

The Behavioralist as Dietician: Leveraging Behavioral Economics To Improve Child Food Choice and Consumption

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Abstract

Childhood obesity has reached epidemic proportions, with now almost a third of children ages 2-19 deemed overweight or obese. In this study, we leverage recent findings from behavioral economics to explore new approaches to tackling one aspect of childhood obesity: food choice and consumption. Using a field experiment where we touch more than 1,500 children, we report several key insights. First, we find that individual incentives can have large influences: in the control, only 17% of children prefer the healthy snack, whereas the introduction of small incentives increases take-up of the healthy snack to roughly 75%, more than a four-fold increase. The observed treatment effects compare favorably to educational messages, which alone have little influence on food choice. Second, we find that incentives framed as losses have consistently large effects—both in the food choice decision and in whether the child actually consumes the snack. Third, educational messages combined with incentives framed as losses have the largest impacts, both during and after our incentivized time period. For policymakers, our findings show the power of using behavioral economics to combat childhood obesity. For academics, our approach opens up an interesting combination of theory and experiment that can lead to a better understanding of theories that explain health decisions and what incentives can influence them.

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Keywords: field experiment, food choice, child behavior, incentives

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1. Introduction

Obesity is a major public health concern, leading to many chronic conditions such as high blood pressure, diabetes, cardiovascular disease, and certain cancers (Pi-Sunyer, 1993). A major component of this problem is the decision by individuals to habitually consume high quantities of low-nutrient, high-calorie foods and beverages. While many interventions to improve nutrition have been geared towards adults, there is a growing need to address nutritional decision-making among children and adolescents. This is because 17% of the nation's youth have body mass indices (BMIs) at or above the recommended 95th percentile (National Institutes of Health, 1998; Ogden et al., 2002, 2010). Lack of proper nourishment, such as not meeting the RDA requirements for fruits and vegetables, affects health and hampers growth among children and can also contribute to lack of concentration and energy, resulting in poor performance in school (Whitaker et al., 2006; Jyoti et al., 2005; Weinreb et al., 2002). Importantly, children from low-income families are at higher risk (Cole et al., 2008; Neumark-Sztainer et al., 1996).¹

Children's health and weight are closely linked to dietary behavior. American children consume less than 20% of the recommended amount of whole grains and just 10% of the recommended amount of dark green and orange vegetables and legumes (Just et al., 2007). The tendency to consume an unhealthy diet is learned at an early age and persists throughout adulthood, as individuals are more likely to eat familiar foods (Smith and Tasnadi, 2007). These habits are often learned in the home, which may create a cycle of unhealthy behaviors (De Bourdeaudhuij, 1997; Campbell et al., 2007; Dowda et al., 2001).

Academics have recognized the obesity problem and have begun to take important steps in understanding its causes and consequences. For example, interventions for adults by the U.S.

¹ Lower-income students have less food security and are more likely to be overweight or obese, so targeting this socioeconomic group is of vital importance (Casey et al., 2001; Ogden et al., 2006).

Department of Agriculture and the U.S. Department of Health and Human Services have included providing advice about healthful choices and requiring labeling of foods (Welsh et al., 1993). Likewise, interventions that include nutritional education for children have shown some progress in terms of increases in fruit and vegetable consumption (Reynolds et al., 2000; Perry et al., 1998; Nicklas et al., 1998).² Interestingly, even though behavioral economics has touched nearly every field in economics, one area where behavioral economics has made fewer inroads is in food choice. Yet food choice is an important area where the insights gained from behavioral economics might produce the highest social benefits.

In this study, we conduct a large-scale field experiment to explore how behavioral economics can be leveraged to improve child food choice. Our experiment revolves around one major behavioral tenet: some people have reference-dependent preferences, wherein carriers of utility are changes relative to a neutral reference point rather than absolute levels. In certain cases, such people will exhibit behavior consistent with a notion of *loss aversion*, an insight gained from Kahneman and Tversky's (1979) prospect theory.

We conducted our field experiment in after school programs in the Chicago area, called 'Kids Cafes,'³ which provide children from low-income families a free meal and activities. In the field experiment, children were given a choice between a dried fruit cup (healthier choice) and a cookie (less healthy choice). Children were allowed to select only one item. We randomly assigned Kids Cafe sites to either receive a gain-frame incentive (in which the child received a small prize if and only if he/she selected and fully consumed a fruit cup), a loss-frame incentive

² These studies included featuring nutrition education as a primary component, and employed the National Cancer Institute's (NCI) "5 a Day for Better Health" initiative. Our study, on the other hand, uses a short educational message.

³ Note that the correct name of the program does not include an apostrophe in "kids." The food provided in the program is reimbursable through the United States Department of Agriculture (USDA) and administered by each participating site individually.

(in which the child received a small prize but then it was taken away if he/she did not select and consume a fruit cup), a 3-minute educational message delivered by the experimenter about the benefit of fruits versus cookies, or a loss frame- incentive combined with the educational message. 1,616 individual children and adolescents across 24 sites participated in the experiment, which lasted several weeks. We then observed children after the experiment concluded, in an effort to explore if the incentives or educational messages had a habit-forming effect.

We find that in the absence of immediate incentives, many students will choose the unhealthy snack—about 17%. Yet, once an incentive is introduced, students were drawn to the healthy choice—at a rate of nearly 80%. This more than four-fold increase is achieved with small incentives. Importantly, the educational message has little influence on food choice: even after providing information about the healthy choice, children are not persuaded to make the switch from cookie to fruit. Yet, what does work quite effectively is the combination of the educational messaging and loss-based incentives. In this case, not only do many children choose the healthy snack, but they ultimately consume the snack. Whereas in the education treatment only 60% of the children who choose the fruit ultimately consume it, over 90% of children in the incentive treatments who choose the fruit consume it. Importantly, this ‘within-experiment’ effect spills-over to the long-run. Upon returning a week after the experiment is completed, we find that children in the control group continue to choose the unhealthy snack at a low rate—around 13%. Yet children in the messaging and loss treatment choose the healthy choice at a nearly double rate—26%.

