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THE BEHAVIORALIST AS NUTRITIONIST: LEVERAGING BEHAVIORAL ECONOMICS TO IMPROVE CHILD FOOD CHOICE AND CONSUMPTION

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ABSTRACT

Childhood obesity has reached epidemic proportions in the U.S., 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 include 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. There is some evidence that the effects continue after the treatment period, consistent with a model of habit formation. Second, we find little evidence that the framing of incentives (loss versus gain) matters. While incentives work, we find that educational messaging alone has little influence on food choice. Yet, we do observe an important interaction effect between messaging and incentives: together they provide an important influence on food choice. For policymakers, our findings show the power of using incentives 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 healthy decisions and what incentives can influence them.

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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 contributor to obesity is the decision by individuals to consume high quantities of low-nutrient, high-calorie foods and beverages habitually. 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 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 begun to take important steps in understanding the causes and consequences of obesity. For example, interventions for adults by the U.S. Department of

[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 import (Casey et al., 2001; Ogden et al., 2006).

Agriculture and the U.S. Department of Health and Human Services have included providing advice about healthy 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 affect 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. The field experiment methodology is ideal in this setting because it allows us to infer the causal effects of treatment (see, for example, other field experiments in health economics; Okeke et al., 2009).

We conducted our field experiment in after school programs in the Chicago area, called 'Kids Cafes', which provide children from low-income families a USDA-sponsored 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

[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.

loss-frame incentive (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. In total, 1,614 individual children and adolescents across 24 sites participated in the experiment, which lasted several weeks. We also observe children after conclusion of the treatment period to explore whether the incentives or educational messages had an effect after we removed the treatment.

We find several interesting insights. First, in the absence of incentives, about 17% of students choose the healthy snack. Yet, once an incentive is introduced, students are drawn to the healthy choice at a rate of nearly 80%. This more than four-fold increase is achieved with small incentives. Importantly, we find little evidence that a loss frame works better than a gain frame. Indeed, if anything we find some evidence that after treatment children in the gain treatment choose the healthier option than those in the loss treatment.

Second, 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. This is surprising, since our educational message was crafted using the USDA *MyPyramid for Kids*[3] as a guide. 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 message treatment only 60% of the children who choose the fruit ultimately consume it, over 93% of children who received both the education message and incentive who choose the fruit consume it. Importantly, this effect spills-over to the post treatment period: upon returning a week after

[3] Information about MyPyramid is available here: http://www.cnpp.usda.gov/MyPyramidDevelopment.htm. Note that MyPlate replaced MyPyramid as the official USDA guide in June 2011, after our data collection had concluded.

the experiment is completed, we find that children in the control group continue to choose the unhealthy snack at a low rate—around 12%. Yet, for those in the treatment that combines incentives and educational messaging, nearly twice as many children choose the healthy choice.

These results suggest that there could be an important place for educational messages, and that they have their greatest impact when combined with a small individual incentive. 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 pecuniary and non-pecuniary incentives. 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 our paper is organized as follows. Section 2 summarizes the underlying theoretical framework that motivates our design. Section 3 describes the experimental design and implementation. Section 4 summarizes the main results. Section 5 concludes.

2. Background

Our experiment involves an exploration of both non-pecuniary and pecuniary incentives. While the effect of information and standard pecuniary incentives on behaviors have been modeled for decades, the theory underlying why there might be behavioral differences between a standard (gain) incentive and "loss" incentive is less mainstream. Pioneered by Tversky and Kahneman's riskless framework (1991), the idea that losses and gains can yield different behaviors in our setting has its roots in prospect theory. 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:

$$V(c, c^r) = u(c) + R(c, c^r)$$

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

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

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, it has been tried in other areas. For instance, studies in the area of worker productivity (Hossain and List, 2012), teacher performance (Fryer et al., 2012), and student performance in the classroom (Levitt et al., 2012) have all attempted to use loss framing to induce greater effort in field experiments.

In addition, many other potentially impactful interventions have been explored in this important area. For instance, 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, standard incentives have been explored. One particularly interesting concurrent study is due to Just and Price (2011), who 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, 2011, 2013; Volpp et al., 2008), smoking cessation (Volpp et al., 2009), and compliance with healthy preventive behaviors (Malotte et al., 2008).

Recent concerns have been raised about the long-term impact of extrinsic incentives - Gneezy at 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 the 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 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 (see Appendix). 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 1,614 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 17 regular participants, while the largest program has 287 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 by the authors and also 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.

