



Insight

A Publication for Child Nutrition Professionals from the National Food Service Management Institute — Spring 2004

Relationships of Meal and Recess Schedules to Plate Waste in Elementary Schools

OVERVIEW

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 child care facilities participate in the NSLP, which provides nutritionally sound lunches to approximately 25 million children each school day. Nutritional requirements are consistent with the goals of the Dietary Guidelines for Americans and must provide for lunch, on the average over each week, one-third of the daily recommended dietary allowance established by the Food and Nutrition Board of the National Research Council of the National Academy of Sciences.

School-aged children are in a time of rapid growth and development. Because of this period of growth, it is very important that they are provided nutritious meals to assist in meeting their physical, social, and emotional needs. Researchers have recognized that 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. Additionally, a significant relationship between nutrition and a child's ability to learn has been established.

However, environmental factors may influence consumption of lunch. These factors include the placement of recess in relation to the lunch period and the amount of time children have to eat. In order for children to receive the nutritional benefits of the school lunch, they must be ready to eat and have adequate time to consume their meal. Elementary students who have lunch first and then have recess could anticipate recess and may not focus on eating. As a result, the students might not

eat as much of their meal when compared to students who have recess before lunch. This may possibly result in more plate waste. It may also contribute to lack of energy in the afternoon, resulting in poor attention and an inability to learn. Elementary students also need to have adequate time to eat. There is concern among many school foodservice personnel, parents, teachers, and school administrators that the time often provided for students to eat is not adequate.

The National Food Service Management Institute (NFSMI), Division of Applied Research contracted with Central Washington University to explore these issues. This publication of Insight describes the plate waste study conducted and how foodservice directors and building administrators can use the information to modify their school day to reduce plate waste and improve consumption of lunch. Informed consent procedures for the protection of human subjects in research were approved and followed throughout the study.

STUDY OBJECTIVES

The purpose of this study was to determine the impact of lunch placement in the school day relative to recess and the length of the lunchtime on nutrient consumption of students in the third through fifth grades. The specific objectives of the plate waste study were to estimate the amount of food wasted and nutrients consumed

- when students had recess before lunch compared to students who had recess after lunch.
- when students had a 20 minute lunch period compared to students who had a 30 minute lunch period.

RESEARCH BACKGROUND

Plate waste studies have been traditionally used to estimate the amounts of food wasted during meal-time. Plate waste can also, indirectly, estimate the amount of food consumed. The placement of recess in relation to the lunch period has been shown to have an important impact on the amount of food wasted and consumed by elementary children. In a study examining the placement of recess in relation to the lunch period, Getlinger and colleagues showed that plate waste decreased from 34.9% to 24.3% when recess was scheduled before lunch rather than after lunch in elementary school grades 1-3. Similar studies investigating the placement of recess in relationship to the lunch period have demonstrated comparable results. In a survey of public school cafeteria managers, one-fourth mentioned plate waste as being at least a moderate problem in their operation, particularly elementary schools. The National School Nutrition Dietary Assessment Study estimated that about 12 percent of calories from food offered by the NSLP were wasted, with an estimated direct economic loss of \$600 million. Plate waste in the NSLP varies by food type, with fruits and vegetables being wasted more than other meal components.

The results of the School Health Policies and Programs Study 2000 demonstrated that almost one-fifth of schools gave students less than 20 minutes to eat lunch. There is concern that this time is not long enough to encourage students to eat their lunch. The length of the lunch period and the amount of time spent waiting in line have also been identified as significant factors in students' participation in the school lunch program.

METHODS

How was the plate waste study set up?

Plate waste was collected for a ten-day period in each of three elementary schools in the same school district for grades three through five. The three elementary schools were chosen specifically for the placement of the lunch periods and for the length of the lunch period. Study participants included 1,119 elementary students who had recess before lunch and 889 having recess after lunch. The following two comparisons were made:

- Comparison 1 - School 1 was compared to School 3. School 1 had recess before lunch while School 3 had recess after lunch. Both had 30-minute lunch periods, had the same free and reduced eligibility rate, and started lunch at the same time (Table 1).
- Comparison 2 - School 1 was compared to School 2. School 1 had a 30-minute lunch period while School 2 had a 20-minute lunch period. Other factors were similar.

Students in the study all ate in a common cafeteria, which included one single serving line with the exception of School 2, which had 2 serving lines after the single line check-in. Some elementary students ate in their classrooms on designated days. Students who ate in their classrooms were not included in the study.

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 since many of the students in these schools were members of Spanish-speaking families.

