

## **What Third Graders Select and Eat from School Lunches When They Have Choices**

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### **ABSTRACT**

#### **Objectives**

This study compares the food and nutrient content of school lunches offered to, selected and eaten by Third Grade students. The food and drink choices included a range of main dish and milk items, and a variety of fruits, vegetables, grain products and condiments.

#### **Methods**

Ninety-three Third Graders were included in the study. The nutrient content of the lunches offered was calculated from the sum of food choices for each menu item planned. For nutrient analysis, foods were weighted by the relative amount of each that was planned. The total amount of each menu item offered was averaged over the number of children expected for lunch. Lunch items offered were pre-measured daily. To estimate the content of lunches selected, several samples of unitary food items were weighed and averaged. Several probable serving sizes of bulk items available for self-service portioning from the variety bar were measured, weighed, and displayed for size comparison with bulk items on lunch trays. Lunches eaten by students were calculated by weighing each of the child's leftover foods and subtracting that amount from the weight of the same item selected.

#### **Results**

Third Graders most frequently selected entrees and milk but were much less likely to select vegetables. A minority who selected condiments regularly served themselves three times the per-child amount offered. Overall, the children ate only two-thirds of the calories offered from the lunches they selected. Lunches consumed were denser in total fat and saturated fat than lunches offered. Two-thirds of the students ate lunches meeting the National School Lunch Program (NSLP) standard for vitamin C; one-third met the vitamin A standard; and only 10% met the iron standard.

#### **Application to Child Nutrition Professionals**

Many elementary school children do not eat as much food during lunch as schools are mandated to offer. Research to determine factors that influence consumption would be useful. It is especially important that entree choices, when offered, be nutrient dense and relatively low in fat.

### **INTRODUCTION**

One of the U.S. Public Health Service's objectives for 2000 (U.S. Department of Health and Human Services [USDHHS], 1990) and 2010 (USDHHS, 2002) is to improve the nutritional quality of foods children eat in school. In 1995, the U.S. Department of Agriculture (USDA) released the School Meals Initiative (SMI), which mandated that schools participating in the National School Lunch Program (NSLP) offer lunches that meet one-third of the age-appropriate

1989 Recommended Dietary Allowance (RDA) for calories, protein, calcium, iron, and vitamins A and C by the 1996-97 school year (USDA, 1995). Additionally, the SMI required school meals to follow the 1990 *Dietary Guidelines for Americans* (DGA), which recommends limiting total fat to no more than 30% and saturated fat to less than 10% of calories; offering a variety of foods, including plenty of grain products, vegetables, and fruits; reducing sodium and cholesterol; and increasing dietary fiber (USDA & USDHHS, 1990).

These dietary standards were created in response to the 1992 *School Nutrition Dietary Assessment-I* (SNDA-I) study that found elementary school lunches offered by the NSLP averaged 37% of their calories from fat (Burghardt et al., 1995). In this study, six- to ten-year-olds reported eating school lunches found to contain 36% of their calories from total fat and 14% from saturated fat (Devaney et al., 1995). A 1998-99 follow-up study, *School Nutrition Dietary Assessment-II* (SNDA-II), found that the fat content of elementary school lunches served had decreased to 33% and saturated fat to 12% of calories (USDA, 2001).

The 1995 *Continuing Survey of Food Intakes by Individuals* (CSFII) showed that the foods six- to eleven-year-olds ate at school were more dense in saturated fat (Lin & Frazao, 1997) than foods eaten anywhere else. The study included a la carte and vending machine items, as well as foods served in school lunches. Calorie and nutrient intakes were based on the 24-hour dietary recalls of the children involved in the study. In 2002, USDA reported that only 14% of elementary schools offered salad bars of any kind during the school week (USDA, 2002). Schools with salad bars typically offer a larger variety of vegetables and fruits than other schools, but data are not available for children's consumption from such menus (USDA, 2002).

In 1995, the Oregon Department of Education (ODE) introduced a voluntary menu service system, Food Pyramid Choice Menus (FPCM), based on the Food Guide Pyramid (USDA, 1992). Rather than a fixed lunch menu, participating schools offered daily choices of main dish items, milk, and a variety bar of fruits, vegetables, and grain products to elementary school children. The FPCM system is designed to increase the likelihood that children will find at least one healthful food item that they like in each menu category each day, and maximize the possibility that the lunches they eat meet SMI nutrient requirements. Statewide, two years after implementation, 52% of elementary schools offering FPCM lunches met the standard for total fat and 39% met the standard for saturated fat in lunches served. Twenty-two percent of lunches offered still averaged more than 34% of calories from total fat, with only 9% averaging more than 12% of calories from saturated fat (Georgiou et al., 2000).

