Volume 42, Issue 1, Spring 2018

Journal of Child Nutrition & Management

Published by School Nutrition Association

Nudges To Increase Fruits and Vegetables Consumption: Results From A Field Experiment

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ABSTRACT

Purpose/Objectives

Research on incentivizing consumption of fruits and vegetables (F/V) has been and continues to be conducted in school lunchrooms. This study examined the use of stickers and toys to nudge F/V selection and consumption among students in grades 1 through 5. The study was conducted in two low-income elementary schools in West Texas.

Methods

Kid friendly stickers were applied to the schools' lunchroom F/V serving containers in a food safe manner. Students who selected and consumed their F/V portion were given an inexpensive toy at the end of the lunch period. Consumption and selection of F/V was measured over three periods starting with the observation at baseline period (13 days) followed by the intervention period (15 days) and the post-intervention period (14 days).

Results

Results suggest that displaying stickers to change the choice architecture while using incentive to promote consumption in school lunchrooms, sustainably and inexpensively increased the selection and consumption of F/V in these settings at one cent per serving. The number of servings of F/V consumed increased from 1.77 during baseline to 6.08 during intervention (p value <.0001, 242% higher than at baseline). A smaller but significant improvement was sustained post intervention where servings of F/V consumed was 2.51 (p value <.0001, 42% higher than at baseline).

Conclusions and Application

The findings of this study support a low-cost method to improve F/V consumption that can easily be replicated across the country. Similar low-cost interventions can support current policy emphasis in improving F/V consumption and combating childhood obesity.

Keywords: childhood obesity, behavioral economics, NSLP, food choice, fruit and vegetable consumption

INTRODUCTION

Throughout the United States (U.S.), policies are in place to encourage healthful eating among children. For example, the National School Lunch Act, as amended to include provisions of the Healthy Hunger-Free Kids Act of 2010 (HHFKA) regulates the National School Lunch Program (NSLP) in the U.S. The HHFKA ensures that healthful servings of fruits and vegetables (hereafter referred to as F/V) are made available and accessible to children in school lunchrooms through the NSLP (Food and Nutrition Service [FNS], 2017). However, this policy does not ensure consumption of F/V, as F/V are not often voluntarily eaten by kids. Children often throw

away their servings of F/V leading to high cost estimates for food waste (Cohen, Richardson, Austin, Economos, & Rimm, 2013). Ensuring adequate consumption of F/V under a supportive policy environment such as the HHFKA is a public health challenge. Mandatory policies cannot provide solutions to such challenge and can lead to unintended consequences, such as a decrease in NSLP participation and an increase in lunchroom food waste.

Within the existent challenge, changing children's food behavior toward healthful food consumption is possible (Aldridge, Dovey, & Halford, 2009; Esposito, Fisher, Mennella, Hoelscher, & Huang, 2009). Small toys and stickers, most commonly associated with McDonald's Happy Meal®, have long been a successful nudge for encouraging purchase of McDonald's food by children. Use of cartoon characters is also common. Cartoon characters commonly used in cereal food marketing have been found to influence taste assessment of products (Lapierre, Vaala, & Linebarger, 2011). In another study, children significantly preferred the taste of foods that had popular cartoon characters on the packaging compared with the same food without characters (Roberto, Baik, Harris, & Brownell, 2010).

As such, the literature suggests children's food behaviors can be affected by simple nudges like cartoon characters. Marketing approaches or nudges can also be used to support healthful food environments for children (Kraak & Story, 2014; Roberto, Pomeranz, & Fisher, 2014). Another study reported an increased selection of healthful snacks using incentives; however, the study was conducted in an after-school setting (List & Samek, 2015). Several studies have reported positive findings based on choice architecture changes in the school lunchroom, in which the environment is changed to involuntarily affect food choice decisions (Thapa & Lyford, 2014; Cohen, Richardson, Cluggish, Parker, Catalano & Rimm, 2015).

Through a partnership with the county school district, a nudging and choice architecture intervention was implemented in school cafeterias during lunchtime on school days. The purpose of this study was to evaluate the impact of using inexpensive stickers and small toys on selection and consumption of F/V by children in the participating schools. The study also evaluated whether the effect was sustained after the intervention. This current study adds to the growing literature on the use of low-cost strategies in school lunchrooms to support NSLP policy of encouraging consumption of F/V and reducing food waste (Kennedy & Guthrie, 2016).

