

Are Mealtime Best Practice Guidelines for Child Care Centers Associated with Energy, Vegetable, and Fruit Intake?

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Abstract

Background: Mealtime best practices for obesity prevention in child care have been developed from experimental studies and expert opinion. Our objective was to describe adherence to best practices in child care centers and to evaluate the association between mealtime practices and children's dietary intake.

Methods: We conducted an observational study of 349 preschoolers, ages 36 to 72 months, from 30 child care centers in Cincinnati, Ohio (November 2009 to January 2011). Trained observers recorded providers' behaviors related to six mealtime best practice recommendations and documented children's intake ($n=60$ group lunches). General linear mixed models were used to evaluate the association between practice use and children's total energy (caloric consumption) and fruit and vegetable consumption.

Results: Adherence to individual mealtime best practices was variable (0%–77%). Staff sitting with children at lunch was associated with lower energy intake and higher vegetable intake. Staff eating some of the same foods was associated with higher energy intake and higher vegetable intake. Staff encouraging children to try new/less-favorite foods more than once was associated with lower fruit intake. Staff having general conversations with children (not addressed in recommendations) was associated with lower vegetable intake. Family-style meal service, staff talking about healthy foods, and staff helping children assess hunger before seconds were not significantly associated with intake.

Conclusions: Few mealtime best practices were associated with dietary intake. Given the number of meals children consume in child care and the prevalence of childhood obesity, efforts to identify mealtime practices that improve children's dietary intake are crucial for obesity prevention.

Introduction

The preschool years have been highlighted as a critical period for obesity prevention.^{1–4} Children who become overweight/obese during this time have a fivefold increased risk of being overweight/obese adults.⁴ Furthermore, evidence suggests that dietary preferences are established during this time and track into adulthood.^{5,6} Preschool children typically consume a narrow variety of foods, which includes low quantities of vegetables.⁷ This is thought to be secondary to young children's innate preference for sweet foods,⁸ avoidance of new foods,⁹ and limited exposure to fruits and vegetables by caregivers.¹⁰ To address the obesity epidemic for this young age group it is recommended that caregivers provide children with repeated exposures to fruits and vegetables and enthusiastically

model consumption, as young children are influenced by adult dietary behaviors.¹¹ Furthermore, to avoid excess energy consumption, it is recommended that caregivers serve young children age-appropriate portion sizes or allow children to self-serve,¹² as studies suggest that disproportionate serving sizes promote excess energy consumption beginning as young as two years old.^{13,14}

While parental involvement is key in guiding dietary choices and modeling healthy behaviors, parents are not the only caregivers involved in mealtimes. The majority (61%) of children three to six years of age are enrolled in child care centers,¹⁵ where they spend an average of 33 hours per week¹⁶ and consume up to two-thirds of their daily energy.¹⁷ As a result, child care providers play a significant role in preschoolers' eating, through both their verbal and nonverbal cues during meals.

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Best practices for child care mealtime environments that support obesity prevention are outlined by the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) program. These best practices were derived from experimental studies and expert opinion; few studies have examined them in real-world settings.¹⁸ Recommended best practices related to staff behaviors at mealtimes include (1) staff serve meals family style, allowing children to self-serve, (2) staff sit with children at meals, (3) staff eat the same foods as children, (4) staff informally talk with children about healthy foods, (5) staff encourage children to try new or less favorite foods, and (6) staff help children determine if they are still hungry before serving seconds.¹⁹ Seven studies in child care centers have examined child care providers' adherence with these best practices, including both staff behaviors and comments at meals.^{12,20–25} Collectively, the studies indicate wide variation in mealtime environments and staff behaviors. Three of the studies relied on child care centers to self-report on mealtime practices through a survey and had modest response rates (41%–45%).^{12,20,21} Two of the studies examined how execution of best practices relates to children's actual dietary intake.^{24,25} Of the two, only one used direct observation²⁵ and both were conducted in the Netherlands, limiting their generalizability to US children. Thus, the aim of the current study was to describe adherence with mealtime best practices in child care centers and to evaluate the association between use of child care best practices and children's dietary intake, specifically total energy (kcal) and servings of vegetables and fruits consumed.

