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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

Jeanne P. Goldberg[a,c], **Sara C. Folta**[a], **Misha Eliasziw**[b], **Susan Koch-Weser**[b], **Christina D. Economos**[a], **Kristie L. Hubbard**[a], **Lindsay A. Peterson**[a], **Catherine M. Wright**[a], and **Aviva Must**[b]

Jeanne P. Goldberg: jeanne.goldberg@tufts.edu; Sara C. Folta: sara.folta@tufts.edu; Misha Eliasziw: misha.eliasziw@tufts.edu; Susan Koch-Weser: susan.koch_weser@tufts.edu; Christina D. Economos: christina.economos@tufts.edu; Kristie L. Hubbard: kristie.hubbard@tufts.edu; Lindsay A. Peterson: lindsay.peterson@tufts.edu; Catherine M. Wright: catherine.wright@tufts.edu; Aviva Must: aviva.must@tufts.edu

[a]Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy, Tufts University, 150 Harrison Avenue, Boston, Massachusetts 02111, USA

[b]Department of Public Health and Community Medicine, Tufts University School of Medicine, 136 Harrison Avenue, Boston, Massachusetts 02111, USA

Abstract

Objective—*Great Taste, Less Waste* (*GTLW*), a communications campaign, capitalized on the synergy between healthy eating and eco-friendly behaviors to motivate children to bring more fruits and vegetables and fewer sugar-sweetened beverages (SSBs) to school.

Methods—A cluster-randomized trial in Eastern Massachusetts elementary schools in 2011–2012 tested the hypothesis that *GTLW* would improve the quality of foods from home more than a nutrition-only campaign – *Foods 2 Choose* (*F2C*) – or control. Lunch and snack items from home were measured at baseline and 7 months later using digital photography. Mixed linear models compared change in mean servings of fruits, vegetables, and SSBs among groups, and change in mean prevalence of packaging type. Change in prevalence of food items of interest was compared among groups using generalized linear models.

Results—582 third and fourth graders from 82 classrooms in 12 schools participated. At follow-up, no significant differences were observed between groups in change in mean servings or change in prevalence of items of interest. No packaging differences were observed.

[c]Address correspondence to: Jeanne P. Goldberg, PhD, RD, Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy, Tufts University, 150 Harrison Avenue, Boston, Massachusetts 02111, USA. jeanne.goldberg@tufts.edu Phone: 617-636-0895 Fax: 617-636-3727.

CONFLICT OF INTEREST STATEMENT

All authors declare no conflict of interest.

Conclusion—GTLW was well-received but no significant changes were observed in the quality of food brought to school. Whether classrooms are an effective environment for change remains to be explored.

Keywords

Fruits and vegetables; Elementary school children; Behavioral intervention; Innovative approaches; Nutrition communication

1. Introduction

US children consume too few fruits and vegetables, excessive calories from energy-dense, nutrient poor foods and beverages, inadequate fiber and too little dairy (Piernas and Popkin, 2010; Wang et al., 2008). School environments serve a critical role in providing food to children (Fox and Hall, 2012; IOM, 2007; Story et al., 2009). Policies to improve the school food environment (Peterson and Fox, 2007; Story et al., 2008) and far-reaching changes specified in the Healthy Hunger Free Kids Act (2010) provide guidance on the quantity and quality of foods served.

A substantial fraction of food consumed at school eludes regulation however. Forty percent of US schoolchildren bring lunch on any given day and nearly 50% consume snacks at school, many brought from home. These foods are unaffected by federal policies. Compared to National School Lunch Program (NSLP) participants, children who bring lunch consume fewer vegetables and fruits, less fiber (Hur et al., 2011), and more sugar-sweetened beverages (SSBs) and snacks high in added sugars and fats at school (Briefel et al., 2009; Johnston et al., 2012). Approaches that motivate children and their families to select healthier foods are needed.

