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Impact of changes to the Child and Adult Care Food Program on children's dietary intake in family child care homes

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Abstract

Objective: To estimate the impact of recent changes to the Child and Adult Care Food Program (CACFP) meal pattern on young children's diets in family child care homes (FCCHs) serving racially/ethnically diverse children.
Design: In a natural experimental study of thirteen CACFP-participating FCCHs, we used digital photographs taken of children's plates before and after meals matched with menus to measure children's dietary intake both prior to implementation of the new meal patterns (summer/fall of 2017) and again 1 year later (summer/fall of 2018). Generalised estimating equations tested for change in intake of fruits, vegetables, whole grains, 100 % juice, grain-based desserts, meat/meat alternates and milk, adjusting for clustering of observations within providers.
Setting: FCCHs in Boston, MA, USA.
Participants: Three- to 5-year-old children attending FCCHs.
Results: We observed 107 meals consumed by twenty-eight children at the thirteen FCCHs across an average of 2·5 (SD 1·3) d before the CACFP policy change, and 239 meals consumed by thirty-nine children across 3·8 d (SD 1·4) 1 year later. During lunch, fruit intake increased by about a third of a serving (+0·38 serving, 95 % CI 0·04, 0·73, $P = 0·03$), and whole grain intake increased by a half serving (+0·50 serving, 95 % CI 0·19, 0·82, $P = 0·002$). No changes were seen in other meal components.
Conclusion: Young children's dietary intake in CACFP-participating FCCHs improved following the CACFP meal pattern change, particularly for fruits and whole grains, which were targets of the new policy. Additional research should examine impacts of the changes in other child care settings, age groups and locales.

Keywords
Child care
Dietary intake
Nutrition policy
Policy implementation

Early childhood is a critical time for developing healthy eating habits. Early exposures to both healthy foods (such as fruits and vegetables) and less healthy foods and beverages (such as sugar-sweetened beverages) strongly predict later consumption of those foods[1–3]. Additionally, individuals' eating habits have been shown to be amenable to change during this period of development, with several intervention studies indicating that different strategies of exposing young children to healthy foods can help improve eating habits[4]. Given that poor diet and its impacts on chronic disease remain major public health challenges through the life course[5], ensuring that young children start out with healthy diets is an important public health priority. However, national studies suggest that young children's dietary habits are not set up to promote lifelong health, with infrequent consumption of vegetables (other than white potatoes) and high consumption of sugary drinks and desserts[6,7].

One important recent policy strategy to address young children's diet quality in the United States was an update of the meal pattern standards for the Child and Adult Care Food Program (CACFP). CACFP is a federal food assistance program in the United States that provides tiered reimbursements to child care providers, both centre- and family-based, for meals served, with reimbursement size based on family income (similar to the structure of the National School Lunch Program). The programme reaches an estimated 1·8 million children daily. To qualify for reimbursements, the meals served must adhere to a set of meal pattern standards, which historically had been more focused on preventing hunger than chronic disease. As part of the Healthy Hunger Free Kids Act, and as of October

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2017, CACFP now requires for children aged over 2 that: a whole grain be served at least once a day for children when a grain is served; 100 % juice be limited to one small serving per day; both a fruit and a vegetable must be served at lunch; and cereals and yogurts must be limited in sugar content. Such changes could positively influence children's diets[8]. Additionally, a set of stronger 'best practice' standards was included in the updated CACFP requirements; these voluntary standards encouraged providers to further increase servings of whole grains to twice per day, serve a fruit or vegetable at each snack, limit red/processed meats and eliminate fruit juice[9].

CACFP reaches nearly half of all children who attend family child care homes (FCCHs)[10,11], that is, regulated child care programmes where a provider cares for a small number of children in her or his home. Relatively little is known about the food environments in these settings, which are smaller and less centralised than the more frequently studied centre-based setting, and may serve a larger share of lower-income families due to their lower fees[12]. Two recent studies have suggested that there is room for improvement in the quality of children's dietary intake in these FCCHs[13,14]. A recent survey of child care providers participating in CACFP in California suggested that FCCHs were already complying with several of the individual new meal pattern standards, but few were implementing all of the new standards[15]. Thus far, the impact of CACFP meal pattern changes on children's diets in these settings is unclear.