Methods

Thirty licensed, full-time, child care centers were randomly selected from a list of all eligible child care centers in Hamilton County (Cincinnati area), Ohio to participate in an observational study of physical activity and nutrition environments in child care—the Preschool Eating and Activity Study (PEAS).²⁶ Two classrooms per child care center were randomly selected to participate. Eligible children were between the ages of 36 and 72 months and had been enrolled at the center for at least one month. Written informed consent was received from the directors at each child care center and from a parent of each participating child prior to study commencement. Data collection occurred on a consecutive Tuesday and Wednesday at each of the 30 centers between November 2009 and January 2011.

Three observers were present on each day. Two observers separately recorded the foods and beverages consumed by three children each during lunch (total of six children observed during each lunch). Observation was performed using a validated protocol for visual estimation of dietary intake developed by Ball et al.²⁷ One additional observer recorded the mealtime practices and teacher behaviors using a form adapted from the validated Environmental Policy Assessment and Observation instrument (EPAO).²⁸ Demographics of child participants were collected via parent

questionnaires. Energy intake during lunch and servings of whole vegetables and fruits consumed were quantified using the Nutrition Data System for Research (NDSR) software (versions 2009, 2010, and 2011), developed by the Nutrition Coordinating Center at the University of Minnesota (Minneapolis, MN). For this analysis, fried vegetables and vegetable juice were not counted towards servings of whole vegetables, and fried fruits (e.g., fried pineapples) and fruit juice (including 100% juice) were not counted towards servings of whole fruits.

General mixed linear models with child care center as a random effect were used to evaluate the association between teacher mealtime behaviors and children's dietary intake. A Tukey-Kramer adjustment was used to test between individual levels of the main effect, when significant. Teacher variables were matched to the child, as appropriate for the center and classroom. For the majority of the dependent variables there was just one response per class. For “Sitting with children at lunches,” “Modeling healthy eating,” and “Talking with children at lunches,” the response was considered positive if at least one teacher was performing the best practice during the lunch. Statistical software SAS (SAS version 9.3; SAS Institute Inc., Cary, NC) was used for data management and analysis. A *p* value of <0.05 was considered statistically significant. The study was approved by the institutional review board at Cincinnati Children's Hospital Medical Center.

Results

Demographics

Thirty full-day child care centers participated (10% refusal rate) in the study, involving a total of 60 classrooms and 349 preschoolers between 36 and 72 months of age. Characteristics of the child participants are presented in Table 1. The 30 child care centers included 12 (40%) for-profit centers, 9 (30%) religious-affiliated centers, and 8 (27%) Head Start centers. Twenty-five (83%) of the centers participated in the Child and Adult Care Food Program (CACFP).

Mealtime Practices

Lunches were 27 ± 7 minutes in duration [interquartile range (IQR): 21–32 minutes]. The majority (53%) of centers had a commencement to the lunch (e.g., a blessing, song, or shared saying), which occurred before children were allowed to eat. Children had to wait for everyone to be served prior to eating in 52% of centers, waiting a median of 4 minutes (IQR: 1–8 minutes). During 34% of lunches, slower eaters (“stragglers”) were pressed to finish their food so the rest of the class could move on to the next activity. Fruit was served at 93% of lunches and vegetables were served at 100% of lunches. Table 2 lists the types of fruits and vegetables served by frequency.

In regards to best practices (Table 3), family-style service occurred at 12% of lunches. At least one staff member sat with children at 29% of lunches and ate some of the same foods as the children at 66% of lunches. Staff used

Table 1. Demographic Characteristics of Participating Children

Child characteristic	Sample size ^a	Frequency
Male, n (%)	349	166 (48%)
Age (in years), mean (SD)	349	4.3 (0.7)
Eligible for subsidized lunches through CACFP, n (%)	334	195 (58%)
Race, n (%)	336	
White		140 (42%)
Black		139 (41%)
Other ^b		57 (17%)
BMI, mean (SD)	343	16.4 (1.8)
BMI z-score, mean (SD)	326	0.5 (1.0)
Household income (\$)	322	
<25,000		129 (40%)
25,000 – 50,000		72 (22%)
>50,000 – 75,000		27 (8%)
>75,000 – 100,000		23 (7%)
>100,000 – 150,000		35 (11%)
>150,000		36 (11%)
Highest level of parent education	333	
≤ high school		62 (19%)
Some college/associate's/technical trade		141 (42%)
College graduate		76 (23%)
Graduate School		54 (16%)
Household composition	331	
2-parent household		167 (50%)
1-parent household		164 (50%)

^aDemographic data was gathered through parent surveys and staff measurement of children. Sample sizes vary due to missing responses.