These results suggest that there is an important place for educational messages, and that they have their greatest impact when combined with a small individual incentive. In addition,

the results suggest that behavioral interventions can be leveraged to improve health outcomes with little cost: changing the frame of the incentive is a costless modification that yields significant promise. Finally, the findings have important implications for not only immediate choice, but show that longer-term impacts can be achieved with the correct mix of incentives and information. Contrary to wide-spread concern that incentives may crowd out the intrinsic motivation to choose healthy foods, we do not find that incentives have a detrimental effect on food choice—rather, we find the opposite.

The remainder of the paper is organized as follows. Section II summarizes the underlying theoretical framework that motivates our design. Section III describes the experimental design and implementation. Section IV summarizes the main results. Section V concludes.

2. Theoretical Background

The theory underlying why there might be behavioral differences between the gain and loss frame is founded on Kahneman and Tversky’s prospect theory (Tversky and Kahneman, 1991). Prospect theory conjectures that a value function exists that is (i) measured over deviations from a reference point assessed over some narrowly bracketed timeframe, (ii) convex for losses and concave for gains, and (iii) initially steeper for losses than for gains (Tversky and Kahneman, 1991). For our purposes, consider a representative agent who derives benefits and costs as follows:

$$V(c, c') = u(c) + R(c, c')$$

Where u is utility over consumption and r is the value function of prospect theory. Let $u(\cdot)$ be increasing and concave in c . We define utility derived in relation to a reference point, $R(\cdot)$:

$$A(.) = \begin{cases} r(c - c^r), & \text{if } c \geq c^r \\ s(c - c^r), & \text{if } c < c^r \end{cases}$$

Where r is increasing and concave and s is increasing and convex. Estimates of the ratio of r and s (when linearity is assumed) have found $-s(-x)/r(x) \cong 2$ (see Tversky and Kahneman, 1991). In the spirit of this finding, if children are loss-averse, then the negative utility they receive from a loss of x is greater in magnitude than the positive utility they receive from a gain of x for any positive x . This simple formulation provides the basis of our most novel intervention.

It is important to recognize that even though such a behavioral insight has not been taken to food choice and consumption, many other potentially impactful interventions have been explored in this important area. For example, messaging has been an important point of interest. Simple verbal prompts have been successfully used to encourage children to choose healthier meals. When cafeteria workers asked children whether they would like a fruit, the number of children consuming fruit increased significantly (Schwartz, 2007; Perry, 2004).

Likewise, incentives have been explored. One particularly interesting study is due to Just and Price (2011), who concurrently with our work, explore the impact of small prizes or 25-cent rewards on children's choices in the school cafeteria, and find that an incentive increases the fraction of children choosing a healthy fruit or vegetable side item by 80%. Wasting of food is also reduced by 43%. The observed effects were greater at schools with a larger fraction of low-income children.

Incentives have also proved to be effective in changing health prevention related behavior in adults. A series of related novel studies that explore the effect of incentives on health-related behaviors have also been aimed at adults. Incentives have been shown to be effective for weight loss (Cawley and Price, 2008; Volpp et al., 2008), smoking cessation (Volpp et al., 2009), and compliance with healthy preventative behaviors (Malotte et al., 2008).

Recent concerns have been raised about the long-term impact of extrinsic incentives - Gneezy et al. (2011) suggest that in some contexts, incentives may crowd out intrinsic motivation, and literature in psychology is concerned with potential negative ‘rebound effects’ (Lepper et al., 1973). More work is needed to understand the long-term impact of incentives, but there is some preliminary evidence that long-term impact could be positive in the health domain. For example, Charness and Gneezy (2009) found that adults given incentives to attend a gym continued attending the gym even after incentives were removed.

Our framework takes the literature in a new direction by using behavioral economics to guide our treatment set. In doing so, we simultaneously explore the effect of messaging and the effect of our treatment after the intervention concludes. This permits us a glimpse of whether habit formation might play a role in food choice. Our study includes both urban and suburban neighborhoods, with a particular focus on how the incentives impact children and adolescents ages 6-18. Importantly, our students come from households with below average earnings.

3. Experimental Setup & Design

3.1 Experimental Procedures

After eating the after school meal, children approached the experiment table and were given the choice of a dried fruit cup or a cookie. Each cookie was individually presented on a napkin on a tray full of cookies, and the dried fruit was similarly presented in small plastic cups. Both options were available at all times. Children could either choose one fruit or one cookie, were instructed not to share the fruit or cookie and were asked to eat it in the cafeteria. The experimenter read a standard message about the choice, and then read a message about the

incentive or education, depending on treatment. We recorded the choice that was made, and research assistants also observed whether or not the food item was consumed.

The experiment was conducted at 24 different after school programs called ‘Kids Cafes’ in the Chicago area, with 1,616 separate children participating at some point during the study. The majority of the sites were in the program between February and March of 2011, and the remaining sites were in the program in the second phase between April and May of 2011. Kids Cafes are located in community centers, schools and churches in low-income areas of Chicago, where the majority of children are eligible for the Free or Reduced Lunch Program. At each Kids Cafe, children eat a meal and may also participate in homework help sessions, art projects, or other activities, depending on the site. Attendance at most Kids Cafes is not required and children participate either daily, several times a week, or sporadically. In addition, Kids Cafes vary in size: the smallest program has 19 regular participants, while the largest program has over 300 participants. In the analysis, we use between-subject variation as our major indicator of differences, and within-subject variation for some subjects to investigate change in choices over time. Over 30 different experimenters assisted in the implementation of the treatments, with 3-8 experimenters in each team. Experimenters were trained extensively and also periodically evaluated during the study in order to ensure that the implementation was comparable across sites.

Each site was visited 2 times per week for either 2.5 weeks or 4.5 weeks, depending on the randomly determined length of study at each site. We varied treatment length to explore habit formation, but note that habit formation data is available for only a subset of children, because all children did not participate in the program every day. We find little evidence of differential selection by treatment.