When evaluating the nutrient content of school lunches, it is important to distinguish among the foods offered to, selected, and eaten by children. This study compares the food and nutrient content of lunches that Third Graders selected and ate, as well as the food choices they were offered, which included a variety of lowfat fruits, vegetables and grain products.

## **METHODOLOGY**

### **Sample and Study Design**

This descriptive study involved Third Graders attending two Oregon elementary schools in a suburban school district. Data were collected on school lunches as offered, selected and eaten

during one week in February 1997. The schools had implemented the FPCM lunch system one year prior to the study under a grant from the ODE. It has been shown that food preferences may vary with family income (Kennedy & Goldberg, 1995) and, as a result, it was important that each school selected for the study enrolled fairly equal numbers of children who were eligible for free and reduced-price (45%) and full-price (52%) meals. Eligibility status data were missing for 3% of the students. One hundred and three of 140 Third Graders (74%) agreed to participate. Complete data for at least three days were collected from 93 individuals (66%), who comprised the final data set. The research was approved by the Oregon State University Institutional Review Board and the local school system. Informed consent was obtained from each child and a parent or guardian.

FPCM schools use food-based menu planning and the USDA offer-versus-serve option, which requires that each school offer foods from the following categories: meat/meat alternative, grain/bread, two different fruits and/or vegetables, and milk. Children are allowed to decline up to two items. The Oregon FPCM system offers at least three main dish choices, two milk choices, and a variety bar with eight or more fruits and vegetables and three or more grain/bread choices. Children may select one main dish item, most of which include a grain serving, one serving of milk, unlimited fruits and vegetables, and an additional grain serving. Children at FPCM schools receive training in sanitation procedures for self-service foods and are encouraged to help themselves to any foods they want in the amounts they anticipate eating. Grant-funded FPCM schools agree to provide one classroom nutrition education activity and send a Food Guide Pyramid poster home with each child before implementing the menu system.

### **Lunches as Offered**

For this study, a per-child lunch, as offered, was defined as the sum of all menu items planned, divided by the number of children expected to eat lunch that day. Each menu item was weighted by the relative proportion in which it was planned. Menu items for each day were broken down into the following categories: entrees, milk, fruits, vegetables, grain products, condiments and sunflower seeds. Condiments and other foods, although offered and included in this analysis, are not FPCM menu items.

The nutrient content of each menu item offered was weighted according to the item's amount relative to the total amount of food offered in its menu category. The week's menus (Figure 1), as well as quantities planned and recipes or labels for each food item, were obtained two weeks in advance under the direction of a food/nutrition professional. Menu items and recipes were recorded using forms similar to those described by Ebzery, et al. (1996). Examples and details of analysis have been described previously (Georgiou et al., 2000; Lee et al., 2001). Recipes were analyzed using the NutriKids (LunchByte, 1995) nutrient analysis software developed for the NSLP. This methodology is comparable to that used in *SNDA-II* (USDA, 2001) for data on lunches "served."

Menu Item	Monday	Tuesday	Wednesday	Thursday	Friday
Entrée	Tamales Pizza Cheeseburger Burrito Peanut Butter/Jelly Sandwich	Spaghetti Pizza Cheeseburger Burrito Turkey Sandwich	Nachos Pizza Cheeseburger Burrito Turkey Sandwich	Turkey/Gravy Pizza Cheeseburger Burrito Ham/Cheese Sandwich	Ravioli Pizza Cheeseburger Burrito Tuna Sandwich
Milk	NF Chocolate Milk 2% Milk	NF Chocolate Milk 2% Milk	NF Chocolate Milk 2% Milk	NF Chocolate Milk 2% Milk	NF Chocolate Milk 2% Milk
Variety Bar (Fruits, Vegetables, Grain Products)	Apples Oranges Pears Carrots Broccoli Celery Cauliflower Beets Corn Saltines White Bread	Apples Applesauce Oranges Carrots Broccoli Celery Cauliflower Lettuce Mixed Veg <sup>1</sup> Garlic Bread Saltines Mixed Grain Bread	Apples Oranges Grapes Bananas Apricots Beets Broccoli <sup>1</sup> Graham Crackers Saltines Mixed Grain Bread	Apples Oranges Fruit Salad Bananas Cranberry Sauce Carrots Broccoli Celery Cauliflower Green Beans <sup>1</sup> Hot Rolls White Bread Graham crackers	Apples Oranges Bananas Pineapple Carrots Broccoli Celery Cauliflower Mixed Veg <sup>1</sup> Hot Rolls Saltines Graham crackers Cupcake
Condiments	Salsa Ketchup Mustard Butter Ranch Dressing	Salsa Ketchup Mustard Butter Ranch Dressing	Salsa Ketchup Mustard Butter Ranch Dressing	Salsa Ketchup Mustard Butter Ranch Dressing	Salsa Ketchup Mustard Butter Ranch Dressing
Other Foods		Sunflower Seeds			