Our study's aims were to (1) estimate dietary intake of 3–5-year-old children attending Boston FCCHs that participate in CACFP, and (2) evaluate whether children's dietary intake improved from before to after the change in meal pattern standards. We hypothesised that children's intake of juice, sugary cereals and sugary yogurts would decrease; children's intake of milk and meat/meat alternates would stay stable; and that children's intake of fruits, vegetables and whole grains would increase in response to the new standards.

Methods

Study design and sample

This study is a pre/post, within-setting natural experimental evaluation of the changes to CACFP meal patterns among children attending FCCHs in Boston, MA. We collected data on children's dietary intake at FCCHs during the summer and early fall before the standards went into effect on 1 October 2017, as well as roughly 1 year later (summer and fall of 2018). We recruited FCCH providers from a list of licensed FCCH providers in Boston, downloaded from the Massachusetts Department of Early Education and Care website[16]. Eligibility criteria for this study included: (a) operating a licensed FCCH in the city of Boston; (b) serving at least one child between the ages of 3 and 5; and (c) participating in CACFP. With an initial goal of sampling thirty providers for this study, we randomly selected providers from a list of 396 providers with valid contact information until we reached close to our targeted sample size. Through this process, we ended up randomly sampling and then inviting 263 of the 396 providers (66·4 %). Of these, fifty-six respondents (21·2 % of those contacted) were not eligible (nineteen did not participate in CACFP, and thirty-seven did not have 3- to 5-year-olds in their care). An additional eighty-one providers declined, stating they were too busy or uninterested, and an additional ninety-seven never responded after up to five attempts. Twenty-nine providers (11·0 % of those sampled; 7·3 % of the entire Boston FCCH population) agreed to participate at baseline; at follow-up, sixteen providers were lost to follow-up, with four closing their programmes, an additional four losing enrolment of any 3–5-year-old children, and the remaining eight stating they were too busy, resulting in a final longitudinal sample of thirteen providers. Although we found no differences in the amounts of any foods or beverages served at baseline between those who were in the longitudinal sample and those who were lost to follow-up, we did find that Spanish-speaking providers were significantly less likely to participate in the longitudinal sample, as all of the providers who closed their programmes or lost enrolment of preschool-aged children were Spanish-speaking. This study was determined to be not a human subjects research by the Harvard T.H. Chan School of Public Health Institutional Review Board.

Measures

Dietary intake

The primary outcome for this study was 3–5-year-old children's dietary intake at the FCCH; specifically, our goal was to determine whether intake of foods and beverages impacted by the meal pattern changes actually changed from before to after policy implementation, including 1 % milk, 100 % juice, water, fruits and vegetables, whole grains, refined grains, meat/meat alternates, grain-based desserts and sugary cereal. Because community advisors for this study (local nutrition technical assistance providers for child care settings and outreach health educators) had counselled that Boston FCCH providers tended to be uncomfortable with observers, it was not feasible to use a direct observation method on site, such as plate waste weighing. Therefore, for this study, we adapted a method leveraging digital photography to assess children's intake, based on several studies indicating that digital photographs can be a valid and reliable strategy for capturing intake in specific settings[17,18]. At a brief visit, providers were trained by the research assistants (RAs) on how to take a picture using a smartphone of each 3–5-year-old's meal once the child had been served (either by the provider or self-served) and directly after the meal. RAs trained providers to take photographs from a height of 18 inches. As this

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study was determined not to be a human subjects research, no identifying information was collected on individual children. Therefore, to keep track of which child ate which plate, providers were given numbered cards to place next to each plate, so that the before and after photographs could be matched. Providers were given a checklist to keep track of when they had taken photographs of meals, and urged to take photographs for as many meals as possible during a week of data collection. Providers then sent their photographs to a study e-mail account. RAs returned briefly at week end to collect menus and a brief survey on CACFP experiences.

