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The Relationship of Meal and Recess Schedules to Plate Waste in Elementary Schools

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ABSTRACT

Purpose/Objectives
The purpose of this study was to determine the impact that scheduling recess before and after the lunch period had on nutrient consumption and plate waste for students in Grades 3, 4, and 5. The study was conducted in two elementary schools in central Washington.

Methods
Plate waste data were collected for 20 days to determine the amount of food consumed and wasted. Nutrient intake 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 scheduling of recess and lunch were evaluated using analysis of variance (ANOVA).

Results
The results of the study show that when recess was scheduled before lunch students consumed significantly more food and nutrients than when recess was scheduled after lunch. Plate waste decreased from 40.7% to 27.2%.

Applications to Child Nutrition Professionals
Results from this study may be used to influence elementary school officials to schedule lunch after recess to improve school lunch consumption and reduce plate waste.

INTRODUCTION

The National School Lunch Program (NSLP) plays an essential role in the lives of many school-aged children. Currently, about 99,000 schools and residential childcare facilities participate in the NSLP, and these institutions provide nutritionally sound lunches to more than 28 million children each school day (U.S. Department of Agriculture National School Lunch Program, 2004).

Due to the fact that school-aged children are in a time of rapid growth and development, it is important to provide them with meals that help meet their physical, social, and emotional needs. Students who participate in the NSLP have better nutrient intakes than students who eat elsewhere, including students who bring lunch from home, eat from vending machines, or eat off campus (Gordon, Devaney, & Burghardt, 1995; Rainville, 2001). Additionally, a significant relationship between nutrition intake and a child's ability to learn has been established (Troccoli, 1993).

In a survey of public school cafeteria managers, one-fourth mentioned plate waste as being at least a moderate problem, particularly in elementary schools. Attention to recess, free time, and socializing rather than eating were cited as factors related to increased plate waste (National School Lunch Program, 2003). The National School Nutrition Dietary Assessment Study (School Nutrition Dietary Assessment Study, 1993) found that about 12% of calories from food offered by the NSLP were wasted, with an estimated direct economic yearly loss of $600 million. Plate waste in the NSLP varies by food type, with fruits and vegetables being wasted in greater quantities than other meal components (Guthrie & Buzby, 2002). Students tend to eat more of their entree at lunch than other foods provided (Lindeman, Slapar, & Carr, 1997). Environmental factors, which may influence consumption of lunch, include the amount of time children have to eat, the time of day the lunch is served, and the placement of recess in relation to the lunch period.

The placement of recess in relation to the lunch period has been shown to have an important impact on the amount of food consumed by elementary children. Getlinger et al. (1996) found that plate waste decreased from 34.9% to 24.3% in elementary school children (Grades 1-3) when recess was scheduled before lunch. Similar studies investigating the placement of recess in relationship to the lunch period have demonstrated similar results (Read & Moosburner, 1985; Ruppenthal & Hogue, 1977; Smith, 1980).

Increased plate waste associated with recess after lunch may be related to a combination of factors. One factor may be that students who have recess before lunch are hungrier by lunchtime and, thus, eat more food and waste less. Another factor may be that students who have recess after lunch may find it uncomfortable to exercise with a full stomach. Recommendations for athletes and casual exercisers include putting off exercise after they have consumed food. The wait time varies depending on the size of the meal. If a large meal is consumed, up to a four-hour wait is recommended. If the meal is a small snack, an hour or less may be required for a person to feel comfortable during exercise (Clark, 1998). Children may learn that it is more beneficial to eat less at lunch in order to be more physically comfortable during recess, even if it means being hungry later in the day.

METHODS

Plate waste data were collected for a 10-day period in two elementary schools for Third, Fourth, and Fifth Grades. At each school, all students in the study ate in a common cafeteria, which included a single serving line. Every student in the two schools received all items offered for lunch. Food-based menus were written district-wide and each school followed a similar menu during the plate waste collection period. School One had recess before lunch and School Two

scheduled recess after lunch. Students in both schools had a 30-minute lunch period that started at 12:30 p.m. Furthermore, both schools shared a similar demographic makeup and had 86% of their students qualify for free and reduced-price lunches.

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 with all children prior to beginning the study. 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 asking their child to dispose of the tray directly into the garbage and not give it to the research assistants for weighing. Research assistants were recruited from the community and were trained in the 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 laptop 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 measured using the gram scale, and an average 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. The same menu cycle was used throughout the study period, and many of the daily menu items offered were similar among the two schools during the study periods. However, the same menu items were not served at both schools during the actual 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, research assistants measured plate waste data using the following procedures:

- Step 1: The student personal identification number that corresponded to a particular tray number was entered into the Lab View program for each tray weighed.

- Step 2: An individual menu item was placed on the top loading digital scale in a plastic weighing container.
- Step 3: The weight of the menu item was automatically entered into the Lab View program spreadsheet.
- Steps 2 and 3 were repeated for each menu item included in the school lunch.