<sup>1</sup>These vegetables were offered hot, pre-portioned in bowls and offered along with hot entrees rather than as part of the variety bar.

Figure 1. Food Pyramid Choice Menus for the Week of the Study

### Lunches as Selected

Lunch items on the serving line were pre-measured daily in school kitchens. Five samples of unitary items, such as entrees and containers of milk, were weighed, and an average was determined for each item. Several self-serving sizes of bulk items on the variety bar, such as applesauce and salad dressing, were measured, weighed, and displayed for comparison with lunch trays. The students' trays were identified by numbers and decorative name tags. Children served themselves in the lunch line and then relinquished their trays, briefly, while the food

items and amounts selected were either visually compared with pre-measured samples or counted and recorded, out of sight of the child. The trays were returned quickly.

Food items selected were analyzed after converting NutriKids data for each food into Food Processor (ESHA Research, 1996) software files, which are more suitable for analyzing data for individual children. Omitted values for the nutrients studied were obtained from product labels, so there were no missing nutrient values. Data were analyzed using Statistical Package for the Social Sciences (SPSS)mainframe software (1996).

### **Lunches as Eaten**

Children left their trays on the tables after lunch. In order to calculate the amount of food eaten by each child, plate waste from each food item was weighed and subtracted from the amount selected. Procedures for measuring lunches offered, selected and eaten were piloted for 20 Third Graders at one elementary school. The accuracy of the visual estimations of food quantities selected, as compared to actual weights, was considered satisfactory by the data collectors. Data collection forms were revised for speed and accuracy.

## **RESULTS AND DISCUSSION**

### **Menu Categories as Offered, Selected, and Eaten**

Given an assortment of menu choices, including a variety bar, the Third Graders in this study selected and ate menu items in very different proportions than they were offered. All children selected a main dish every day and almost all children selected milk every day. Table 1 shows that the great majority of children selected fruit from the variety bar at least half of the days they ate lunch, while almost half never selected a vegetable. Third Graders who selected entrees, fruits, vegetables, and grains selected smaller amounts than the per child amounts offered. The students selected barely more than half the amount of vegetables offered per child. Similarly, other studies have found that elementary school children are less likely to select vegetables than other school lunch foods in an offer-versus-serve system (Lee et al., 2001; Reger et al., 1996). By contrast, this study found that Third Grade students who selected milk, condiments, and sunflower seeds did so in amounts greater than those offered per child. Those children who selected condiments at least once a day selected almost three times the amount offered.

Third Graders ate only 66% to 80% of the foods they selected from each menu category. Children who selected main dishes, milk, grain products, condiments and other foods ate them in greater proportions compared to amounts offered than they ate fruits or vegetables. A study of Fifth Graders found they ate similar proportions of the fruits and vegetables they had selected from school lunches (Gray et al., 2002). The *1998 CSFII Supplemental Children's Survey* found that only about one-fourth of seven- to nine-year-old children, nationwide, met the Healthy Eating Index recommendations for fruit or vegetable consumption (USDA, 2001) and that children's fruit consumption had declined since earlier surveys.

