

Several Strategies May Lower Plate Waste in School Feeding Programs

Joanne F. Guthrie and Jean C. Buzby

USDA's school nutrition programs include the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). On an average schoolday in 2001, 27.5 million children ate an NSLP lunch and 7.8 million children ate an SBP breakfast, at an annual cost to USDA of about \$6.5 billion for the NSLP and \$1.4 billion for the SBP. Because of the importance of the programs to schoolchildren's diets and because of the programs' magnitude, there is a high level of interest in how well the programs operate. One way to gauge the efficiency of a feeding program is to measure plate waste, which is generally defined as the quantity of edible food served that is uneaten. Although some food served will inevitably be wasted, excessive waste may be a sign of an inefficient operation or one that is not responsive to children's appetites or food preferences.

Excessive plate waste may also indicate that children are not fully benefiting from the nutrients offered by school meals, particularly if waste is primarily derived from foods, such as vegetables and fruits, that are underconsumed by American children in comparison with Federal dietary guidance. Nutritious, balanced meals eaten during childhood can provide benefits in terms of children's health, well-

being, and academic achievement and reduce risk factors for some chronic diseases in later life. Good eating habits learned early in life may carry over into adulthood. In short, healthful eating, coupled with regular physical activity, helps to optimize physical and cognitive development, maintain a healthful weight, and reduce risk of chronic disease.

USDA's Economic Research Service (ERS) reviewed studies on plate waste in school nutrition programs, particularly the NSLP, to determine the level of plate waste in these programs, factors that contribute to plate waste, and strategies that may reduce plate waste.

The best available data suggest that approximately 12 percent of foods served as part of the NSLP are wasted, resulting in an estimated direct economic loss of over \$600 million. Plate waste is ubiquitous and probably impossible to completely eliminate—a review of data on household and commercial food waste indicates that consumer plate waste levels are comparable to NSLP levels. Nevertheless, reductions in plate waste can make program operations more efficient, lower costs, and enhance the program's success in meeting nutrition objectives.

Most school meal services use the offer versus serve provision to



While most schools have decreased plate waste in student meals by using the offer versus serve provision, some schools have reduced waste even further by coupling the provision with other strategies, such as self-service bars.

Credit: Ken Hammond, USDA.

Joanne F. Guthrie (202) 694-5373 jguthrie@ers.usda.gov
Jean C. Buzby (202) 694-5370 jbuzby@ers.usda.gov

Guthrie is a nutritionist and Buzby is an agricultural economist with the Food and Rural Economics Division, Economic Research Service, USDA.

decrease plate waste while maintaining nutritional benefits. Under this provision, children may select a portion of the complete school meal (see box on school meal programs), though they are encouraged to take the complete meal. Some elementary schools decrease waste by scheduling lunch after recess. Other strategies that may be useful in decreasing plate waste include nutrition education campaigns, expanded use of self-service and regulatory options for customizing portion sizes to children's grade levels, and improvement of quality, appearance, and/or acceptability of foods.

Plate Waste in the National School Lunch Program

Plate waste has been defined as the proportion of food served that is uneaten, the amount of calories uneaten, or the amount of nutrients uneaten. Plate waste in children's school lunches has traditionally been measured via one of three methods: physical measurements (such as weighing discarded food), visual estimates made by trained observers, and food consumption as recalled by children.

ERS conducted a comprehensive review of school plate waste studies carried out between 1977 and 2001. Most studies focused on a handful of schools in a particular region. Plate waste estimates from these smaller studies ranged from 10 to 37 percent, probably indicating both local variations in plate waste and the effects of different study methodologies.

The only nationwide study that assessed the nutrient content of food actually eaten by students and the amount of food wasted was the School Nutrition Dietary Assessment Study-I (SNDA-I). The SNDA-I collected data for the 1991-92 school year by interviewing a nationally representative sample of about 3,350 students in grades 1 through 12. Students were asked to recall all the food and beverages they consumed over a 24-hour period. For school meals,

students were questioned not only about the food they ate but also about the food they selected or were served but did not consume. The study did not look at food wasted in lunches brought from home.