RAs downloaded the photos and identified each food and beverage seen in each photograph. If the item could not be identified from the photograph alone (e.g. a sandwich where the filling was not easily identifiable), RAs consulted the provider's menu for that corresponding day and meal. Using the menus, when necessary, to identify the types of certain foods (including the milkfat of milks served), foods were categorised as: fruits (excluding juice); vegetables; whole grains (the first ingredient of a product is a whole grain, based on the nutrition facts label for the product); refined grains (the first ingredient is not a whole grain); grain products of unknown whole grain content; meat or meat alternates (meat, fish, soy products, cheese, yogurt, eggs, nuts/nut butters and beans/legumes). If the whole grain content of grains or milkfat content of milks on the menu were unclear, RAs followed up with providers during their in-person visits to verify what was served both through asking the provider and reviewing the pantry contents. Using the brands of cereals listed on the provider's menu or obtained in the RA's review when available, and based on nutrition facts labels found on manufacturers' websites, breakfast cereals were further categorised as meeting the new CACFP standard for sugar (no more than 6 g of sugar per dry ounce) or not; this information was missing for ten out of thirty instances of cereal consumed at baseline, and zero instances of cereals consumed at follow-up. Providers rarely listed the type of yogurt available on their menu, and RAs were not able to verify the brands for these observations; thus, we were unable to assess changes in the sugar content of yogurt in this analysis. Beverages were categorised as low-fat or skim milk, reduced-fat milk, whole-fat milk (and further classified as flavoured/unflavoured), water, 100 % juice or sugar-sweetened beverages (SSBs). Cookies, sweet pie crusts, doughnuts, cereal bars, breakfast bars, granola bars, sweet rolls, toaster pastries, cake and brownies were classified as grain-based desserts, in keeping with the CACFP definition; these could also have been cross-classified as whole grains if they had a whole grain as the first ingredient[19].

Then, RAs, who were either registered dieticians or in dietetics training, examined the pre-consumption photograph for each child per meal and estimated how much of each food and beverage was served to each child to the nearest tablespoon, fluid ounce or pieces[20]. RAs used the corresponding post-consumption photograph to estimate how much of each component had been consumed, in increments of 10 %. RAs were trained using a training protocol from a previous study that also utilised digital photographs of children's intake while in care to estimate dietary intake; this involved practicing estimations of portion sizes with twenty test photographs for which in-person, measured estimates of portion sizes were available until RAs consistently rated the photographs accurately[21]. These estimation methods have been validated previously[18,22], and inter-rater reliability in this study ranged from Spearman's r of 0·96 for beverages to 0·99 for fruit. The number of servings of each food/beverage item consumed were then calculated by converting the estimated tablespoons, fluid ounces or pieces consumed into the number of CACFP-defined serving sizes consumed. For meat/meat alternates, which have recommended serving sizes in units of ounces, RAs converted estimates of volume (pieces, tablespoons) to weight in ounces by utilising data on weight per volume of given foods from the USDA's Food Composition Standard Reference Database.

Statistical analysis

The average servings consumed per child per meal (breakfast, lunch and snack) of each food/beverage category were calculated at baseline and follow-up. To analyse whether children's dietary intake changed from before to after the meal pattern changes, we used generalised estimating equations to test whether children's average consumption during breakfast, lunch and snack, as well as the amounts of foods and beverages served to them were significantly different at follow-up, adjusting for the clustering of observations by observation day and provider. Analyses were conducted using SAS, version 9.4.

Results

Among the thirteen FCCH providers, about three-quarters primarily spoke English (n 10, 76·9 %), while the remaining providers primarily spoke Spanish (Table 1). At baseline, the average number of children enrolled in the FCCHs was 7·6 (SD 2·3), with enrolment of 3–5-year-old children of 2·7 (SD 1·8); both the total number enrolled and the number of 3- to 5-year-olds were slightly higher at follow-up. All thirteen providers served CACFP-reimbursable lunch and afternoon snack; twelve (92·3 %) served breakfast; nine (69·2 %) served morning snack; and seven (53·9 %) served supper. At both baseline and follow-up, less than half had received a training about CACFP meal pattern changes.

The average number of observation days per provider was 2·5 (SD 1·3) at baseline and 3·8 (SD 1·4) at follow-up. Across the thirteen providers, 107 pre/post-consumption pairs of photographs of a child's consumption of a meal were taken at baseline; thirty-two of these were of a breakfast being consumed (29·9 %), forty-eight were of a lunch

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Table 1 Characteristics of Boston family child care provider study participants, *n* 13, 2017–2019

Characteristic	Baseline		Follow-up	
	Mean	SD	Mean	SD
Program size (number of children enrolled)	7·6	2·3	8·3	2·2
Number of 3–5-year-old children enrolled	2·7	1·8	3·9	2·3
Years programme has been in operation	4·0	1·5	4·3	0·9
	n	%	*n*	%
Provider employs at least one assistant	9	69·2	Same	
Primary language				
English	10	76·9	–	
Spanish	3	23·1	–	
Serves breakfast	12	92·3	12	92·3
Serves lunch	13	100	13	100
Serves morning snack	9	69·2	8	61·5
Serves afternoon snack	13	100	13	100
Serves supper	7	53·9	7	53·9
Provider attended a training about CACFP meal pattern changes	5	38·5	6	46·2
Number of total meals observed	*N* 107		*N* 239	
Breakfasts	32	29·9	74	31·0
Lunches	48	44·9	98	41·0
Snacks	27	25·2	67	28·0

(44·9 %), and twenty-seven were of a snack (25·2 %). Providers documented more meals at follow-up, with 239 pairs of photographs taken of a child's consumption of a meal (Table 1).