### **Nutrients and Other Food Components in FPCM Lunches**

The goal of the SMI is to help children eat school lunches that are limited in fat and are adequate in calories, protein, and micronutrients. Unfortunately, children do not always eat lunches as balanced as those they are offered. The eight- and nine-year-olds in this study ate only two-thirds

(470 kcal) of the lunches they were offered and selected themselves (Table 2). This gave them ample opportunity to eat meals quite different in composition than those offered. They ate, on average, less of the main dish, milk, fruits, vegetables and grains, but more of the condiments and sunflower seeds than were offered per child. For this reason the lunches they ate were more dense in fat but lower in micronutrients than those offered. Their caloric intake from school lunches is similar to that of ten-year-olds in the *Bogalusa Heart Study* (Farris et al., 1992), who ate 23% of the 1989 RDA for calories (499 kcal) and to that of Sixth Graders, who were offered reduced-fat menus in West Virginia (462 kcal) (Nucci & Stuhldreher, 2003). Other studies have reported higher calorie intakes from school lunches among elementary school children (570 kcal) (Lee et al., 2001); among Third through Sixth Graders (623 kcal) (Donnelly et al., 2000); and among six- to ten-year-olds (680 kcal) (Devaney et al., 1995).

### **Table 2 (in Adobe Acrobat form)**

It is important to note that the lunch intakes in several of the studies (Devaney et al., 1995, Farris et al., 1992, Nucci & Stuhldreher, 2003) were obtained from children's recalls, while this study included only measured food items. School breakfast and lunch recalls of Fourth Graders have been reported to be extremely inaccurate (Baxter et al., 2002). This study's data, obtained by direct measurement, are likely to be more accurate than those obtained from food recalls.

Table 2 shows that the FPCM lunches in this study, as offered, were more concentrated in total fat (33% kcal) and saturated fat (12% kcal) than the NSLP standards. These proportions are the same as those reported for the 1998-99 school year, nationwide, in *SNDA-II* (USDA, 2001). Third Graders in this study selected lunches even more concentrated in total fat (36% kcal) and saturated fat (14% kcal) than the average lunch offered. This difference is attributed to their choosing lunches with remarkably fewer calories from carbohydrate and slightly fewer calories from protein, but the same number of calories from fat as in the lunches offered. In contrast to the selective menu in this study, two other studies offered similarly aged children non-selective school lunches with only 29% of calories from fat. Children ate lunches very close in fat density to those lunches offered (Rainville, 2001, Krupin & Georgiou, 1993 ). In these cases, non-selective menus appear to be more effective than the selective FPCM menus in limiting the fat content consumed during a meal.

In this study, the week's menus exceeded NSLP standards for protein, calcium, vitamin C, and vitamin A by at least 50%, and met standards for calories and iron. The NSLP does not include specific standards for the fiber, sodium, or cholesterol content of school lunches. Compared to the recently recommended Dietary Reference Intakes (DRIs) for these food components (Committee on Dietary Reference Intakes, 2002; Committee on Dietary Reference Intakes, 2004), the menus provided a minimal amount of cholesterol, somewhat less dietary fiber, and much more sodium than the new, lower recommendations.

Third Graders selected and ate lunches that were lower in calories than lunches offered. Their choices of foods and the amounts of each food selected and eaten resulted in their consuming lower amounts of micronutrients than were offered. Lunches selected, on average, met recommendations for energy, protein, and most micronutrients, but were slightly low in iron. Although average lunch intakes of vitamin A, vitamin C, and calcium met NSLP standards, only

one-third of Third Graders ate the recommended amounts of vitamin A, and only two-thirds ate the appropriate amount of vitamin C or calcium.

Iron intake averaged 70% of the NSLP recommendation. This is somewhat lower than the iron intake reported through recall by children in the *SNDA-I* study (Devaney et al., 1995) and for rural Midwestern elementary school children whose intakes were actually measured (Lee et al., 2001) Only 10% of the Third Graders in the current study ate lunches that met the NSLP standard for iron. This is comparable to research that found less than 10% of Sixth Graders ate lunches containing enough iron after a program to reduce fat in school lunches was implemented; before the program went into effect, more than 30% met the iron recommendation (Nucci, & Stuhldreher, 2003). In contrast to this FPCM study's sample, more than 40% of seven- to ten-year-olds eating non-selective low-fat lunches in Michigan met the NSLP guideline for iron (Rainville, 2001). The low iron intake of students eating FPCM lunches is a concern and may reflect entree choices offered and selected and the items available in the variety bar.

Table 3 shows the percent of total calories and the percent of each food component that was contributed by each lunch food category to the average lunch as eaten. In lunches consumed, main dishes provided half the calories and more than half of the protein, fat, saturated fat, cholesterol, iron, and sodium. Condiments contributed more than 10% of the saturated fat children ate from their lunches. Children consumed more than half the calcium in their lunches from milk, more than half the vitamin C from fruit, and almost half the vitamin A from vegetables, although vegetables accounted for only 1% of calories in lunches eaten. Limited frequency and amount of vegetables selected and eaten appears to have contributed to the overall low vitamin A intakes shown in Table 2. Main dish items and grain products from the variety bar were the greatest contributors to iron intake.