Table 1 provides a sample timeline of implementation. On the day before 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 choices 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. 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, or less than 1%, of Kids Cafe participating children are not in the data.[5]

[TABLE 1: TIMELINE OF IMPLEMENTATION. ABOUT HERE]

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

[5] Note that 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.

The first 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 availability and was provided by the Greater Chicago Food Depository.

[TABLE 2: FRUITS AND COOKIES SERVED. ABOUT HERE]

3.2 Experimental Design

The goal of the experiment was to discover whether gain-framed incentives, loss-framed incentives, an educational message, or both message and incentive would prompt children to choose and consume the healthier food item over a less healthy snack. 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 unique children who participated throughout the study, while Table 4 provides a snapshot of the number of children who participated in Periods 1 and 2. Although we have on average 323 children participating per treatment, we only have on average 186 and 160 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. ABOUT HERE]

[TABLE 4: OBSERVATIONS PER DAY. ABOUT HERE]

We conducted one baseline treatment (No Intervention – denoted BASELINE) 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 "Gain" Incentive Only (denoted GAIN), the child only chooses a prize if he/she selects and consumes the fruit. In "Loss" Incentive Only (denoted LOSS), 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 take the prize out of the box and give it to the child if they observe the child eating the fruit cup, or take the prize away if the child chooses not to eat the fruit cup. In Education (denoted EDU), the experimenter reads a short educational message about the benefits of fruit and displays the USDA's MyPyramid for Kids board prior to asking the child to select a fruit or a cookie. The message does not involve the experimenter explicitly prompting the child to choose the fruit over the cookie. In Education + "Loss" Incentive (denoted EDU+LOSS), the experimenter both reads an educational message and conducts the same procedure for incentive as in LOSS.

The prizes available in the incentive treatments (GAIN, LOSS, EDU+LOSS) 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.[6] All treatments were accompanied by a bulletin board that showcased the different prizes or showcased the food pyramid (or both, as in EDU+LOSS)

[FIGURE 1: PHOTO OF GIFT DISPLAY. ABOUT HERE]

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 17% to around 80%. In addition, despite the fact that not all children observed in later periods participated in all days of treatment, there is evidence that a greater proportion of children consumed fruit following the end of the incentives in the long treatment type group.

[FIGURES 2a,b: FRUIT OVER STUDY DAYS. ABOUT HERE]

4.2 Baseline and Treatment Comparison on Selection

Our main comparison is selection of fruit versus cookie between the first day (without treatment) and the second day (with treatment), pooling both short and long treatments. As summarized in Figures 2a and 2b, 21% of children selected fruit in period 1, and 16% selected

[6] The USDA Food Pyramid can be found at www.mypyramid.gov.

fruit in period 2 of BASELINE. There are no statistically significant differences in proportion of fruit chosen in period 1 across most treatments, but significantly fewer children selected fruit in EDU+LOSS as compared to the other treatments (Chi squared p-value < 0.10). Randomization is at the site level, and sites differ by location and activities provided, but our data suggest little differential selection by treatment. Moreover, the direction of differences for EDU+LOSS relative to the others might provide us with a lower bound of the potential positive effects of this treatment in subsequent analysis.

We conducted Chi square 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 was 16%. Our GAIN treatment increased the proportion of children selecting fruit to 78%, while LOSS increased the proportion of children selecting fruit to 76% (p-values < 0.01 for BASELINE vs. LOSS and BASELINE vs. GAIN). Our EDU treatment did not prove effective, as the proportion of children selecting fruit in period 2 dropped to 11% (p-value > 0.10 for BASELINE vs. EDU). Importantly, EDU+LOSS increased the number of children selecting fruit to 86%, which is significantly higher than BASELINE, EDU, or incentive alone (p-values <0.01 when comparing BASELINE to EDU+LOSS or to EDU; p-value<0.05 when comparing EDU+LOSS to LOSS or GAIN).

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 and conducting Wilcoxon Mann-Whitney tests. The proportion of children selecting fruit in GAIN, LOSS or EDU+LOSS is significantly different from BASELINE (p-value < 0.05 for GAIN and p-values < 0.10 for LOSS and EDU+LOSS). The proportion of children selecting

fruit in EDU+LOSS was significantly higher than EDU (p-value <0.05). No significant effects between EDU+LOSS and LOSS were observed.

We also conducted pair wise comparison tests (sign-rank) for children who were in the program for both periods. Table 5 displays the change in proportion, between period 1 and period 2, of children choosing fruit across treatments. There are no statistically significant changes from period 1 to 2 in BASELINE or EDU (p-values = 0.37 and 0.18, respectively). By comparison, there is a statistically significant improvement in fruit choice for students in GAIN, LOSS, and EDU+LOSS (p-values <0.01). These data lead to a first two results:

Result 1: Use of token incentives can induce children to select healthier foods.