At baseline on average, during breakfast children were served 0·59 (SE 0·17) serving of milk, and consumed about a half serving of 1 % milk (0·42 serving, SE 0·11) (Fig. 1). Water and 100 % juice were not served. Children were served over a half serving of fruit at breakfast (0·57 serving, SE 0·18), but only consumed about a quarter of a serving (0·24 serving, SE 0·09). In contrast, they were served and consumed over a full serving, on average, of refined grains (1·32 servings consumed, SE 0·31). Less than half a serving (0·42, SE 0·35) of whole grains was served, with children consuming 0·37 serving (SE 0·30) on average. Meat/meat alternates were infrequently served at breakfast (0·14 serving, SE 0·013), but were fully consumed when served. Cereals with sugar content over the 6 g per dry ounce limit and grain-based desserts were rarely served.

During lunch, children were served and consumed a little over a half serving of 1 % milk, never consumed juice and very rarely consumed water. Children were served 0·29 (SE 0·18) serving and consumed 0·14 (SE 0·14) serving of fruit at lunch (SD 0·56) and were served 0·47 (SE 0·26) and consumed 0·18 (SE 0·11) serving of vegetables. Whole grains were almost never served; instead, substantial amounts of refined grains were (2·78 servings, SE 0·13). While they were served about a full serving of meat/meat alternates on average (1·05, SE 0·21), they consumed 0·79 serving on average (SE 0·23). At snack, more 100 % juice was served (0·28 serving, SE 0·12) than milk (0·12 serving, SE 0·12), and the consumption of milk was very low (0·06 serving, SE 0·09); water was never consumed or served. Refined grains appeared to be the most common component of snack (1·26 servings served, SE 0·23). Children were also served nearly a half serving per day per snack of fruit on average (0·48 serving, SE 0·15) and consumed 0·36 serving (SE: 0·14). Whole grains were almost never served, and vegetables were very rarely served and consumed at snack. Water was never served or consumed at snack.

Findings from generalised estimating equations suggested that, at breakfast, fruit serving and consumption increased significantly by about a third of a serving (+0·33 increase in consumption, 95 % CI 0·13, 0·57, $P = 0·002$), but no other components were significantly different, that is, a child's average intake from a breakfast remained fairly similar from before to after the policy change, including the intake of sugary cereals and grain-based desserts (Table 2). At lunch, however, more substantial changes were observed. Fruit intake increased at lunch (+0·38 serving, 95 % CI 0·04, 0·73, $P = 0·03$), though the amount of fruit actually served did not significantly increase. Whole grain intake increased by a half of a serving (+0·50 serving, 95 % CI 0·19, 0·82, $P = 0·002$). In contrast, servings of refined grains decreased by more than half a serving (–0·59, 95 % CI –1·02, –0·16, $P = 0·007$), and refined grain intake decreased by 0·39 serving (95 % CI –0·74, –0·04, $P = 0·03$). At snack, the amount of 100 % juice served to children decreased significantly (–0·22 serving per day, 95 % CI –0·39, –0·05, $P = 0·01$), but the amount *consumed* did not significantly decrease. No other snack components changed significantly.

