusted mean number of best practices followed (1.51; 95% CI: 0.25-2.78). Among centers serving snacks, having a registered dietitian develop menus was associated with better compliance for minimum nutrition standards (adjusted mean 1.37, 95% CI: 0.66-2.07) and best practices (1.11, 95% CI: 0.09-2.14), with similar results for menu development by corporate offices/sponsors or food managers.

Table 2. Meeting minimum nutrition standards and best practices among Connecticut licensed child care centers serving meals, 2019^a

Nutrition standards and practices	All centers (n = 108)	Non-CACFP ^b centers (n = 26)	CACFP centers (n = 82)	CACFP vs non-CACFP ^c
	←—————adjusted mean (SE)—————→			
Serving minimum number of meal components, % met				<i>mean difference (95% CI)</i>
Breakfast (3 components): milk, vegetables, fruit or both, grains	66.3 (4.2)	40.3 (6.4)	88.6 (1.9)	48.2 (35,61.5)***
Lunch (5 components): milk, meat/meat alternates, vegetables, fruit, grains	45.3 (3.2)	22.4 (3.5)	65 (2.9)	42.5 (33.3,51.7)***
Minimum nutrition standards (state licensure and CACFP), % met				
Unflavored nonfat/low fat milk to 2- to 5-year-old children	56 (4)	36.7 (6.8)	72.6 (3)	35.9 (21.2 to 50.7)***
At least 1 serving of whole grains per day	50.1 (3.1)	28.3 (3.8)	68.9 (1.7)	40.7 (32.3 to 49)***
Fruit and vegetables as 2 components at lunch	70.6 (3)	60.5 (5.3)	79.2 (2.6)	18.7 (7 to 30.5)***
No grain-based dessert	86.7 (1.6)	83.8 (3)	89.2 (1.3)	5.3 (−1.2 to 11.8)
Breakfast cereal of ≤6 g of sugar per ounce	65.8 (3.5)	51.3 (6)	78.3 (2.4)	26.9 (14 to 40)***
Meeting ≥ 5 minimum nutrition standards	44.3 (3.5)	25.1 (5.4)	60.7 (2.7)	35.5 (23.6 to 47.5)***
Total number of minimum standards met	4.1 (0.1)	3.4 (0.2)	4.7 (0.1)	1.4 (1 to 1.8)***
Meeting all six minimum standards, %	20.5 (2.2)	6.7 (1.7)	32.3 (2.9)	25.6 (18.9 to 32.3)***
Best practices (CACFP), % met				
Fruit or vegetable as 1 of 2 components at snack	16.8 (3.3)	15.4 (6.2)	18.1 (2.5)	2.7 (−10.8 to 16.1)
Dark green vegetables at least once per week	63.2 (3.3)	56.7 (6.2)	68.9 (2.5)	12.2 (−1.3 to 25.6)
Red and orange vegetables at least once per week	82.6 (1.8)	83.5 (3.4)	81.8 (1.5)	−1.8 (−9.2 to 5.6)
Bean and peas at least once per week	52.1 (2.9)	46.9 (5.1)	56.6 (2.9)	9.7 (−2.1 to 21.4)
Starchy vegetables at least once per week	68.1 (3.2)	63.3 (6.3)	72.2 (2.4)	9 (−4.4 to 22.4)
Other vegetables at least once per week	78.5 (2.3)	77.5 (4.2)	79.4 (2.0)	1.9 (−7.4 to 11.2)
At least 2 servings of whole grains per day	19.6 (2)	18.1 (3.8)	21 (2)	2.9 (−5.7 to 11.5)
Processed meats one serving per week or less	87.2 (4)	85.4 (6)	90.2 (3.6)	4.8 (−9.5 to 19.1)
Natural cheese only	15.4 (4.3)	20.8 (7)	8 (2.6)	−12.7 (−27.7 to 2.2)
Pre-fried food one serving per week or less	70.9 (2.9)	67.4 (5.4)	73.8 (2.8)	6.4 (−5.6 to 18.4)
No noncreditable foods with added sugars, including candy, sugary drinks	65 (3)	63.9 (5.5)	65.9 (3)	2 (−10.4 to 14.4)
Total number of best practices met	7.1 (0.1)	6.8 (0.2)	7.3 (0.1)	0.5 (0.04 to 0.96)*