Result 2: Education alone does not have a significant effect on food choice, but there is an important interaction effect between education and loss framed incentives.

[TABLE 5: CHANGE IN PROPORTION. ABOUT HERE]

We also compare the relative effectiveness of our different treatments to test our theoretical model. Different from theoretical predictions, LOSS did not result in significantly different proportions of children selecting fruit than GAIN (Chi squared –p-value>0.10). Together, these two insights lead to our next result:

Result 3: The gain and loss treatment are equally effective in moving children to choose the healthy option.

4.3 Effects Post-Intervention on Selection

We follow the participants post-intervention to determine whether choices are different when incentives are removed. Table 6 summarizes the proportion of children choosing fruit following the treatment for each length (long and short) and treatment type, including all

children, even if they participated in only one day of the study. We find significant differences between the proportion choosing fruit in EDU+LOSS post-treatment (26%) relative to BASELINE (13%) in the long treatment sessions (Wilcoxon rank-sum *p*-value < 0.01). This is the only significant difference we find, as the differences in Post-treatment for LOSS (20%) relative to BASELINE is not significant at conventional levels (p < .10).[7] In the short session treatments,

In the short session treatments, we find improvements from BASELINE to EDU+LOSS (p-value < 0.10) but not for any other treatment.[8]

[TABLE 6: CHOOSING FRUIT FOLLOWING TREATMENT. ABOUT HERE]

These data lead to our next result:

Result 4: Combining education and loss incentives positively affected choice post-experimental treatment, whereas providing education or incentives alone did not have a significant long-term effect.

4.4 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 implemented, a direct link from choice of food to consumption cannot be taken for granted. For example, Just et al. (2013) find that in the lunchroom at school, over 44% of items taken by students are wasted.[9] Our study provides evidence of the link between selection and consumption, which is another interesting variable for our theory and for policymakers. If

[7] We also see a decrease for Education Only treatment with *p*-value < 0.10.

[8] Wilcoxon ranksum test p-value has a sign in the opposite direction than expected with p-value < 0.10 for Baseline vs. Education+Loss, p-value 0.00 for Baseline vs. Education, and no significant differences between Baseline and Loss Incentive alone. There are also no significant differences between Loss Incentive and Education+Loss (p-value = 0.11) or between Education and Education plus Loss.

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

incentives linked to consumption help to reduce costly food waste, this provides another, financial motivation for schools and other programs serving food to implement them.

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 BASELINE", "ate 1/4", "ate 1/2", "ate 3/4" and "ate all."[10] Table 7 describes the amount of data available for the subsequent analysis, including all days of treatment and baseline observations.

[TABLE 7: OBSERVED DATA. ABOUT HERE]

Figures 3a and 3b provide histograms of consumption amounts for Period 2, while Table 8 provides proportion of consumption data by treatment. Consumption is generally clustered at the full serving, for both cookies and fruit, with 70%-90% of students consuming the full amount. The exception is the fruit consumption in BASELINE and EDU – in which almost 20% of students ate 1/4 or less of their fruit. While consumption is generally high in incentivized treatments, conditional on choosing fruit, LOSS leads to higher consumption than GAIN, with 96% consumption in LOSS but 90% consumption in GAIN (p-value = 0.10 for overall comparison, and p-value = 0.06 for those who selected only fruit). Consumption in EDU+LOSS is similar to that of LOSS alone. It is interesting to see that loss and gain incentives have an effect at the level of consumption but not selection.

Assuming that children who chose cookies consumed 0 fruit, we calculate average amount of fruit consumed in Period 2 to be 0.12 servings in BASELINE, 0.06 servings in EDUCATION, 0.66 servings in GAIN, 0.74 servings in LOSS, and 0.82 servings in EDU+LOSS. All incentivized treatments have significantly higher consumption of fruit as compared to EDU and BASELINE (Wilcoxon ranksum p-values < 0.01). We observe significant

[10] This is out of 4,773 observations (across all days, sites and participants).

differences in amount of fruit consumed between GAIN and EDU+LOSS (Wilcoxon ranksum *p*-value = 0.02) but not between GAIN and LOSS or EDU+LOSS and LOSS. Thus, we can conclude that not just selection, but also consumption of fruit is increased through our token incentives. This brings us to our last result:

Result 5: Use of token incentives can induce children to *consume* healthy foods.

