Impact of the MyPyramid Color-bar Signage System on fruit and vegetable choices and consumption among Kindergarteners

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Abstract

The purpose of this study was to evaluate the impact of the MyPyramid Color-bar Signage System, which is a unique, targeted environmental change for school cafeterias paired with nutrition education, designed to increase fruit and vegetable consumption among Kindergarteners in an inner city school. The color-bar system is an educational tool to assist pre-readers with choosing a variety of colors at their meals. A nutrition education lesson designed to teach students about MyPyramid and the signage system was introduced to students in the intervention school Kindergarten classrooms during the week the signage system was implemented in the cafeteria. A second school served as the control. Students' food selection was assessed using photographs of student trays. Post-consumption trays were collected and food was measured to assess plate waste and calculate consumption.

At baseline, total consumption between schools was not significantly different [intervention: n=49, 307.0 g (SD 112.43); control: n=48, 326.0 g (SD 116.96)]. At follow-up mean total consumption did not differ by school [intervention: n =44, 335.6 g (SD 120.34); control: n=72, 349.6 g (SD 117.79)]. Though there was no difference in percent vegetable consumption, percent fruit consumption was significantly higher in the intervention school (68.9% (SD 38.71)) compared to the control school (51.9% (SD 39.5) p=0.0391). Data from this study will inform full implementation and evaluation of the program system wide, which, if successful, may serve as a model nationwide for targeted nutrition education linked to school environmental changes.

Introduction

Childhood overweight and obesity are current public health threats, and compared to national rates, Knox County boasts a higher-than-average rate of childhood overweight/obesity (1). Although several dietary factors may play a role in preventing and treating childhood obesity, diets high in fruit and vegetable are associated with lower risks of overweight and obesity (2-6). It is theorized that daily intakes of adequate fruits and vegetables lower overall daily energy density and increase fiber intake, which may lead to greater satiety (7). Increasing consumption of fruits and vegetables is a potential strategy for decreasing overweight/obesity (8,10). It is theorized that early, repeated exposure to fruits and vegetables may increase the establishment of lifelong positive dietary patterns (10,12). Therefore, Knox County Schools adopted a system of My Pyramid visual materials linked with classroom nutrition education, which targets fruit and vegetable consumption in all Kindergartners attending KCS facilities. The target population was Kindergarteners, in 2 urban public elementary schools, serving primarily low-income and minority students, as this is the population at highest risk for childhood overweight/obesity (13-14), later development of diseases associated with overweight/obesity (15-16), low consumption of fruits and vegetables (9), and lack of access to fruits and vegetables in local food stores (17-18). The My Pyramid Color-bar Signage System is designed to be a color-coded educational tool to assist pre-readers with choosing a variety of colors at their meals.

This was a quasi-experimental design, taking advantage of a planned environmental change, as well as development of a novel measurement technique. One school delayed implementation of the My Pyramid food signage system until January 2009, and served as the control. The intervention school began the signage system in November 2008. There were four kindergarten classes with 75 students enrolled in the control school and four kindergarten classes with 78 students enrolled in the intervention school.

We hypothesized that Kindergartners, exposed to an environmental change paired with classroom nutrition education, would consume more fruits and vegetables compared to children without the exposure.

Methods

MyPyramid and how to use the MyPyramid Color-bar Signage System was introduced to students in the intervention school classrooms during the week the color-bar signage system was implemented in the cafeteria. The education and signage were always paired and this project evaluated the entire exposure. An example of a cafeteria poster is shown in **Figure 1**.