The data were analyzed by linking gram total weights and nutrient totals to each menu item on Excel spreadsheets using Microsoft Access. The amount of nutrients offered for each of the two schools is shown in Table 1, along with the recommended nutrient levels required for school lunch. Differences were analyzed regarding the amount of nutrients and percentages of nutrients offered using analysis of variance (ANOVA). Fisher's protected least significant difference (PLSD) post hoc tests were completed on those nutrients where a significant F-value was calculated with ANOVA to determine where important differences existed ($p < 0.05$).

Table 1: Mean Amount Of Nutrients Offered During the School Lunch Program at Each School

Nutrients	Recommended Nutrient Levels for School Lunch Grades K-6	Recess Before Lunch (School #1)	Recess After Lunch (School #2)
Calories	664	622.4 ± 118.6	652.9 ± 106.9
Carbohydrate (g)	Not specified	89.2 ± 17.3	88.6 ± 22.1
Protein (g)	10	27.8 ± 4.6	30.5 ± 4.7
Total Fat (g)	22*	16.8 ± 4.9	19.4 ± 6.3
Saturated Fat (g)	7*	5.8 ± 2.2	5.7 ± 1.7
Vitamin A (RE)	224	458.5 ± 417.9	384.9 ± 291.4
Vitamin C (mg)	15	17.5 ± 18.3	27.7 ± 25.1
Iron (mg)	3.5	3.8 ± 0.9	3.7 ± 1.1
Cholesterol (mg)	100	40.5 ± 11.6	54.2 ± 26.3
Calcium (mg)	286	465.9 ± 108.5	421.4 ± 130.7
Fiber (g)	3.33	5.6 ± 1.8	6.5 ± 3.0
Sodium (mg)	1350	1366.4 ± 319.3	1304.1 ± 371.7

*Based on less than 30 % of calories from fat and less than 10% calories from saturated fat. All values in school columns are mean ± standard deviation. Means are derived from 10 days of lunches served at each school.

RESULTS AND DISCUSSION

Results

Table 2 shows the grams of food consumed and wasted by students in each of the schools. A total of 1119 observations were made at School One and a total of 889 observations were made at School Two over the 20-day data collection period. Results show that for all children, the grams of food eaten were greater and the amount of food wasted was lower when recess was scheduled before lunch ($p<0.0001$). Overall, food waste decreased from 40.1% to 27.2% when recess was scheduled before lunch.

Table 2: Mean Amount Of Food Offered, Eaten, And Wasted For All Student Trays In Grades 3-5

	Recess Before Lunch (School #1)	Recess After Lunch (School #2)
All Students Grades 3-5	N=1119	N=889
Amount of food offered (g)	568.8 ± 52.2	565.3 ± 71.5
Grams of food eaten (and % offered that was eaten)	410.9 ± 103.2* (72.8 ± 18.2*)	330.7 ± 121.8 (59.9 ± 21.5)
Grams of food wasted (and % of offered that was wasted)	156.6 ± 108.1* (27.2 ± 18.2*)	223.1 ± 122.9 (40.1 ± 21.5)

All values are mean ± standard deviation.

N represents number of lunch trays measured.

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

Table 3 shows the differences in macronutrients consumed by all students in both schools. The intake of calories and all macronutrients (grams of fat, saturated fat, carbohydrate, and protein) expressed, as a percentage offered, was greater for all students when recess was scheduled before lunch ($p<0.0001$). The total intake of calories and carbohydrates also was greater for all students

when recess was scheduled before lunch. Total protein intake, however, was not different between the two schools.

Table 3: Mean Amount Of Macronutrients Consumed For All Student Trays Grades 3-5

Nutrients	Recess Before Lunch (School #1)	Recess After Lunch (School #2)
All Students Grades 3-5	N=1119	N=889
Calories (% of offered)	503.3 ± 133.0** (81.1 ± 16.8**)	463.5 ± 153.5 (71.5 ± 20.5)
Total Fat (g) (% of offered)	14.3 ± 4.9 (86.2 ± 18.3**)	15.0 ± 5.9* (77.6 ± 22.3)
Saturated Fat (g) (% of offered)	4.9 ± 2.1** (85.4 ± 18.8**)	4.2 ± 1.8 (75.0 ± 24.9)
Carbohydrate (g) (% of offered)	70.7 ± 19.9** (79.3 ± 18.1**)	59.8 ± 26.0 (69.2 ± 20.7)
Protein (g) (% of offered)	22.1 ± 6.2 (79.9 ± 18.2**)	21.6 ± 7.2 (68.9 ± 22.2)

All values are mean ± standard deviation.

N represents number of lunch trays measured over a 10-day observation period.

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

* Two-sample t-test indicated significant difference compared to recess before lunch, $p<0.05$.