METHODS

Study design

The study design was a repeated measures field experiment involving baseline, intervention, and post-intervention data collections with replications in two elementary schools. The research was approved by the Institution's Human Research Protection Program under expedited review with a waiver of written consent, as the project involved no more than minimal risk to participants. At the school level, a research approval was received from the Research, Assessment and Accountability Office of the participating school district. Letters explaining the research study in English and Spanish were sent to all parents in student take-home folders prior to the start of the study.

Participants

Elementary school children receiving the NSLP meal in Grades 1through 5 from two selected schools (referred to as School 1 and School 2 hereafter) participated in this study during Fall of 2013. The two schools were similar in that they served predominantly low income Hispanic neighborhoods located two miles apart. According to the 2013/2014 school year statistics, 84%

and 90% of enrolled students were eligible for free lunch, and 9% and 6% qualified for reduced price lunch, respectively, in the two schools. Both schools used Offer versus Serve in the nutrition program and both were designated Title 1 schools. In the 2013/2014 school year, 94% (total N=558) and 96% (total N=296) of the students, respectively in Schools 1 and 2, were Hispanic. Male students represented 49% and 58% of populations at each of the two schools, as reported in the Common Core of Data by the National Center for Education Statistics (2015). Both schools were in the same school district, hence were governed by the same school nutrition authority.

Data collection procedures

Data collection involved observations on whether F/V were selected and levels of consumption (selected and not eaten, selected and half eaten, or completely eaten). As part of a reimbursable meal, students were to have selected at least one service of fruit or vegetable. F/V in the school lunchrooms were served in pre-portioned 4-ounce containers. Data on F/V consumption were collected by observing individual plate waste of children during lunchtime. Plate waste record sheets, developed based on the Quarter-Waste Method, (Hanks, Wansink, & Just, 2014) were used to collect data. This method has been validated and found to be reliable and precise (Hanks et al., 2014) and has been used in previous research on response to time incentives (Price & Just, 2014) in school lunchrooms. The plate waste was observed during the last minutes of each grade levels' lunchtime, using the lunch schedule provided by school administration.

Data collection excluded starchy F/V's such as mashed potatoes and French fries, and fruit juices. Potato products were not included for two reasons: 1) potatoes are classified as a starchy food by many nutritionists; moreover, potato sides were served in the form of fries or other processed form, and 2) potatoes in general are liked by students and did not warrant intervention to promote consumption and selection. Fruit juice was not included because it was provided in pre-packaged cartons which were difficult to observe visually.

The data collection method was pilot tested by two researchers involved in observing plate waste data. These researchers conducted data collection for two hours in each school to compare data for accuracy. The pilot data were not different between the observers. Data were collected from the two participating schools in three periods: before, during, and after the intervention. Plate waste data were collected an average of 10 days in Schools 1 and 6 days in School 2 during Fall 2013. In School 1 (School 2), students' trays were observed for 13 days (7 days) during the baseline period, followed by 10 days (7 days) during intervention, and 7 days (5 days) in post intervention period. The data were recorded each day for each student participating in NSLP; student confidentiality was maintained as the data recording did not involve collection of student name or student identification number only recording based on grade level. Student level demographics such as race, age, socioeconomic factors within grade were not observed.

Research intervention

Researchers conducted the study in coordination with lunchroom staff. Nudging for selection of F/V was provided by using small stickers depicting superheroes, cartoon characters, monsters, fairies, princesses, etc. A sticker was placed on the outside of F/V serving containers in a food safe manner. The use of stickers changed the food choice decision of children from a taste-based decision to a fun-based decision. Children could earn a game token for a finished serving of F/V. This token could be exchanged for a safe, inexpensive small toy (wrist bands, jumping frogs, etc.). Toys, stickers, and tokens were purchased in bulk for a nominal cost. During the intervention, the researcher in charge of data collection handed out tokens when going around the table to observe waste data to children who had finished their serving of F/V. The students

were instructed to keep the token with them until they exited the cafeteria. Another researcher exchanged the token for a small toy as the students exited the lunchroom. The intervention provided immediate and positive feedback to the children for finishing their servings of F/V and instilled an association of F/V consumption with fun.

Measures

Four measures were analyzed, two measures of F/V selection and two measures of F/V consumption. Selection of F/V does not necessarily translate to consumption. Students not consuming F/V could either be students not selecting F/V from the lunch line at all, or students who select F/V but did not consume what was selected, thus leading to food waste. Previous research studies on F/V in school lunchrooms have focused on consumption, but not selection. In this study, two measures of F/V selection were constructed: 1) frequency for which the student selected and consumed at least one serving of F/V during the days of observation, and 2) frequency for which the student selected but did not consume at least one serving of F/V across the same period of observation.