Table 1 provides a sample timeline of implementation. On the first day of the experiment, experimenters arrived to acquaint themselves with the center staff, present a schedule for visits to the center, explain the distribution of the desserts, and request assent forms from the children and reverse consent forms from the parents. The forms stated that children would be offered choices of desserts throughout the study, that their choice would be recorded, and that they may have the opportunity to receive prizes or educational messaging as part of the study.⁴ Children who had a completed assent on file, and no form declining consent from the parent, participated in the experiment. Children who assented but whose parents declined to consent still received a fruit or a cookie during the experiment but did not enter into the data collection process. Children who did not assent but whose parents consented, or children who did not have assent or consent on file, did not participate in any part of the experiment. Most students assented either on the day of assent or the following day when the dessert was offered, while most parents did not decline to consent, so that only 12 children, or less than 1%, of Kids Cafe children are not in the data.

Table 1: Timeline of Implementation – Phase I

Sample Date	Day #	Long Treatments (X sites)	Short Treatments (X sites)
<i>Mon., Feb. 7th</i>	<i>0</i>	<i>Assent/Introduction Day</i>	
<i>Wed., Feb. 9th</i>	<i>1</i>	<i>Baseline</i>	
<i>Mon., Feb. 14th</i>	<i>2</i>	<i>Treatment (1)</i>	
<i>Wed., Feb. 16th</i>	<i>3</i>	<i>Treatment (2)</i>	<i>Baseline</i>
<i>Wed., Feb. 23rd</i>	<i>4</i>	<i>Treatment (3)</i>	<i>Baseline*</i>
<i>Fri., Feb. 25th</i>	<i>5</i>	<i>Treatment (4)</i>	<i>Baseline</i>
<i>Mon., Feb 28th</i>	<i>6</i>	<i>Treatment (5)</i>	<i>Survey Collection</i>
<i>Wed., March 2nd</i>	<i>7</i>	<i>Baseline</i>	
<i>Mon., March 7th</i>	<i>8</i>	<i>Baseline*</i>	
<i>Wed., March 9th</i>	<i>9</i>	<i>Baseline</i>	
<i>March 11-18</i>	<i>10</i>	<i>Survey Collection</i>	

**Due to a logistical constraint, observations are not available for Day 4 in Short and Day 8 in Long for most sites, because most sites were served a celery + peanut butter option instead of the usual dried fruit cup in observance of National Nutrition month in March.*

⁴ In this spirit, our field experiment should be considered a framed field experiment in the parlance of Harrison and List (2004).

The second day of the experiment involved a baseline treatment in which all children received the choice of fruit or cookie and results were recorded. The next 1 or 5 days (depending on length of assigned treatment) consisted of treatment days, in which children made the choice of fruit or cookie and also either continued in the baseline treatment or received an incentive or educational message, as described in Section 3.3. The last 2-3 days consisted of additional baseline treatments.

Table 2 provides a list of the fruit and cookie options that were available throughout the study. In general, we alternated between three different cookies and two different dried fruit options. The choice of cookie and fruit for delivery was dependent on the availability and was provided by the Greater Chicago Food Depository.

Table 2: Fruits and Cookies Served

Fruits	Cookies
<i>Dried Banana with Acai</i>	<i>Snickerdoodle Cookie</i>
<i>Dried Mango</i>	<i>Lemon Cookie</i>
	<i>Brown Sugar Shortbread Cookie</i>
	<i>Chocolate Chip Cookie (1 site on one day only)</i>

3.2 Experimental Design

The goal of the experiment was to discover whether gain-framed incentives, loss-framed incentives or an educational message would prompt children to choose a healthier food item over a less healthy one. Short and long study sessions were conducted in order to explore the possibility of habit formation. Table 3 summarizes the treatments, including the total number of separate children who participated throughout the study, while Table 4 provides a snapshot of the number of children who participated in Periods 1 and 2. Notice that although we have on average 365 separate children participating per treatment, we only have on average 186 and 160 separate

children in each treatment in periods 1 and 2, respectively. This difference in numbers is due to the high turnover of children at sites on a day to day basis.

Table 3: Summary of Treatments

	Short Study Session	Long Study Session	Total
Baseline – No Incentive, no education		2 sites, 116 children – 80/36* <i>2 Additional Sites in P1, 188 children – 42/146**</i>	2 sites, 304 children
“Gain” Incentive Only – Gain incentive only	5 sites, 428 children – 31/34/38/242/83		5 sites, 428 children
“Loss” Incentive Only – Loss incentive only	5 sites, 216 children – 35/37/19/62/63 <i>3 additional sites with 211 new children***</i>	1 site, 107 children	7 sites, 390 children
Education Only – Education message only	3 sites, 141 children – 46/69/26	2 sites, 341 children – 294/47	5 sites, 482 children
“Loss” Incentive + Education – Incentive +Educational message	1 site, 55 children	3 sites, 170 children – 63/25/82	4 sites, 225 children

**One of the two sites does not have any observations for Period 1, because there was a failure in delivery of cookies.*

***2 additional treatments “Cookie only” and “Fruit only” were also conducted, but we were not able to study habit formation because there were not enough returning children. Thus, we instead use these sites as baseline sites only in period 1.*

****3 sites participated in Phase I and II, and in Phase II we were able to secure observations from additional ‘new’ children who did not participate at all in Phase I. 427 children total participated at these sites and 211 (40%) were new.*

Table 4: Number of Observations per Day – Periods 1 & 2

	Period 1	Period 2	Both Days
Baseline – No Incentive, no education	157	83	62*
“Gain” Incentive Only – Gain incentive only	221	210	89
“Loss” Incentive Only – Loss incentive only	192	183	116
Education Only – Education message only	216	185	97
“Loss” Incentive + Education –Incentive +Education	145	140	111

**In Baseline, for Period 1 we have observations from 5 sites and for Period 2 we have observations from only 2 of the sites.*

We conducted one baseline treatment in which children continued to receive a choice of cookie or fruit during treatment days. The key treatment that we explore following the theory outlined in Section 2 is whether a “gain” or a “loss” framed incentive is more effective. In the

“gain” incentive treatment, the child only chooses a prize if he/she selects and consumes the fruit. In the “loss” incentive treatment, the child first chooses a prize, which is then placed in a clear plastic box and taped shut. The child can keep the box as he/she goes up to the line to select a fruit or a cookie. If the child selects a cookie, the child has to forfeit his/her prize, but if he/she chooses the fruit, he/she kept the prize. Experimenters then took the prize out of the box and gave it to the child if they observed the child eating the fruit cup, or took the prize away if the child chose not to eat the fruit cup. In the education treatment, the experimenter read a short educational message about the benefits of fruit and displayed the USDA’s Food Pyramid board prior to asking the child to select a fruit or a cookie. The experimenter did not explicitly prompt the child to choose the fruit over the cookie.