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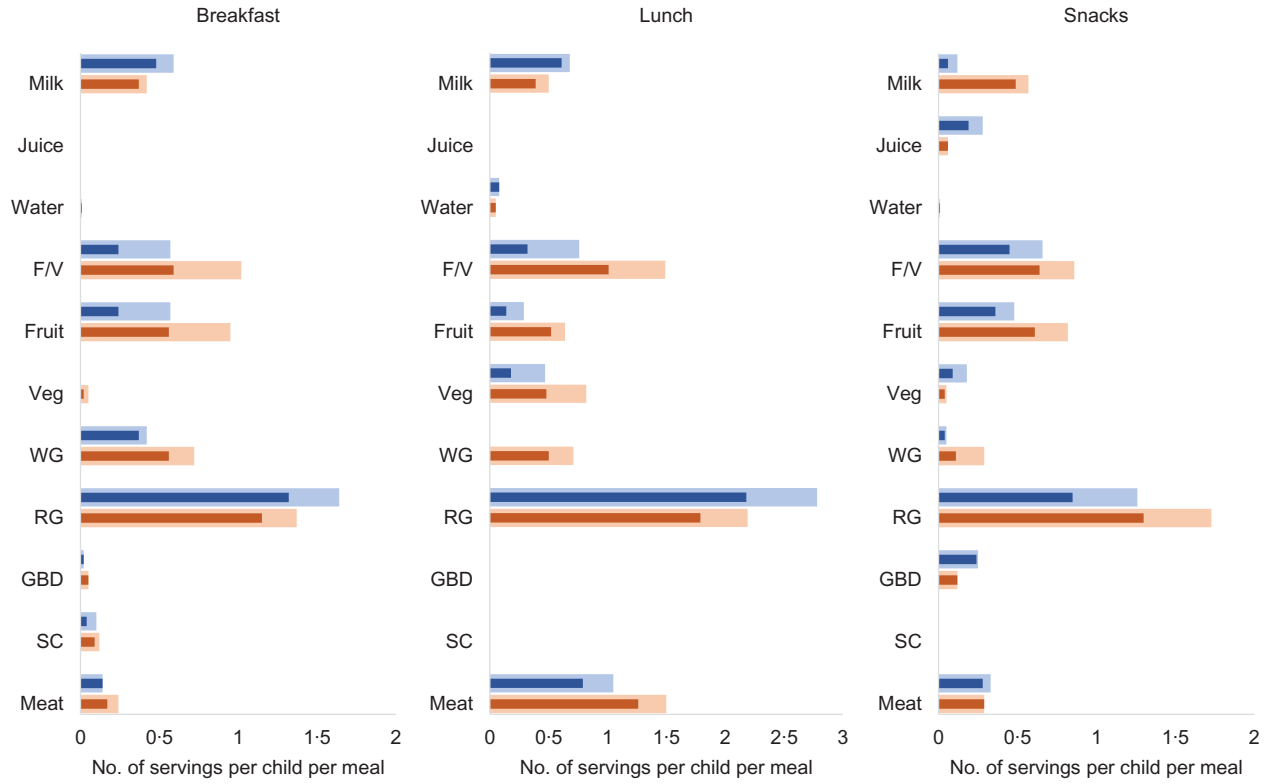

Fig. 1 CACFP meal components: Mean servings and means consumed per child per meal, baseline to follow-up. Milk, 1 % milk; Juice, 100 % juice; F/V, fruits and vegetables; Veg, vegetables; WG, whole grains; RG, refined grains; GBD, grain-based desserts; SC, sugary cereal; Meat, meat/meat alternates; Breakfast: *N* 32 at baseline, *N* 72 at follow-up; lunch: *N* 48 at baseline, *N* 98 at follow-up; snacks: *N* 27 at baseline, *N* 67 at follow-up. , baseline, served; , baseline, consumed; , follow-up, served; , follow-up, served

Discussion

In this small study of children's dietary intake in FCCHs from before to after the new CACFP meal patterns were implemented, we found that children's intake improved in several of the areas targeted by the new standards. In particular, intake of fruit increased during both breakfast and lunch; whole grain intake increased by a half serving during lunch; and refined grain intake decreased during lunch. While no changes were seen in the intake of several of the high-sugar food and beverage categories targeted by the updated meal pattern standards – including 100 % juice, yogurt with a sugar content of greater than 23 g per 6 ounces, cereals with a sugar content of greater than 6 g per dry ounce, or grain-based desserts – children in our sample already consumed little to none of these foods and beverages at baseline. At the same time, no increases were seen in water intake or vegetable intake – two targets of the updated meal pattern standards that were consumed at very low levels at baseline in this sample. Additionally, while whole grain intake increased at lunch, refined grain intake appeared to increase during snack (with no changes to whole grain intake at other meals), suggesting that there is still much to go in leveraging CACFP to improve young children's diets. Providers may need more implementation support and assistance with potentially increased costs of providing healthy foods in order to more fully meet the goals of the revised meal pattern. Researchers should work to identify what some of the barriers to full implementation are and how providers can be better supported.