Two measures of F/V consumption were constructed from the plate waste data: 1) servings of F/V consumed by each student across the observed days in increments of half servings, and 2) frequency at which the student ate at least one serving of F/V across the observed days. Similar measures of observation have been used in previous research that has reported findings based on plate waste data (Price & Just, 2014).

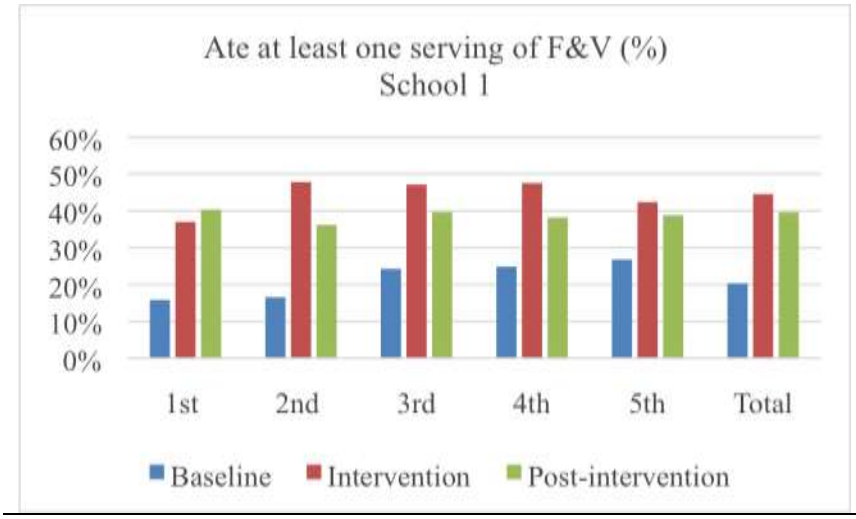
Data analysis

A repeated measures multivariate regression was used to estimate the impact of using inexpensive stickers and toys on measures of F/V selection and consumption. Measures of F/V selection and consumption were regressed separately on a baseline, an intervention, and a post-intervention variable. The baseline variable controlled for observations completed before the intervention. The intervention variable controlled for the observations conducted during the intervention and the post-intervention variable controlled for the observations made during the post-intervention period. The model also included controls for grade level (1-5), day of the week, and school fixed effect. These variables were designed to control for any fixed characteristics by grade, day of the week, and school that could affect the outcome measures. The F/V on the menu included: fresh cucumber slices, fresh apple slices, sliced cucumber with diced tomatoes, diced pears (canned), green beans (canned), corn (canned), whole banana, apple sauce, sliced orange, watermelon cubes, diced carrot and peas (canned), green peas (canned), refried beans, fresh broccoli, mixed fruit cocktail (canned), and carrots. The model does not control for variation of types of F/V on the menu during the observation periods.

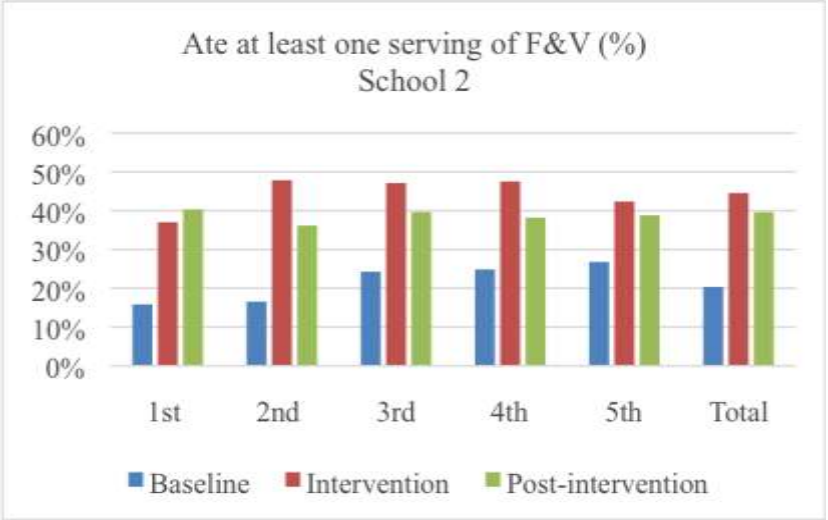
RESULTS

Changes in F/V consumption between periods were compared from baseline to intervention, and baseline to post-intervention. There was a 25% and 47% increase in trays with all F/V consumed from baseline to intervention in School 1 and School 2, respectively. The increase in trays with all F/V consumed from baseline to post-intervention was 20% and 23% in Schools 1 and 2, respectively. The frequency of trays with all F/V consumed during the three periods for the two schools by grade level are shown in Figure 1. There was a similar pattern across all grades, with highest consumption during the intervention period followed by the post-intervention period.