The prizes available in the incentive treatments are displayed in Figure 1. Children could select between a number of different items, each worth 50 cents or less, including different colored fruit key chains, pens, wristbands, small rubber ducks, and trophies. All of these items also varied in colors to make sure that children in the “long” groups continued to value the incentive throughout the experiment (for example, there were 5 different colors of wristbands, so children could ‘collect’ all 5). The educational message was based on the USDA’s Food Pyramid guidelines for children.⁵ All treatments were accompanied by a bulletin board that showcased the different prizes or showcased the food pyramid.

⁵ The USDA Food Pyramid can be found at www.mypyramid.gov.

Figure 1: Photo of Gift Display



4. Results

4.1 Summary

Figures 2a and 2b provide a snapshot of our results for both the long and short treatment types, respectively. Significant increases in fruit selection occurred on days when an incentive was offered, raising the proportion of children choosing fruit from approximately 20% to 80%. In addition, despite the fact that not all children observed in later periods participated in the full treatment, there is evidence that a greater proportion of children consumed fruit following the end of the incentives in the long treatment type group.

Figure 2a: Proportion of Children Selecting Fruit over Study Days - Long

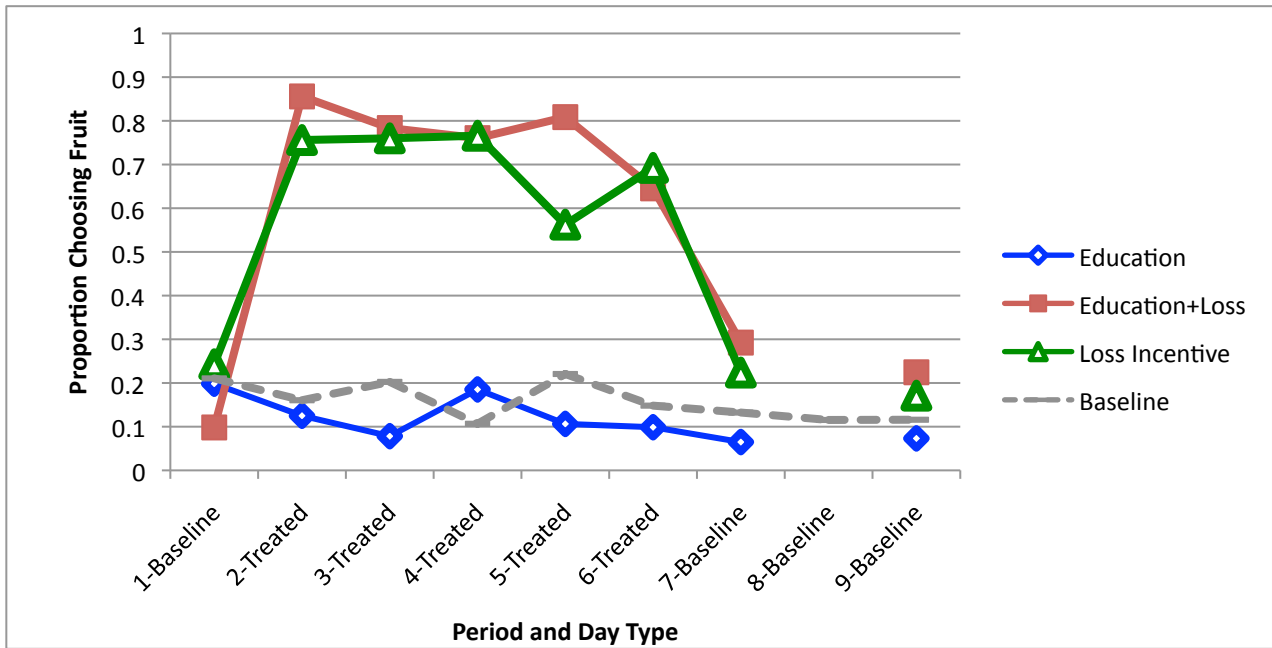
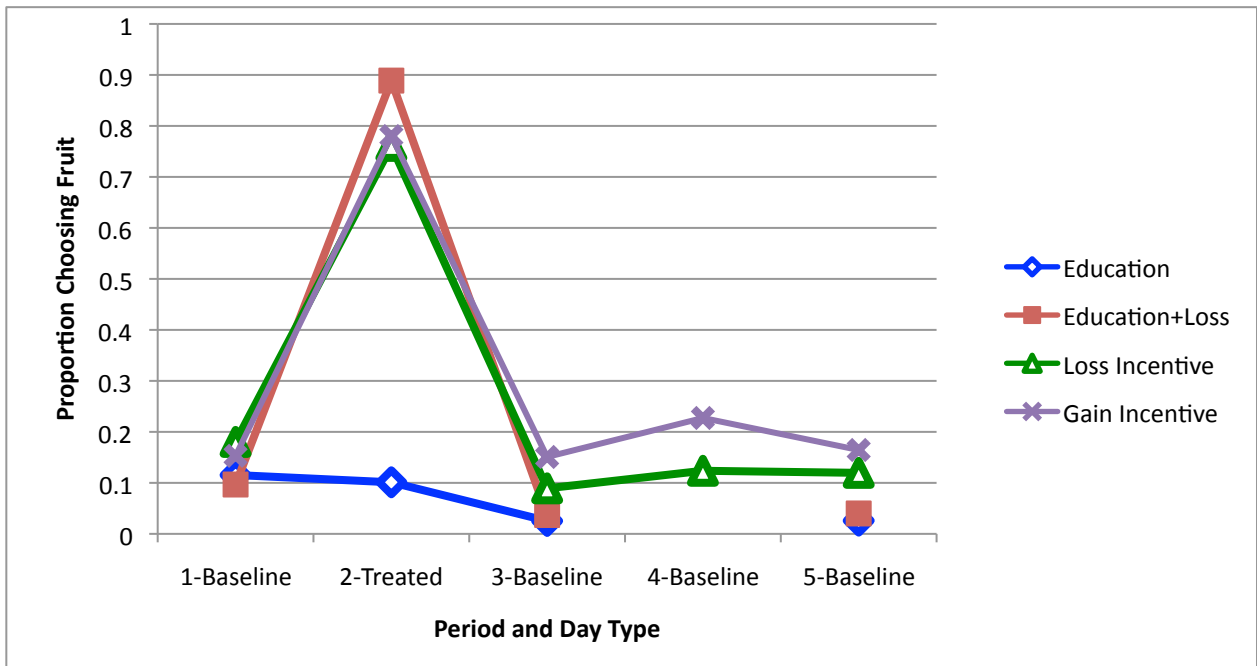