^b“Other” includes the following races: Asian, American Indian, mixed race, or other category.

CACFP, Child and Adult Care Food Program.

Table 2. Type and Frequency of Fruits and Vegetables Served at Lunches (N = 60) in Child Care Centers

Fruit	Frequency	Vegetable	Frequency
Peaches	18%	Green beans	17%
Pineapples	17%	Peas	10%
Fruit cocktail	13%	Broccoli	10%
Pears	12%	Salad	10%
Oranges	10%	Corn	10%
Banana	7%	Carrots	8%
Apple	7%	Fried potatoes	8%
More than one type	7%	Mixed vegetables	7%
No fruit	7%	Beans	5%
Applesauce	3%	Baked potatoes	5%
		Collard greens	3%
		Tomato soup	3%
		Celery	2%
		Zucchini	2%

Children consumed the least amount of energy with family-style lunches (mean of 291 kcal). However, the difference was not statistically significant in pairwise comparisons to pre-plated lunches (mean of 349 kcal, $p=0.5$) or packed lunches (mean of 423 kcal, $p=0.43$). It was significantly different from mixed service lunches (lunches where a pre-plated meal was provided but additional servings or specific foods were available family style) (mean of 412 kcal, $p=0.01$) (Table 3). Average vegetable intake was 0.5 servings with family-style service, 0.3 servings with pre-plated service, 0.2 servings with packed lunches, and 0.6 servings with mixed service. Only pairwise comparison of pre-plated versus mixed service produced a statistically significant difference ($p=0.006$).

Staff sitting with children for most of the lunch was associated with lower energy intake (313 kcal vs 368 kcal, $p=0.04$) and higher vegetable intake (0.5 servings vs 0.3 servings, $p=0.03$). Staff eating some of the same foods was associated with higher energy intake (375 kcal vs 309 kcal, $p=0.008$) and higher vegetable intake (0.4 servings vs 0.3 servings, $p=0.04$). There were no statistically significant differences in fruit consumption by meal service type, whether staff sat with children, or whether staff ate some of the same foods.

The best practice of staff talking about healthy foods at meals was not significantly associated with energy, fruit, or vegetable intake. Staff talking with children about topics unrelated to food, a behavior not specifically addressed in mealtime best practice recommendations, was associated with children consuming lower amounts of vegetables (0.3 servings vs 0.5 servings, $p=0.02$). Staff talking with

lunch as an opportunity to talk about healthy foods during 33% of lunches and encouraged children to consume new or less-desirable foods one or more times at 77% of lunches. With regard to second helpings, staff asked if children wanted seconds in 78% of lunches. Staff were never observed asking children if they were still hungry before serving seconds. In 37% of lunches, staff gave second helpings to children who had not asked for them.

Dietary Outcomes

Overall, children consumed an average of 349 kcal, 0.4 servings of vegetable, and 0.5 servings of fruit at lunch.

Table 3. Relationship between Child Care Mealtime Best Practices and Dietary Intake