^aResults are estimates from the models estimating a logistic regression for categorical variables (yes or no for meeting each standard) and a linear regression for count measures (normal distribution), controlling for CACFP participation, National Association for the Education of Young Children (program that works to promote high-quality early learning for children aged 0-8) accreditation, school readiness (a state-funded program that provides access to quality educational programs for children aged 3 and 4), posting CACFP guidelines, menu preparation by center director, dietician, CACFP sponsor/corporate office, food manager/chef, meal prepared on site, meal prepared from vendor, full kitchen/partial kitchen, having a microwave, any nutrition training, and % of population with income below poverty line and % of population with bachelor's degree or higher. Limit 100% fruit/vegetable juice to one serving per day, whole fruit served more often than juice, and lean meats, nuts and legumes only were excluded.

^bCACFP = Child and Adult Care Food Program.

^cTwo-sample *t* test *P* values. All analyses are weighted to account for the unequal probability of sample selection and nonresponse.

P* < 0.05, **P* < 0.001.

Table 3. Meeting minimum nutrition standards and best practices among Connecticut licensed child care centers serving snacks, 2019^a

Nutrition standards and practices	Non-CACFP ^b			CACFP vs non-CACFP ^c
	All centers (n = 176)	centers (n = 101)	CACFP centers (n = 75)	
Serving minimum number of meal components, % met	←—————adjusted mean (SE)—————→			mean difference (95% CI)
Snack (2 components from milk, meat/meat alternates, vegetables, fruit, or grains)	53.4 (1.4)	44.1 (1)	87.8 (1)	43.8 (41 to 46.6)***
Minimum nutrition standards (state licensure/ CACFP), % met				
Unflavored nonfat/low fat milk to 2- to 5-year-olds	27.3 (2.2)	15.3 (1.8)	71.7 (2.9)	56.5 (49.6 to 63.3)***
At least 1 serving of whole grains per day	20.7 (2.1)	7.1 (1.3)	70.8 (3.2)	63.6 (56.7 to 70.5)***
Limit 100% fruit/vegetable juice to one serving per day	88.1 (1.2)	88.5 (1)	85.2 (5.9)	−3.3 (−15.2 to 8.6)
No grain-based dessert	64.1 (2)	58.8 (2.3)	83.6 (2.5)	24.8 (18.2 to 31.4)***
Breakfast cereal of ≤6 g of sugar per ounce	65.1 (1.7)	61.1 (2)	79.9 (1.6)	18.9 (13.8 to 23.9)***
Meeting ≥ 5 minimum nutrition standards	18.4 (2.1)	6.2 (1.5)	63.2 (4)	56.9 (48.5 to 65.3)***
Total number of minimum standards met	2.7 (0.1)	2.2 (0.1)	4.7 (0.1)	2.5 (2.2 to 2.8)***
Meeting all six minimum standards, %	8.3 (1)	1.7 (0.4)	32.9 (2.9)	31.2 (25.5 to 37)***
Best practices (CACFP), % met				
Fruit or vegetable as 1 of 2 components at snack	15 (1.2)	15.3 (1.2)	13.8 (3.2)	−1.6 (−8.4 to 5.2)
Whole fruit served more often than juice	72.1 (1.8)	72.3 (1.8)	69.5 (11.7)	−2.8 (−26.4 to 20.8)
Dark green vegetables at least weekly	23.1 (2)	11.1 (1.4)	67.2 (4)	56.1 (47.6 to 64.5)***
Red and orange vegetables at least weekly	41.7 (2.2)	31.4 (2.1)	79.5 (2.7)	48.2 (41.3 to 55.1)***
Bean and peas (legumes) at least weekly	32.5 (1.8)	26.5 (1.9)	54.7 (3.4)	28.2 (20.5 to 36)***
Starchy vegetables at least weekly	24.3 (2.2)	10.8 (1.5)	74 (3)	63.2 (56.6 to 70)***
Other vegetables at least weekly	40.8 (2)	29.8 (1.7)	81.2 (3)	51.3 (44.6 to 58.1)***
At least 2 servings of whole grains per day	8 (1.1)	4.5 (0.9)	20.8 (2.8)	16.3 (10.5 to 22.2)***
Processed meats one serving per week or less	94.3 (1.7)	95.2 (1.6)	83.7 (9.3)	−11.5 (−30.4 to 7.4)
Natural cheese only	27.8 (1.9)	34 (2.1)	5.2 (1)	−28.8 (−33.4 to −24.1)***
Pre-fried food one serving per week or less	88.7 (0.9)	92.9 (0.7)	73.1 (2.5)	−19.8 (−24.9 to −14.7)***
No noncreditable foods with added sugars, including candy, sugary drinks	66.5 (1.1)	68.9 (1.2)	57.4 (1.6)	−11.5 (−15.6 to −7.5)***
Total number of best practices met	5.2 (0.1)	4.7 (0.1)	7.1 (0.1)	2.4 (2.1 to 2.8)***