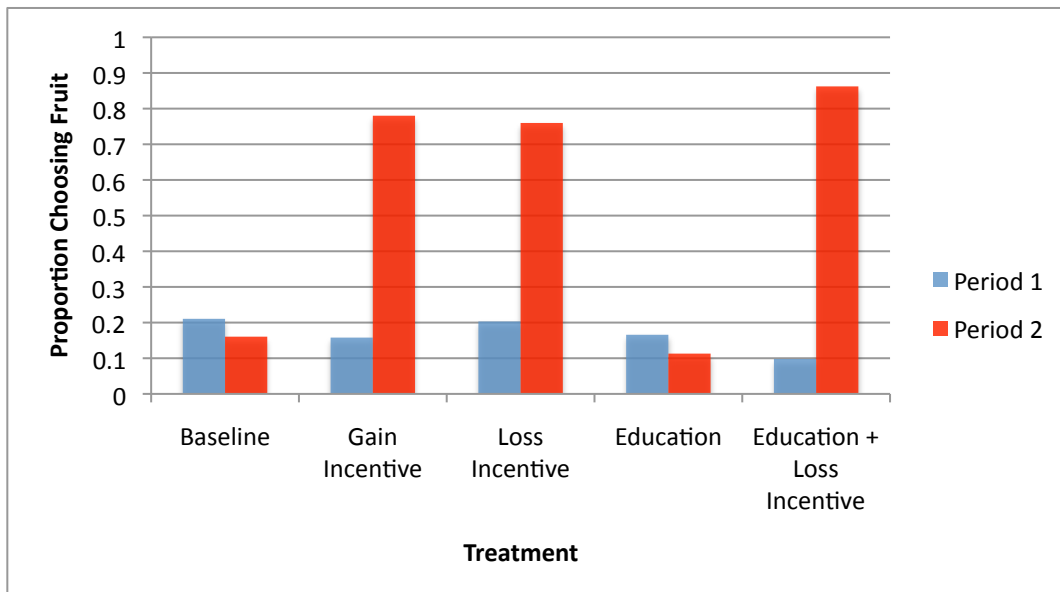
Figure 2b: Proportion of Children Selecting Fruit over Study Days – Short



4.2 Baseline and Treatment Comparison

Our main comparison is between the first day (without treatment) and the second day (with treatment), pooling both short and long treatments. As displayed in Figure 3, 17% of children selected fruit in period 1 overall, and 21% selected fruit in the baseline treatment. There are no statistically significant differences in proportion of fruit chosen in period 1 across most treatments, but significantly fewer children selected fruit in the Loss+Education treatment as compared to the other treatments.⁶ Because randomization is at the site level, and sites differ by location and activities provided, we may expect some differential selection by treatment. Yet these observations suggest little differential selection by treatment. Moreover, the direction of differences for Loss+Education relative to the others would simply give us a lower bound of the potential positive effects of this treatment in subsequent analysis.

Figure 3: Fruit Selection, Periods 1 & 2



⁶ A Wilcoxon Mann-Whitney ranksum test results in p -values that are above 0.10 in most pairwise comparisons (e.g., Baseline vs. Education p -value = 0.49). However, comparing Education + Loss, we find that this treatment results in significantly fewer students choosing fruit compared to Baseline (p -value = 0.01), Education (p -value = 0.03), Loss Incentive (p -value = 0.01) and Gain Incentive (p -value = 0.08).

We conducted Wilcoxon Mann-Whitney rank sum tests to compare the proportion of children selecting fruit in period 2 in each treatment. In period 2, the proportion of children selecting fruit in baseline decreased to 16%. The gain incentive treatment increased the proportion of children selecting fruit to 78%, while the loss incentive increased the proportion of children selecting fruit to 76% (p -values < 0.01 for baseline vs. loss and baseline vs. gain). The education treatment was not effective, as the proportion of children selecting fruit in period 2 dropped to 11% (p -value = 0.29). However, education together with loss incentives increased the number of children selecting fruit to 86% (p -value < 0.01 when comparing baseline to loss+education). The comparisons above are conducted using the child's choice as a unit of observation. However, we find similar results when using the average choice at the site as a unit of observation (p -value = 0.01 for baseline vs. loss-incentive and baseline versus education+loss incentive, but p -value = 0.20 for baseline vs. education only).

We also conducted pair wise comparison tests (sign-rank) for children who were in the program for both periods. There is no statistically significant change from period 1 to 2 in baseline or in the Education Only treatment. (p -value = 0.25 and 0.18, respectively). By comparison, there is a statistically significant improvement in fruit choice for students in Gain, Loss and Loss+Education treatments (p -values < 0.01). Table 5 displays the *change* in proportion, between period 1 and period 2, of children choosing fruit across treatments. These data lead to a first result:

Result 1: Incentives significantly increase the proportion of children selecting fruit.

Table 5: Change in Proportion of Children Choosing Fruit, Periods 1 to 2

	Change in Proportion from Period 1 to 2	Number of Observations
Baseline – No Incentive, no education	-0.05	62
“Gain” Incentive Only – Gain incentive only	0.62	89
“Loss” Incentive Only – Loss incentive only	0.56	116
Education Only – Education message only	-0.05	97
“Loss” Incentive + Education –Incentive +Education	0.76	111

We also compare the relative effectiveness of our different treatments to test our theoretical model. We find that there is no statistically significant difference between Loss and Gain Incentive (p -value = 0.64). However, the proportion of children choosing fruit in Loss+Education is significantly greater than the proportion of children choosing fruit in Loss or in Education alone (p -values = 0.03 and <0.01 , respectively). Together, these two insights lead to our next two results:

Result 2: The gain and loss treatment are equally effective in moving children to choose the healthy option.