Figure 1: ***Percentage of servings with at least one serving of fruits and vegetables (F\V) eaten by grade for School 1 (top panel) and School 2 (bottom panel).***



	1st	2nd	3rd	4th	5th	Total
Baseline	16% (1509)	17% (1365)	24% (1236)	25% (362)	27% (306)	20% (5774)
Intervention	37% (905)	48% (1003)	47% (1362)	48% (772)	42% (1036)	45% (5078)
Post-intervention	40% (1141)	36% (940)	40% (1069)	38% (492)	39% (657)	40% (4299)



	1st	2nd	3rd	4th	5th	Total
Baseline	20% (611)	25% (537)	19% (540)	16% (468)	23% (325)	20% (3092)
Intervention	64% (634)	67% (609)	77% (630)	72% (449)	76% (388)	67% (3368)
Post-intervention	47% (213)	35% (223)	52% (315)	38% (216)	48% (190)	43% (1439)

The total number of F/V servings selected (regardless of consumption) observed in each school during each period by grade level is shown in Table 1. The researchers observed 24,000 F/V servings throughout the three data collection periods at Schools 1 and 2, respectively with 5,774 and 3,092 at baseline, 5,078 and 3,368 during intervention, and 5,249 and 1,439 post intervention.

Table 1: ***Fruits and vegetables (F/V) servings[1] observed by grade in two schools across the three periods (N=24,000).***

Grade	Baseline	Intervention	Post intervention
School 1	13 days	10 days	7 days
Grade 1	1509	905	1141
Grade 2	1365	1003	940
Grade 3	1236	1362	1069
Grade 4	362	772	492
Grade 5	306	1036	657
Total	5774	5078	5249
School 2	7 days	7 days	5 days
Grade 1	611	634	213
Grade 2	537	609	223
Grade 3	540	630	315
Grade 4	468	449	216
Grade 5	325	388	190
Total	3092	3368	1439

[1] Numbers in each cell correspond to the servings of F/V selected (fully consumed, half eaten, or not eaten at all).

Number of student trays observed in each school during the three periods, average servings of F/V consumed, and percentages for other measures of F/V selection and consumption at Schools 1 and 2 are shown in Table 2. Measures of consumption, namely the average number of servings of F/V consumed and percentage fully consuming at least one serving of F/V, was highest during intervention in both schools.

Table 2: ***Mean (SE) measures of fruit and vegetable (F/V) selection and consumption in two schools during baseline, intervention, and post-intervention.***

Measures of F/V selection and consumption	Baseline	Intervention	Post intervention
No. of student trays observed in School 1	463	386	501
Average number of servings of F/V consumed	2.987 (0.095)	5.951 (0.144)	4.163 (0.089)
Percentage full consumption of one serving of F/V	24 (0.008)	45 (0.008)	40 (0.007)
Percentage selected but did not eat at least one serving of F/V	35 (0.009)	7 (0.005)	58 (0.008)
Percentage did not select a serving of F/V	41 (0.009)	48 (0.008)	2 (0.003)
No. of student trays observed in School 2	258	258	258
Average number of servings of F/V consumed	2.603 (0.074)	8.800 (0.126)	2.432 (0.087)

Percentage full consumption of one serving of F/V	21 (0.007)	67 (0.009)	43 (0.014)
Percentage selected but did not eat at least one serving of F/V	35 (0.008)	11 (0.006)	31 (0.012)
Percentage did not select a serving of F/V	44 (0.007)	22 (0.006)	26 (0.011)

Table 3 displays the multivariate regression based on measures of selection. The percentage of participants who selected F/V at intervention was 63.4% (p value <.0001, 9.5% increase from baseline), and at post-intervention was 89.3% (p value <.0001, 54.23% increase from baseline). Therefore, the increase in selection of F/V was sustained and highest at post-intervention. The percentage of participants who selected but did not consume F/V at intervention was 3.4% (p value .0028, 88% lower than at baseline), and at post-intervention was 41.7% (p value <.0001 47.35% higher than at baseline). Thus, the percentage of students who selected yet did not consume F/V was observed to be lowest during intervention and increased post-intervention.