➢Assessment of Consumption

    ➢Photographs of trays (See Figure 2)

       ➢ Disposable trays were pre-labeled with numbered, removable stickers
       ➢ After meals were purchased, research assistants guided children to a small table where a digital camera was mounted
       ➢ Research assistants removed the numbered sticker, and placed the sticker on either a pink or a blue card to Identify the child's gender
       ➢ This card was placed beside the tray and a photograph was taken

    ➢ Test meals

       ➢ At both schools, 3 samples of each offered food was collected, weighed, and a mean weight (in grams) calculated

➢ Creation of Consumption Variables

       ➢ Upon completion of the meal, a team of research assistants collected, carefully wrapped, and labeled the trays
       ➢ Wrapped trays were transported to a university laboratory where individual foods were measured (in grams) and recorded
       ➢ Each photograph was independently assessed by two research assistants and a "tray" created on a spreadsheet
       ➢ Average weights of test foods were used for the weight of food selected
       ➢ Actual weights of remaining foods were then added to the spreadsheet
       ➢ Consumption was created from the difference between these two variables
           ➢ If this variable was negative, it was critically assessed and removed from analysis if greater than 110% of the food served
           ➢ If less than 110% of food served, then this variable was considered to be zero, or nothing consumed
           ➢ For each food group, the weights of individual foods were summed, allowing an overall food group consumption variable

These data were collected at baseline (October) and at follow-up (January)

Institutional Review Board approval was received for this project, with the following constraints: in the event that a child's face was captured in the photograph, the data would not be used.

Results

Baseline (**Figure 3**) - 48 trays from the control school and 46 trays from the intervention school were available for baseline data analysis. T-tests revealed that vegetable intake was significantly higher in the control school compared to the intervention school (58.5 vs 35.1 g; p=0.0014) , though this was driven by fried potato consumption. When fried potatoes were removed from the analysis, vegetable consumption was not different between schools (9.2g vs 2.9 g, control vs. intervention; p=0.088). However, intakes of vegetables decreased dramatically upon removal of fried potatoes.

Follow-up (**Figure 4**) - At follow-up, 72 trays from the control school and 44 trays from the intervention school were available for analysis. The control school consumed significantly more vegetables than the intervention school (92.8 g (SD 43.02) vs 31.1 g (SD26.86), respectively; p=<0.0001). However, analysis of vegetable intake with fried potatoes removed was not possible, as the intake was negligible at both schools. Fruit intake was significantly higher in the intervention school compared to the control school (63.2 g (SD 45.86) vs. 28.5 g (SD 34.6), respectively; p=<0.0001) and this was also significantly higher than baseline (data not shown). Students in the intervention school also consumed significantly more bread than did students in the control school (34.6 g (SD 15.98) vs 17.3 g (SD 18.7), respectively; p=<0.0001), though the control school students consumed significantly less bread at follow-up than at baseline (data not shown). There were no differences between schools in terms of milk, meat, or overall intake.