It is interesting to note that male students who had recess scheduled after lunch consumed slightly more fat than those with recess scheduled before lunch. The fat intake of males was higher when they had recess after lunch (15.6 + 6.0 grams when compared to the males with recess before lunch at 14.4 + 4.8 grams, $p < 0.005$), while the fat intake of females was similar

between the two schools. This may indicate that when students are anticipating recess after lunch, they may eat the higher fat- and protein-concentrated foods first and leave the carbohydrate-rich foods. When recess is scheduled before lunch, students may be hungrier at mealtime and, thus, eat a larger amount of all foods, including the carbohydrate-rich foods. The percentage of calories consumed from carbohydrates increased from 52% to 56.7% when recess occurred before lunch.

Table 4 shows the amounts of vitamins and minerals consumed (vitamins A and C, iron, and calcium) by all students. With the exception of vitamin C, the consumption of vitamins and minerals was significantly greater when recess occurred before lunch. Eating lunch after recess improved the intake of foods containing calcium, iron, and vitamin A. The amount of vitamin C consumed as a percent of that which was offered was greater for students who had recess before lunch. The amount of vitamin C offered to students with recess after lunch was larger, which resulted in a greater total intake of vitamin C, although the percentage of vitamin C consumed was less.

Table 4: Mean Amount Of Vitamins And Minerals Consumed For All Students Grades 3-5

Nutrients	Recess Before Lunch (School #1)	Recess After Lunch (School #2)
All Students Grades 3-5	N=1119	N=889
Iron (mg) (% of offered)	3.1 ± 1.0*** (82.1 ± 20.4***)	2.7 ± 1.2 (73.6 ± 26.2)
Calcium (mg) (% of offered)	340.9 ± 138.0*** (73.1 ± 24.1***)	252.4 ± 149.5 (57.9 ± 29.4)
Vitamin A (RE) (% of offered)	249.2 ± 269.7** (63.7 ± 29.5***)	219.8 ± 175.7 (57.6 ± 27.6)
Vitamin C (mg) (% of offered)	10.7 ± 9.4 (69.5 ± 21.1***)	13.0 ± 13.9.††† 53.4 ± 27.6)

All values are mean ± standard deviation.

N represents number of lunch trays measured over a 10-day observation period.

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

**Two sample t-test indicated significant difference compared to recess after lunch, $p<0.001$

Discussion

Students who went to recess before lunch consumed more food and nutrients than those who had recess after lunch, with a corresponding decrease in food waste from 40.1% to 27.2%. These results are similar to those reported by Getlinger et al. (1996), who found food waste decreased from 34.9% to 24.3% when recess was scheduled before lunch. This increased food waste exhibited by the students who had recess after lunch is of concern because the School Health Policies and Program Study (Wechsler, Brener, Kuester & Miller, 2001) showed that elementary schools are more likely to schedule recess immediately after lunch rather than before lunch; only 4.6% schools reported scheduling recess immediately before lunch.

Scheduling recess before lunch is also associated with improved intakes of calcium, iron, and vitamin A. Encouraging students to eat foods rich in these nutrients is important, as data indicate that many children eat fewer than the recommended servings of these foods in their daily diet (United States Department of Agriculture, 2001). Data from the continuing Survey of Food Intakes by Individuals (CFSII) show that only about one in three children meet the requirement for fruit intake, and 45% meet the recommended servings of vegetables (Gleason & Suitor, 2001). In addition, the data show that soft drink intake is on the rise, while milk intake is decreasing. In order for growing children to meet their nutritional needs and to supply their large energy requirements, the nutrients found in fruits, vegetables, and milk must be included as part of their diets.

Research has demonstrated a clear connection between nutrition and a child's ability 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 be designed to promote optimum consumption of a well-balanced diet. Both schools in this study had a very high free and reduced-price rate of participation (86%). This may suggest that many of the children come from homes where food availability is limited and, consequently, it is essential that they receive optimal nutrition at school in order to learn, grow, and develop appropriately.

Data indicate that recess should be scheduled so that elementary school children participate in recess before they eat. Children with recess scheduled after lunch often seem more anxious to go out to recess and less interested in eating lunch (Buergel et al., 2002). When recess is scheduled before lunch, children may come to lunch hungry, ready to eat, and free from many distractions.

CONCLUSIONS AND APPLICATIONS

Two conclusions can be drawn from the results of this study. First, when recess is scheduled before lunch, elementary school children consume significantly more food and have less plate waste than children who have recess after lunch. Second, when recess is scheduled before lunch children consume more calories and total nutrients including calcium, vitamin A, and iron than when they have recess after lunch.

Based on the results of this study, the following recommendations can be made: Whenever possible, elementary school administrators should schedule recess before lunch to ensure that students receive the optimal nutritional benefits of their school lunch. Improved intake of nutrients and calories is essential to the well being of children. Children who are well nourished are more likely to pay attention in the classroom and are better able to learn.

Further research is needed to analyze the relationship between lunch intake and learning to determine if consumption of adequate nutrients at lunch is associated with enhanced learning in the afternoon hours. Research also is needed to determine if the results of the current study are similar in schools with a lower percent of students qualifying for free and reduced-priced lunches. Additionally, continued investigation is essential to determine if students in other geographical areas also exhibit similar eating behaviors when lunch is scheduled before or after recess.

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