## CONCLUSIONS AND APPLICATIONS

Many elementary school children simply do not eat as much food during lunch as schools are mandated to offer. As a result, it is necessary to consider the foods students actually select and eat in order to effectively plan nutritionally balanced school lunches. This study is unique in that it compares the energy and nutrient content of lunches as offered to, selected, and eaten by Third Graders when several choices of each food category were offered daily and children served themselves from a fruit, vegetable and grain product variety bar. The Third Graders in this study selected entrees, milk, and fruit most frequently, and vegetables and grain products less frequently. Children ate the greatest proportions of the main dishes, milk, grain products and condiments they selected. They ate smaller amounts of the fruits and vegetables. As a result of their food choices, the students ate only about two-thirds of the calories offered, but ate proportionately more of the total fat and saturated fat offered than the protein and carbohydrates offered. Third graders also ate less iron, calcium, and vitamins A and C than were offered per child.

Not much is known about why elementary school children eat so much less than is offered from school lunches. One possible explanation may be the current social environment where snacking between meals is a growing trend among American children. Such snacking is estimated to account for approximately 25% of the students' total calories (Jahns et al., 2001). Also, it is clear

from this study that children have school lunch food preferences. They exercise their preferences through both the foods they select from school lunches and the amount of each food they actually eat. It would be worthwhile to investigate explanations for children's school lunch eating behaviors.

No method of estimating the nutrient content of school lunches offered, selected or eaten can be completely accurate. This is especially true when menu choices are offered and children select the amount of foods they want from a variety bar. By weighting amounts of each food offered in a menu category for analysis, the authors were able to make credible estimates of the calorie and nutrient content of the average lunch offered per child. Rather than rely on food recalls of children, foods selected and eaten were measured for each individual.

The SMI applies nutrient standards to lunches as planned two weeks before service. The authors found that planned lunches were likely to include a surplus of main dishes, as the precise number of children eating lunch on any particular day was unknown. This distorted somewhat the calculated mean values for calories and nutrients in the average main dish as offered. This effect would, particularly, be the case among nutrients for which entrees contributed the greatest portion of calories: protein, total and saturated fat, cholesterol, iron, and sodium. It would be worthwhile to collect additional data onsite the day the meals are served (Ebzery et al., 1996).

Also, since the sample was relatively small and the school district studied was not randomly selected, these findings cannot necessarily be generalized for all Third Graders. In evaluating the effectiveness of the FPCM system, it would be helpful to have comparative data from the same children before implementation of such a menu system. Large-scale studies that measure the foods offered, selected, and eaten by elementary school children before and after implementation of selective menus also would contribute significantly to the understanding of school lunch behavior.

The most effective intervention to improve the nutritional quality of children's diets is yet to be identified. Menu interventions that give children a choice of healthful foods at school, like the FPCM approach, appear to have some promise when paired with classroom nutrition education. A multifaceted intervention, the Child and Adolescent Trial for Cardiovascular Health (CATCH), entailed such a comprehensive approach. The CATCH program, which was implemented in 96 schools, includes classroom curricula and school foodservice components, as well as physical education, and it encourages the involvement of parents (Nicklas et al., 1994). Pre- and post-intervention data show the program successfully reduced fat intake of Third through Fifth Graders, but did not help to increase their fruit and vegetable intake (Perry et al., 1998). Three-year follow-up data showed intervention children still maintained a lower fat intake than students in the control group, but the difference between the fat intake of the two groups had decreased over time (Nader et al., 1999). Clearly, influencing the food choices of children is a complex undertaking requiring further study.

This study supports the understanding that offering food choices shows potential for helping to raise the nutritional quality of lunches eaten. Although the FPCM system appears to be more successful in getting children to voluntarily select fruits than to select vegetables and grain products at lunch, it also may provide children with the opportunity to eat higher-fat lunches than

they would if choices were not available. When a selective menu is offered, it is important that all entree choices be relatively low in fat and high in nutrient density, especially for iron, as main dishes are more frequently eaten than other lunch items. Attention should be given to offering fruits and vegetables rich in vitamin A that children will select and eat. High-fat condiments should be minimized and classroom education should focus on healthful food choices.

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