This study is the first, to our knowledge, to evaluate how children's actual dietary intake changed from before to after the CACFP policy change. Our findings are consistent with some of the hypothesised changes put forward in a health impact assessment of the new standards, which did suggest that whole grain and fruit and vegetable intake could substantially increase[8]. Although this report also anticipated more reductions in 100 % juice and sugary yogurts and cereals, we did not observe reductions, likely because these items were infrequently served to children in our sample, that is, providers were already meeting, or close to meeting, the new meal pattern standards. Two recent larger-scale studies of child care programmes participating in CACFP prior to the policy change also found that a majority of programmes reported already adhering to several of the CACFP standards, similar to our study[15,23]. It may be that, because child care programmes were already near compliant with the new standards, in order to see more substantial

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Table 2 Changes in dietary intake from before to after CACFP changes went into effect among thirteen Boston family child care providers (*n* 61 observations at baseline, *n* 125 observations at follow-up), 2017–2019

Food or beverage (in CACFP serving sizes)*	Adjusted change in servings *served* per child†	95 % CI	*P*-value	Adjusted change in servings *consumed* per child	95 % CI	*P*-value
Breakfast						
Beverages						
1 % milk	–0·17	–0·55, 0·21	0·38	–0·11	–0·37, 0·16	0·43
100 % juice	n/a			n/a		
Water	0·01	–0·01, 0·04	0·32	0·01	–0·01, 0·04	0·32
Fruits and vegetables	**+0·44**	**0·24, 0·65**	**<0·001**	**+0·35**	**0·13, 0·57**	**0·002**
Fruits	**+0·38**	**0·19, 0·57**	**<0·001**	**+0·33**	**0·12, 0·53**	**0·002**
Vegetables	+0·05	–0·01, 0·10	0·12	0·02	–0·01, 0·06	0·16
Grain products						
Whole grains	+0·30	–0·39, 0·99	0·39	+0·19	–0·40, 0·78	0·52
Refined grains	–0·26	–1·15, 0·62	0·56	–0·17	–0·92, 0·59	0·66
Grain-based desserts	+0·03	–0·02, 0·08	0·27	+0·03	–0·02, 0·08	0·27
Sugary cereal	+0·02	–0·19, 0·22	0·88	+0·05	–0·09, 0·19	0·48
Meat/meat alternates	+0·10	–0·14, 0·34	0·41	+0·03	–0·17, 0·24	0·75
Lunch						
Beverages						
1 % milk	–0·19	–0·54, 0·17	0·30	–0·22	–0·60, 0·17	0·27
100 % juice	n/a			n/a		
Water	–0·02	–0·13, 0·08	0·65	–0·03	–0·13, 0·07	0·54
Fruits and vegetables	+0·73	–0·16, 1·63	0·11	**+0·69**	**0·08, 1·29**	**0·03**
Fruits	+0·35	–0·11, 0·81	0·13	**+0·38**	**0·04, 0·73**	**0·03**
Vegetables	+0·34	–0·19, 0·87	0·20	+0·30	–0·01, 0·60	0·06
Grain products						
Whole grains	**+0·73**	**0·38, 1·08)**	**<0·001**	**+0·50**	**0·19, 0·82**	**0·002**
Refined grains	**–0·59**	**–1·02, –0·16**	**0·007**	**–0·39**	**–0·74, –0·04**	**0·03**
Grain-based desserts	n/a	n/a	n/a	n/a	n/a	n/a
Sugary cereal	n/a	n/a	n/a	n/a	n/a	n/a
Meat/meat alternates	+0·45	–0·22, 1·12	0·18	+0·47	–0·21, 1·16	0·18
Snack						
Beverages						
1 % milk	+0·45	–0·05, 0·95	0·08	+0·43	–0·03, 0·99	0·07
100 % juice	**–0·22**	**–0·39, –0·05**	**0·01**	–0·13	–0·27, 0·02	0·09
Water	+0·01	–0·01, 0·04	0·34	+0·01	–0·01, 0·04	0·34
Fruits and vegetables	+0·20	–0·31, 0·71	0·45	+0·19	–0·23, 0·60	0·38
Fruits	+0·33	–0·13, 0·79	0·15	+0·25	–0·16, 0·66	0·23
Vegetables	–0·13	–0·40, 0·15	0·36	–0·05	–0·19, 0·08	0·44
Grain products						
Whole grains	+0·24	–0·28, 0·76	0·37	+0·07	–0·19, 0·33	0·60
Refined grains	+0·48	–0·05, 1·00	0·08	**+0·46**	**–0·003, 0·91**	**0·05**
Grain-based desserts	–0·13	–0·43, 0·17	0·39	–0·13	–0·43, 0·18	0·42
Sugary cereal	n/a	n/a	n/a	n/a	n/a	n/a
Meat/meat alternates	0·03	–0·42, 0·35	0·87	–0·003	–0·36, 0·36	0·99

Bold values represent statistically significant.