^aAll analyses are weighted to account for the unequal probability of sample selection and nonresponse. Results are estimates from the models estimating a logistic regression for categorical variables (yes/no for meeting each standard) and a linear regression for count measures (normal distribution), controlling for CACFP participation, National Association for the Education of Young Children (that works to promote high-quality early learning for children aged 0-8) accreditation, school readiness (a state-funded program that provides access to quality educational programs for children aged 3 and 4), posting CACFP guidelines, menu preparation by center director, dietician, CACFP sponsor/corporate office, food manager/chef, meal prepared on site, meal prepared from vendor, full kitchen/partial kitchen, having a microwave, any nutrition training, and % of population with income below poverty line and % of population with bachelor's degree or higher. Limit 100% fruit/vegetable juice to 1 serving per day, whole fruit served more often than juice, and lean meats, nuts and legumes only were excluded.

^bCACFP: Child and Adult Care Food Program.

^cTwo-sample *t* test *P* value.

P* < 0.05, **P* < 0.001.

DISCUSSION

In this study of adherence to nutrition standards among CT licensed center-based programs, CACFP-participating centers

had much better compliance than non-CACFP centers. Of the 6 key nutrition standards, CACFP centers met on average 79% of them, and non-CACFP centers that provided meals met 56%

(difference 23%, 95% CI: 16%-29%). These differences were even more pronounced for centers serving snacks (the majority of nonparticipating centers), with non-CACFP centers meeting on average 2.2 minimum standards vs 4.7 among CACFP counterparts ($P < 0.001$). The state licensing requirement to follow CACFP standards does not appear to be sufficient for ensuring that centers adopt the standards.

The better adherence among CACFP-participating centers contributed to higher nutritional quality of the meals and snacks offered to young children. Most CACFP centers regularly offered whole grains, low-fat/nonfat milk, and low-sugar cereal, and less than half of non-CACFP programs complied with these required standards. CACFP centers were also more likely to meet the minimum number of meal or snack components—less than a quarter of non-CACFP centers had the 5 required components for lunch. Even among CACFP centers, there was surprisingly low compliance with listing 5 lunch components (65% of centers listed 5 components). It is possible that centers were still adjusting to the new CACFP requirement of serving fruit and vegetables as separate components for lunch. The requirement for the components was implemented in 2017, but 21% of CACFP centers were not meeting this new change in 2019. Compliance with the requirement to serve a whole grain daily also emerged as a challenge—although CACFP centers were more likely to do this, only about two-thirds met the standard. Serving whole grains has been found to be a key challenge in childcare settings,^{25,26} suggesting that professional support may be needed in helping providers serve whole grain products. Recent research on professional support for implementation of the updated CACFP nutrition standards identified a need for more time, money, and staff²⁷ and information from state agencies regarding CACFP-reimbursable products, menu ideas, recipes, and cooking demonstrations.²⁸ Importantly, all centers were successful in implementing other new rules, such as not serving sugary drinks and grain-based dessert and limiting fruit juice.

