

The Relationship Between the Length of the Lunch Period and Nutrient Consumption in the Elementary School Lunch Setting

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Please note that this study was published before the implementation of Healthy, Hunger-Free Kids Act of 2010, which went into effect during the 2012-13 school year, and its provision for Smart Snacks Nutrition Standards for Competitive Food in Schools, implemented during the 2014-15 school year. As such, certain research may not be relevant today.

ABSTRACT

Purpose/Objectives

The purpose of this study was to determine what impact the length of a lunch period had on nutrient consumption and plate waste for elementary students in Grades 3, 4, and 5.

Methods

Plate waste data were collected for a total of 20 days, ten days at each school, to determine the amount of food consumed and wasted in two elementary schools. School One had a 30-minute lunch period, while School Two had a 20-minute lunch period. Nutrient intake (calories, protein, carbohydrates, total fat, saturated fat, vitamins C and A, iron, and calcium) was calculated using the following formula:

$$\frac{\text{Nutrient Intake}}{\text{Food offered} - \text{Amount wasted}} = \text{Amount of food consumed}$$

Differences in nutrient intake and plate waste related to the length of the lunch period were ascertained using analysis of variance (ANOVA).

Results

The results showed that when students had a longer lunch period they consumed significantly more food and nutrients than when the lunch period was shorter. Likewise, plate waste decreased from 43.5% to 27.2%.

Applications to Child Nutrition Professionals

The results of this study may be used to influence elementary school officials to schedule lunch periods that are long enough to ensure that children have enough time to consume their food.

INTRODUCTION

Research has shown that students who participate in the National School Lunch Program (NSLP) consume diets that are higher in calories and other nutrients, as compared to those who receive lunches from other sources, including from home, from vending machines, or bought off campus (Gordon, Devaney, & Burghardt, 1995; Rainville, 2001). However, some concern has been raised as to whether students have enough time to adequately consume lunch. In a survey of school cafeteria managers, 44% reported "not enough time to eat" as being a possible factor related to plate waste (School Lunch Program, 1996). Additionally, in the same survey cafeteria managers in elementary schools reported plate waste as being at least a moderate problem, compared to managers in middle and high schools.

Plate waste, which is defined as the quantity of food served but not eaten, represents approximately 12% of the food calories served to students in the NSLP (Guthrie & Buzby, 2002). Decreasing excessive plate waste, particularly in foods like milk, fruits, and vegetables, would be beneficial to children whose diets often are lacking important nutrients (Gleason & Sutor, 2001).

Previous studies examining the amount of time children have to eat lunch have demonstrated that elementary school children may spend a major part of their lunch time waiting in line for service, which could significantly decrease the time available to eat (Bergman, Buergel, Joseph, & Sanchez, 2000; Buergel, Bergman, Knutson, & Lindaas, 2002; Sanchez, Hoover, Sanchez, & Miller, 1999). The length of the lunch period and the amount of time spent waiting in line also has been identified as significant factors in student participation in the school lunch program (Marples & Spillman, 1995; Mauer, 1984). Children who are not given adequate time to eat the food provided may, in turn, have increased plate waste and decreased consumption of nutrients.

Purpose of the Study

The purpose of this study was to determine the impact that the length of a lunch period had on plate waste and nutrient consumption by elementary students in Grades 3, 4, and 5. The study was conducted in two elementary schools in central Washington State.

Methods

Plate waste was collected for a 10-day period in each of two elementary schools for all students in Grades 3, 4, and 5 who ate in a common cafeteria. School One received a 30-minute lunch period, which began at 12:30 p.m., and School Two received a 20-minute lunch period, which started at 12:20 p.m. for the Third Grade students and 12:40 p.m. for Fourth and Fifth Grade students. Although School Two was scheduled for a 20-minute lunch period, in actuality, the amount of time allotted for lunch was less. After 15 minutes, a bell rang and students were expected to stop eating and dispose of their lunch trays in preparation for returning to the classroom.

Students in both schools had recess before lunch and had a similar demographic makeup. School One had 86% of its student population qualify for free and reduced price lunches, while School Two had 93% of its enrollment qualify. Food-based menus were written district-wide, and each school followed a similar menu during the study period. Students in the study received all items offered for lunch.

The University Human Subjects Review Committee at Central Washington University approved the study prior to data collection. Handouts describing the purpose of the study were sent home prior to the beginning of the study at each school. The handouts were written in both English and Spanish. Parents who did not wish to have their child involved in the study had the option of requesting that their child dispose of the tray directly in the garbage and not give it to the research assistants for weighing. Research assistants were recruited from the community and were trained in plate waste procedures prior to data collection.

