

How Nutritious Are Children's Packed School Lunches? A Comparison of Lunches Brought From Home and School Lunches

Sarah Minaya, MS; Alice Jo Rainville, PhD, RD, CHE, SNS, FAND

ABSTRACT

Through reinforcement of policies and nutrition standards linked to the National School Lunch Program (NSLP), school environments play an important role in preventing childhood obesity. The NSLP includes mandated nutrition standards that specify recommended servings of vegetables, fruit, whole grains, dairy and protein, as well as limits on calories, saturated fat, trans fat and sodium. Packed lunches students bring from home are not required to meet nutrition standards and often fail to reach the nutrient quality of lunches provided by the NSLP. Students' packed lunches are frequently high in calories provided by desserts, snack foods and sugar-sweetened beverages (SSB) and often deficient in fruits and vegetables. In this review, authors summarize recent research and discuss the food and nutrient content of students' packed lunches compared to NSLP student lunches, focusing on both the School Meals Initiative standards and the 2012 nutrition standards.

Keywords: packed school lunches; school lunches; school nutrition; National School Lunch Program

INTRODUCTION

In school year 2009-2010, 63% of children participated in the National School Lunch Program (NSLP) throughout all grade levels (Fox & Condon, 2012). Therefore, 37% of children brought a packed lunch from home, left an open campus for lunch, ate competitive foods or chose not to eat. Out of the 63% of children who participated in the NSLP, participation rates were highest in elementary schools and lowest in high schools (Fox & Condon, 2012). Packed lunches are not required to meet nutrition standards, and the contents often fail to reach the nutrient quality of NSLP lunches.

The U.S. Department of Agriculture (USDA) periodically evaluates the NSLP through the implementation of the School Nutrition Dietary Assessment (SNDA). In the first SNDA study, SNDA-I 1991-1992, the levels of fat, saturated fat and sodium in students' lunches were found to be in excess of the recommendations set by the Dietary Guidelines for Americans. This led to the establishment of the School Meals Initiative for Healthy Children (USDA, Food and Nutrition Service [FNS], 2000). The School Meals Initiative standards required that schools limit saturated fat to no more than 10% and total fat to 30% or less of calories in each meal, and include a minimum of 33% of the recommended daily allowance for calories, protein, vitamins A and C, calcium and iron (Fox & Condon, 2012). In 2012, the nutrition standards mandated by the Healthy, Hunger-Free Kids Act required schools to offer only skim or 1% milk, increase whole grain options, offer a variety of fruits and vegetables daily and weekly and limit the amount of calories, sodium, saturated fat, and trans fat in students' lunches (USDA-FNS, 2012).

Researchers have used different methods of measuring students' lunches and consumption, including digital photography, direct observations, plate waste and combinations of these methods. Swanson (2008) conducted a pilot study using digital photography to evaluate elementary school lunches and found it was an unobtrusive, accurate and low cost method for collecting detailed school lunch data. Since that time, researchers (Bergman et al., 2014 and Hubbard et al., 2014) have successfully used digital photography for packed lunches, making this a reliable method for measuring students' food consumption. Richter et al. (2012) found that direct observations by nutrition students were also accurate and reliable.

The purpose of this review is to describe recent research and discuss the food and nutrient content of students' packed lunches compared to NSLP student lunches, focusing on both the School Meals Initiative guidelines and the 2012 nutrition standards. Only U.S. studies published from 2010 to present were included to keep the focus on recent lunches from home.

CURRENT RESEARCH

Comparing Elementary and Middle School Packed Lunches to School Lunches

Studies Conducted Using School Meals Initiative Standards. Several studies conducted prior to 2012 compared school meals and packed lunches based on the School Meals Initiative standards that focused on required amounts of nutrients. Bergman et al. (2014) used digital photography to compare the nutrient content and nutrients consumed in packed lunches and NSLP lunches for grades 2-5 in Washington state schools designated as part of the HealthierUS School Challenge. These schools were recognized for their healthy school nutrition environments. The data was collected in the 2011-2012 school year, before the new meal pattern. School lunches (n=344) were significantly ($p<.05$) higher in protein, cholesterol, calcium, iron, sodium and vitamin C than packed lunches (n=276). Packed lunches included significantly less ($p<.05$) calories, more fat and saturated fat than NSLP lunches. Students who consumed NSLP lunches were significantly ($p<.05$) more likely to meet School Meals Initiative standards for percentage of calories from fat, protein, calcium, iron and vitamins A and C. Students with packed lunches consumed significantly ($p<.05$) more saturated fat, fiber and less sodium than students who consumed NSLP lunches.