The SNDA-I study found that NSLP participants wasted about 12 percent of the calories in the food that they were served. (Plate waste in any particular school or district may differ substantially from the NSLP average due to local circumstances and operating conditions.) Estimates of food waste at the consumer level suggest that the 12-percent estimate of plate waste in the NSLP is not unreasonable. The direct economic cost of plate waste in the NSLP is estimated at over \$600 million annually. This estimate was calculated by multiplying 12 percent by \$5.49 billion, the portion of the \$6.2 billion NSLP allocation for fiscal 2000 that went to cash payments for meals. The estimate does not include the costs of the Federal share of State administrative expenses, any wasted commodity entitlements or bonus food, or the private costs of wasted foods purchased by students under the NSLP program. It does not adjust for differences in the costs of food items wasted (for example, more expensive entrees versus less expensive side dishes) because these data are not available. The method also assumes that the economic costs of plate waste include the overhead and labor costs of preparing and serving the meals. Finally, the estimate does not include the value of lost nutrition and health benefits.

According to the SNDA-I study, girls who participate in the NSLP tend to waste more food and nutrients than boys. For example, girls wasted 16.6 percent of calories and boys wasted 9 percent. Younger children who participated in the NSLP tend to waste a higher proportion of their food and nutrients than older children. For example, children under 11 years old wasted

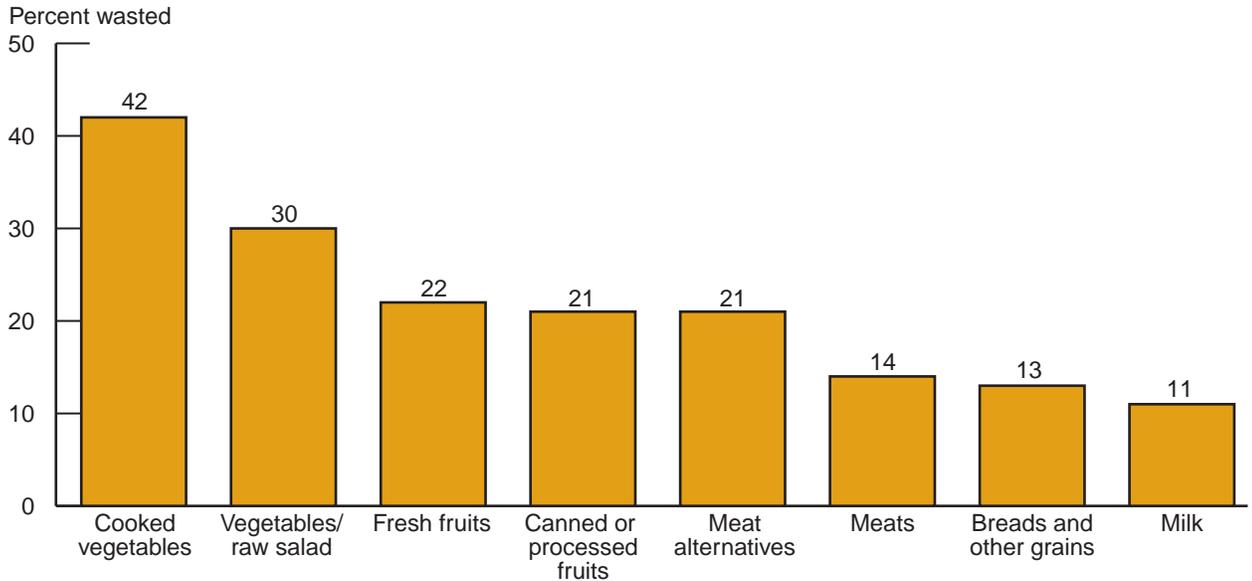
USDA School Meal Programs Allow Flexibility in Meeting Nutrition Standards

Meals served under USDA's School Breakfast Program (SBP) and National School Lunch Program (NSLP) must meet nutrition standards established by USDA's Food and Nutrition Service. These standards require that breakfasts meet one-fourth and lunches meet one-third of recommended dietary levels for food energy (calories), protein, calcium, iron, and vitamins A and C. School meals must also contain no more than 30 percent of calories from fat and less than 10 percent of calories from saturated fat and they are recommended to be moderate in cholesterol and sodium. However, States have flexibility in how they plan meals to meet these standards.