Two Ohaus CT1200 Portable Digital gram scales (Ohaus Corporation, Florham Park, NJ) were used to determine plate waste in grams. Two lap top computers (Dell Inspiration 3200 D266XT TS30H, and IBM ThinkPad 380XD) with Lab View 6I (National Instruments, Inc., Austin, TX, 2000) installed were connected to the digital gram scales during the data collection process. The nutrient content of foods offered during the study was determined using the Nutrikids Nutrient Analysis and Menu Planning program (Lunchbyte Systems, Inc., Rochester, NY, 2001).

At the start of each lunch period, three to five servings of each pre-portioned menu item were weighed using the gram scale and an average gram weight of each food item was obtained and recorded. Three items were weighed when the foods were very consistent in weight. Five items were weighed when the items had variation in weight. Because the same menu cycle was used throughout the study period, many of the daily menu items offered were similar between the two schools. However, the same menu items were not served at each of the schools during the days of data collection. For this reason, the percent of nutrients consumed also was calculated using the following formula:

$$\frac{\text{Amount of nutrients consumed}}{\text{Amount of nutrients offered} \times 100} = \text{Percent nutrients consumed}$$

Paper lunch trays were used for the study. Each tray was assigned to a specific student; an assigned tray number was matched to the student's personal identification number, which was obtained from a master list received from the school administration. The master list was used to gather demographic data about the students' gender, age, grade level, and free or reduced-price eligibility. Student names were not used; confidentiality was maintained throughout the study.

At the conclusion of the meal, students brought their trays to the disposal area for collection. After all trays were collected, the research assistants measured plate waste data using the following procedures:

- Step 1. The student identification number, which corresponded to the tray number, was entered into the Lab View program for each tray weighed.
- Step 2. Each individual menu item was placed on the top loading digital scale in a plastic weighing container.
- Step 3. The gram weight of the menu item was automatically entered into the Lab View program spreadsheet.
- Steps 2-3 were repeated for each menu item included in the school lunch.

Data were analyzed by linking the gram total weights and nutrient totals for each menu item. The amount of nutrients offered in the meals served at the two schools is outlined in Table 1, along

with the recommended nutrient levels required for school lunch. Differences between the amount of nutrients and percentages of nutrients offered and consumed were ascertained using analysis of variance (ANOVA). Fisher's protected least significant difference (PLSD) post hoc tests were used on those items where a significant F-value was calculated with ANOVA to determine where significant nutrient differences existed ($p < 0.05$).

Table 1: Mean Amount Of Nutrients Offered During the School lunch Program at Each School			
Nutrients	Minimum Nutrient Levels for School Lunch (Grades K-6)	30 Minute Lunch Period (School #2)	20 Minute Lunch Period (School #3)
Calories	664	622.4 ± 118.6	697.9 ± 142.1
Carbohydrate (g)	Not specified	89.2 ± 17.3	96.4 ± 23.1
Protein (g)	10	27.8 ± 4.6	29.9 ± 7.7
Total Fat (g)	≤22*	16.8 ± 4.9	20.2 ± 9.5
Saturated Fat (g)	≤7*	5.8 ± 2.2	7.0 ± 5.3
Vitamin A (RE)	224	458.5 ± 417.9	391.9 ± 321.5
Vitamin C (mg)	15	17.5 ± 18.3	29.6 ± 33.1
Iron (mg)	3.5	3.8 ± 0.9	3.5 ± 0.9
Cholesterol (mg)	100	40.5 ± 11.6	53.4 ± 26.6
Calcium (mg)	286	465.9 ± 108.5	463.3 ± 182.5
Fiber (g)	Not specified	5.6 ± 1.8	7.0 ± 3.9
Sodium (mg)	1350	1366.4 ± 319.3	1241.8 ± 402.5
*Based on less than 30 % of calories from fat and 10% calories from saturated fat.			
All values are mean ± standard deviation.			
Means are derived from 10 days of lunches served at each school.			

Results And Discussion

Results

The grams of food consumed and wasted for each of the schools are shown in Table 2. The grams of food eaten were greater and the amount of food wasted was less for students who had a 30-minute lunch period ($p < 0.0001$). Overall food waste decreased from 43.5% to 27.2% when the length of the lunch period was 30 minutes versus 20 minutes.