	Frequency (% of children)	N ^a	Energy intake (kcal)		Vegetable intake (servings)		Fruit intake (servings)	
			Mean (SE) ^f	P value ^b	Mean (SE) ^f	P value ^b	Mean (SE) ^f	P value ^b
Overall sample		349	354 (9)		0.4 (0.02)		0.5 (0.03)	
Mealtime practices								
<i>1. Meal service style</i>		349		0.02		0.01		0.08
Family style (children self-serve)*	12%		291 (36) ^d		0.5 (0.09) ^{d,e}		0.5 (0.1)	
Pre-plated (staff-serve)	70%		349 (17) ^{d,e}		0.3 (0.04) ^d		0.5 (0.05)	
Packed lunch (parent-provided)	4%		423 (80) ^{d,e}		0.2 (0.2) ^{d,e}		1.1 (0.2)	
Mixed (family and pre-plated) ^c	13%		412 (34) ^e		0.6 (0.09) ^e		0.4 (0.10)	
<i>2. Sitting with children at lunch</i>		349		0.04		0.03		0.5
Staff sits most of meal*	29%		313 (25)		0.5 (0.07)		0.5 (0.07)	
Staff doesn't sit most of meal	71%		368 (18)		0.3 (0.05)		0.5 (0.05)	
<i>3. Modeling healthy eating</i>		349		0.008		0.04		0.8
Staff eats some of the same food*	66%		375 (18)		0.4 (0.05)		0.5 (0.05)	
Staff doesn't eat same food	34%		309 (22)		0.3 (0.06)		0.5 (0.07)	
<i>4. Talking with children at lunch</i>		349		0.06		0.4		0.9
Staff talk about healthy food*	33%		377 (20)		0.4 (0.06)		0.5 (0.06)	
Staff don't talk about healthy food	67%		339 (17)		0.4 (0.05)		0.5 (0.05)	
Staff have general conversation	67%	349	366 (17)	0.05	0.3 (0.05)	0.02	0.5 (0.05)	0.07
Staff don't talk	33%		324 (22)		0.5 (0.06)		0.6 (0.06)	
<i>5. Encouraging new or less-favorite foods</i>		243		0.7		0.5		0.008
Staff encourages three or more times*	22%		344 (29)		0.4 (0.08)		0.4 (0.09) ^e	
Staff encourages two times*	29%		343 (27)		0.4 (0.08)		0.4 (0.09) ^e	
Staff encourages one time*	25%		311 (29)		0.5 (0.08)		0.7 (0.09) ^d	
Staff doesn't encourage	23%		337 (29)		0.3 (0.08)		0.5 (0.09) ^{d,e}	
<i>6. Providing second servings</i>		312						
Staff helps child assess hunger before seconds*	0%		-	-	-	-	-	-
Child gets seconds even though they did not ask	37%		357 (22)	0.8	0.3 (0.06)	0.06	0.5 (0.06)	0.9
Child does not get seconds when they don't ask*	63%		361 (19)		0.4 (0.06)		0.5 (0.06)	

^aData were gathered from parent surveys and staff measurement of children. Sample sizes vary due to missing responses.

^bP value is for the main effect in the mixed model analysis.

^cMixed lunches: Lunches where a pre-plated meal was provided but additional servings/specific foods were available family style.

^{d,e}For variables with more than two categorical options, pairwise comparisons within each column that were statistically significant (i.e., p value < 0.05) are indicated by different letters in superscript.

^fSE is the standard error.

*Starred items are considered best practice.

children had no association with children's fruit intake (Table 3). Staff gently encouraging children to try new or less-favorite foods once was also not significantly associated with higher fruit intake; however, repeat encouragement (two or more times) was associated with a significant decrease in fruit intake (Table 3). There were no significant associations between staff encouragement to try new or less-favorite foods and energy consumption or vegetable intake. Because we never observed staff determining if children were still hungry before providing seconds, we were unable to look at the association of this best practice with children's dietary outcomes. Children being given seconds when they did not ask for them was not associated with higher energy, vegetable, or fruit intake.

Discussion

In general, we found low adherence with mealtime best practice recommendations. Few centers in our study (12%) served family-style lunches. Our rates are considerably lower than rates of family-style service obtained through self-report in Oklahoma and Western states (31%–49%);^{12,20} however, they are in line with what has been directly observed in North Carolina (8%).²³ The differences could be a result of geographic variation in practice secondary to state licensing requirements and/or cultural norms, or due to misclassification among studies using self-report rather than direct observation. Center respondents self-reporting usual practices may misinterpret what is meant by family style (*e.g.*, including lunches where staff and children eat together and food is placed in bowls on dining table but where staff still serve the children initial portions and/or seconds) or may overreport children's opportunities for self-service (social desirability bias).

Staff sitting with children for most of the lunch (29%) was also lower than comparison studies (56%–81%).^{20–25} Sixty-six percent of staff ate some of the same foods as the children ate, which is on the higher end of the range reported in the literature (27%–79% eating the same foods).^{20–25} Similar to family-style lunches, the variability for sitting with children and eating some of the same foods could be a result of geographic variation or due to assessment with self-report. Staff only talked about healthy foods at a third of lunches (33%), which is consistent with previous reports (23%–88%).^{20–23,25} We did not observe any lunches where a child was asked if they were still hungry prior to being served seconds. Other studies have found this best practice to occur 22%–43% of the time.^{20,23,25} Moreover, staff gave seconds even when a child did not ask for them during a third (37%) of lunches. This typically occurred when an index child asked for seconds and the staff member served the index child as well as any peers in the vicinity who had finished their initial serving. We found this occurred more frequently in our study compared to past literature (17%–28%).^{24,25}