[FIGURES 3a.b: CONSUMPTION DETAIL. ABOUT HERE]

[TABLE 8: PROPORTION OF FRUIT/COOKIES CONSUMED. ABOUT HERE]

We define the "rate of waste" as the average proportion of whole servings of items that were not consumed in each treatment. Rate of waste for our desserts, on average, is only 9% - a small waste rate in comparison to ~40% waste rates in school lunchrooms. Table 8 provides waste data by treatment for both types of desserts. Notice that all of our treatments reduce the rate of waste significantly – while treatment waste rates are around 5%-10%, rate of waste in baseline is 23% (all pairwise Wilcoxon Mann-Whitney ranksum test *p*-values < 0.05 for BASELINE vs. treatments).

[TABLE 9: OVERALL WASTE RATE ABOUT HERE]

5. Conclusion

We conducted a framed field experiment to investigate the relative impact of short, educational messages and token 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 field 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 find some results that suggest behavioral interventions can affect food consumption choices. First, 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. Importantly, 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 habits that are less likely to lead to obesity. Combining educational messaging with incentives also affects 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.

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.

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TABLES AND FIGURES

Table 1: Timeline of Implementation – Phase I Example

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

*Note: *Observations not available for Day 4 in Short and Day 8 in Long for most sites, because sites were served a celery + peanut butter option instead of the usual dried fruit cup in observance of National Nutrition month. Phase II implementation is same, but on different dates in Spring 2011.*

Table 2: Fruits and Cookies Served

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

Note: Fruit and cookie choices alternated between the options listed above, depending on the day.

Table 3: Summary of Treatments: Children Participating Throughout Study

	Short Study Session	Long Study Session	Total
No Intervention – (NONE)		2 sites, N=192– 80/36* *2 Sites P1 only, N=76* **	4 sites, N=304
"Gain" Incentive Only – (GAIN)	5 sites, N=419– 32/34/38/232/83	*Not conducted*	5 sites, N=428
"Loss" Incentive Only – (LOSS)	5 sites, N=212– 33/35/19/62/63	1 site, N=108	6 sites, N=390
Education Only –message only (EDU)	3 sites, N=137– 45/68/24	2 sites, N=333– 287/46	5 sites, N=482
Education + "Loss" Incentive –Incentive + message (EDU+LOSS)	1 site, N=45	3 sites, N=168– 63/24/81	4 sites, N=225

Note: This table describes the number of sites and individual students per site who participated in the experiment. Randomization to treatment was conducted at the site level. Short and Long study sessions differ only in the number of total treated observations prior to the post-observation period.
**One of the two sites does not have any observations for Period 1, of a delivery mishap.*
***2 additional sites were only visited in P1.*

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

	Period 1	Period 2	Both Days
No Intervention (NONE)	157	83	65*
"Gain" Incentive Only (GAIN)	221	210	100
"Loss" Incentive Only (LOSS)	191	183	117
Education Only (EDU)	216	184	105
Education + "Loss" Incentive (EDU+LOSS)	145	140	111

*Note: Since we track ID of student, we are able to determine which students attended on both pre-treatment Day and the treatment day. *In Baseline, for Period 1 we have observations from 5 sites and for Period 2 we have observations from only 2 of the sites.*

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

	Proportion in Period 1	Proportion in Period 2	Change in Proportion from Period 1 to 2	Number of Observations
No Intervention (NONE)	0.210	0.160	-0.05	62
"Gain" Incentive Only (GAIN)	0.208	0.839	0.63	89
"Loss" Incentive Only (LOSS)	0.195	0.774	0.58	115
Education Only (EDU)	0.180	0.107	-0.07	97
Education + "Loss" Incentive (EDU+LOSS)	0.099	0.856	0.76	111

Note: This table reports the proportion change from periods 1 to 2, using only students who participated in and have data on both days 1 and 2 of the experiment, where Period 1 is a baseline day and Period 2 is a treatment day.

Table 6: Proportion of Children Choosing Fruit Post Treatment

	NONE	EDU	GAIN	LOSS	EDU+LOSS
Long	0.12 (0.33) N=189	0.068 (0.25) N=190	N/A	0.19 (0.39) N=143	0.26 (0.44) N=204
Short		0.026 (0.16) N=156	0.17 (0.38) N=417	0.11 (0.31) N=326	0.04 (0.19) N=52

Note: This table reports the average proportion of children choosing fruit following treatment, including both of the post-treatment days of observation, and including all children even if they did not attend all treatment days. Number in parentheses represents the standard deviation.