Table 3: ***Multivariate regression to estimate the impact of nudging and choice architecture intervention[1] on fruits and vegetables (F/V) selection and consumption measures***

Outcome measures	Baseline	Intervention	Post intervention
Measure of F/V selection			
Percentage selected but did not eat at least one serving of F/V	0.283	0.034	0.417
P value	<.0001	0.0028	<.0001
Percentage selected at least one serving of F/V	0.579	0.634	0.893
P value	<.0001	<.0001	<.0001
Measure of F/V consumption			
Servings of F/V consumed	1.773	6.081	2.512
P value	<.0001	<.0001	<.0001
Percentage ate at least one serving of F/V	0.296	0.601	0.476
P value	<.0001	<.0001	<.0001

[1] The intervention was use of inexpensive stickers and toys in F/V serving containers in school cafeteria. Measures of F/V selection and consumption were constructed from plate waste data observed at the lunch tray level. Students' trays were observed for plate waste data for an average of 10 days during the baseline period, followed by 8.5 days during the intervention period, and 6 days during the post intervention period

Multivariate regression based on measures of consumption at baseline, intervention, and post-intervention are also shown in Table 3. The servings of F/V consumed at intervention was 6.08 (p value <.0001, 242% higher than at baseline). The servings of F/V consumed at post-intervention was 2.51 (p value <0.0001, 42% higher than at baseline). The percentage of participants who ate at least one serving of F/V during intervention was 60.1% (p value <.0001, a 30.5 percentage point increase from baseline). The percentage of participants who ate at least one serving of F/V post-intervention was 47.6% (p value <.0001, an 18-percentage point increase from baseline). Therefore, the change in F/V consumption was highest at intervention and was sustained post-intervention.

DISCUSSION

The dichotomy between some marketing messages that promote the consumption of less healthful foods and the current movement to support access to healthful food options is real. Food marketing and advertising affects children's food behavior, often with negative public health consequences (Story & French, 2004) At the same time, there are policies in place at the federal level, such as the Healthy Hunger-Free Kids Act of 2010 (FNS, 2017) that support the provision of healthful meals in the school lunchroom. However, school lunchroom policy does not translate to healthful diet if what is served is not eaten. Advertising clearly affects children's food choice decisions (Andreyeva, Kelly, & Harris, 2011; Harris, Bargh, & Brownell, 2009; Terui, Ban, & Allenby, 2011). Advertising influences decisions at the point of selection (Cheyne, Gonazalez, Meija, & Dorfman, 2011). In the school setting, the point of selection for F/V would be in the lunch line. However, there is limited research pertaining to the use of innovative industry style advertising and marketing techniques that could be used in school cafeterias to promote healthful food behavior in children.

This study investigated a low-cost nudging technique in school lunchrooms to promote selection and consumption of F/V. The findings of this study demonstrate a positive step toward increasing selection and consumption of F/V in school lunchrooms through point of selection nudging and choice architecture intervention. Specifically, this study found that using stickers and toys are effective low-cost techniques to nudge and increase both selection and consumption of F/V. In this study, servings of F/V consumed by each child were increased by six servings per week, at a cost of one cent per serving for incentives. Such techniques could be used in school lunchrooms to encourage healthful food selection and consumption. Furthermore, research has shown school nutrition staff are willing to encourage changes in the cafeteria to promote healthy choices (Thapa, Bennett, Keong, Palmer, Hardy & Welsh, 2017). As such, findings should be of interest to school nutrition professionals working to provide healthful diets for children that will not result in plate waste.

This study joins a number of recent nudging and choice architecture interventions such as moving the time for recess to before lunch (Price & Just, 2014), and multi-component interventions (Esaff, Homer, Sahota, Baybrook, Coan, & McLeod, 2015). Other studies involving nudges and choice architecture in school lunchrooms found increases in consumption of F/V (Thapa & Lyford, 2014). Another reward-based intervention was effective in reducing F/V neophobia (extreme dislike of F/V among children unfamiliar with these foods) with a persistent effect observed six months after the intervention (Laureati, Bergamaschi, & Pagliarini, 2014). Another study found significant increase in F/V consumption during an intervention, but sustainability of the program was not clear as post-intervention data was not collected (Lowe, Horne, Tapper, Bowdery, & Egerton, 2004).