*CACFP serving sizes for 3–5-year-olds are as follows. At breakfast, milk = 6 fluid ounces; fruit, vegetable or 100 % juice = ½ cup; grains = ½ slice bread, ½ serving roll, biscuit or muffin, ¼ cup cooked grains, ½ cup cold flake cereal or ¾ cup puffed cereal; and meat/meat alternates = ½ ounce of meat, fish, tofu/alternate protein product or cheese, ½ large egg, 1/8 cup cooked dry beans or peas, 1 tbs nut butter, 2 ounces yogurt or ½ ounce nuts/seeds. At lunch, milk = 6 fluid ounces; fruit = ¼ cup; vegetables = ¼ cup; 100 % juice = ½ cup if served; grains = ½ slice bread, ½ serving roll, biscuit or muffin, ¼ cup cooked grains; and meat/meat alternates = 1·5 ounces of meat, fish, tofu/alternate protein product or cheese, ¾ of an egg, 3/8 cup of cooked beans or peas, 3 tbs peanut butter or 6 ounces yogurt. At snack, milk = 4 fluid ounces; fruit or vegetable = ½ cup; grains = ½ slice bread, ½ serving roll, biscuit or muffin, ¼ cup cooked grains, ½ cup cold flake cereal or ¾ cup puffed cereal; and meat/meat alternates = ½ ounce of meat, fish, tofu/alternate protein product or cheese, ½ large egg, 1/8 cup cooked dry beans or peas, 1 tbs nut butter, 2 ounces yogurt or ½ ounce nuts/seeds.

†Generalised estimating equations adjusted for clustering of repeated observation days within providers. Estimates of changes in specific types of grain products (whole grains, refined grains, grain-based desserts and sugary cereals) adjusted for overall changes in grain servings.

improvements in children's dietary intake, stronger standards, such as those proposed by the Institute of Medicine[24], may be necessary.

The study's quasi-experimental design and measurement of children's actual consumption served as strengths, but there were also several limitations. Our sample was small, which may have both resulted in non-representative results regarding both children's baseline intake and their changes in intake, as well as reduced power to detect significant changes; it also precluded us from conducting multi-level analyses of potential predictors of adoption of the CACFP changes at the provider level. Our study was also limited to the city of Boston, and thus it is unknown whether these results could be generalisable to other cities or locales. Without a comparison group of FCCHs that did not experience CACFP meal pattern revisions, we cannot be sure that any changes observed were solely due to CACFP meal pattern changes, although we did monitor other policies and programmes related to nutrition for FCCH providers during this time and found no other

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intervention programmes or policies that were accessible to FCCHs in our sample. Our measurement approach for estimating children's dietary intake may have resulted in bias. It is possible, for example, that participating providers may have omitted the photographs of less healthy foods and beverages. However, in a survey conducted concurrently with these FCCH providers (data not shown), we found that while providers were generally aware that CACFP meal pattern standards were changing, they were largely unaware of the specific changes they were expected to make (e.g. serve whole grains once a day when grains are served). It is also likely that our method may have missed when children obtained second or third servings of an item, resulting in potential underestimation of intake. While on site, weighed pre/post-measurements of plate waste would have been optimal; this method may have been still highly reliable and allowed us to collect estimates of intake without intruding on FCCH providers' privacy, which was a major concern of providers. Additionally, our estimates of baseline serving and consumption of different food groups in this sample were similar to the corresponding estimates of food and beverage consumption in prior studies of CACFP-participating child care centres[25–27], bolstering the idea that the estimation method was likely adequate.

Conclusions

In this sample of Boston family child care providers, children's dietary intake improved on some of the domains targeted by the updated CACFP meal patterns – specifically, the intake of whole fruits and whole grains increased, while that of refined grains may have decreased during lunch. Improvements in other domains, however, were not observed. While additional studies in other locales and child care settings are needed to further evaluate the impact of the CACFP meal pattern policy change, these results also suggest that providers may need more assistance in meeting the new standards.

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