This paper describes a school-based intervention, *Great Taste, Less Waste (GTLW). GTLW* used a communication strategy that linked healthy eating to the environment to improve the quality of foods from home. The goal was to engage third and fourth graders by capitalizing on the synergy between healthier diets and food choices with minimal environmental impact. The approach evolved from evidence that children of this age want to protect the natural environment (Bonnett and Williams, 1998; Chawla, 1988; Vaughan et al., 2003; Zelezny, 1999). Foods that contribute to a healthy diet, especially whole fruits and vegetables, tend to require fewer environmental resources to produce (Carlsson-Kanyama et al., 2003; Marlow et al., 2009; Meier and Christen, 2012). The overlap between individual and environmental health offered a unique opportunity to engage two powerful motivators, altruism and concern for the environment, through positive messages linking behaviors in both spheres. We expected children to communicate nutrition-eco messages to their parents who would provide appropriate foods. A similar communication pathway effectively promoted recycling in the home (Evans et al., 1996; Leeming et al., 1997). Direct communication to parents reinforced classroom activities. The campaign was evaluated over one school year in a cluster-randomized trial. We tested the effectiveness of this nutrition-eco approach, *GTLW*, against a similar nutrition-only campaign -- *Foods 2 Choose* (*F2C*) -- and a control. We hypothesized that children who received *GTLW* would bring significantly more fruits and vegetables and fewer SSBs to school than children in the other groups. We

expected children who received *F2C* to bring more fruits and vegetables and fewer SSBs to school than those in the control group, but that the magnitude of the effect would be more modest. We also expected children in *GTLW* to bring fewer single-serve packaged items and more items in reusable containers than children in the other groups.

2. Methods

Intervention framework

The *GTLW* and *F2C* campaigns were designed according to an integrated theoretical framework (Figure 1). The Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980), used in prior successful nutrition interventions with children (Economos et al., 2007; Folta et al., 2006; Folta et al., 2004) guided the GTLW framework. In both *GTLW* and *F2C*, activities and messages at school were expected to influence children through changes in attitudes and perceived social norms. Additional change strategies in both campaigns and curricula were derived from Social Cognitive Theory (Bandura, 1986), and targeted knowledge, skills, and self-efficacy. Nutrition objectives for both campaigns were identical: to promote fruits and vegetables and replace SSBs with water or low-fat dairy. In *GTLW* only, messages and activities were designed to promote altruistic beliefs about the value of environmentally sound nutrition practices. Altruism and concern for community are constructs that have been shown to predict positive environmental behaviors (Arvola et al., 2008; Barr, 2003; Bissonnette and Contento, 2001; Blanchard et al., 2009; Brown and Cameron, 2000; Collins and Chambers, 2005; Kaiser et al., 2005; Raats et al., 1995; Sparks et al., 1995; Stern, 2000). *GTLW* promoted whole foods such as apples which are both nutritionally sound and require less energy to produce and package than a range of apple products.

Intervention Development

The research team collaborated with creative consultants to develop the campaign. Focus groups with children and parents identified food preferences and barriers to packing healthy foods. Findings informed development of campaign themes and actionable messages to be incorporated into the curricula and parent materials. The concept that emerged as most successful relied on graphics of food faces created with foods to be promoted. To address concerns of school personnel about taking time from educational goals, lessons were aligned with Massachusetts educational frameworks. Materials were pre-tested in classrooms and refined during a pilot year. Written and verbal communication with teachers confirmed that lessons were well-accepted by children and required little modification.

Intervention

Both campaigns featured a 22-lesson curriculum. A color workbook with in-class and family activities supported the 30-minute classroom lessons. Participants received campaign kits with reusable food containers and a packing guide with information about purchasing and packing healthy lunches and snacks. Monthly parent newsletters, sent home in children's backpacks, extended information in the guide with timely nutrition advice and seasonal recipes. Other campaign elements included a school-wide poster contest and presentations to

parents at school events. Monthly emails to teachers provided tips for integrating and sustaining program messages.

Study design and sample

GTLW was evaluated using a cluster-randomized trial in 3rd and 4th grade public elementary school classrooms across Eastern Massachusetts during the 2011–2012 school year. Since lunches and snacks from home were the target of the intervention, participating schools could have no more than 30% of children eligible for free lunches and no more than 10% eligible for reduced-price lunches. The trial was powered to detect a mean change in servings of fruits and vegetables brought to school. Based on previous work (Must et al., 2005), we expected a mean difference of 0.43 servings of fruits and vegetables between the *GTLW* and control groups, and a mean difference of 0.25 servings between the *F2C* and control groups, with a sample standard deviation of 1.11. A one-way analysis of variance sample size calculation with a 60% retention rate, 80% power at a 5% significance level, and a design effect of 1.18 (average classroom-cluster size of 10 students and an estimated intra-class correlation coefficient of 0.02) required 254 students per group. Initial recruitment took place in spring 2011. Fifteen schools were randomly assigned to three conditions of 5 schools each: *GTLW, F2C,* and control. Communities with multiple schools participating were block-randomized to ensure equal representation within the community.