The current study tested the use of inexpensive stickers and toys to improve selection and consumption of F/V. This approach has not been previously tested in NSLP school lunchroom settings. During the intervention, children made their own decisions, hence there was self-attribution which involves greater satisfaction (Just & Wansink, 2009). In this study, children could choose the foods they wanted to eat from the five items offered as the schools used Offer versus Serve. A study found that branding cannot only change a child's affective reaction to a food but can also impact how much of that food a child eats (Keller et al., 2012). The current intervention also provided a distraction which affects food selected, the amount consumed, and the eater's perception of how much food he/she consumed (Just, Mancino, & Wansink 2007).

Research has shown that individuals' unique preferences and aversions are based on predisposed biological tendencies but are also further cultivated and modified through experiential learning. Early on, children are primed to favor sweet and savory foods, with preferences shaped over time in response to different social and environmental factors (Ventura & Worobey, 2013). Research has also shown that food preferences take shape early in life and continue until adulthood (Devine, Conners, Bisogni, & Sobal, 1998). While children's diets are affected by a multitude of factors, familiarity is imperative (Aldridge et al., 2009). Children like what they know and eat what they like (Cooke, 2007). Cycle menus used in the schools provide repeated exposure to F/V and could thus develop a lifetime of healthful food habit with nudges to promote selection and consumption.

CONCLUSIONS AND APPLICATIONS

Results of nudging and choice architecture interventions on F/V consumption by children participating in the NSLP in two elementary schools were examined in this study. Lunchrooms in two elementary schools serving low-income neighborhoods with similar demographics were chosen for the intervention. Low-cost marketing methods such as stickers (to encourage selection) and toys (to encourage consumption) were used. Students were incentivized to not only select but consume F/V during school lunch time. An average cost of one cent per serving of F/V was calculated for this study. This investment led to increased selection and consumption of F/V in school meals during the intervention. Yet an increase in F/V selection and consumption was also found during post intervention when compared to baseline data. Equally effective across five grade levels (1-5), this study successfully and sustainably encouraged students to consume F/V. Findings from this study contribute to the growing body of literature on application of behavioral economics to promote healthful food behaviors among elementary school students. This is an important stage for development of healthful food habits as peer pressure and stigma against F/V could increase in middle and high school years.

Application to School Nutrition Professionals

It is also important to consider the intervention in the context of the current policy environment. The current NSLP legislation guarantees increased availability of F/V on school menus. However, NSLPs have to remain financially solvent while complying with legislation (Just & Wansink, 2009; Ralston, Newman, Calauson, Guthrie & Buzby, 2008). A plate waste study conducted in Boston Middle Schools participating in the NSLP found students waste of served meals resulted in an estimated $432,349 of food discarded annually (Cohen et al., 2013). Because the current study was successful in encouraging F/V selection and consumption in a low-income neighborhood at a cost of one cent per serving of F/V, such strategies could be used by child nutrition professional administering the NSLP in economically distressed communities. The findings may be particularly useful with low income children who may have limited access to F/V outside the NSLP (Dong & Lin, 2009), and as a result, have not developed taste preferences for F/V. Such application of low-cost behavioral economics strategies in the school lunchroom is important in the context of recent changes in NSLP meal standards designed to provide a healthful diet and prevent childhood obesity (Kennedy & Guthrie, 2016).

Sustainable interventions that support improved selection and consumption of F/V by students in elementary schools could provide solutions to combat the issues of unhealthy dietary choices and increased food waste. A relatively novel practice of using inexpensive stickers and toys on F/V served in school cafeterias could be beneficial in improving consumption of these foods in NSLP across the country.

Implications for future research

The findings of this study are based on an intervention replicated in two schools that are similar in their socio-demographic characteristics. Hence, it is not clear whether findings are generalizable to the population of school nutrition programs. Similar interventions followed by program effectiveness analysis in wider jurisdictions could provide evidence-based policy recommendations for further behavioral economic interventions in school lunchrooms. The current study reports the effect of a dual component intervention using inexpensive stickers and toys. Previous research in the area has also shown positive effect of more than one intervention (Golub, Gunther, Hanks, Holloman, & Kennel, 2015). Hence, a combination of interventions appears to be effective. Future research in this area could focus on determining an optimal intervention time to improve habit formation toward desired F/V consumption. While the current research was conducted in a low-income setting, future research could be conducted using a randomized field study in schools serving neighborhoods of different socio-economic status. Such studies could examine the relative effectiveness of such interventions in improving F/V consumption among students in diverse settings.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Cornell Center for Behavioral Economics in Child Nutrition Programs for providing funding for the study and the participating schools for their support and provision of the infrastructure to conduct this research.

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