

Preschool Children in Childcare Settings Do Not Consume a Healthy Diet Despite Menus that Meet Recommended Dietary Standards

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Abstract: *Purpose/Objective:* To compare preschool lunch menus that meet dietary guidelines to what is actually served and consumed.

Methods: Fifty-two preschool children (mean±SD, age 3y and 10m ± 8m) from a university early childhood center participated in the 10-week study. Dietary intake was measured by a registered dietitian using direct observation for pre and post meal analysis. Energy and nutrient content was completed using Food Processor Nutrition Analysis by ESHA.

Results: There was a significant ($p<0.05$) difference for total kilocalories (kcal) between what was on the menu (448 ± 130) and to what was served to the children (523 ± 148) compared to what was consumed (361 ± 178) by the children. There was a significant ($p<0.05$) difference for grams of fat between what food was listed on the menu ($16.0 \pm 8.7g$), the food served to the children ($21.2 \pm 9.7g$), and the food consumed ($14.5 \pm 10.0g$) by the children. There was a significant ($p<0.05$) difference for grams of carbohydrate between what food was listed on the menu ($55.3 \pm 18.9g$) and the food served to the children ($56.5 \pm 20.5g$) compared to what was consumed ($38.5 \pm 21.7g$) by the children. Children consumed only 46.9% of the vegetables, 88.9% of dairy products, 82.0% of fruits, 81.8% of grains and 72.8% of meats served, and 77.9% of all fats/sweets served to them at lunch.

Conclusion: The results indicated that menus that meet recommended dietary standards do not translate into what children are served or consumed, in particular, for vegetables.

Keywords: Dietary Intake, Early Childhood, Served, Food Preference.

INTRODUCTION

It is recommended that child-care facilities provide half to two-thirds of the Recommended Dietary Allowances for children in full-day child care [1], placing a great deal of responsibility on the provider to ensure nutritionally adequate, healthful food. Through the United States Department of Agriculture (USDA) Child and Adult Care Food Program (CACFP) [1], over 3.2 million children receive nutritious snacks and meals while in some form of child care, including Head Start [2]. The CACFP monitors and reviews the menus to ensure that the food served meets certain meal pattern requirements for nutrition. The CACFP is a USDA food assistance program that provides reimbursement to child-care providers for meals and snacks. This program ensures nutritious food is on the menu, but there is not an evaluation of the nutrition that children actually consume. Thus, it is difficult to determine if children are actually eating a healthy diet. Although childcare menus must meet strict nutrition guidelines,

what is actually eaten by children is not restricted. In fact, limited research indicates that childcare centers' menus are different from the food actually served and consumed [3-6]. Despite the appearance that children are provided nutritious meals, there is actually no assurance that what the children are served or consumed meets dietary guidelines, which may lead to poor nutrient intake (increased fat and sugary food, less fruit and vegetables) by children and contribute to children becoming overweight or obese. There are few studies that have actually measured dietary intake of children in a child care setting. Collectively, to date, the research determining dietary intake of children in child care settings have been of limited duration (one to five days) [4, 7-10] and used dietary measures with wide variations (recall, self-report, survey) [4, 7-11], making it difficult to accurately determine the dietary intake of children. There have been no longer term studies using direct observation measures to determine the actual dietary intake of children. Therefore, the purpose of this study was to compare preschool menus that meet dietary guidelines to what is actually served and consumed by preschoolers.

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METHODODOLOGY

Participants

Children

Fifty-two preschool children (mean \pm SD, age 3y, 10m \pm 8m; Male, N=26, 4y, 0m \pm 8 m; Female, N=26, 3y, 7m \pm 6m) from a university early childhood center participated in the 10-week study. The preschool children were 50% Caucasian, 35% African American, and 15 percent Asian. There were no known food allergies and/or special needs identified as “dietary restrictions” that required food service staff to make any adjustments prior to serving the child. Prior to the start of the study, parents signed an informed assent for their children to participate. The teachers signed an informed consent form prior to participation. The study was approved by the researchers’ university Internal Review Board.

Childcare Center

The Early Childhood Center (ECC), located on a university campus, provides full-day, year round early childhood care and education for the children of students, faculty, staff, and others in the University community, ages two through five, Monday - Friday. All food was prepared daily by the university dining services and transported in bulk to the ECC, a distance of less than half a mile. Food was divided into separate amounts and delivered to each of the three classroom by a classroom aid. Using that day’s menu, which listed the serving sizes for each food, teachers pre-plated each child’s plate using standardized measure cups and spoons. All children ate lunch in the classroom.