Children who brought food from home at least three times per week were recruited through flyers, with study information provided in English and Spanish. Parent informed consent forms were collected by classroom teachers. Children provided their assent at baseline data collection. Study procedures were reviewed and approved by Tufts University Institutional Review Board (IRB).

Intervention delivery and monitoring

The campaign was delivered to all students in participating classrooms. Teacher trainings, 60 to 90 minutes each and conducted in all participating schools, introduced the curricula, built enthusiasm, and reviewed study logistics. Staff met with control condition teachers to outline their role in the study. Campaign implementation commenced after baseline measurements.

Study staff visited schools at least five times during the intervention to document the extent of implementation, including campaign visibility reflected in banners, posters, and student artwork. Post-intervention, teachers reported number of lessons taught by paper-and-pencil or electronic survey. They provided qualitative feedback on content and student response for each lesson taught and on lesson extensions such as composting, gardening, class cookbooks, and measurement of class-generated waste. Classroom observations provided additional evidence of the extent to which individual lessons were taught, adherence to lesson plans, and student responses. Principals were interviewed for their perspective on campaign implementation.

Assessments

Baseline data were collected in all schools in fall 2011. Follow-up measurements were conducted approximately seven months later, in spring 2012. Visits were coordinated with principals and teachers; students and parents did not know measurement dates in advance. Socio-demographic data (child and parent age, sex, race/ethnicity, household income, and parent education) were collected via parent questionnaire and returned with consent forms at baseline.

Lunch and snack items were digitally photographed (Swanson, 2008) by trained research assistants (Figure 2). Photos were supplemented by a checklist that provided essential details such as sandwich filling, type of beverages, and intention to obtain school lunch or milk (Kremer et al., 2006; Mitchell et al., 2010). Measurements were conducted in the morning, before snack and lunch periods. Two cameras were used to photograph foods from angle (35 degrees) and aerial (20.5 inches high) perspectives to capture details of individual foods and packaging. Participants arranged items on placemats printed with a 1-inch grid, removing lids from reusable containers and unwrapping home-packed items. To eliminate potential parent concerns, only children handled their foods and beverages.

All methods were reviewed and modified as necessary in pilot schools during the year before the full intervention. Digital-photography and checklist methods were tested and refined to ensure the capture of necessary details and acceptability to participants. Day-to-day variability of lunch and snack items was assessed to justify use of a single pre- and post-intervention measure (unpublished results). Digital images and checklists were used to estimate servings of fruits, vegetables, and SSBs, and provide packaging information. Two trained coders entered items into a project-specific database, categorizing items into nearly 200 food types. Label information was used for portion sizes of packaged foods. Home-packed items were classified as small, medium, or large based on reference weights (grams) from the Nutrition Data System for Research (NDSR, University of Minnesota) using a reference manual with photos of standardized portions developed for the project. If NDSR information was unavailable, portions were defined as small (0.5 FDA servings), medium (1 FDA serving), and large (1.5 FDA servings). Coders' estimates were compared to identify and resolve discrepancies. Further details about coding procedures are reported elsewhere (Hubbard et al., 2014). The method met validity and inter-rater reliability criteria. Coders correctly classified portion sizes more than 80% of the time. Once coded, items were sorted into groups of primary interest: fruits, vegetables, and SSBs. Fruits, but not fruit juices, were considered in counting fruit servings. Packaging was categorized as home-packed, or if in commercial packaging as single- or multiserve.

Statistical methods

Descriptive statistics were used to summarize baseline participant demographics, fruits, vegetables, SSBs, single-serve packages, and reusable containers brought from home. Mixed linear models compared change in mean servings of fruits, vegetables, and SSBs among groups, as well as change in mean prevalence of packaging type. The prevalence of single-serve packages and reusable containers was calculated as a ratio of these items to total items per tray.

Change in prevalence of one or more food items of interest was compared among groups using generalized linear models. The effect of child's age, gender, race, household income, and maternal education on results was assessed by comparing regression coefficients corresponding to the condition variable (*GTLW*, *F2C*, or control) from the mixed linear models and generalized linear models with and without these additional variables. As the regression coefficients for the intervention factor were not appreciably changed, these additional demographic variables did not confound the results. Therefore, the final models included only the condition variable. All analyses accounted for clustering at the school level. SAS 9.2 (SAS Institute, Cary, NC, USA) was used for analyses. Results with p-values less than 0.05 were considered statistically significant.