Figure 1. Sample cafeteria poster for the MyPyramid Color-bar Signage System
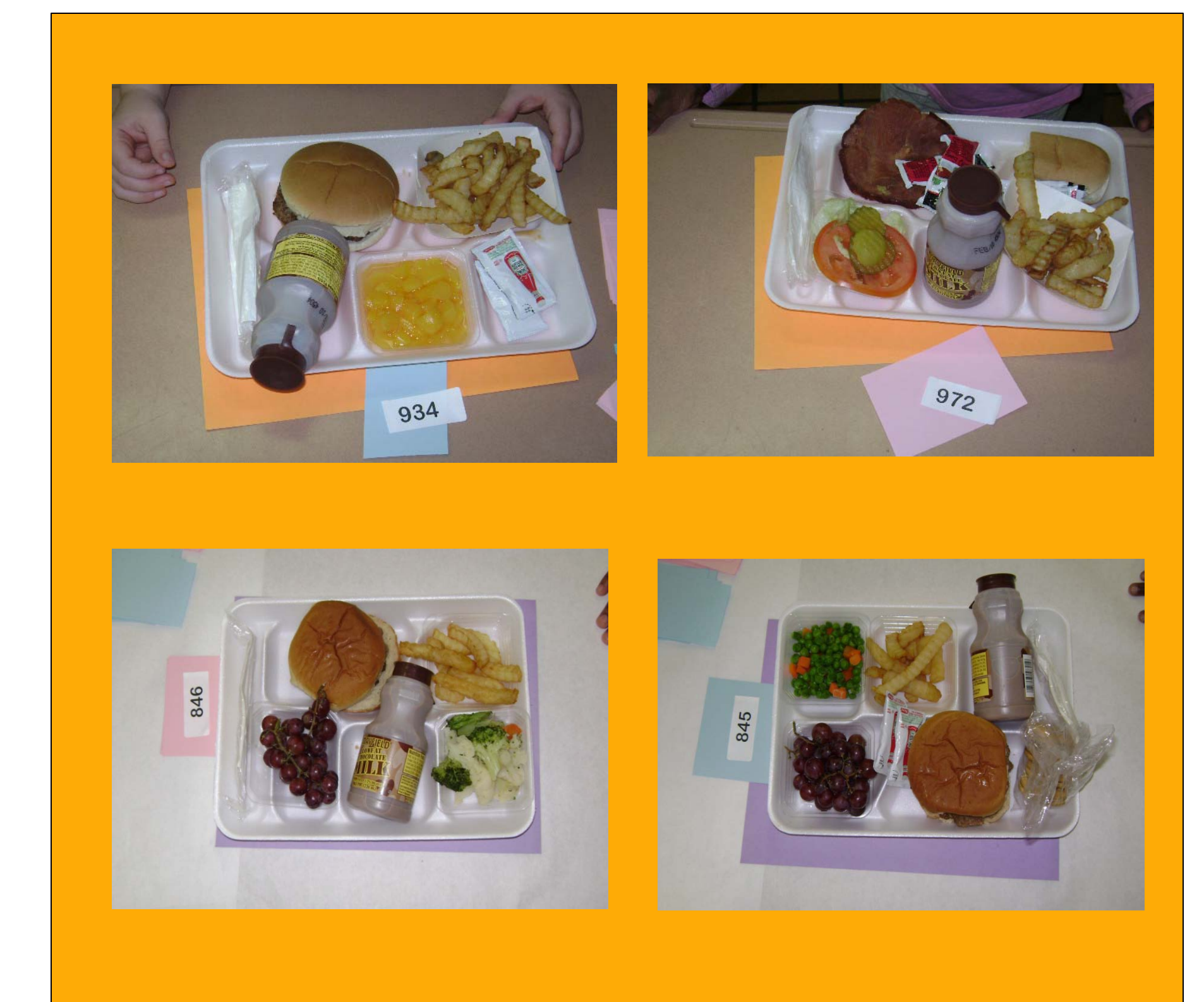