Nutrition Research Staff Training

All nutrition research staff attended a 3 hour training session conducted by a registered dietitian (RD), where the procedures were described and demonstrated. The research staff practiced determining the type and portion size from sample pre- and post-meal photos previously prepared by the RD. The RD prepared sample lunch meals from foods and beverages available to the children. These prepared meals were used as a standard for assessing the ability of nutrition staff to identify foods and estimate portion sizes from digital photographs. The portion size of all foods and beverages was measured by the nutrition staff both before and after removing a specified amount in order to simulate consumption of the food. Prior to collecting data on study participants (preschool children), nutrition research staff were required to satisfactorily evaluate

digital photographs from 20 sample meals. Energy intake for each of the 20 meals was then calculated using ESHA Food Processor Nutrition Analysis Software. In order to ensure accuracy and reliability of dietary analysis by the research staff research staff were required to produce energy expenditure estimates from digital photography that were within 5% of actual energy intake for all 20 sample meals. Any nutrition staff not meeting this standard received additional training from the RD before being re-evaluated using 20 new meals until the standard was achieved. Additional training and re-evaluation was required for staff failing to meet this standard. Inter-rater reliability coefficients for digital photograph assessments were \geq 0.95.

Data Collection

Dietary Assessment Using Direct Measures

More detailed explanation can be found here [12]. Briefly, after obtaining their food, each child reported to the research station located in a corner of the classroom and placed their tray in a docking station to standardize distance and the camera angle for digital photographs. Two digital still photographs were taken by a digital camera (Canon Power Shot, Melville, NY) approximately 30 inches above the tray. One photograph was taken from directly above the tray (90° angle) and another was taken at a 45° angle to maximize depth perception and improve identification of specific food and beverage items. Research staff placed the date, meal (i.e., lunch), participant identification number, and when necessary, food description (i.e., skim vs. whole milk) on a small card and the card was placed on the food tray and photographed. Condiments were served in individual bowls to assess portion size. Additionally, standard measures for both liquids and solids were included in the photo to guide the assessment of portion size. After completing their meal, the children returned to the research station where the identical photographic procedure was repeated to verify the quantity of food consumed. If second helpings were obtained, the photographic procedure was repeated with the second round of food and beverage items. All digital photographs were downloaded to a secure server for analysis using ESHA Food Processor Nutrition Analysis Software, which is a computer based software application that analyzes nutrition in food, menus and recipes using the comprehensive Food and Nutrient Database [13]. Each meal was analyzed by a trained research staff as described above. ESHA calculates

nutrition values and provides nutritional information for ingredients, foods, meals or an entire day in report and analysis formats. The nutrition database includes more than 75,000 ingredient combinations and over 10,000 foods including brand name products. This procedure has been successfully used by others [14, 15].

Student Taste Preference and Satisfaction

A food preference survey was administered orally by a registered dietitian to children immediately after each meal to assess if each food was Yummy (happy face), Yucky (sad face) or OK (no expression). The registered dietitian would ask each child separately about each food served and to point or say one of the three options. Each response was confirmed by the investigator before being recorded.

Dietary Menus

A five week cycle menu was used; we collected data for two complete cycles. The five week menus met the required standards set forth by the USDA Child and Adult Care Food Program (CACFP) [1, 16].

Data Analysis

Data was measured to determine the menus, the mean quantity of food served to children and the mean quantity of food consumed by the children and compared with the menus. Descriptive statistics were calculated including means and standard deviations. ANOVA was performed to determine whether differences between menu, food served, and food consumed existed. All statistical analyses were performed using SAS statistical software, (version 9.3, 2010, Statistical Analysis Systems, Cary, NC). Data is reported as mean \pm standard deviation (SD).

RESULTS

School Menus, Food Served and Consumed

There were significant ($p < 0.05$) differences for total kilocalories (kcal), percent and grams of carbohydrates, fat and proteins between what was on the menu compared to both served and consumed, with consumed being significantly lower than both the menu and served (Table 1). There were also significant differences for vitamins and minerals between what was on the menu compared to both served and consumed. Consumption of vitamins was significantly lower than both the menu and served (Table 1). Consumption of vegetables (46.9%) was significantly ($p < 0.05$) lower than dairy (88.9%), fruits (82%), grains (81.8%), and meats (72.8%).