Currently, most schools plan SBP and NSLP meals using one of two approaches. Most schools use a food-based approach in which meals are planned to include minimum quantities of five meal pattern items (that is, milk, meat or meat alternative, two servings of vegetables and/or fruits, and bread or bread alternative). Some schools use a nutrient-based approach in which a computerized nutritional analysis of the week's menu ensures that the meals meet USDA standards. Schools that use a nutrient-based approach are required to serve milk and to offer at least one entree and one side dish, but within these broad guidelines, schools have flexibility in how they develop menus that meet nutrient guidelines. For example, they could serve a tortilla wrap sandwich stuffed with meat, vegetables, and cheese as an entree; a fruit cup as a side dish; and milk as a beverage.

The offer versus serve provision in school meal service is implemented somewhat differently in schools using nutrient-based approaches and those using food-based approaches to menu planning. In schools that use the nutrient-based meal planning systems, students must select at least two of the USDA meal-pattern items offered, one of which must be an entree, and may decline a maximum of two menu items. Children in schools that use the food-based menu planning systems must take a full portion of at least three of five meal-pattern items offered to get a reimbursable lunch, although they are encouraged to take all five items.

Figure 1—Kids Not Heeding "Eat Your Vegetables" Advice



Source: U.S. General Accounting Office Survey, July 1996.

14.8 percent of their food, while children age 11-14 wasted 11.9 percent and children over 14 wasted 6.5 percent.

Plate waste in the NSLP varies by food type, with vegetables and salads tending to be the most wasted items according to a U.S. General Accounting Office (GAO) survey of NSLP cafeteria managers (fig. 1). Although the SNDA-I found few differences among the percentages wasted of most nutrients, the B-vitamin folate, which is found primarily in fresh vegetables and fruit, was most wasted (15 percent), consistent with the types of food most likely to be wasted.

The 12-percent plate waste estimate is derived from a study conducted in 1991-92 and may not reflect current conditions in schools. One of the most important changes in the school foodservice environment in the past decade was the 1995 implementation of USDA's School Meal Initiative (SMI), which modernized nutrition standards for meals served under the NSLP and SBP and placed increased emphasis on nutrition education as a part of the programs. Other foodservice changes that may have influenced

meal acceptance, independent of USDA involvement, include an increase in sales of foods and beverages that are not part of the school nutrition programs (see box on outside foods) and increased use of pre-prepared and brand-name foods in school cafeterias. Available plate waste studies predate these major changes and therefore do not reflect their effects.

Several Strategies Can Help Reduce Plate Waste

In light of both individual and day-to-day variations in appetite and energy needs and in tastes and preferences, it is unlikely that plate waste could be completely eliminated in any foodservice setting. School meal programs face special challenges to minimizing plate waste, such as scheduling constraints that interfere with student meal consumption or result in serving meals when children are less hungry, the difficulty in adapting meals to widely varying student energy needs and food preferences, and the availability of substitute foods from competing sources, such as school stores and vending machines. Nevertheless,

lowering plate waste promotes efficient program management and can increase realization of the nutritional benefits of school meals, particularly when excessive waste is primarily derived from foods, such as fruits and vegetables, that are underconsumed in comparison with Federal dietary guidance.

If reducing plate waste were associated with encouraging children to eat more calories than they needed and the result was to promote obesity, nutritional benefits would of course be decreased. In such cases, although plate waste represents economic inefficiency, encouraging a child to "clean your plate" may add costs in the form of obesity-related health risks. A more effective approach to plate waste reduction might be to increase meal flexibility. USDA school meal regulations allow several options for increasing meal flexibility, such as using the offer versus serve provision for meal service, allowing children to serve themselves, and more closely tailoring portion sizes to appetites and needs. Other possible strategies for reducing plate waste include rescheduling lunch hours, im-

proving the quality and acceptability of food, and providing nutrition education to school children.