Table 2: Mean Amount Of Food Offered, Eaten, And Wasted For All Students In Grades 3-5		
	30-Minute Lunch Period (School #1)	20-Minute Lunch Period (School #2)
All Students Grades 3-5	N=1119	N=758
Amount of food offered (g)	568.8 ± 52.2	605.2 ± 33.8
Grams of food eaten (% offered that was eaten)	$410.9 \pm 103.2^*$ ($72.8 \pm 18.2^*$)	338.3 ± 132.9 (56.5 ± 22.1)
Grams of food wasted (% of offered that was wasted)	$156.6 \pm 108.1^*$ ($27.2 \pm 18.2^*$)	260.2 ± 133.1 (43.5 ± 22.1)
All values are mean \pm standard deviation.		
N represents number of lunch trays measured.		
*Two-sample t-test indicated significant difference compared to recess after lunch, $p < 0.0001$.		

Differences in macronutrients (grams of fat, saturated fat, carbohydrates, and protein) were greater for all students receiving a 30-minute lunch period versus the 20-minute lunch period ($p < 0.0001$) (Table 3).

Table 3: Mean Mean Amount Of Macronutrients Consumed For All Students Grades 3-5		
Nutrients	30-Minute Lunch Period (School #1)	20-Minute Lunch Period (School #2)
All Students Grades 3-5	N=1119	N=758
Calories (% of offered)	$503.3 \pm 133.0^*$ ($81.1 \pm 16.8^*$)	432.9 ± 176.3 (64.4 ± 24.2)

Total Fat (g) (% of offered)	14.3 ± 4.9 (86.2 ± 18.3*)	12.8 ± 6.3 (72.6 ± 29.3)
Saturated Fat (g) (% of offered)	4.9 ± 2.1* (85.4 ± 18.8*)	3.9 ± 2.3 (69.7 ± 30.7)
Carbohydrate (g) (% of offered)	70.7 ± 19.9* (79.3 ± 18.1*)	59.3 ± 30.2 (61.6 ± 25.8)
Protein (g) (% of offered)	22.1 ± 6.2 (79.9 ± 18.2*)	18.6 ± 7.3 (64.7 ± 25.7)
<p>All values are mean ± standard deviation.</p> <p>N represents number of lunch trays measured over a 10-day observation period.</p> <p>* Two-sample t-test indicated significant difference compared to recess after lunch, p<0.0001.</p>		

With the exception of vitamin C, the consumption of vitamins and minerals was greater when students had a 30-minute lunch period (Table 4).

Table 4: Mean Amount Of Vitamins And Minerals Consumed For All Students Grades 3-5		
Nutrients	30-Minute Lunch Period (School #1)	20-Minute Lunch Period (School #2)
All Students Grades 3-5	N=1119	N=758
Iron (mg) (% of offered)	3.1 ± 1.0* (82.1 ± 20.4*)	2.4 ± 1.2 (70.1 ± 29.2)
Calcium (mg) (% of offered)	340.9 ± 138.0* (73.1 ± 24.1*)	218.5 ± 144.4 (50.6 ± 31.3)
Vitamin A (RE) (% of offered)	249.2 ± 269.7* (63.7 ± 29.5*)	171.1 ± 206.7 (45.4 ± 32.1)
Vitamin C (mg) (% of offered)	10.7 ± 9.4 (69.5 ± 21.1*)	11.5 ± 14.4 (53.3 ± 26.9)
<p>All values are mean ± standard deviation.</p> <p>N represents number of lunch trays measured over a 10-day observation period.</p>		

*Two sample t-test indicated significant difference compared to recess after lunch, $p < 0.0001$.

Although there was no significant difference in the total amount of vitamin C consumed between the two schools, the amount of vitamin C consumed as a percent of that offered was greater for students who had the 30-minute lunch period ($p < 0.0001$). Providing a longer lunch period also was associated with improved intake of foods containing calcium, iron, and vitamin A.

Discussion

Students who were provided with a 30-minute lunch period consumed more food and nutrients than those who had the shorter lunch period, with a corresponding decrease in food waste from 43.5% to 27.2%. Providing a longer lunch period may provide the time necessary to encourage students to eat more of the foods most often neglected, such as fruits, vegetables, and milk (Guthrie & Buzby, 2002). However, according to the School Health Policies and Programs Study (Wechsler, Brener, Kuester, & Miller, 2000), one-fifth of U.S. schools give students less than 20 minutes to eat lunch.