3. Results

Fifteen schools from seven districts were recruited and randomized to one of three conditions. In fall 2011, after randomization and before teacher trainings were completed, three schools from different districts, all randomized to *F2C*, withdrew. Principals cited competing demands unrelated to the study, including school administration turnover and unanticipated curriculum requirements. Eighty-two classrooms from the remaining 12 schools participated.

The *GTLW* group included 5 schools, 36 classrooms, and 327 children (39.2% of invited students). The *F2C* group included 2 schools, 15 classrooms, and 78 children (11.4% of invited students). The control group included 5 schools, 31 classrooms, and 177 children (24.2% of invited students). The mean number of enrolled children per classroom was 7 (range 1 to 23). Mean age was 9.1 years, 57.7% were girls, 74.4% were non-Hispanic white, 44.8% had household incomes less than $70,000, and 83.2% of mothers had college education or higher (Table 1). Figure 3 presents the CONSORT diagram of recruitment and analyses.

In *GTLW* schools, 34 of 39 teachers attended trainings. In three *F2C* schools, 24 of 27 teachers attended trainings. One *F2C* school withdrew after training. Observations by study staff documented that the poster contest was implemented in all intervention schools. Study staff confirmed, through school visits and photographs sent by school liaisons, that student posters were prominently displayed in schools. In post-intervention surveys, *GTLW* teachers reported teaching an average of 13.6 (7–22) lessons. *F2C* teachers reported teaching an average of 9.6 (4–14) lessons. Post-intervention principal interviews indicated that the campaign was well-executed and of benefit to the children. Details of implementation are presented in Table 2.

Of the 675 children enrolled and consented, 35 had missing baseline or follow-up photos and 58 had no food or drink items at baseline or follow-up. Analyses were confined to children with at least one item at baseline and follow up (n=582; 86.2%).

At baseline, the overall mean servings of fruits, vegetables and SSBs were 0.54, 0.09, and 0.42, respectively. With respect to prevalence, 45.9%, 8.1%, and 42.4% of children brought one or more fruits, vegetables, and SSBs, respectively. Over half (58.9%) of items brought by children at baseline were in single-serve packages and 13.1% were in reusable containers.

At follow up, there were no discernible changes in mean servings of fruits, vegetables or SSBs among the *GTLW*, *F2C*, and control groups (Table 3). There were no discernible changes in prevalence of fruits or SSBs across groups. Prevalence of vegetables increased from baseline to follow-up in the *GTLW* and control groups, and declined in *F2C*. Changes in prevalence of vegetables brought were statistically significant. However, they were too small to be of clinical significance.

4. Discussion

Recent studies have reported some success in improving the quality of US school children's diets (Wang et al., 2010; Wengreen et al., 2013), specifically those interventions that included environmental or policy changes (Cohen et al., 2014; Coyle et al., 2009; Davis et al., 2009; Jamelske and Bica, 2012). However, changes in the school food environment have limited impact on personal food choices, especially foods and beverages brought to school. This multi-component, novel school-based intervention sought to address food from home through a classroom curriculum with a variety of supplementary activities and parent communications. Though process data indicated that the campaign was well-received by children, teachers, school administrators and families, there was no measurable impact on foods that children brought from home. Several factors may explain the results.

First, the study was underpowered as a result of the unexpected dropout in the *F2C* group. As planned, we recruited 15 schools to permit randomization into three groups of five schools. Three schools in *F2C* withdrew after randomization, citing concerns about principal turnover and new mandatory academic programs. This occurred after the study had launched and trainings had begun. Attempts to recruit replacement schools failed primarily because the school year was underway. That made it impossible to adequately compare two approaches different only with respect to the inclusion of the eco component.

Second, despite the fact that the campaign was well-received, behavior change depended on the transfer of information through a complex pathway. Campaign messages would have to be delivered by teachers to children, who would then need to be motivated to relate those messages to their parents. Parents would then need to be persuaded, either by their child or by materials sent in the child's backpack, to purchase, prepare, and pack the healthy foods promoted. Even if messages were delivered as planned, other factors may have interfered with parents acting on the information. In formative research, parents repeatedly cited time, cost, and convenience as major barriers to packing healthy lunches and snacks. In addition, their motivation may be tempered by previous experiences with negative feedback from their child in the form of complaints or uneaten food returning home. Future studies should test different channels and messaging strategies to reach parents directly along with children.