Increasing Meal Flexibility Lowers Waste

The offer versus serve provision for school meal service typically allows students to choose two or more USDA meal-pattern items offered (see box on school meal programs), and in many schools, offer versus serve has been coupled with strategies to match serving portions to children's appetites, such as self-service bars. As implemented in some school districts, the offer versus serve provision has increased fruit and vegetable consumption, probably by offering more choices. For example, many elementary schools in Oregon offer a "Food Pyramid Choice Menu" that features six or more fruit and vegetable choices. Daily food waste decreased by as much as 36 percent in participating school districts, according to the Oregon Department of Education, and students ate more fruits, vegetables, and grains.

Schools that participate in the NSLP and serve lunch to senior high school students are required to implement the offer versus serve provision. Offer versus serve has also become common in junior high, middle, and elementary schools. For example, close to 90 percent of elementary schools used the offer versus serve provision in the 1997-98 school year. Schools that do not use the provision serve complete meals to all students.

Because the variations in appetite and energy needs among students are probable causes of plate waste, tailoring portion sizes more closely to children's needs seems likely to decrease plate waste. USDA's Food and Nutrition Service sets minimum required serving sizes for each of several age/grade categories that are served school meals. However, schools that use a nutrient-based meal planning approach are allowed to customize serving sizes to more narrowly defined age/grade groups. A 1997-98 study of the implementation of USDA's SMI found that, while a majority of school foodservice man-

Do Outside Foods Compete With the NSLP?

In most schools, National School Lunch Program (NSLP) and School Breakfast Program (SBP) meals are not the only purchasable food choices available to students. The School Nutrition Dietary Assessment Study II, which was recently completed by USDA's Food and Nutrition Service, reports that, as of the 1998-99 school year, students in more than 9 out of 10 schools could purchase a la carte foods and beverages (that is, items not sold as part of an NSLP or SBP meal) in school cafeterias. The range of a la carte options tends to increase as students get older. At the elementary school level, 28 percent of schools limit a la carte items to milk only; an additional 11 percent limit a la carte offerings to milk, juice, and desserts. At the middle school and high school levels, a la carte offerings tend to be more extensive and may be more likely to completely substitute for NSLP meals or meals brought from home.

Vending machines selling foods and beverages were present in 76 percent of high schools, 55 percent of middle schools, and 15 percent of elementary schools. Finally, 41 percent of high schools, 35 percent of middle schools, and 9 percent of elementary schools sold food items through school stores, snack bars, or canteens. More recently, the Centers for Disease Control and Prevention's School Health Policies and Programs Study 2000 found that 95 percent of high schools, 62 percent of middle schools, and 26 percent of elementary schools have one or more vending machines from which students can purchase food or beverages. Also, 59 percent of high schools, 39 percent of middle schools, and 27 percent of elementary schools sold food items through school stores, snack bars, or canteens.

The presence of competing food options may decrease the likelihood that a child will purchase the USDA school meal, but, for those who continue to participate in the meal program, competing foods could also affect plate waste. For example, a child could choose a federally reimbursed school lunch but also purchase additional foods, such as snack or dessert items, from competitive sources and fail to completely consume the school lunch because part of it was replaced by the competing item. In such cases, plate waste would not represent a loss of calories but rather a substitution of items of differing calorie and nutrient profiles. In the future, it may be necessary to assess the role of competing food options in children's school meal choices to fully understand the nutritional significance of plate waste.



"Farm-to-school" programs and other strategies that incorporate fresh and local produce into school meals may not only increase participation in school meals and consumption of salads and other vegetables but may also decrease plate waste.

Credit: Ken Hammond, USDA.

agers reported no impact of SMI on plate waste, a larger proportion of managers using the nutrient-based approach to meal planning believed that plate waste had decreased, compared with managers using other approaches. This finding may be attributable to differences between school districts other than approaches to menu planning. Further studies would be necessary to establish whether the nutrient-based approach was more effective at controlling plate waste, as well as to what extent its benefits could be attributable to customizing portion sizes.