Students who are well nourished are better equipped to learn (Troccoli, 1993). Since school lunch is designed to provide children with one-third of their nutrient requirements for the day, it is essential that the school environment achieve a favorable dining experience by providing an appropriate amount of time for optimum food consumption. Both School One and School Two had very high rates of free and reduced-price participation (86% and 93%, respectively). This suggests that some children may come from homes where food availability is limited and, consequently, it is essential that these students receive optimal nutrition during lunch in order to learn, grow, and develop appropriately.

Scheduling a 30-minute lunchtime was associated with improved intakes of calcium and vitamin A, suggesting that when students are given adequate time they may consume more milk, fruit, and vegetables, which are rich in these nutrients. This is particularly important, because the diets of many children are lacking in these foods and the nutrients they contain (Gleason & Sutor, 2001).

Many variables, in addition to the length of the lunch period, have an impact on the amount of time students have to eat their lunch. One of these is the amount of time it takes for the students to get to the serving line, including standing in line to receive a tray, waiting for the cashier, and the time to travel to the lunch table. Previous studies have shown that waiting in the service line can vary from 2.5 to 3.3 minutes for elementary school students, depending on the type and speed of service (Conklin & Lambert, 2001). Students need approximately eight to ten minutes to consume their lunch (Bergman et al., 2001; Conklin & Lambert, 2001). This represents the time required to actually eat and drink but does not include time to socialize. Buerger et al. (2002) showed that this consumption time increases when children are given more total time to eat.

Conclusions And Application

The following conclusions can be drawn from this study:

1. Children who have a 30-minute lunch period consume significantly more food and nutrients than those who have a 20-minute lunch period. Scheduling a longer lunch period may allow children adequate time to consume their entire meal and, thus, provide them with the nutrients needed to effectively learn.
2. Children who have a 30-minute lunch period waste less food than those who have a 20-minute lunch period. By providing a longer lunch period, schools may waste less food.

Another question, however, must be asked: "How long of a lunch period is needed to ensure adequate time for elementary students to eat?" The approximate amount of time required for school lunch may be determined by the following guidelines, as proposed by Buerger et al. (2002) in a previous research study and slightly modified here. The factors influencing the lunch period and recommended times for each factor are as follows:

Factor 1. Wait Time (5-9 minutes): Wait time can be determined at each school by timing from when the lunch period starts to when the last child sits down and is ready to eat. In many schools, a bell rings to indicate the start of the lunch period. This often begins at the time when children are released from their classroom and walk to the cafeteria. Previous studies have shown that waiting in the service line can vary from 2.5 to 3.3 minutes for elementary school students, depending on the type and speed of service. However, this does not take into consideration the amount of time it takes a child to travel from the classroom to the cafeteria. In addition, in some schools, children eat in the classroom. Then they must travel to and from the cafeteria to obtain lunch. Bergman et al. (2000) found that the total wait time for children who ate in their classrooms was twice that of children who ate in the cafeteria (9 minutes, 16 seconds versus 4 minutes, 45 seconds).

Factor 2. Consumption Time (9 minutes): The average time it takes for students to eat is about nine minutes (Bergman et al., 2000). This time is for food consumption alone and does not account for socializing and other important mealtime functions.

Factor 3. Standard Deviation (5-7 minutes): Students eat at different rates. The average student consumes food more quickly than the more deliberate eater. This can be accounted for by adding in two times the standard deviation to account for almost all eaters. Previous studies have found that the standard deviation for consumption ranges from 2.5 to 3.5 minutes (Sanchez et al. 1999; Bergman et al., 2000). Two times 2.5 to 3.5 minutes results in five to seven minutes to account for the most deliberate eaters.

Factor 4. Social Time (5 to 10 minutes): Sanchez et al. (1999) observed that students use much of their lunchtime to socialize. While the optimum amount of socialization time is unknown, extra time set aside at lunch is important for students to develop social skills and have some down time before they go back into the formal learning environment. An adequate period of time needs to be provided for social interaction, but too much time can result in discipline problems. Conklin and Lambert (2001) indicated that students use as much time as they have available to socialize and that socialization time varied from 2.5 to 21.4 minutes. A range of five to ten minutes for socialization is a best estimate based on the above data.

Nutrient Intake

Wait Time (5-9 minutes)
+ Consumption Time (9 minutes)
+ Standard Deviation (5-7 minutes)
+ Social Time (5-10 minutes)

24-35 minutes as an
appropriate amount of time
for providing a healthful school
dining environment.

This proposed lunchtime range might be too short for schools that have excessive waiting and might be too long for schools that have less than a five-minute waiting time for travel, service, and seating.

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BIOGRAPHY

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