The lack of discernible change can be further explained by challenges specific to the foods being promoted by the campaign. Fresh fruits and vegetables often require some preparation, and are susceptible to spoilage. In addition, the marketplace is saturated with shelf-stable, relatively low-cost, convenient, and highly palatable snack foods that are heavily marketed to both parents and children. Timing of post-intervention measurements may also have contributed to the lack of change. Follow-up measurements were conducted

in May and early June, when availability of high quality, fresh fruit at reasonable prices in New England is variable. Few “grab and go” vegetables are available for parents to pack, and convenient options tend to be expensive. Parents may also believe that vegetables are less appealing to their children and more likely to be wasted (Bathgate and Begley, 2011; Smith and Cunningham-Sabo, 2013). At family events during the campaign, several parents said they did not know which vegetables to pack that would be acceptable. Yet, during classroom observations, when children were offered unfamiliar vegetables, most tried them enthusiastically. Unfortunately, parents did not observe this directly.

The null effect of the intervention on SSBs may be attributed to several factors. Campaign materials may not have sufficiently emphasized beverages, which were more difficult to portray in food faces. Lessons focused on beverages were included in the second half of the curriculum. Process evaluation data indicated that not all teachers taught those later lessons, in part due to time constraints. To the extent that this occurred, messaging around SSBs may have been inadequate. Finally, shifting children away from SSBs, which are aggressively marketed and come in attractive, convenient packaging that children find compelling and parents find easy to pack, is challenging.

The study has many strengths. Connecting messages about healthy eating to altruistic behaviors is attractive to children at this age (Cheng and Monroe, 2012; Evans et al., 2012). The overall content and messaging strategy was based on multiple rounds of formative research and pilot testing with the target audiences. This approach maximized the likelihood they would be accepted and used. Digital photography proved to be an efficient approach to collecting detailed information about food from home in an elementary school setting.

Both curricula were aligned with state educational frameworks and integrated across core academic subjects. That was critical to their acceptance by schools. The combined focus of nutrition and environmental concerns in *GTLW* provided even greater opportunities to reinforce concepts from other disciplines, including math, language arts, and science. Nutrition can then be more easily taught by classroom teachers who may lack formal nutrition education, and have varying levels of comfort with the subject (Snelling et al., 2012).

Robust outcome evaluation depends on process observations that document fidelity to the intervention. Schools typically present two major challenges to obtaining these data. Data collection may interfere with intervention delivery and can be burdensome to teachers. To minimize those potential barriers, we opted to collect only the data we felt were most critical to understanding outcomes. These included evidence of implementation and acceptance of the campaign by teachers, students, and parents. Prior to launch, some school staff expressed concern that the campaign would be disruptive. However, responses to the campaign were overwhelmingly positive and enthusiastic. Once launched, teachers thought the campaign was informative and fun. As others have reported (Hingle et al., 2010), obtaining representative parent feedback was challenging. We capitalized on PTA meetings and other school events to interact with parents. In general, parents said children were sharing what they had learned and asking for foods that had been sampled or discussed. They also found campaign materials useful.

Several limitations are worth noting. As mentioned above, the study was underpowered due to dropouts in the F2C group. Another limitation of this study is that it was designed to evaluate foods and beverages that children brought to school, but not consumption. Our approach was pragmatic: low respondent burden was crucial to schools' participation. The time required to assess plate waste was well beyond what schools would accept, and would have required a more complicated application of digital photography. In addition, our measures did not capture changes in overall diet. Future studies should include these assessments.

Finally, it is possible that selection factors influenced participation in the study so that children who enrolled came from families where mothers had more education than other children in the schools. We do not have information about maternal education level for non-participants. While there may be participation bias, this study provides further evidence that even among children from relatively more educated households there is room for improvement in the foods and beverages they bring to school (Hubbard et al., 2014; Caruso and Cullen, 2015).

The prevalence of elementary school children who bring lunch and/or snack to school is not likely to decline in the foreseeable future. Given the demonstrated nutritional deficits of foods brought from home, efforts to improve the contents of the lunch box should continue. GTLW was well-received by teachers, students, and administrators, critical to implementing a successful school-based intervention. Yet, the fact that no significant differences were detected in the full intervention group is troubling. While there is no doubt that the nutrition-eco approach is not "the" answer to changing these specific behaviors, we believe that qualitative evidence associated with this project is substantial enough to warrant further modifications of the campaign to better engage parents and to repeat the evaluation in a study with sufficient power to detect change.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Strategies to improve food brought from home to school are an unmet need
- Nutrition-eco messages are well-received in schools and warrant further study
- Classroom teachers are an underutilized resource for nutrition education in schools