All schools participating in USDA meal programs have the option of allowing students to serve themselves—for example, via self-service bars. Self-service items need to meet USDA portion-size

guidelines to be reimbursable, but students may have more opportunity to choose a preferred mix of items. One study of elementary schoolchildren in Louisiana found that use of self-service bars for fruits and vegetables resulted in students consuming about one-half serving more of these foods; plate waste also decreased by a small amount.

Lunch Schedules Affect Plate Waste

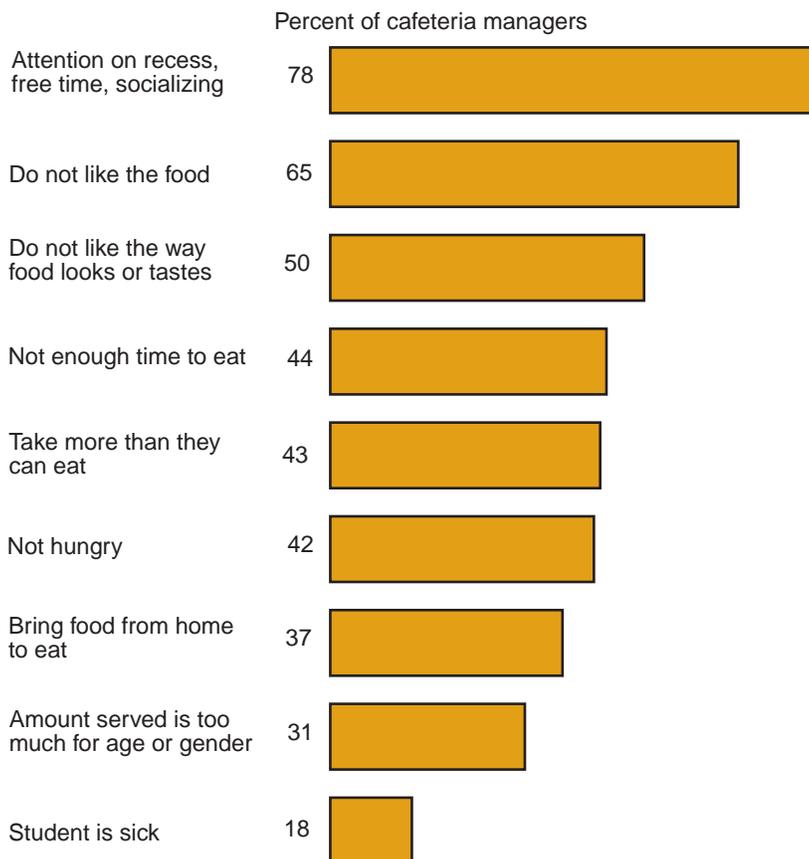
Rescheduling lunch so that it follows recess has also been shown to reduce plate waste, potentially providing cost savings to the NSLP and increasing the benefits that children receive from the program. For example, a study conducted in Illinois showed that overall food waste decreased from 35 percent to

24 percent when recess was rescheduled to precede lunch. The School Health Policies and Programs Study 2000 conducted by the Centers for Disease Control and Prevention (CDC) found that only 18.2 percent of elementary schools scheduled recess before lunch for half or more of classes.

Lengthening school lunch periods may also decrease levels of plate waste. Forty-four percent of public school cafeteria managers surveyed reported “not enough time to eat” as a possible reason for students’ plate waste (fig. 2). Studies suggest that in most cases, however, children have adequate time to eat their lunches. A study sponsored by the National Food Service Management Institute found a small number of cases in junior and senior high schools in which long waiting lines resulted in students having less than 10 minutes to eat, but effects on plate waste were not assessed.