Methods for collecting the plate waste and calculating consumption were developed. These included:

- Weighing three to five servings of each pre-portioned menu item to determine average serving sizes of each menu item before the meal was served.
- Weighing the uneaten menu items on each tray at the end of the lunch period.
- Calculating the amount and percentage of waste for each served item.
- Calculating the amount of calories and nutrients consumed daily by each student. This was accomplished by using the plate waste data, the average serving size of each food item, and nutrient analysis of the amount of food that was missing and assumed to be eaten by the student.

How were the data collected and analyzed?

- Nutrient Consumption - From the average item serving size and the amount of waste left for each item on each tray, the amount and percentage consumption of each item were calculated using an electronic spreadsheet. Nutrient consumption for each item for calories and the following nutrients was determined: carbohydrate, protein, fat, saturated fat, vitamin A, calcium, and iron. An electronic spreadsheet was also used to sum the total for calories and the nutrients listed above, daily for each student. A spreadsheet containing demographic data (gender, age, grade level, and free or reduced eligibility rate) obtained from school administration corresponding to the individual student's personal identification number was linked to the electronic spreadsheet containing the plate waste data for each student. Only student identification numbers linked to the demographic data were used, not student names. Student confidentiality was maintained throughout the study.

Table 1 Elementary School Recess Placement, Lunch Schedule, Length of Lunch, and Free and Reduced Eligibility Rate

Elementary School	Recess Schedule	Lunch Start Time	Length of Lunch (Min)	Free and Reduced Eligibility Rate (%)
School 1	Before Lunch	12:30 p.m.	30	86
School 2	Before Lunch	12:40 p.m.	20	93
School 3	After Lunch	12:30 p.m.	30	86

- Data Analysis - Statistical analysis was performed to determine if the placement of recess relative to the lunchtime had an impact on the amount of plate waste and the amount of calories and nutrients consumed. Analysis was also performed to determine if the length of the lunch period had an impact on the amount of plate waste and the amount of calories and nutrients consumed.

RESULTS

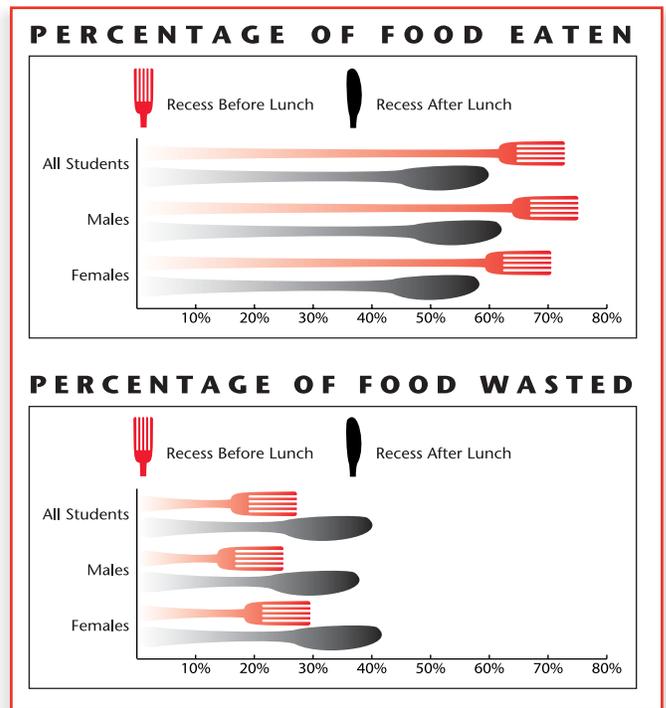
Placement of Recess and Nutrient Consumption

Researchers found for all children, the percentages of offered food eaten were significantly greater and the amount of offered food wasted was significantly lower when recess was scheduled before lunch. Overall, food waste decreased from 40.1% to 27.2% when recess was scheduled before lunch.

Elementary students having recess before lunch and recess after lunch consumed 503 and 464 calories, respectively. However, the total amount of protein consumed was not significantly different when comparing all students receiving recess before and after lunch. Carbohydrate intake was significantly greater for all participants when recess was scheduled before lunch. Fat intake was actually a little bit higher in the school that had recess after lunch.

The consumption of most vitamins and minerals was significantly greater when recess occurred before lunch. Most notably, calcium intake was significantly higher in the school with recess before lunch and represented a 35 percent increase in intake (252.4 mg in the school with recess after lunch compared to 340.9 mg in the school with recess before lunch).

Graph 1 When fed lunch after recess compared to lunch before recess



What does this indicate?