The discrepancy in adherence between CACFP-participating and nonparticipating centers is consistent with prior research showing that, despite the state licensing requirement to follow CACFP standards, centers that do not participate in CACFP are often unaware of the standards or the program itself.¹³ Prior research also showed that adherence to other required nutrition and physical activity policies in childcare is often low.^{29,30} The reasons for CACFP-participating centers' better adherence to the nutrition standards were not directly tested in this study. However, it is likely that without the robust implementation structure for CACFP, including federal reimbursements for meals/snacks meeting the standards, periodic monitoring for compliance, extra training, and technical assistance provided by the state's CACFP office, nonparticipating centers are simply unable to comply at the same rates. Prior studies have found that robust technical assistance with targeted trainings and other implementation support have been successful in helping childcare providers meet nutrition and physical activity standards.^{31–33} In this context, these study results suggest that childcare providers need help in the implementation of licensing regulations to influence the quality of foods served.

Similarly, without a strong implementation and financial reimbursement plan in place to help providers adopt the voluntary CACFP best practice standards, there is low adherence to these standards across all centers. Of note, few programs served a fruit or vegetable as a snack component or served at least 2 whole grains daily, and no programs served only lean meats, nuts, and legumes. Given the optional nature of these additional standards, their likely higher costs, and the greater difficulty in implementation without the support of nutritionists, it is unsurprising that they are rarely seen. Similar findings were reported in prior work assessing compliance with best practices among CACFP centers.³⁴ On a positive note, almost all centers follow best practices for beverages. Childcare centers in this sample did not, by and large, serve sugary drinks, flavored milk, or candy; of the 7487 menu items examined, lemonade or fruit drinks were listed only 4 times and flavored milk twice. Juice restrictions were also met.

The study results suggest that certain implementation resources may be more relevant than others for providers in following strong nutrition standards. Although nutrition training is often thought of as critical for implementing new nutrition policies, training alone might have little impact on whether providers successfully adopt standards. Instead, having access to a nutritionist or predeveloped menus was associated with better adherence to standards. Childcare providers, who are experts first and foremost in the care and education of young children but not necessarily the particulars of nutrition science, benefited significantly from the assistance of nutrition experts, which resulted in more nutritious meals observed in this study. Providers who utilized food service vendors, which usually employ experts in food procurement, preparation, and meal planning and have familiarity with different federal food program requirements, were more likely to adhere to CACFP standards. Rather than training child care providers themselves, it may be that encouraging them to leverage the expertise of nutrition and food service professionals is a higher-impact strategy for improving adherence to nutrition standards and ultimately the quality of child nutrition in ECE settings.

Finally, centers should provide more detailed information in their menus about foods and beverages served, so that parents have better information about food options available to their children. Although licensing regulations require that centers share menus with families, the level of detail is not regulated. Parents can more accurately report on their children's dietary restrictions when they are fully informed about all selections available to their children. Menus are often the only available source of information for licensing agencies and researchers, so centers have an incentive to demonstrate compliance.

This study is subject to several important limitations. First, the study does not observe what foods were served to children. Previous research has shown some discrepancies between meals listed on the menu and what was served, although they seemed modest.^{35–38} Lack of detail on certain menus might have affected the accuracy in assessing center compliance with nutrition standards and underestimated it. Although menu analysis provides a convenient way to assess meal quality without expensive data collection through

center visits, it has limitations of not observing actual ingredients and serving sizes. The study cannot make inferences about children's food intake. Certain best practice recommendations, such as use of locally sourced food, could not be assessed using menu data. Finally, this study was based on 1 state and future evaluations should include samples in other states.

CONCLUSION

Based on menu and survey data, CACFP participation is associated with higher meal quality and better adherence to CACFP nutrition standards and some best practices. Simply requiring compliance with CACFP nutrition standards in state licensing regulations, without providing the implementation supports that come along with CACFP participation, might not be sufficient to ensure better nutrition in ECE settings. Providers outside of CACFP need additional supports in the implementation of licensing regulations to improve the food environment for young children. Snacks could benefit most from changes to meet the required standards.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

T. Andreyeva conceptualized and designed the study, managed the day-to-day operation of the studies and oversaw study staff, drafted and revised the manuscript, and approved the final manuscript as submitted. M. Cannon managed the day-to-day operation of the study, including data collection and entry, and approved the final manuscript as submitted. X. Sun analyzed data, reviewed the initial draft, and approved the final manuscript as submitted. E. L. Kenney contributed to the study's design and results interpretation, contributed to drafting and revising the manuscript, and approved the final manuscript as submitted.