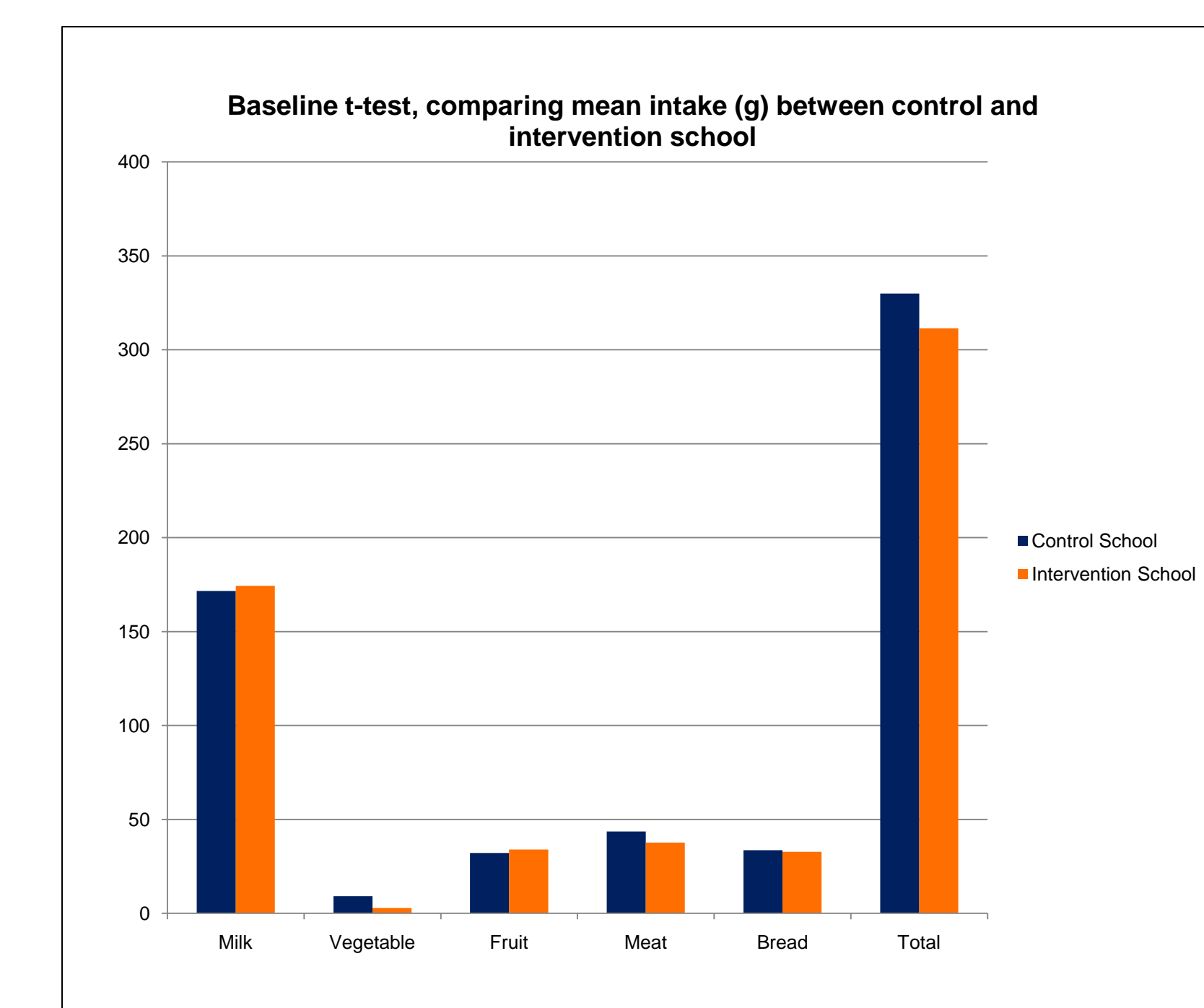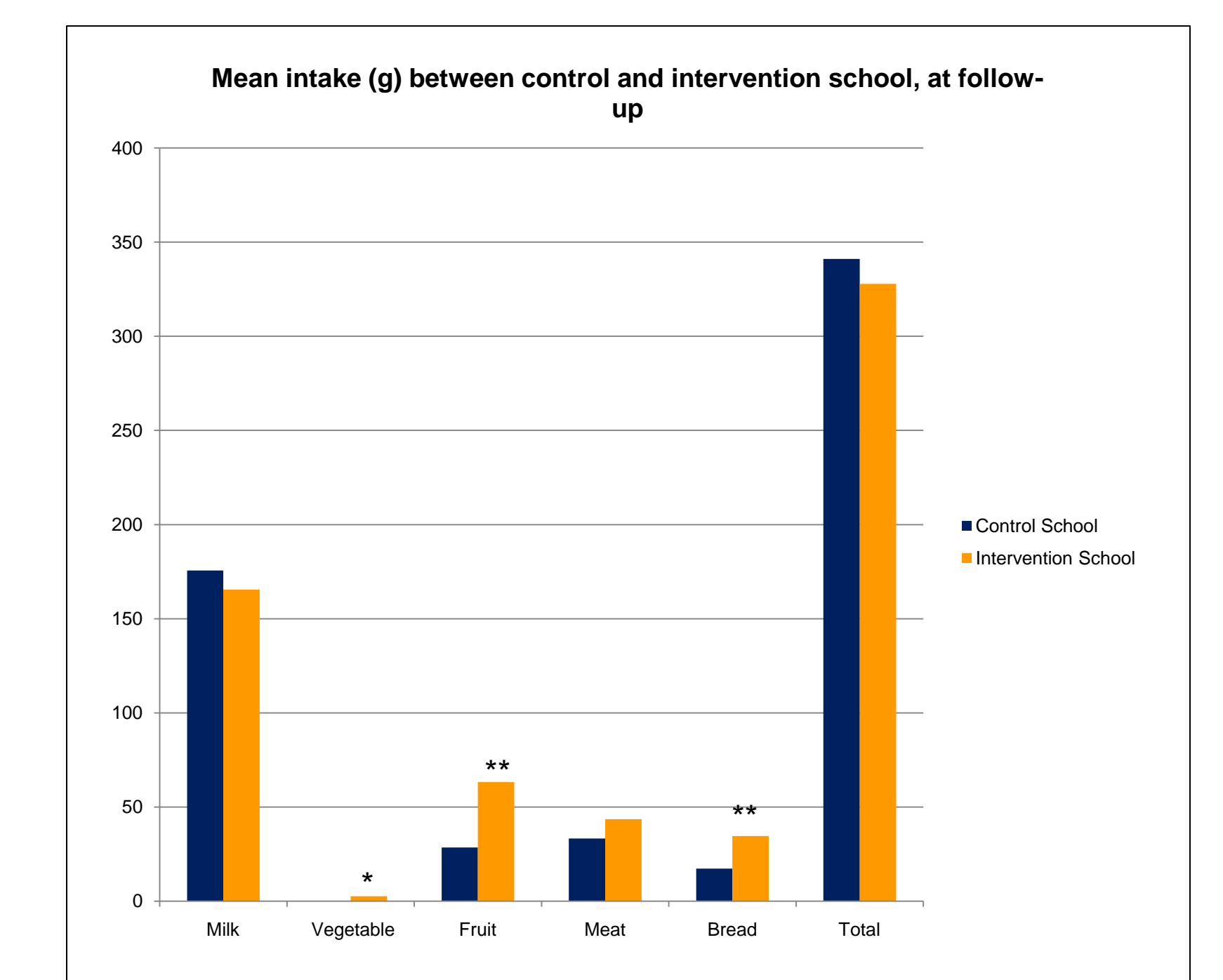