If elementary students are preoccupied with going to recess, the findings indicate that they do not eat as much of their lunch when compared to students who have already participated in recess. The lunch they do consume tends to consist of high-protein and high-fat foods, such as the entrée. If students have already participated in recess, they still eat their entrée, but will also eat more foods containing calcium and vitamins, such as milk, vegetables, and fruits. This group also leaves less total plate waste.

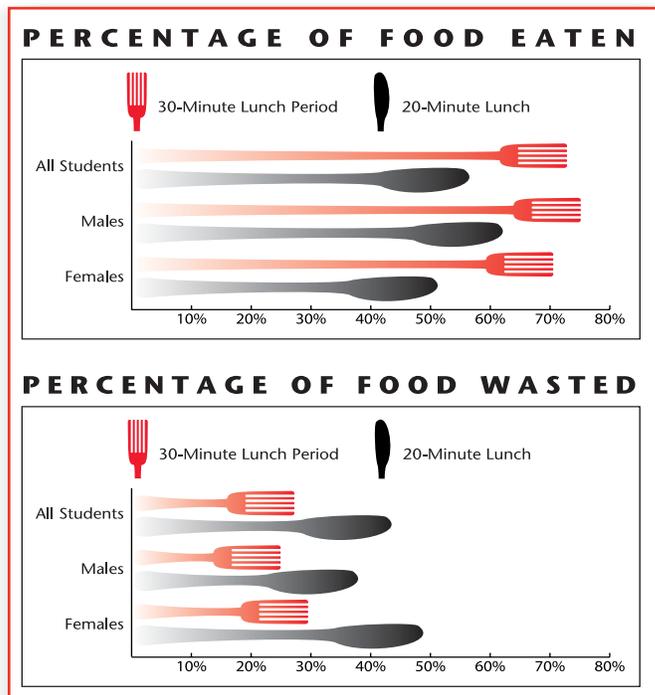
Length of Lunch Period and Nutrient Consumption

Researchers compared the length of the lunch period and nutrient consumption. The amount of food eaten was significantly greater and the amount of food wasted was significantly lower for the students who had a 30-minute lunch period. Overall, food waste decreased from 43.5% to 27.2% when the length of the lunch period was 30 minutes versus 20 minutes.

The total intake of all macronutrients and the percentage of that which was offered were also significantly greater for students receiving the 30-minute lunch period when compared to the students who received the 20-minute lunch. The amount of vitamin A and calcium consumed were also significantly greater when students were given a 30-minute period to consume lunch versus when they were given 20 minutes.



Graph 2 When the lunch period time is 30 minutes versus 20 minutes



What do the findings indicate?

When elementary students were given more time at lunch, they ate more of the lunch provided. The optimum time for lunch has not been established, but the current study indicates that there is improved intake when the length of lunch is 30 minutes rather than 20 minutes with the further caveat that recess is offered before lunch in both situations.

PRACTICAL USE OF THIS INFORMATION

What did this research determine about the placement of recess relative to lunch and the length of lunch in elementary schools?

While the specific findings of this study are limited to the schools in which the data were collected, the following ideas can be useful in setting policy concerning the placement of lunch relative to recess in elementary schools.

1. 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.
2. When recess is scheduled before lunch, children consume more calories and total nutrients, including carbohydrates and calcium, than when they have recess after lunch.

3. Children who have a 30-minute lunch period consume significantly more food and nutrients than those who have a 20-minute lunch period and have significantly less plate waste.

How can the school foodservice administrators and school administrators address the issues related to school schedule to improve consumption and reduce plate waste?

1. Elementary school administrators should schedule lunch after recess in order to offer students the opportunity to consume a well-balanced school lunch and receive the benefits of this meal for the remainder of the day.
2. Elementary school administrators should give consideration to all the factors influencing the time for elementary students to eat, allowing the students to benefit from the consumed calories throughout the remainder of the school day.
3. School foodservice directors and site managers should constantly assess their level of productivity for meal service to assure that service is efficient and timely.
4. Elementary school administrators should consider the amount of time it takes elementary students to prepare for the lunch period by washing hands and walking to the cafeteria as a factor in determining the total lunch period.

How much lunch time is needed to insure adequate eating time for elementary students?

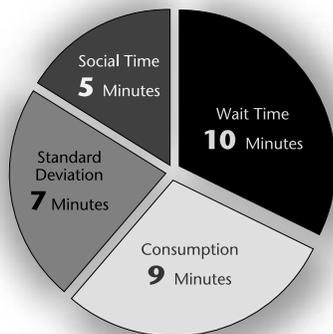
The approximate amount of time required for school lunch may be established by the following guidelines proposed by Buerger and colleagues in a previous research study and slightly modified here. The factors influencing the lunch period and recommended times for each factor are as follows:

- **FACTOR 1: Wait Time (10 Minutes):** This can be determined at each school, depending on the type of serving system, food production efficiency, and number of students waiting to be served. Wait time can be resolved by timing the student who takes the longest to get through the lunch service system. This would be timed from when the lunch period starts to when the

last person sits down at the eating area and is ready to eat. This might be as little as 5 minutes or may be as great as 15 minutes. As an example, we'll use 10 minutes.