Table 7: Observed Consumption

	NONE	EDU	GAIN	LOSS	EDU+LOSS
Observed w/ detailed amounts	74.29%	72.7%	30%	78.7%	77.2%
Observed w/o detailed amount	24.5%	26.2%	67.6%	20.5%	22.4%
Number of Observations	3,007	626	210	380	545

Note: This table describes the proportion of people for whom we observed detailed consumption data. The differences in number of observations per treatment are 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.

Table 8: Proportion of Fruit and Cookies Consumed

	Fruit	*N*	Cookies	*N*
Baseline	81.3%	8	76.2%	43
"Gain" Incentive Only	89.5%	50	95%	10
"Loss" Incentive Only	95.7%	98	92.9%	28
Education Only	65%	11	93.1%	98
Education + "Loss" Incentive	95.4%	65	80%	10

Note: This table uses data on proportion consumed, for all students that consumption was recorded, for period 2 only. Consumption is conditional on first selecting fruit or cookie.

Table 9: Overall Waste Rates

	Rate of Waste	*N*
Baseline	23.0%	51
"Gain" Incentive Only	9.6%	60
"Loss" Incentive Only	4.9%	126
Education Only	9.9%	109
Education + "Loss" Incentive	6.7%	75

Note: This table uses data on proportion wasted overall, defined as 1-consume amount, for all students that consumption was recorded, for period 2 only.

FIGURES

Figure 1: Photo of Gift Display

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

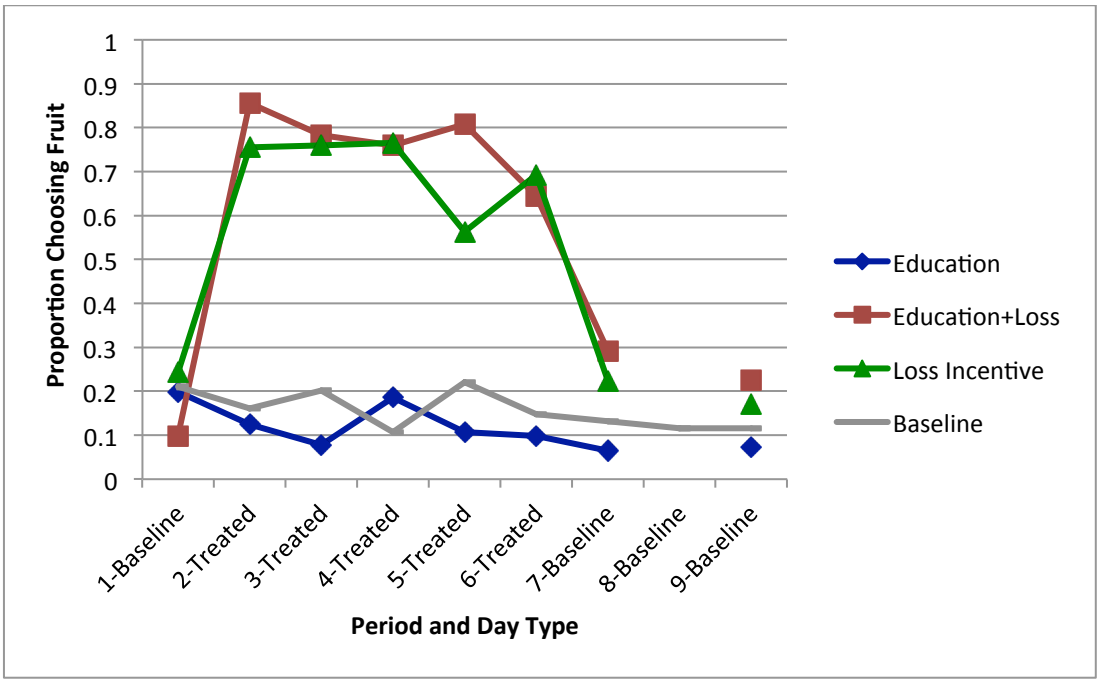
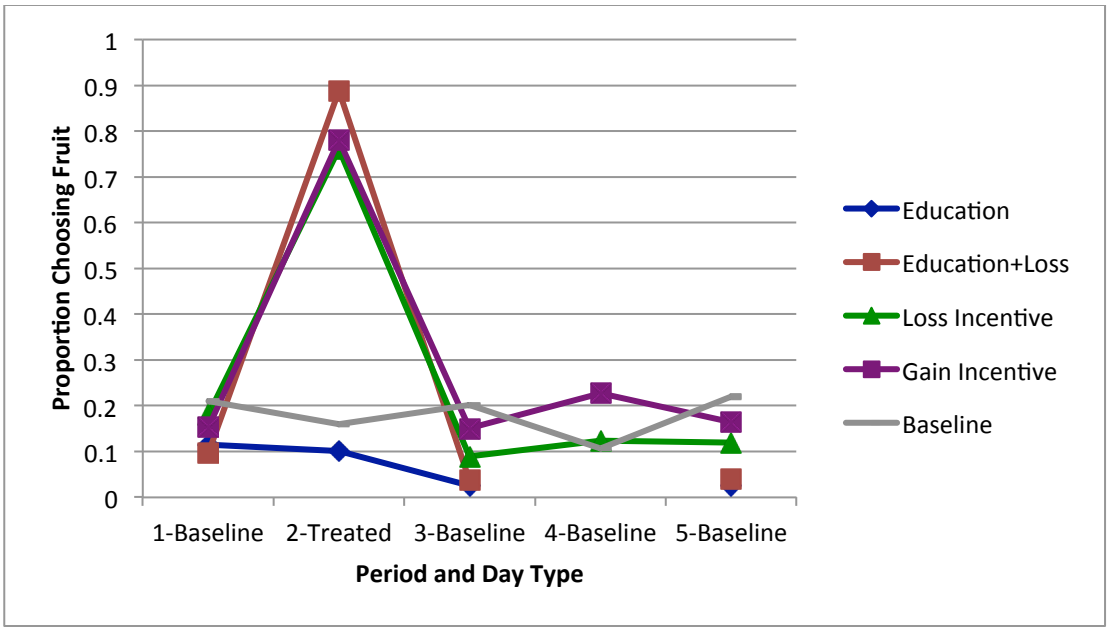