Figure 2. Example of photographs of student trays

Figure 3. Baseline Consumption, in grams

Independent sample t-test, significance at ≤ 0.05

Figure 4. Follow-up Consumption, in grams

*ANOVA, controlling for baseline vegetable intake, significance at ≤ 0.05; p=0..0259
** p = =<0.0001

Conclusion

Based on results of this pilot study, it is apparent that increasing fruit intake among Kindergarteners, using the MyPyramid Color-bar Signage System, seems to be achievable. Analysis of vegetable intake revealed that Kindergartners are overwhelmingly choosing fried potatoes, which is not surprising. However, if these are being selected over other, healthier options, it is likely that future interventions should target improving the nutrient profile of this popular selection, while further increasing the visibility and appeal of more nutrient-dense vegetables. Therefore future interventions designed to increase intake of nutrient-dense vegetables among Kindergartners should incorporate these strategies in addition to use of the MyPyramid Color-bar Signage System of environmental change and classroom nutrition education.

References

1. East Tennessee 2 Step Content Panel. *East Tennessee 2 Step -- Eat Smart... Move More -- Achieving Healthy Weight in East Tennessee: Recommendations for Schools, Worksites, Healthcare Systems, and Communities. Knoxville (TN):* East Tennessee Regional Health Office and the Knox County Health Department. 2005.
2. Maffeis C. Childhood obesity: The genetic-environmental interface. *Baillieres Best Pract Res Clin Endocrinol Metab.* 1999;13:31-46.
3. Ritchie L, Ivey S, Masch M, Woodward-Lopez G, Ikeda J, Crawford P. *Pediatric Overweight: A Review of the Literature.* Berkeley, CA: The Center for Weight and Health. College of Natural Resources. University of California, Berkeley; 2001.
4. Vioque J, Weinbrenner T, Castello A, Asensio L, Garcia de la Hera M. Intake of fruits and vegetables in relation to 10-year weight gain among Spanish adults. *Obesity.* 2008;16:664–670.
California Department of Health Services. A Special Report on Policy Implications from the 1999 California Children's Healthy Eating and Exercise Practices Survey (CalCHEEPS). Available at: http://www.calendow.org/uploadedFiles/CalCHEEPS_1999.pdf. Accessed on September 26, 2008.
5. Neumark-Sztainer D, Story M, Resnick MD, Blum RW. Correlates of Inadequate fruit and vegetable consumption among adolescents. *Prev Med.* 1996;25:497-505.
Muller MJ, Koertzinger I, Mast M, Langnase K, Grund A, Koertzinger I. Physical activity and diet in 5 to 7 years old children. *Public Health Nutr.* 1999;2:443-4.
6. Rolls BJ, Ello-Martin JA, Carlton Tohill B. What can intervention studies tell us about the relationship between fruit and vegetable consumption and weight management? *Nutr Rev.* 2004;62:1-17.
7. Healthy People 2010. 19 Nutrition and Overweight page. Available at: http://www.healthypeople.gov/Document/HTML/Volume2/19Nutrition.htm. Accessed Sept. 3, 2008.
Nicklas TA, Hayes D. Position of the American Dietetic Association: Nutrition Guidance for Healthy Children Ages 2 to 11 years. *Journal of the American Dietetic Association.* 2008;108:1038-1047.
US Department of Health and Human Services. The Report of the Dietary Guidelines Advisory Committee on *Dietary Guidelines for Americans, 2005.* US Department of Health and Human Services Web site. http://www.health.gov/DietaryGuidelines/dga2005/report/. Accessed Sept. 28, 2008.
8. Cooke L. The importance of exposure for healthy eating in childhood: a review. *J Hum Nutr Diet.* 2007;20:294-301.
Casey PH, Szeto K, Lensing S, Bogle M, Weber J. Children in food-insufficient, low-income families -- Prevalence, health, and nutrition status. *Archives of Pediatrics & Adolescent Medicine.* 2001. 155(4):508-514.
9. Haas JS, Lee LB, Kaplan CP, Sonneborn D, Phillips KA, Liang SY. The association of race, socioeconomic status, and health insurance status with prevalence of overweight among children and adolescents. *AJPH.* 2003. 93(1):2105-2110.
10. Hannon TS, Rao G, Arslanian SA. Childhood obesity and type 2 diabetes mellitus. *Pediatrics,* 2005. 116(2):473-480.
Dietz WH. Childhood weight affects adult morbidity and mortality. *J Nutr.* 1998. 128:S411.
11. Diez-Roux AV, Nieto FJ, Caulfield L, Tyroler HA, Watson RL, Szklo M. Neighbourhood differences in diet: the Atherosclerosis Risk in Communities (ARIC) Study. *Journal of Epidemiology and Community Health.* 1999. 53(1):55-63.
12. Morland K, Wing S, Roux AD, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine.* 2002. 22(1):23-29.
13. Carr D, Levins J, Lindeman A. Plate waste studies. *Practical Research.* National Food Service Management Institute.
14. Haas JS, Lee LB, Kaplan CP, Sonneborn D, Phillips KA, Liang SY. The association of race, socioeconomic status, and health insurance status with prevalence of overweight among children and adolescents. *AJPH.* 2003. 93(1):2105-2110.
15. Hannon TS, Rao G, Arslanian SA. Childhood obesity and type 2 diabetes mellitus. *Pediatrics,* 2005. 116(2):473-480.
16. Dietz WH. Childhood weight affects adult morbidity and mortality. *J Nutr.* 1998. 128:S411.
17. Diez-Roux AV, Nieto FJ, Caulfield L, Tyroler HA, Watson RL, Szklo M. Neighbourhood differences in diet: the Atherosclerosis Risk in Communities (ARIC) Study. *Journal of Epidemiology and Community Health.* 1999. 53(1):55-63.
18. Morland K, Wing S, Roux AD, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine.* 2002. 22(1):23-29.
19. Carr D, Levins J, Lindeman A. Plate waste studies. *Practical Research.* National Food Service Management Institute.