Similarly, Hur, Burgess-Champoux and Reicks (2011) conducted a study using digital photography of fourth and fifth grade students' lunches in Minnesota schools. Packed lunches (n=44) included significantly more calories ($p=.048$), total fat ($p=.003$) and total sugar ($p<.001$) than NSLP lunches (n=85) using School Meals Initiative standards. In addition, packed lunches contained slightly more dietary fiber at 4.1g compared to 3.8g, and significantly less sodium ($p=.039$) at 728 mg versus 912 mg in NSLP lunches. Packed lunches were significantly lower ($p<.001$) in fruits and vegetables.

Students who brought packed lunches consumed more fiber and less sodium than students who ate NSLP lunches (Bergman et al. 2014; Hur et al. 2011). Hur et al. concluded that NSLP lunches (912 mg of sodium) exceeded the sodium limit of 733 mg for one meal (2,200 mg/day) set by the Dietary Guidelines for Americans (U.S. Department of Agriculture [USDA] & U. S. Department of Health and Human Services [USDHHS], 2015). Conversely, Bergman et al. found that while packed lunches contained less sodium, both NSLP (1,148.5 mg) and packed lunches (922.7 mg) contained more sodium than recommended by the Dietary Guidelines (733 mg). The higher fiber intake in packed lunches was consistent with the added fiber found in processed

snacks such as granola bars and crackers, and not a high intake of fruits, vegetables or other whole grains.

In a comparable study trained research assistants performed 2,107 observations of second grade students in seven different Texas schools. Johnston, Moreno, El-Mubasher and Woehler (2012) found that packed lunches (n=811) contained significantly fewer ($p<.001$) fruits, vegetables, dairy and more desserts and sugar-sweetened beverages (SSB) than NSLP lunches (n=1,296). Furthermore, only 13.2% of students' packed lunches included a vegetable; 45.3% included a fruit; 41.8% included dairy; 60% included high fat/high sugar foods; and 47.2% included an SSB. This compared to NSLP lunches where 29.1% included a vegetable; 75.9% included fruit; 70% included dairy; 17.5% included desserts; and 0.3% included an SSB. Johnston et al. (2012) chose to include 100% fruit juice as a fruit serving in this study, which can be seen in the high fruit intake in both groups.

Studies Conducted Using 2012 NSLP Nutrition Standards. Several studies evaluated packed lunches using the 2012 NSLP nutrition standards. The standards emphasized the nutrient density and quality of foods served, while still focusing on specific nutrients as previously indicated in the School Meals Initiative. In an observational study, trained research staff evaluated 242 elementary and 95 intermediate Texas school students' packed lunches and NSLP lunches using 2012 nutrition standards (Caruso & Cullen, 2015). Over a two-month period, researchers found that 90% of packed lunches included desserts, snack chips and SSB. In addition, students' packed lunches contained significantly more sodium ($p<.001$ for both grade levels), less vegetables ($p<.001$ for both grade levels), and exceeded saturated fat limits when compared to NSLP nutrition standards. Intermediate school students' packed lunches did not contain adequate amounts of vegetables, fruits, whole grains and milk (brought or consumed) when compared to the NSLP nutrition standards of $\frac{1}{2}$ cup fruit, $\frac{3}{4}$ cup vegetables, $\frac{1}{2}$ oz. whole grains and 1 cup milk daily (USDA-FNS, 2012).

Comparable to earlier studies, packed lunches that were brought and consumed by students contained large amounts of carbohydrates including snack foods, desserts and grains (Bergman et al., 2014). Hubbard, Must, Eliasziw, Folta and Goldberg (2014) conducted research in six Massachusetts public school districts for third and fourth graders (n=626), and lunches (n=301) were compared to 2012 NSLP standards. Researchers used digital photography and a supplemental food inventory to document students' lunches. Children were eligible if they brought food from home at least three days per week. The median number of items brought for lunch was three and a typical lunch was water, a sandwich and a snack food. Only 3% of lunches included milk, and 11% of students stated that they planned to buy milk. Forty-two percent of lunches contained salty snack foods; 28% had a dessert; 34% had a fruit; and 11% had vegetables. Only 27% of lunches met three or more NSLP standards for protein, grains, fruit, milk and vegetables. Grains and protein had the highest percentage at 66% and 65%, while milk, fruit and vegetables were low at 32%, 15% and 6% respectively.