Figure 2b: Proportion of Children Selecting Fruit over Study Days – Short



Note: Figures 2a and 2b present the number of children selecting fruit versus cookies, divided by the total number of children who made a selection. Data is missing for some treatments in Long – Day 8 and Short – Day 4 because on that day a fruit/cookie selection was not served at those sites due to a logistical error.

Figure 3a: Proportion Consumed when Cookie was Selected, Period 2

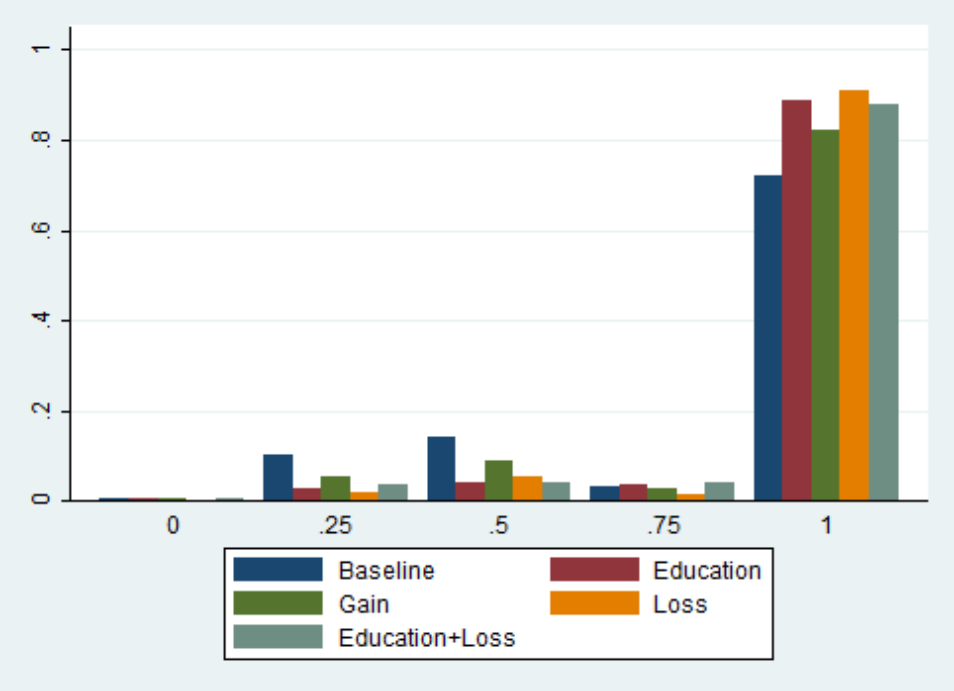
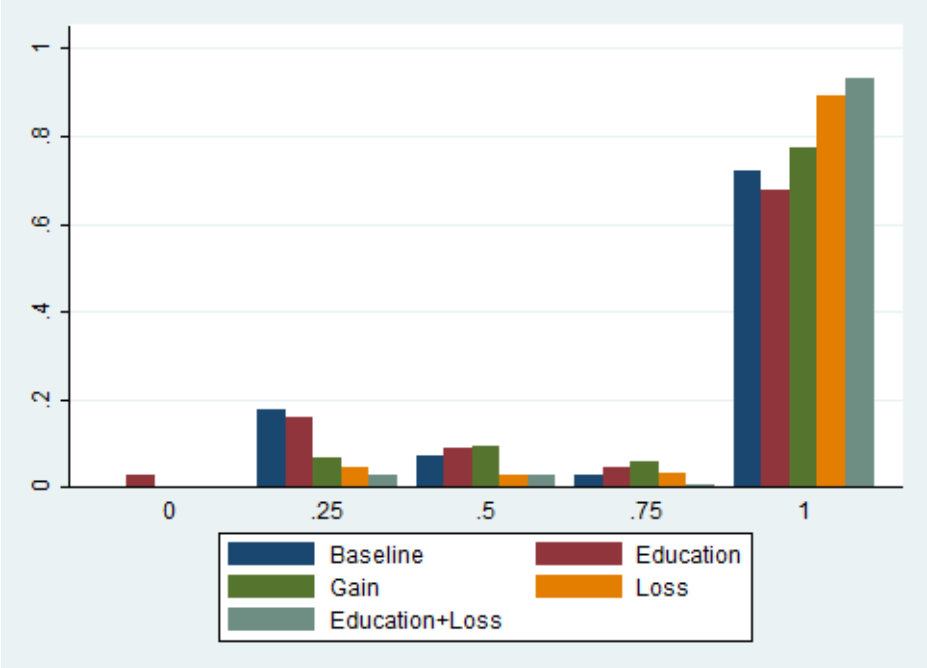