Lunches that are served very early or very late in the day may also increase plate waste. Forty-two percent of NSLP cafeteria managers surveyed cited children being “not hungry” as one reason for plate waste. Lunches scheduled too soon after breakfast may be a cause of children not being hungry. Moving some of the earlier lunch periods to later times might reduce the volume of plate waste. On the other hand, lunches that are scheduled late in the day may increase plate waste if students have access to alternate foods, such as items from vending machines and snack bars or food brought from home. However, only a minority of NSLP cafeteria managers who responded to the survey felt that changing lunch schedules would decrease plate waste. Concerns also have been raised that scheduling other school activities during lunch, such as club meetings and pep rallies, may discourage children from eating school meals. Data on the effects of these scheduling issues on plate waste are not available.

Figure 2—Cafeteria Managers Cite Socializing and Food Dislikes as Most Likely Reasons Children Waste Food



Source: U.S. General Accounting Office Survey, July 1996.

Improving NSLP Food and Nutrition Education Could Lower Waste

Improving the quality, appearance, and acceptability of foods may also be an effective strategy, but the effects of such improvements are not well documented. ERS identified four strategies currently used to improve the quality, appearance, and/or acceptability of NSLP meals:

(1) **Improving the selection of commodities donated by USDA.** USDA makes commodity food products available to all schools participating in the Federal school meal programs. While these foods are generally viewed favorably by NSLP cafeteria managers, USDA continues to work to further improve the nutritional profile and acceptability of these foods. A study of the effects of increasing the amount of fresh fruits and vegetables made available to schools indicated that such improvements may decrease plate waste. Effects of other changes in commodities on plate waste have not been studied.

(2) **Increasing the use of produce and local foods.** Some schools are incorporating more fresh and local produce and less prepackaged or processed foods into school meal offerings. Case studies of schools that have developed “farm-to-school” programs suggest that such foods may increase participation in school meals and consumption of salad and other vegetables, the food categories most likely to be wasted. For example, the Berkeley, California, Unified School District implemented a “farmers market salad bar” that became very popular with students—NSLP participation increased and students overwhelmingly chose salad bar items over other selections. Such strategies, however, may require changes in operating

and purchasing procedures and may be relatively costly for schools to implement.

(3) **Using commercial food-service companies and/or their products.** An increasing number of schools that participate in the NSLP are using commercial foodservice companies to plan, prepare, and serve school meals. USDA leaves the decision whether to use foodservice management companies and/or brand-name fast foods up to local school food authorities. Although schools that use foodservice management companies appear to do so primarily for financial reasons, 26 percent of those responding to a GAO survey indicated that “increasing the nutritional value of meals” was also a motive. Cafeteria managers cite use of brand-name fast food items as a strategy for decreasing plate waste, presumably by increasing acceptance. A GAO survey of cafeteria managers indicated that an estimated 13 percent of public schools participating in the NSLP during the 1995-96 school year decided to offer brand-name fast foods as part of the USDA school meal, up from 2 percent in 1990-91. The CDC’s School Health Policies and Programs Study 2000 reported that 20 percent of schools offered brand-name fast foods to students, but this figure includes foods sold both as part of the NSLP and as a la carte items. NSLP meals that include brand-name fast foods must be in compliance with USDA’s nutritional standards.

(4) **Increasing student input.** Student advisory groups could help create improved menus that are more acceptable to students, which would likely reduce plate waste. USDA regulations encourage school food authorities to involve students—as well as parents—in their programs. Some schools already

have advisory committees. The American School Foodservice Association (ASFSA) promotes nutrition advisory councils, which it describes as “school clubs that bring students together” and “reinforce the idea that school nutrition programs are for them.” ASFSA reports that 365 schools nationwide had nutrition advisory councils chartered with ASFSA as of spring 2000. This number likely belies the prevalence of this strategy, as many other advisory groups operate independently of the ASFSA program.

Nutrition education has also been cited as a means for improving children’s diets and promoting acceptance of healthful menu items, particularly when coordinated with foodservice activities. One study found that a nutrition education program that involved schoolchildren in preparing and tasting foods later served in the school cafeteria was associated with decreased plate waste. The researchers selected several nutrient-rich foods, such as dark-green and deep-yellow vegetables, that are underconsumed by American children. Schoolchildren who participated in cooking/tasting activities that featured these foods ate more—and wasted less—of these foods when they were later served in the cafeteria. These results indicate that nutrition education may be a useful strategy for decreasing plate waste and enhancing program benefits.