Comparing Pre-Kindergarten and Kindergarten Packed Lunches to School Lunches

Study Conducted Using 2012 NSLP Nutrition Standards. Similar to elementary and middle school students' packed lunches, pre-kindergarten and kindergarten students' packed lunches were inadequate in specific food groups and nutrients when compared to the 2012 NSLP nutrition standards. Farris et al. (2014, 2015) conducted an observational study of pre-kindergarten and kindergarten lunches in three rural Virginia schools. They compared the

nutrient quality of pre-kindergarteners' and kindergarteners' packed lunches (n=561) to NSLP lunches (n=752) using the 2012 NSLP nutrition standards. Packed lunches were significantly ($p<.001$) higher in calories, total fat, saturated fat, sugar, vitamin C and iron, and lower in protein, fiber, vitamin A and calcium. Packed lunches were less likely to contain fruits, vegetables and milk than NSLP meals and included more chips, crackers and SSB. Sixty-one percent of packed lunches contained a dessert, and 17% contained more than one dessert. Only 12.5% of lunches contained both a fruit and vegetable; 10.7% had a juice with no sugar added. Additionally, 20.7% of packed lunches contained milk and 16% contained water, while 41.2% included an SSB. Students whose lunch included an SSB were significantly ($p<.01$) more likely to have a lunch with less protein, fiber, sugar, calcium and iron. Although packed lunches included more processed foods and snacks, surprisingly they contained significantly ($p<.001$) less sodium than NSLP lunches, at a mean of 883 mg versus 1,021 mg.

Preschool Lunches from Home. An observational analysis was completed of 607 preschoolers' sack lunches from early education centers in Texas. Romo-Palafox et al. (2015) found that the mean Healthy Eating Index for packed lunches was 58 out of 100 and dropped to 52 out of 100 for consumed lunches. The Healthy Eating Index measures 12 food categories based on compliance with the U.S. Dietary Guidelines. This includes nine adequacy components scored from 5 to 10 points and three moderation components (sodium, refined grains and empty calories) reverse coded and scored from 10 to 20 points. Forty-nine percent of preschoolers' packed lunches did not provide any vegetables and only one in 10 lunches included greens or beans. Furthermore, 60 to 70% of lunches (packed and consumed) included higher than recommended amounts of refined grains, sodium and saturated fats. However, only 14% of packed lunches did not contain whole fruit.

Nutrition Education Interventions

Nutrition education interventions are an important approach to improving packed lunches in schools. The inclusion of educational materials for parents and activities for students in classrooms can encourage students to try and taste test new foods to incorporate in packed lunches.

The nutrition education intervention *Lunch Is In The Bag* targeted parents through evaluating Texas preschoolers' packed lunches (769 observations on 131 subjects) (Sweitzer et al., 2010). The intervention included parent handouts, classroom activities, educational stations and teacher training and was designed to increase fruits, vegetables and whole grains. Sweitzer et al. found no change in fruit servings; however, significant increases ($p<0.001$) in vegetables and whole grains servings were found. The authors concluded that the *Lunch Is In the Bag* program is a feasible intervention for improving the nutritional content of lunches that parents pack for their preschool children.

In a contrasting study, Goldberg et al. (2015) conducted a cluster-randomized trial in Massachusetts based on the *Great Taste, Less Waste* and the *Foods 2 Choose* campaigns. The *Great Taste, Less Waste* campaign was aimed at increasing the quality of children's food through connections with the environment. The *Foods 2 Choose* campaign was similar, but was aimed at promoting nutrition only. Lessons for both campaigns were taught in elementary schools. This study was different from previous studies due to its focus on whether *Great Taste, Less Waste* would change the contents of packed lunches (n=327) more than the *Foods 2 Choose* campaign lunches (n=78), or control lunches. For *Great Taste, Less Waste* lunches, at baseline, 48% of

lunches included one or more servings of fruit; 9.5% included one or more vegetable servings; and 39.8% included one or more SSB. The *Foods 2 Choose* campaign's baseline percentages for fruit, vegetables and SSB were 32%, 10.3% and 52.6%, respectively. Researchers found while there was no difference in fruit or SSB amounts, students brought fewer vegetables at follow up. While *Great Taste, Less Waste* students brought slightly more vegetables at follow up, the difference was not statistically significant. The authors concluded that there were no significant changes in the quality of packed lunches.