- **FACTOR 2: Consumption Time (9 minutes):** The average time it takes for students to eat is about 9 minutes. This is consumption alone and does not account for socializing and other important functions of mealtime.
- **FACTOR 3: Standard Deviation (7 minutes):** If you consider differences that exist in the fact that some students take longer to eat than the average student, this can account for the more deliberate eaters.
- **FACTOR 4: Social Time (5 minutes):** This is time for students to develop social skills and have some down time before they go back into the formal learning environment.

FACTORS INFLUENCING LUNCH TIME AFTER STUDENTS ARRIVE TO THE CAFETERIA



SUM OF LUNCH TIME IN THE CAFETERIA **31** Minutes

WHERE DO WE GO FROM HERE?

In order to maximize food consumption and nutrient intake for elementary school students, continued research is needed to determine the ideal time needed for the lunch period in a wide range of elementary school settings. Additionally, further studies are needed to determine if calories and nutrients consumed at lunch play a role in readiness to learn, especially in the afternoon hours of instruction.

STAT FACTS

When fed lunch after recess compared to lunch before recess, elementary students:

- Eat **24** percent more food by weight.
- Waste **30** percent less food by weight.
- Eat **8** percent more calories.
- Consume **35** percent more calcium.
- Consume **13** percent more vitamin A.

When the lunch period time is 30 minutes versus 20 minutes, elementary students:

- Eat **21** percent more food by weight.
- Waste **40** percent less food by weight.
- Consume **16** percent more calories.
- Consume **56** percent more calcium.
- Consume **46** percent more vitamin A.

ADDITIONAL RESEARCH

Relationship of the Physical Dining Environment and Service Styles to Plate Waste in Middle/Junior High Schools

While estimates of plate waste in the school nutrition programs have varied over the years, there are few published reports about the possible relationship between the physical dining environment and the amount of a school lunch actually consumed. The National Food Service Management Institute contracted with Texas Tech University to measure aspects of the physical environment in relation to actual food consumption during lunch. The study was conducted in four public junior high schools in Texas. Researchers measured the environmental factors - illumination, noise, temperature, and humidity - in the school dining areas. Individual plate waste was weighed and calculated as a percentage of the total amount of food produced. The overall percentage of plate waste was approximately 22 percent in the four participating schools during the duration of this study.

The only positive correlation between environmental conditions and plate waste was humidity. A regression analysis corroborated the finding that when the relative humidity was higher, the amount of plate waste also increased. The environmental factors - illumination, noise, and temperature - did not appear to influence plate waste in this study. According to opinions expressed by students on perception surveys, the plate waste was in part due to having non-popular menu items for lunch rather than an unacceptable dining environment.

Alfonso Sanchez, PhD, Assistant Professor in the Department of Nutrition and Restaurant/Hotel Management, Texas Tech University conducted the study. Luis R. Contreras, PhD, Assistant Professor of Industrial Engineering at the University of Texas at El Paso collaborated on preparation of the study. A full report of the study can be accessed at www.nfsmi.org/Information/Research.html.

For More Information

RESOURCES:

Bergman, E. Buergel, N. Enamuthu, J. & Sanchez, A. (2000). Time spent by schoolchildren to eat lunch. *Journal of the American Dietetic Association*, 100, 696-698.

Buergel, N. Bergman, E. Knutson, A. & Lindaas, M. (2002). Students consuming sack lunches devotes more time to eating than those consuming school lunches. *Journal of the American Dietetic Association*, 102, 1283-1286.

Getlinger, M. Laughlin, C. Bell, E. Akre, C. Bahram, H. & Arjmandi, B. (1996). Food waste is reduced when elementary-school children have recess before lunch. *Journal of the American Dietetic Association*, 96, 906-908.



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Item Number R- 124-04

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This contracted research project was funded in part by the National Food Service Management Institute-Applied Research Division, located at The University of Southern Mississippi with headquarters at The University of Mississippi. Funding for the Institute has been provided with Federal funds from the U.S. Department of Agriculture, Food and Nutrition Services to The University of Mississippi. The contents of this publication do not necessarily reflect the views or policies of The University of Mississippi or the U.S. Department of Agriculture, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

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