Figure 3b: Proportion Consumed when Fruit was Selected, Period 2



Note: Figures 3a and 3b represent the proportion of dessert consumed, conditional on selecting fruit or cookie. Consumption was recorded at the level of 1/4s. Data is available for 73% of the sample (the sub-set that was observed by the research assistants).

Appendix (For Online Publication Only) – Scripts for the Interventions

USING INCENTIVES TO IMPROVE CHILD FOOD CHOICE

Scripts

Assent

Over the next few weeks, the University of Chicago team will do a study about food choices at the Kid's Cafe. Everyone will get some extra desserts. Everyone can also get rewards later for participating in the study. Please go ahead and write your name (or make a mark) on this sheet if you want to participate.

Control – Choice (also Observation days for all treatments)

Today at Kids Cafe you will get an additional dessert. You will get the choice of either a dried fruit cup, or a cookie (hold up display board). You can only choose one dessert. Please come up to the front to choose a dessert.

You shouldn't share your dessert with anyone – these are the rules. If you try to take anyone else's dessert, we will write up a report and you will not get to choose desserts the next time – so please follow the rules!

Non-Financial Incentive - Gain

Today at Kids Cafe you will get an additional dessert. You will get the choice of either a dried fruit cup, or a cookie (hold up). You can only choose one dessert.

If you choose this dried fruit cup, and eat all of it today, you will also get to pick a gift immediately after you finish eating the dried fruit cup. You can choose ONE from any of these gifts: a wristband, a pen, a trophy, a rubber ducky, or a fruit keychain (hold up the prizes).

If you chose the dried fruit cup, after you finish eating it, one of us will come over to your table and you will get a sticker on your nametag. Go up to the front, show us your sticker and you will get to choose a prize. If you choose the cookie, you will not get a gift. If you choose a dried fruit cup but you do not eat it all, you will not get a gift.

You shouldn't share your dessert with anyone – these are the rules. If you try to take anyone else's dessert or prize, we will write up a report and you will not get to choose rewards the next time – so please follow the rules!

Please come up to the front to choose a dessert.

Non-Financial Incentive - Loss

Today at Kids Cafe you will get an additional dessert. You will get the choice of either a dried fruit cup, or a cookie (hold up). You can only choose one dessert.

But first before you choose a dessert, you should come up to the front and pick a gift. You can choose ONE from any of these gifts: a wristband, a pen, a trophy, a rubber ducky, or a fruit keychain (hold up the prizes display board). We'll put the gift into a closed box for you with your name on it, and you get to take it back to your table.