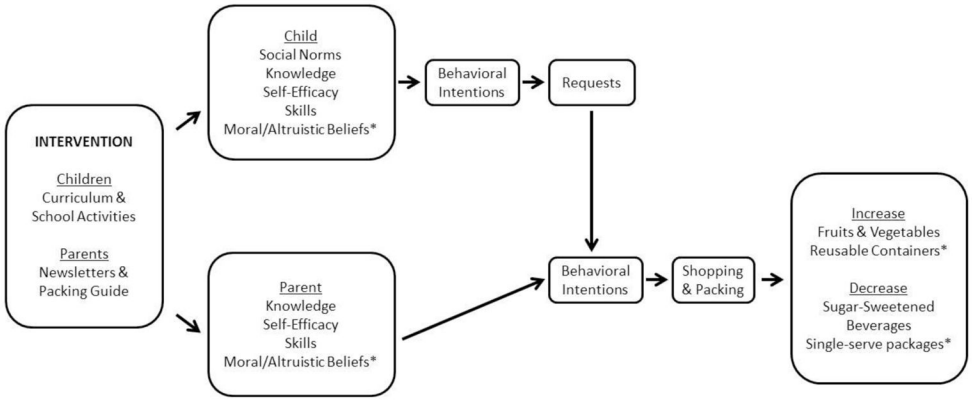

Figure 1.

GTLW & F2C Theoretical Framework

*Items not included in the *F2C* model include moral/altruistic beliefs (both parent and child) and eco-friendly behavioral outcomes.

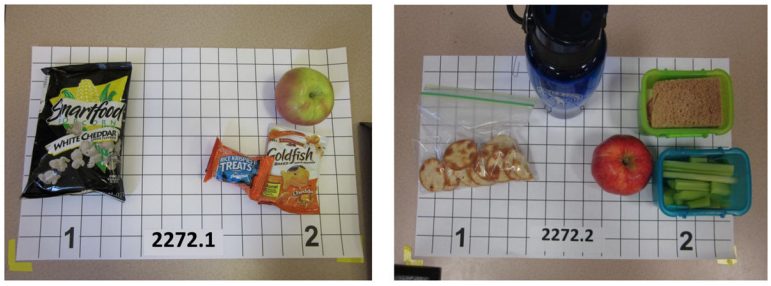

Figure 2.

Baseline (A) and follow-up (B) trays for one study participant[1].

[1]These are actual baseline (fall 2011) and post-intervention (spring 2012) photographs chosen to reflect the potential for change. They are not representative of the universe of data.