Nutrition education interventions can be a critical step in assisting parents in learning more about nutrition and improving packed lunches, while also providing school nutrition professionals information on what barriers parents face when packing students' lunch. Sweitzer et al (2010) found some improvement in preschool lunches after their *Lunch is in the Bag* intervention for preschool parents. Unfortunately, nutrition education interventions by Goldberg et al., 2015 did not change the inadequate nutrition profiles of elementary school packed lunches. Misyak, Farris, Mann and Serrano (2015) called for more research to understand parent and child motivations for packing lunches and decisions on foods included. They also called for a multidimensional approach to improve the quality of meals consumed at schools.

Packed lunches are often limited in providing fruits and vegetables. The higher amount of vitamins and minerals observed in packed lunches, such as vitamin C and iron, can be attributed to fortified SSB, and not to the adequate consumption of whole fruit and vegetables (Farris, et al., 2015; Johnston, et al., 2012). Additionally, two studies showed that one-half of students' packed lunches fail to include any fruits or vegetables (Farris et al., 2014, 2015; Romo-Palafox et al., 2015). As part of the 2012 nutrition standards, students in kindergarten should be offered $\frac{3}{4}$ cup vegetables daily, totaling to five cups weekly (UDSA 2012). This deficiency in fruits and vegetables leads to a higher intake of calories from refined carbohydrates including desserts and snack foods (Farris et al., 2014, 2015). Children are at a critical age for developing eating habits, especially with fruits and vegetables, that continue into adulthood.

CONCLUSIONS AND APPLICATIONS

The 2010-2015 U.S. research studies evaluating the nutrient content of elementary, middle and preschool packed lunches and nutrition education interventions show that packed lunches contain more calories, fat, saturated fat, desserts and SSB than NSLP lunches and do not meet all of the current NSLP nutrition standards. Furthermore, the NSLP provides a wide variety of foods and due to time limitations in preparing food and cost, some parents might find it difficult to provide a variety of protein, low-fat dairy, whole grains and fruit and vegetable sources.

Packed lunches should focus on variety and include various sources of lean protein along with deli meats and peanut butter, including chicken, fish, turkey, eggs and beans. Low-fat dairy should include yogurt, cottage cheese and cheeses. Whole grains can include forms of wheat, barley, oats, corn, quinoa and rice that can be incorporated into packed school lunches through breads, pastas, cereals and brown rice. Fruits and vegetables should be added to packed lunches in the form of cooked, canned, dried or raw. Parents should look for canned fruits packed in 100% fruit juice, water or no sugar added, and vegetables with low sodium or no salt added. High calorie snacks, sweets and desserts should be swapped out for hummus with vegetables, nuts, seeds, pretzels, low fat popcorn, dried fruits and whole fruits with yogurt. SSB can be swapped out for low fat milk, 100% fruit juice and water. Nutrition educators can provide lessons on low-cost and quick ideas for packed lunches. Manufacturers can provide convenient

and low cost options for these healthier food items for parents so making nutritious choices for packed lunches is easier.

School nutrition professionals and health professionals should promote school lunches and work on developing additional information for parents on the nutritional benefits of the NSLP to avoid negative associations and increase NSLP participation. Nutrition educators should host parent meetings that showcase new recipes featuring more fresh fruits and vegetables and incorporating lower sodium options through use of more herbs and spices. Students' food preferences are also an important part of increasing NSLP participation, and school nutrition professionals should include students in surveys and taste testings for new menu items. Future research on packed lunches should focus on understanding the possible barriers parents face, including limited time for shopping and preparing lunches, access to fresh fruits and vegetables, food budgets and children's taste preferences. Finally, future research should include high school students' packed lunches compared to school lunches.

REFERENCES

Bergman, E.A., Saade, C., Shaw, E., Englund, T., Cashman, L., Taylor, K.W., ... Rushing, K., (2014). Lunches selected and consumed from the National School Lunch Program in schools designated as HealthierUS School Challenge Schools are more nutritious than lunches brought from home. *Journal of Child Nutrition & Management*, 38(2), 1-14. Retrieved from <https://schoolnutrition.org/JCNM/>

Caruso, M.L. & Cullen, K.W. (2015). Quality and cost of student lunches brought from home. *JAMA Pediatrics*, 169(1), 86-90. doi:10.1001/jamapediatrics.2014.2220

Farris, A.R., Misyak, S., Duffey, K.J., Davis, G.C., Hosig, K., Atzaba-Poria, N., ... Serrano, E.L. (2014). Nutritional comparison of packed and school lunches in pre-kindergarten and kindergarten children following the implementation of the 2012-2013 National School Lunch Program standards. *Journal of Nutrition Education & Behavior*, 46(6), 621-625. doi:10.1016/j.jneb.2014.07.007