Result 3: Education alone does not have a significant effect, but education paired with incentive is more effective than education or incentive alone.

4.3 Consumption

Programs providing nutritionally balanced meals have been implemented on a wide scale (e.g., the USDA’s Free and Reduced Lunch Program, Kids Cafes). While these programs have been successful, a direct link from choice of food to consumption cannot be taken for granted. For example, Just et al. (2011) find that in the lunchroom at school, over 44% of items taken by students are wasted.⁷ Our study provides evidence of the link between selection and

⁷ In Just et al.’s (2011) work, they find waste going down to only 26% when incentives are introduced.

consumption, which is another interesting variable for our theory and policymakers. If incentives help to reduce costly food waste, this finding can provide another, financial motivation for schools and other programs serving food to implement them.

Table 6 displays the average proportion of fruit selected and average proportion consumed across the different treatment groups and dependent on whether it is a baseline or treatment day. Our experimental administrators were able to observe on average 73% of all consumption by walking around the room while the dessert was being served, at the level of detail of “ate none”, “ate ~1/4”, “ate ~1/2”, “ate ~3/4” and “ate all.”⁸ Table 6 describes the amount of data available for the subsequent analysis. An additional 26% of consumption was observed without amount information.

Table 6: Observed Consumption

	Baseline	Education Only	Gain Incentive	Loss Incentive	Education + Loss
Observed with detailed amounts	74%	73%	30%	79%	77%
Observed without detailed amount	24%	26%	68%	21%	22%
<i>Number of Observations</i>	3,011	627	210	380	545

*Note that the differences in number of observations per treatment is due to the fact that some treatments were conducted only during the “Short” session (Gain Incentive) while the remaining treatments were conducted in both “Short” and “Long” versions. Moreover, the team sent to one of the “Gain” sites during the treatment day did not correctly record amount information.

In the following analysis, we use only the consumption information available at the detailed level (73% of all observed consumption). Consumption is generally clustered at the full serving, for both cookies and fruit, with approximately 80-95% of students consuming the full amount. The exception is the fruit consumption in the “Education” treatment – in which over 20% of students ate 1/4 or less of their fruit. Figure 4 displays the amount consumed when each of fruit or cookie was selected, for all baseline days, and all treated days of each treatment.

⁸ This is out of 4,773 observations (across all days, sites and participants). We instructed experiment administrators to approximate whether

Figure 4a: Proportion Consumed when Cookie was Selected

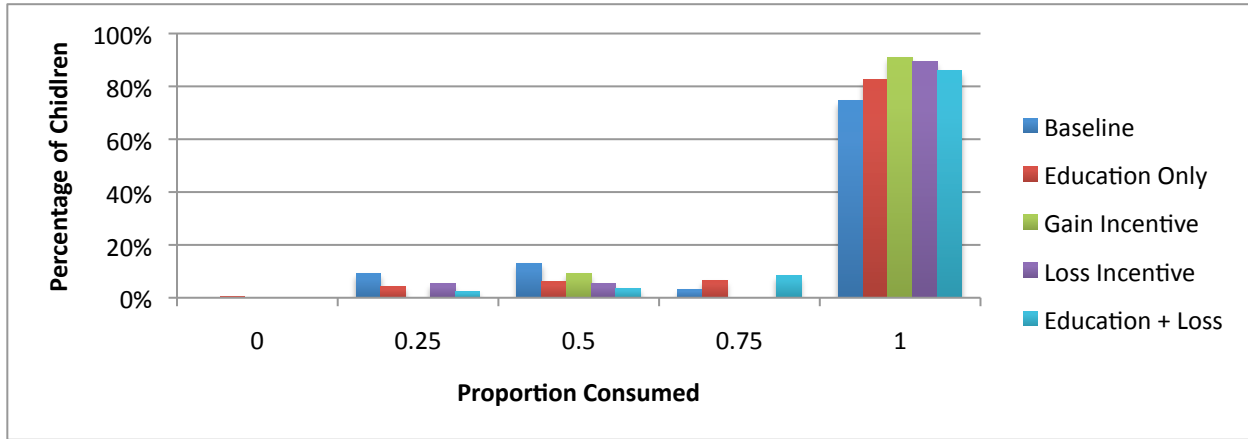
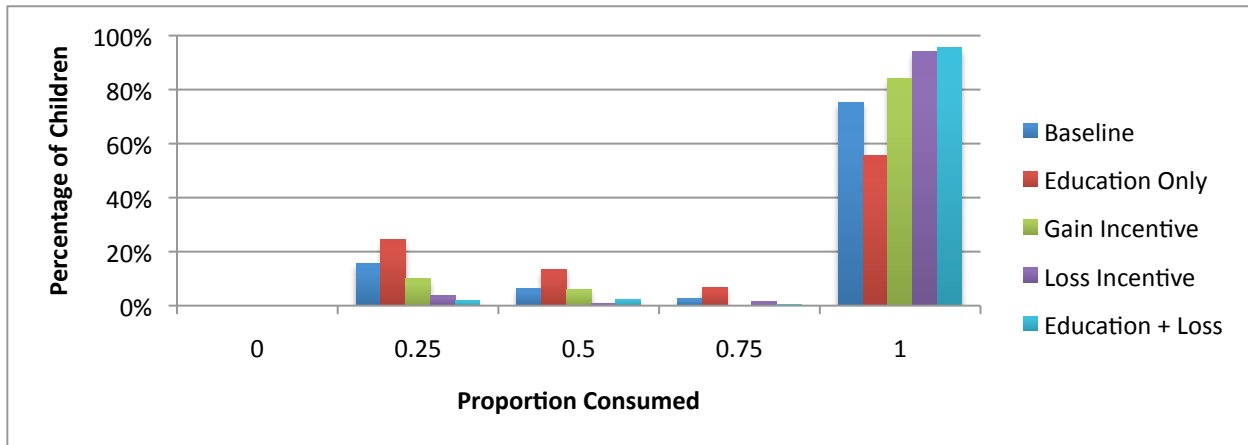


Figure 4b: Proportion Consumed when Fruit was Selected



We define the “rate of waste” as the proportion of whole servings of items that were not consumed in each treatment. The “rate of waste” at baseline is 14% for cookies and 16% for fruit. Waste is lowest in the Loss Incentive and Education + Loss – only 4% and 3% for fruit, and just 1% and 6% for cookies. Fruit waste in the Gain Incentive treatment is at 11%, and cookie waste is 5%. This observation is intuitive, as children who choose a prize and then select a fruit are most likely to consume it in order to keep the prize. Children who choose to forego the

prize for the cookie also have high rates of preference for the cookie and are more likely to finish it.