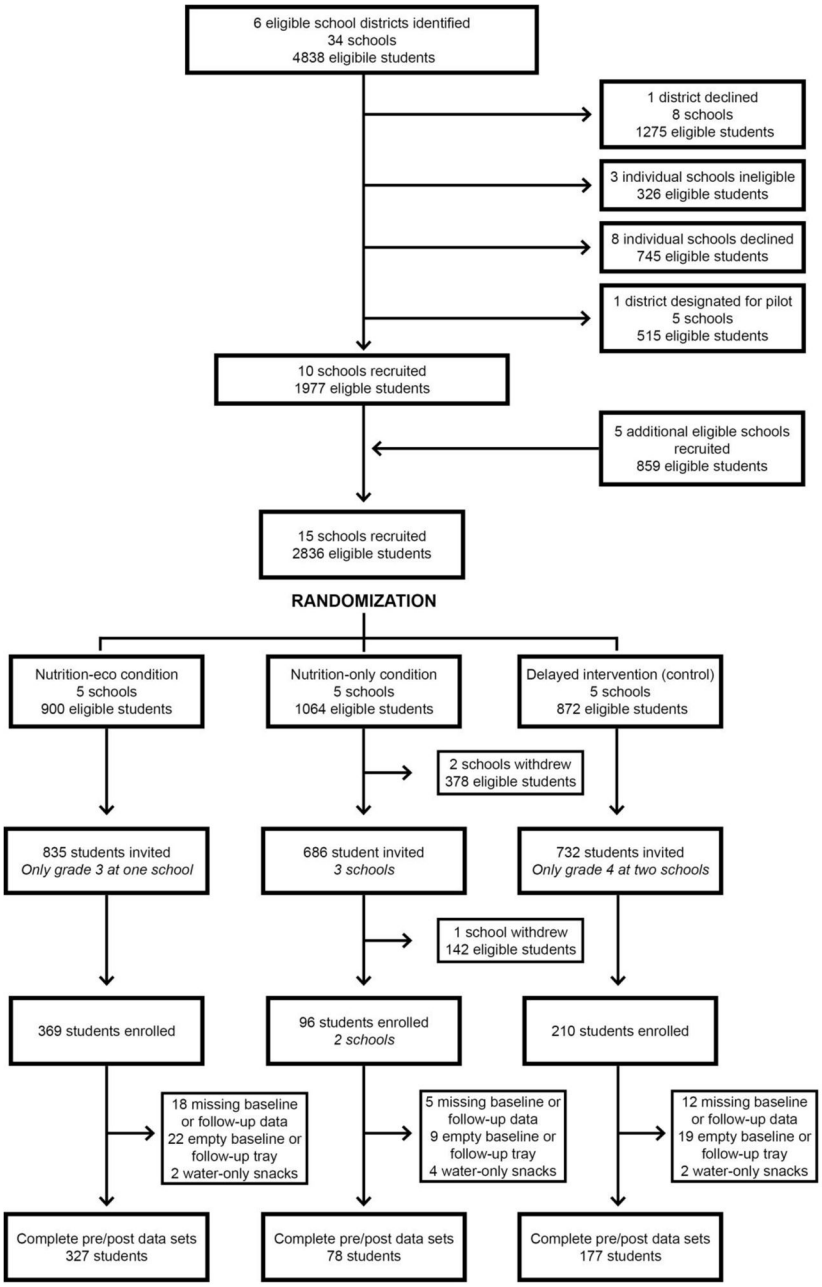

Figure 3.
Participant CONSORT diagram for *Great Taste, Less Waste*, 2011–2012

Table 1

Baseline characteristics of participants

	GTLW (N = 327)	*F2C* (N = 78)	Control (N = 177)	P-value[a]
Demographics				
Age, mean (sd)	9.0 (0.6)	9.2 (0.6)	9.1 (0.6)	0.004
Grade, %				
3rd grade	59.0	41.0	49.1	0.006
4th grade	41.0	59.0	50.9	
Sex, %				
Male	44.6	33.3	41.8	0.19
Female	55.4	66.7	58.2	
Race/Ethnicity, %				
Non-Hispanic white	77.4	70.5	70.6	
Hispanic	10.1	18.0	15.8	
Black/African-American	3.1	0.0	5.1	0.07
Multiracial/Other	7.6	6.4	7.4	
Missing	1.8	5.1	1.1	
Household income, %				
< $30,000	16.5	16.7	19.2	
$30,000 – $70,000	23.9	29.5	33.3	< 0.001
> $70,000	48.6	26.9	37.9	
Missing	11.0	26.9	9.6	
Maternal education, %				
Less than high school	2.1	5.1	2.3	
High school or equivalent	10.1	14.1	12.4	0.35
College or higher	84.1	76.9	84.2	
Missing	3.7	3.9	1.1	
Food items and packaging				
Mean (sd) Servings				
Fruits	0.57 (0.67)	0.37 (0.59)	0.57 (0.70)	0.05
Vegetables	0.11 (0.41)	0.13 (0.50)	0.04 (0.22)	0.10
SSBs	0.42 (0.57)	0.49 (0.51)	0.41 (0.52)	0.53
Prevalence (%)				
One or more fruits	48.0	32.0	48.0	0.03
One or more vegetables	9.5	10.3	4.5	0.11
One or more SSBs	39.8	52.6	42.9	0.12
Mean (sd) Prevalence				
Single-serve packages[b]	57.4 (31.5)	61.7 (35.7)	60.4 (32.2)	0.44
Reusable containers	13.5 (19.9)	7.3 (15.1)	15.0 (25.3)	0.02

sd = standard deviation, SSB = sugar-sweetened beverage

[a] indicates difference significant at p<0.05 among groups at baseline

[b] packaging percentages do not add up to 100% because items were also sent in non-single-serve packaging not typically intended for reuse (ex. plastic wrap, plastic baggies, etc.)