Farris, A.R., Misyak, S., Duffey, K.J., Mann, G.R., Davis, G.C., Hosig, K., ... Serrano, E.L., (2015). A comparison of fruits, vegetables, sugar-sweetened beverages and desserts in the packed lunches of elementary school children. *Childhood Obesity*, 11(3), 275-279. doi:10.1089/chi.2014.0134

Fox, M.K., & Condon, E. (2012). U.S. Department of Agriculture, Food and Nutrition Service. *School Nutrition Dietary Assessment Study – IV: Summary of findings*. Alexandria, VA: Office of Research and Analysis.

Goldberg, J.P., Folta, S.C., Eliasziw, M., Koch-Weser, S., Economos, C.D., Hubbard, K.L., ... Must, A. (2015). Great Taste, Less Waste: A cluster-randomized trial using a communications campaign to improve the quality of foods brought from home to school by elementary school children. *Preventative Medicine*, 74, 103-110. doi:10.1016/j.ypmed.2015.02.010

Hubbard, K.L., Must, A., Eliasziw, M., Folta, S.C. & Goldberg, J. (2014). What's in children's backpacks: Foods brought from home. *Journal of the Academy of Nutrition & Dietetics*, 114(9), 1424-1430. doi:10.1016/j.jand.2014.05.010

- Hur, I., Burgess-Champoux, T. & Reicks, M. (2011). Higher quality intake from school lunch meals compared with bagged lunches. *Childhood Obesity & Nutrition*, 3(2), 70-75. doi:10.1177/1941406411399124.
- Johnston, C.A., Moreno, J.P., El-Mubasher, A. & Woehler, D. (2012). School lunches and lunches brought from home: A comparative analysis. *Childhood Obesity*, 8(4), 364-367. doi:10.1089/chi.2012.0012
- Misyak, S., Farris, A., Mann, G. & Serrano, E. (2015). The importance of improving the nutritional quality of packed lunches in U.S. schools. *Journal of Child Nutrition & Management*. 39 (2), 1-8. Retrieved from <https://schoolnutrition.org/JCNM/>
- Richter, S.L., Vandervet, L.M., Macaskill, L.A., Salvadori, M.I., Seabrook, J.A. & Dworatzek, P.D.N. (2012). Accuracy and reliability of direct observations of home-packed lunches in elementary schools by trained nutrition students. *Journal of the Academy of Nutrition & Dietetics*, 112 (10), 1603-1607. doi:10.1016/j.jand.2012.07.010
- Romo-Palafox, M.J., Sweitzer, S.J., Roberts-Gray, C., Hoelscher, D.M., Byrd-Williams, C.E. & Briley, M.E. (2015). Dietary quality of preschoolers' sack lunches as measured by the Healthy Eating Index. *Journal of the Academy of Nutrition & Dietetics*, 115(11), 1779-1788. doi:10.1016/j.jand.2015.05.017
- Swanson, M., (2008). Digital photography as a tool to measure school cafeteria consumption. *Journal of School Health*, 78(8), 432-437.
- Sweitzer, S.J., Briley, M.E., Roberts-Gray, C., Hoelscher, D.M., Harrist, R.B., Staskel, D.M. & Almansour, F.D. (2010). Lunch is in the bag: Increasing fruits, vegetables and whole grains in sack lunches of preschool-aged children. *Journal of the American Dietetic Association*, 110(7), 1058-1064. doi:10.1016/j.jada.2010.04.010
- U.S. Department of Agriculture, Food and Nutrition Service. (2000). *The School Meals Initiative Implementation Study: First year report*. Retrieved from <http://www.fns.usda.gov/sites/default/files/SMIYear1.pdf>
- U.S. Department of Agriculture, & U.S. Department of Health and Human Services. (2012). *New meal pattern requirements and nutrition standards*. Retrieved from http://www.fns.usda.gov/sites/default/files/LAC_03-06-12_0.pdf
- U.S. Department of Agriculture, & U.S. Department of Health and Human Services. (2015). *Dietary Guidelines for Americans 2015-2020*. Retrieved from http://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf

BIOGRAPHY

Minaya is a Nutritionist with the Richmond County Health Department in Augusta, Georgia. Rainville is a Professor in the School of Health Sciences at Eastern Michigan University in Ypsilanti, Michigan.