On the other hand, waste is highest for fruit in the “Education Only” treatment, and is at 27% of all fruit that was selected. This treatment may result in an increase in waste since children may feel that they should take the fruit because of the educational message, but then fail to consume it because there is less incentive to do so and because it would not have been their first choice. 8% of cookies are wasted in the education treatment. This is an interesting observation, suggesting that any gain from education may be negatively affected by decreased consumption.

Table 7 displays the proportion of fruits and cookies consumed in Period 2 for all treatments. To further the analysis, we conducted pair-wise comparison tests for all children for whom detailed data on amount of fruit consumed is available.⁹ We find that children consume a significantly greater amount of fruit (out of those who selected fruit to start with) in Loss Incentive, Loss and Education, and Gain Incentive than in Education alone (Wilcoxon Mann-Whitney p -values < 0.01).¹⁰ We also find that a greater amount is consumed in Loss Incentive and Education + Loss relative to Gain Incentive, and this result is significant for the former (Wilcoxon Mann-Whitney p -value = 0.05 and 0.21, respectively).

⁹ We choose to report analysis on period 2 instead of all periods aggregated, because period 2 is the only period in which we have data on Gain Incentive (this treatment was only conducted in the ‘short’ length). Averaging data across all treated days gives us a larger sample, since not all children were present in period 2. Using this approach, we find qualitatively similar results. We find that amount is greater in “Loss Incentive” (88%), “Loss and Education” (90%) and “Gain Incentive” versus Education alone (68%) (all p -values < 0.01). While differences remain between “Gain” and “Loss” and “Gain” and “Loss + Education,” the differences are not statistically significant for either (p -values = 0.33 and 0.54).

¹⁰ We do not compare to Baseline in the main text, because we only have 9 observations for baseline. That said, our p -value for Loss versus Baseline is 0.06, for Loss and Education versus Baseline is 0.18, and for Gain versus Baseline is 0.58.

Table 7: Proportion of Fruit and Cookies Consumed

	Fruit	Cookies	<i>Observations</i>
Baseline (Untreated Period 2)	83%	80%	60
“Gain” Incentive Only (Treated Period 2)	90%	95%	63
“Loss” Incentive Only (Treated Period 2)	96%	93%	136
Education Only (Treated Period 2)	60%	90%	127
“Loss” Incentive + Education (Treated Period 2)	95%	80%	81

These data lead to our result:

Result 4: The loss treatments result in increased consumption amounts of fruit more than the gain incentive, but the education treatment results in a decreased consumption of fruit relative to the baseline

4.4 Longer-Term Effects

We follow the participants post-intervention to determine whether any habit formation has occurred. Figures 5a and 5b display the averaged proportion of children choosing fruit in all treatment days and all post-treatment days for long and short treatment types, respectively. Table 8 summarizes the proportion of children choosing fruit following the treatment for each type (long and short) and treatment, including all children, even if they participated in only one day of the study. We find significant differences between the proportion choosing fruit in Education + Loss post-treatment (26%) relative to baseline (13%) in the long treatment sessions (Wilcoxon rank-sum p -value = 0.02). However, there are no statistically significant improvements for Education or Loss Incentive treatments.¹¹ Note that there are no significant differences post-treatment between the Loss Incentive treatment and Education + Loss. In the short session

¹¹ Wilcoxon Mann-Whitney p -value = 0.12 for Loss, and a decrease for Education Only treatment with p -value < 0.01.

treatments, we also do not find significant improvements from Baseline to Gain Incentive, Baseline to Loss Incentive, or Baseline to Education+Loss.¹²