Table 2

Intervention elements and description of implementation, 2011–2012

Element	Description	GTLW	F2C	Delivery timeline
Teacher training	60–90 minute sessions to provide study and intervention overview, in-depth review of elements of campaign with emphasis on lessons in campaign curriculum. Incentives provided to teachers for attending training and a stipend provided to cover supplies.	• Trainings conducted in all five schools • 34/39 teachers attended	• Trainings conducted in three schools (one school received training prior to dropping out) • 24/27 teachers attended	Oct–Nov 2011
Campaign launch	Delivery of campaign materials • Welcome kits for all 3rd and 4th grade students – reusable grocery tote, reusable water bottle, reusable snack containers (1 with freeze lid), shopping and packing guide for parents (provided in Spanish as needed) • Full color workbooks for all 3rd and 4th grade students • Identity materials for schools, including classroom posters and school banner • Homework prizes including branded stickers and pencils	5/5	2/2	Oct–Nov 2011
Lesson implementation	• 22 30-minute lessons taught by classroom teachers • Dose information collected by teacher survey (paper and pencil or electronic) • Qualitative feedback on lessons collected by survey (paper and pencil or electronic)	Mean lessons taught = 13.6 (7–22)	Mean lessons taught= 9.6 (4–14)	Oct 2011–Jun 2012

Element	Description	GTLW	F2C	Delivery timeline
Monthly parent newsletters	• Newsletters sent home via classroom teacher (6 months) • Featured timely nutrition information relevant to parents of elementary school children, tips for packing healthy lunches and snacks, seasonal recipes	• 6 newsletters delivered in all 5 schools • Parent receipt information not collected • Copies provided in Spanish for families who needed	• 6 newsletters delivered in both schools • Parent receipt information not collected • Copies provided in Spanish for families who needed	Dec 2011–Jun 2012
Classroom observations	• Study staff conducted lesson observations by teacher invitation using structured form to record number of students present, use of workbooks and ancillary materials, record student reactions to material, and fidelity to lesson plan • Fruit and vegetable tastings offered as thank you in participating classrooms	• Conducted observations in all 5 schools • 12 classrooms total	• Conducted observations in both schools • 3 classrooms total	Jan–Jun 2012
Parent events	• Study staff attended PTO meetings and other school events to share information about campaign and answer parent questions • Samples of healthy snack ideas provided (ex. sandwich “sushi” featuring fruit and nut butter wraps and vegetable and hummus wraps)	• Attended 1 parent event at all 5 schools • Attendance ranged from small PTO meetings (15–30 parents) to large all-school events (150–200 parents)	• Attended 1 parent event at 1 school • PTO meeting with 20–25 parents in attendance • Second school declined offer to present to parents	Dec 2011–Apr 2012
Poster contest	• Study staff provided contest guidelines to encourage all 3rd and 4th grade students to create persuasive posters featuring campaign themes and messages	• All 5 schools held poster contest • Posters were prominently displayed in school during voting and after winners	• Both schools held poster contest • Posters were prominently displayed in main hallway during voting and after	Mar–Apr 2012

Element	Description	GTLW	F2C	Delivery timeline
	• Schools provided with poster materials, ballots, certificates and prizes for top four winners • Schools encouraged to display posters and hold school-wide voting for winners • Poster contest held in March (roughly mid-point of intervention)	selected (cafeteria or main hallway)	winners selected	

Table 3

Changes in mean servings, prevalence of food items, and packaging from baseline (fall 2011) to follow-up (spring 2012)

	GTLW (N = 327)	*F2C* (N = 78)	Control (N = 177)	Overall P-value	P-value *GTLW* vs. *F2C*	P-value *GTLW* vs. Control
Change in Mean (se) Servings from Baseline[a]						
Fruits	0.13 (0.04)	0.05 (0.09)	0.03 (0.06)	0.42	0.46	0.23
Vegetables	0.03 (0.05)	−0.08 (0.09)	0.09 (0.06)	0.32	0.33	0.41
Sugar-sweetened beverages	0.01 (0.03)	−0.01 (0.07)	0.01 (0.05)	0.97	0.80	0.98
Change in Prevalence from Baseline (%)[b]						
Fruits	6.1	−1.3	1.1	0.12	0.046	0.31
Vegetables	2.1	−5.1	5.1	< 0.001	0.003	0.78
Sugar-sweetened beverages	−2.1	−6.4	−2.3	0.14	0.06	0.98
Change in Mean (se) Prevalence from Baseline[a]						
Single-serve packages	−7.5 (2.1)	0.6 (4.2)	−7.0 (2.8)	0.27	0.12	0.90
Reusable containers	7.2 (1.5)	8.9 (3.0)	3.8 (2.0)	0.31	0.62	0.21

se = standard error

All estimates and inferences were adjusted for clustering within school.

[a] Mixed linear models compared change in mean servings of fruits, vegetables, and SSBs among groups, as well as change in mean prevalence of packaging type.

[b] Generalized linear models compared change in prevalence of one or more food items of interest among groups.