Food Color and Preferences

The majority of food served was white (38.1%), brown (20.4%), or yellow (14.2%) with minimal green (10.7%), orange (10.2%), or red (6.1%) foods. Yummy (75.2%) was most often used by children to describe the food, followed by yucky (17.2%) and okay (7.6%).

DISCUSSION

To our knowledge this is the first long-term study using direct measures to determine the actual dietary intake of children. We found that the amount of food consumed by the children was significantly less than the menu and served amounts, indicating that children were not meeting the dietary recommendations as intended, which could potentially contribute to long-term health consequences. We also found that the consumption of vegetables was significantly lower than other food groups.

The menu used in the current study met dietary standards of the CACFP, which monitors and reviews the menus to ensure that the food served meets certain meal pattern requirements for nutrition based on the DGA. However, similar to shorter dietary studies using observation [10, 17], the results from this study indicate that what is served and is consumed can vary greatly from the menu. The results suggest that menus that meet dietary guidelines may not ensure children are eating a balanced diet. There may be several reasons why the children ate significantly less amount of food than what was served. For example, it has been shown that parents play an important role in shaping a child's food preference, even at an early age [18, 19]. Other reasons that may lead to a decrease in food consumption at preschool are social economic [20], cultural norms, home environment [20], the scope of knowledge about healthy eating [21], parents and children attitudes [18, 19].

The investigators made several important observations that could have potentially influenced the dietary intake by the children in this study. In this study the teachers used the pre-plated method to serve lunch instead of the family style method of allowing the children to take ownership and serve themselves the food selections was not fully implemented. Teachers placed all the food on the child's plate before the child sat down to eat. This may have been due to time constraints or a perception that it is easier to serve the food to children. The fact that teachers served the food rather than allowing the children to serve themselves

Table 1: Lunch Nutritional Analysis of Food from Menu, Served, and Consumed by Preschoolers Measured in a 10-Week Food Observation Study (n=52)

Energy and Nutrition Levels	Menu	Served	Consumed
Primary energy source			
Energy (kcal)	448 ± 130	523 ± 148 ^a	361 ± 178 ^{a,b}
Total carbohydrates (g)	55.3 ± 18.9	56.5 ± 20.5	38.5 ± 21.7 ^{a,b}
Total carbohydrates (%)	49.1 ± 10.0	43.2 ± 11.2 ^a	45.1 ± 15.8 ^{a,b}
Total fat (g)	15.9 ± 8.7	21.2 ± 9.7 ^a	14.5 ± 10.0 ^{a,b}
Total fat (%)	30.8 ± 9.4	35.1 ± 10.1 ^a	33.6 ± 13.9 ^a
Total protein (g)	21.7 ± 5.7	27.9 ± 10.6 ^a	19.5 ± 11.8 ^{a,b}
Total protein (%)	20.1 ± 5.3	21.7 ± 7.2 ^a	21.3 ± 8.1 ^a
Fats and lipids			
Cholesterol (mg)	54.7 ± 41.1	100 ± 153 ^a	57.6 ± 49.9 ^b
Total saturated fat (g)	5.9 ± 3.1	8.2 ± 4.0 ^a	5.8 ± 4.1 ^b
Fiber			
Total dietary fiber (g)	5.2 ± 3.7	5.5 ± 4.7	2.8±2.6a ^b
Vitamins			
Vitamin A (IU)	2,536 ± 3875	2,992 ± 4264 ^a	1,502 ± 3289 ^{a,b}
Thiamin, B1 (mg)	0.4 ± 0.2	0.4 ± 0.6	0.3 ± 0.2a ^b
Niacin, B3 (mg)	4.0 ± 2.1	5.2 ± 4.1 ^a	3.6 ± 3.8a ^b
Vitamin B6 (mg)	0.3 ± 0.2	0.5 ± 0.9 ^a	0.3 ± 0.2 ^b
Vitamin B 12 (µg)	1.3 ± 0.5	1.6 ± 1.2 ^a	1.2 ± 0.9a ^b
Minerals			
Calcium (mg)	380 ± 136	386 ± 156	292 ± 158 ^{a,b}
Iron (mg)	3.1 ± 1.4	3.6 ± 1.9 ^a	2.2 ± 1.9 ^{a,b}
Magnesium (mg)	55.3 ± 22.6	58.9 ± 23.2	38.5 ± 20.3 ^{a,b}
Potassium (mg)	667 ± 270	755 ± 340 ^a	501 ± 306 ^{a,b}
Phosphorous (mg)	381 ± 132	396 ± 150	293 ± 159 ^{a,b}
Sodium (mg)	909 ± 485	1,020 ± 527 ^a	655 ± 446 ^{a,b}
Zinc (mg)	2.2 ± 0.9	2.7 ± 1.7 ^a	1.9 ± 1.7 ^{a,b}