Figure 5a: Choosing Fruit in Treatment, and Post-Treatment: Long

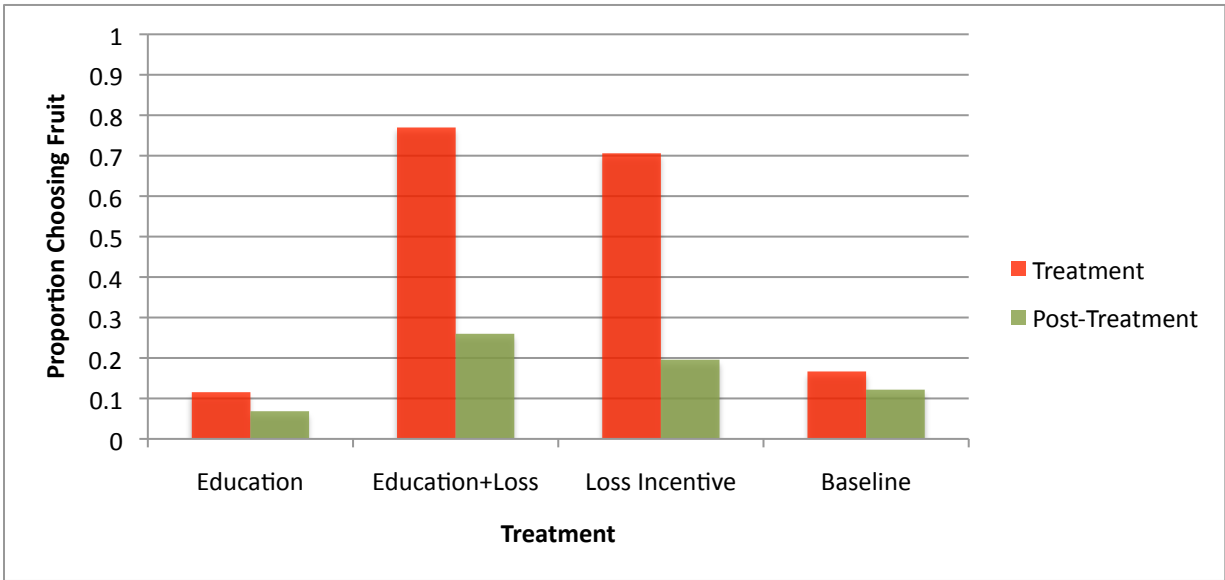
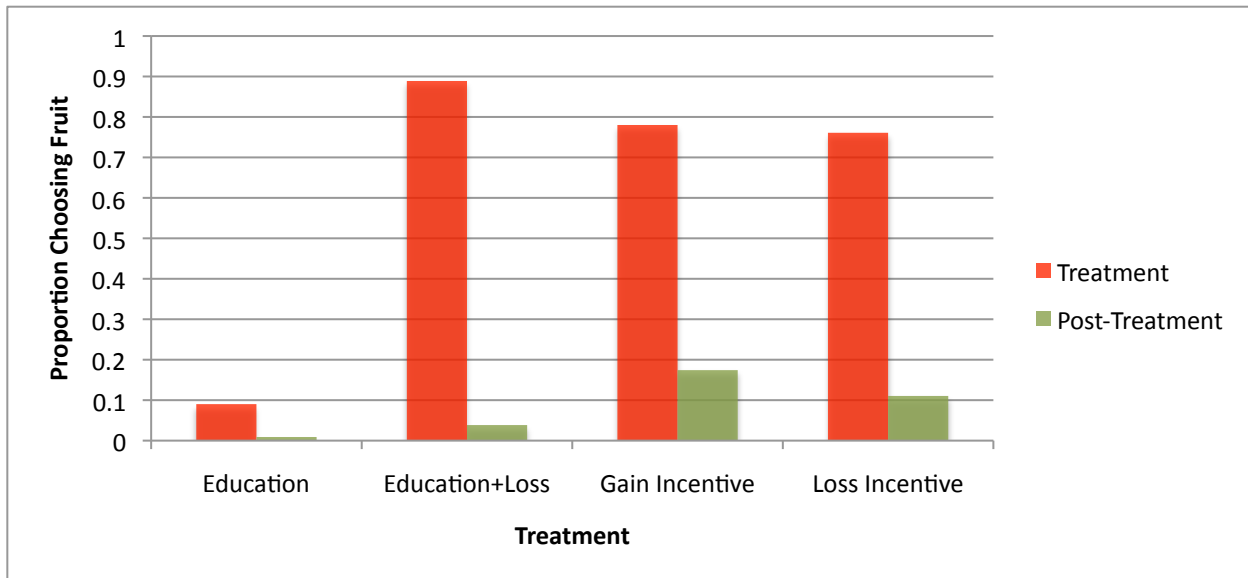


Figure 5b: Choosing Fruit in Treatment, and Post-Treatment: Short



¹² Wilcoxon ranksum test p-value has a sign in the opposite direction than expected with p-value 0.04 for Baseline vs. Education+Loss, p-value 0.00 for Baseline vs. Education, and no significant differences between Baseline and Loss Incentive alone (p-value = 0.40). There are also no significant differences between Loss Incentive and Education+Loss (p-value = 0.11) or between Education and Education plus Loss (p-value = 0.62).

Table 8: Proportion of Children Choosing Fruit Following Treatment

	Baseline	Education Only	Gain Incentive	Loss Incentive	Education + Loss
Long	0.13 (0.27) 93 Obs.	0.06 (0.22) 152 Obs.		0.20 (0.32) 87 Obs	0.26 (0.39) 133 Obs
Short		0.03 (0.15) 103 Obs.	0.14 (0.31) 268 Obs.	0.11 (0.29) 170 Obs.	0.03 (1.12) 33 Obs.

**Standard deviation in parentheses*

These data lead to our final result:

Result 5: Education+Loss Incentive positively affected choice after our incentives terminated, whereas Education only and incentive only did not have a significant long-term effect.

5. Conclusion

We conducted a field experiment to investigate the relative impact of short, educational messages and small incentives, which have been shown to encourage positive behaviors in related settings, on child’s choice to select and consume a dried fruit cup (healthier option) or cookie (less healthy option). The experiment was conducted across 24 different after school programs that regularly serve meals to children ages 7-18 from low-income households. We randomized children to receive either gain framed incentives, loss framed incentives, short educational messages, or a certain combination.

We found that at baseline, only 17% of children preferred the fruit. Our incentives, framed both as gains and losses, significantly increased fruit choice, with nearly 80% of subjects choosing the healthy snack in the incentive treatments. The educational message was not significantly different from baseline, except in combination with a loss framed incentive. One week following the intervention, children in the Education+Loss treatment continued to choose more fruit as compared to children in the other treatments.

Our data suggest that incentives are more effective than a short educational message alone in encouraging children to select a healthier snack instead of a cookie, but that the educational message is quite effective when paired with an incentive. Importantly, pairing the educational message with an incentive results in greater long-term retention of good habits. Gain and loss incentives are equally effective in this setting. Combining education with incentives also improves eating choices in the long term. These findings have implications for the literature on the benefits of more in-depth nutritional education targeted towards children, which suggests that gearing informational interventions towards children may be quite successful (Epstein et al., 1990; Reynolds et al., 2000; Perry et al., 1998; Nicklas et al., 1998). The positive effects that we observed suggest that there is promise in pairing incentives with educational interventions of this type.

Policymakers and organizations interested in improving child food choice behavior may be concerned with the added cost of incentives. Incidentally, we find that incentives or incentives combined with education increase the levels of consumption, reducing waste relative to education alone, and potentially saving the organization money. Moreover, education alone was found to increase waste of fruit relative to the baseline.

While immediate incentives are a highly cost effective intervention in the short term, especially paired with information, it remains an open question whether we could sustain the impact of these types of incentives if they were applied more broadly. This is important future research. More generally, we believe this study demonstrates that behavioral economics can lend powerful insights into our understanding of the health production function and the design of healthy choice interventions. In addition, using field experiments to explore the rich hypotheses that behavioral economics provides should become the rule rather than the exception.

6. References

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