Then you will go to get a dessert. If you choose a cookie, we'll take the box back from you when you get your cookie. If you choose the dried fruit cup, after you finish eating it, one of us will come over to your table and put a sticker on your nametag. If you got a sticker, you can come up to the front, we will open up your box for you and you will keep the gift you picked up. If you don't finish eating all of the dried fruit cup, when you come up to the front you will have to give the box back to us and you will not keep the gift you picked.

You shouldn't share your dessert with anyone – these are the rules. If you try to take anyone else's dessert or prize, we will write up a report and you will not get to choose rewards the next time – so please follow the rules!

Please come up to the front to choose a gift, and then to choose the dessert.

What kinds of choices are healthy? This is a Food Pyramid (show poster). It reminds us to make healthy food choices. Do you notice that some of the color stripes are wider than others? The different sizes remind you to choose foods from the food groups with the widest stripes. You don't need to change all your choices overnight, but eating just one new, good thing everyday will make a big difference!

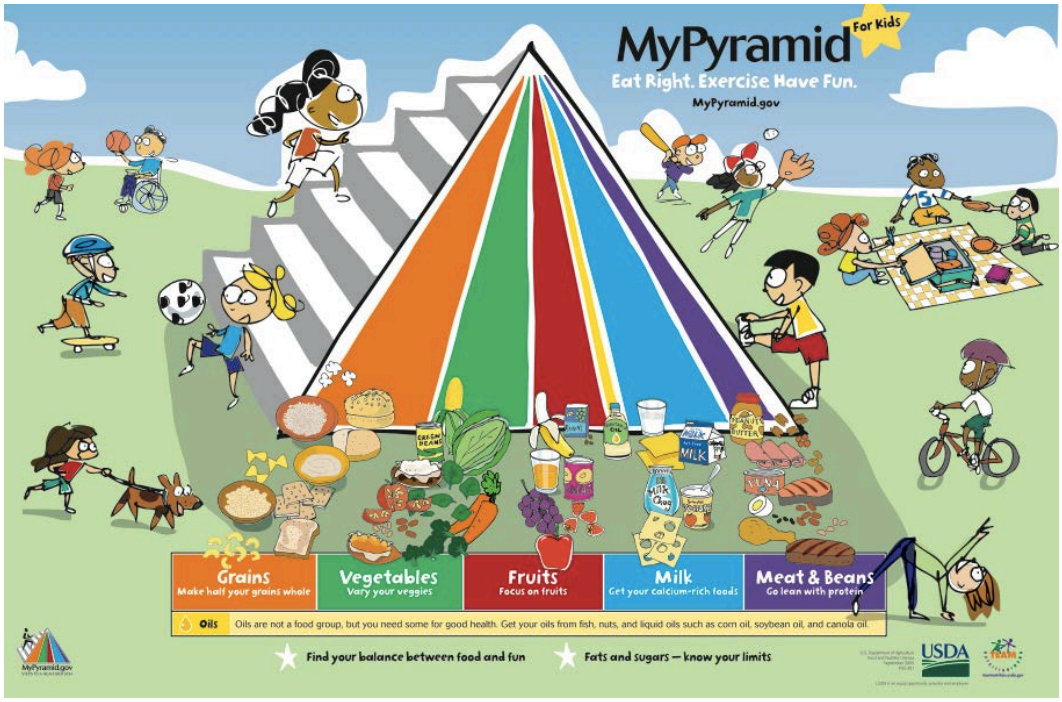
Let's look at the food groups. The orange is the grains group – that includes healthy choices like whole wheat bread and rice. Next is the vegetable group – that includes lots of veggies like carrots, corn, tomatoes, and more (point). Next is the fruit group – that includes fresh, dried and canned fruits of all kinds (point). Next is the milk group (point). Next is the meat and beans group (point).

The fruits group (point to it again) has a pretty wide stripe – that means fruits are a smart choice for eating strong! Fruits are very important for helping you stay healthy and they give you lots of energy. Most people don't get enough fruits everyday – so eating some fruit can go a long way.

What about cookies? Cookies aren't on the pyramid because they aren't part of eating strong. They don't give us very many nutrients and don't help us be strong and healthy, like fruits and veggies do. Small amounts of foods like cake and cookies are fine to eat, but you should only eat them sometimes, like at parties.

Remember, today you will get the choice of either a dried fruit cup, or a cookie (hold up). You can only choose one dessert.

You shouldn't share your dessert with anyone – these are the rules. If you try to take anyone else's dessert, we will write up a report and you will not get to choose desserts the next time – so please follow the rules!



Please come up to the front to choose a dessert.