Values are mean ± SD. ^aSignificantly different from menu, p<0.05. ^bSignificantly different between served and consumed, p<0.05.

may have influenced the amount and frequency of the food children consumed. According to the Academy of Nutrition and Dietetics, Benchmarks for Nutrition in Child Care, it is recommended that childcare providers serve meals family-style as this method of service promotes proper modeling, encourages healthful eating, and provides control to the child compared to pre-plated meals [3, 6]. A potential barrier to the family-style method is that children are able to avoid serving themselves certain foods, in particular fruits, vegetables, and whole grains. Without the food on the child's plate, it is unlikely the child will consume it, resulting in the child not consuming the recommended

healthy diet. The reasons that children may not select the food are preexisting food preferences, distance from the food placed on the table, taste, appearance of the food, not serving the food themselves, lack of familiarity with the food, or childcare providers' feeding practices [6, 9, 16, 18, 21].

Although family-style encourages food to be passed around the table, not having the food on the plate can result in the child not being directly "exposed" to new foods during the entire meal. Pre-plated food discourages "ownership" of the meal thus decreasing the likelihood that new foods will be consumed. There

is also a potential difference in how caregivers interact with the child when the food is on the plate compared to when the food is in separate bowls on the other side of the table. These data suggest that a different approach to serving the food may be needed. For example, a possible solution may require children to serve themselves as they would in family-style but they are required at the beginning of the meal to take a portion size of their choice from all the foods and place it on their plate. By allowing the child to serve themselves a portion size of their choice they maintain "ownership" of the meal, but their "exposure" to the food is different because the food is on their plate in front of them for the entire meal [9]. By having the food on the child's plate the entire meal the caregiver may engage the child differently compared to if the food is on the other side of the table out of view. This approach to meal time may increase the child meeting the minimum dietary intake recommendations and to optimize child-care providers' feeding practices. Clearly, more research into how a child is served and the role that teachers play in a child's food consumption is warranted.

Another observation is the pairing of foods and how this affected the overall color of the food on the plate. In the current study, a majority of the food was white (38.1%) or brown (20.4%). The lack of color may be perceived by the children as less appealing, reducing the consumption [6]. Although the menus met the necessary servings of fruits and vegetables, the combination of how fruits and vegetables were paired with other foods could play a role in how appealing the food, in particular, fruits and vegetables are perceived by the children. For example, in this study a lunch pairing was a white fruit such as cut pears in light syrup with white rice, white bread, white whipped butter, and brown beef. This combination may not be very appealing compared to fresh strawberries, green lettuce, whole grain pasta with red marinara sauce. Perception of the meal could be an important factor in the consumption of foods. How foods are paired with other foods could have contributed to the reduction in the consumption of vegetables by the children [6, 11, 16].

CONCLUSION AND APPLICATION

In summary this is one of the longest studies directly measuring dietary intake of children. We found that the amount of food consumed was significantly less than the menu and served amounts, indicating that children were not meeting the dietary

recommendations as intended, potentially contributing to long-term health consequences. We also found that consumption of vegetables was significantly lower than other food groups.

Over three million children receive nutritious snacks and meals while in some form of childcare 24 [2], making them an ideal environment for improving dietary intake. The results indicated that menus that meet strict dietary standards do not translate into what children are served or consumed, in particular, for vegetables. Until more research is known, in order to increase dietary intake it is recommended that child care centers adopt family style serving method, increase nutritional knowledge of the teachers via workshops, and/or rearrange the pairing of foods on a plate to increase the perception of how appealing the meal is to children. One or all of these methods require minimal training costs and teacher preparation time.

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