The mealtime practice with the best adherence was encouraging children to try new foods (77% of lunches). This

is congruent with what has been both observed and self-reported in child care centers in the United States,^{20,23} but is significantly higher than what has been observed in a study performed in The Netherlands (5%).²⁵

Only two mealtime best practices were associated with increased vegetable consumption. Staff sitting with children at lunch and staff eating some of the same foods were both associated with higher vegetable intake. These findings differ from a study by Gubbels et al. that found no association between these staff behaviors and vegetable consumption.²⁴ However, our findings are consistent with experimental literature, which has demonstrated that adults using enthusiastic modeling increases preschoolers' willingness to try unfamiliar or less-favorite foods.²⁹ The best practice of staff encouraging children to try a new or less-favorite food resulted in a mixed pattern with regards to fruit intake. Encouragement once led to an upward, yet nonsignificant, trend in both vegetable and fruit consumption. However, repeat encouragement was associated with lower fruit intake. To our knowledge, no observational study has examined verbal encouragement of new foods on a continuous scale as opposed to a binary outcome. The experimental literature, however, has shown that children consume less foods in general when they receive excessive cues from caregivers.³⁰ An alternative explanation is that if children aren't eating the fruit, caregivers might be more likely to offer it. Thus, the direction of the effect may be from child to caregiver rather than caregiver to child.

Consistent with previous findings, we found that staff talking about healthy eating was not significantly associated with intake.²⁴ However, staff talking about nonfood-related topics during lunch, a behavior not addressed in best practice recommendations, was associated with decreased vegetable consumption and a downward, albeit nonsignificant, trend in fruit consumption. A potential explanation for these negative outcomes is that children may become so engaged in conversation that new or less-favorable foods are ignored while high-calorie, well-liked foods are consumed automatically.

Two mealtime best practices had significant associations with energy consumption: staff sitting with children at lunch was associated with lower energy consumption, and staff eating some of the same foods was associated with higher energy consumption. It is unclear why these two staff behaviors would have the opposite effect on energy consumption. We speculate that a provider that was sitting with children but not eating could have served as a negative role model, inadvertently discouraging surrounding children from eating. It is important to note, however, that the energy intake associated with both of these staff behaviors was close to the lunchtime calorie target recommended in dietary guidelines (338 kcals for preschoolers).³¹

Family-style meal service was not significantly associated with energy, vegetable, or fruit consumption when compared directly to pre-plated or packed lunches. However, nonsignificant, positive trends for lower energy

consumption and higher vegetable consumption were present. Our ability to detect a statistically significant difference was likely hindered by the few centers using this service style (12%). Family-style service is considered a best practice, as it provides children the opportunity to serve themselves based on internal hunger cues.¹⁷ It also provides opportunities to practice developmental and social skills at mealtimes. Extant experimental studies have shown mixed results regarding the association of family-style meal service with energy intake,^{14,32,33} with some finding lower energy intake^{14,33} and others showing no association.³²

There were several limitations to this study. First, we were unable to determine causality or mechanism from this observational study. Second, only one lunch was observed on a single day for each child involved. A child's dietary intake varies from day to day as well as from meal to meal. Menus also vary from day to day at child care centers. This study was not designed to determine children's usual dietary intake or a center's usual dietary offerings. It was designed to study the associations between teacher behaviors and dietary intake at lunch. The type of fruit or vegetable offered, children's individual tastes, and their prior experience with that fruit or vegetable may have influenced children's consumption.¹⁰ We had limited power to detect statistically significant associations between mealtime practices and children's intake, as we did not observe enough variability in some mealtime practices (e.g., family-style service, encouraging new/less favorite foods). Lastly, all child care centers were located within southwestern Ohio, limiting the generalizability of our results.

Conclusions

This is the first observational study to our knowledge to directly measure mealtime environments and children's associated dietary intake during meals in child care centers in the United States. Our study demonstrates that adherence with individual mealtime best practices varies considerably. Additionally, few best practice guidelines are associated with improved dietary outcomes. Given the percentage of children who consume a majority of their dietary intake in child care and the magnitude of the obesity epidemic, additional research in this area is necessary. Collaborations between child care providers, developmental and obesity-trained clinicians, dietitians, psychologists, and researchers are needed in order to identify modifiable staff behaviors within the child care mealtime environment that promote healthy nutrition and growth.

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Author Disclosure Statement

No competing financial interests exist for any of the authors.

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