Recent Changes in the School Meal Programs May Affect Plate Waste

In this study, ERS synthesized findings from a variety of studies of plate waste in schools participating in the NSLP. Several studies showed that plate waste can be reduced by employing the offer versus serve provision in school meal service and scheduling recess before lunch. Some evidence suggests that nutrition education may

reduce plate waste, particularly when the education is strongly linked to foods served in the school cafeteria. Strategies for tailoring portion sizes to children's appetites, preferences, and needs, such as allowing children to serve themselves, also may decrease plate waste without reducing nutrition benefits, but there is less research on the effects of these strategies.

Finally, most plate waste studies predate major changes in the school foodservice environment between 1996 and the present. Among the most important of these changes are (1) the implementation of USDA's School Meal Initiative, which modernized the nutritional guidelines for the school meal program and promoted increased nutrition education in schools, and (2) the increase in sale of foods and beverages not part of the Federal school meal programs. Another issue is the trend in school foodservice toward more use of pre-prepared items versus items prepared in the cafeteria and the potential effects of this trend on quality and acceptance of NSLP meals. These changes may also have affected plate waste; however, their effects have not yet been studied.

References

- Burghardt, J., and B. Devaney. *The School Nutrition Dietary Assessment Study: Summary of Findings*. Prepared by Mathematica Policy Research, Inc., Princeton, NJ, under Contract No. 53-3198-0-16, with the U.S. Department of Agriculture, Food and Nutrition Service, October 1993.
- Devaney, B.L., A.R. Gordon, and J.A. Burghardt. "Dietary Intakes of Students," *American Journal of Clinical Nutrition*, Vol. 61, suppl., 1995, pp. 205S-212S.
- Getlinger, M.J., C.V. Laughlin, E. Bell, C. Arek, and B.H. Armandi. "Food Waste Is Reduced When Elementary-School Children Have Recess Before Lunch," *Journal of the American Dietetic Association*, Vol. 96, No. 6, September 1996, pp. 906-8.
- Rodgers, P., T. Schuster, and J. Anderson (Technical Advisor, A. Sánchez). *Time Required by School Children to Eat Lunch*. National Food Service Management Institute, University of Mississippi, October 26, 1999.
- U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition, and Evaluation. *School Nutrition Dietary Assessment Study-II: Summary of Findings*. M.K. Fox, M.K. Crepinsek, P. Connor, and M. Battaglia, Project Officer, P. McKinney, July 2001.
- U.S. Department of Agriculture, Food and Nutrition Service. *The School Meals Initiative Implementation Study: First Year Report*. S. Abraham, M. Chattopadhyay, C. Sullivan, L. Mallory, and D.M. Steiger of the Gallup Organization and L. Daft, A. Arcos, and B. Wilbraham of PROMAR International, October 2000.
- U.S. General Accounting Office. *School Lunch Program: Cafeteria Managers' Views on Food Wasted by Students*, GAO/RCED-96-191. Report to the Chairman, Committee on Economic and Educational Opportunities, U.S. House of Representatives, July 1996.
- Wechsler, H., N.D. Brener, S. Kuester, C. Miller. "Food Service and Foods and Beverages Available at School: Results From the School Health Policies and Programs Study 2000," *Journal of School Health*, Vol. 71, Issue 7, September 2001, pp. 313-24. **FR**

This article summarizes a report prepared by USDA's Economic Research Service at the request of the U.S. House of Representatives Committee on Appropriations on plate waste in school nutrition programs, factors that contribute to plate waste, and strategies that may reduce waste. The full report, *Plate Waste in School Nutrition Programs: Final Report to Congress*, by Jean C. Buzby and Joanne F. Guthrie, E-FAN-02-009, March 2002, can be found on the ERS Web site at www.ers.usda.gov/publications/efan02009/efan02009.pdf.