CENTER FOR POLICY RESEARCH
THE MAXWELL SCHOOL
WORKING PAPER SERIES

Incentivizing Healthy Eating in Children: An Investigation of the "Ripple" and "Temporal" Effects of Reward-Based Interventions

Saied Toossi

Paper No. 193
November 2016

ISSN: 1525-3066

Maxwell Syracuse University | Center for Policy Research
426 Eggers Hall
Syracuse University
Syracuse, NY 13244-1020
(315) 443-3114/ email: ctrpol@syr.edu
http://www.maxwell.syr.edu/CPR_Working_Papers.aspx

CENTER FOR POLICY RESEARCH –Fall 2016

Leonard M. Lopoo, Director
Professor of Public Administration and International Affairs (PAIA)

Associate Directors

Margaret Austin
Associate Director, Budget and Administration

John Yinger
Trustee Professor of ECON and PAIA
Associate Director, Metropolitan Studies

SENIOR RESEARCH ASSOCIATES

Badi Baltagi, ECON
Robert Bifulco, PAIA
Leonard Burman, PAIA
Thomas Dennison, PAIA
Alfonso Flores-Lagunes, ECON
Sarah Hamersma, PAIA
Madonna Harrington Meyer, SOC
William Horrace, ECON
Yilin Hou, PAIA
Jeffrey Kubik, ECON
Yoonseok Lee, ECON
Amy Lutz, SOC
Yingyi Ma, SOC
Katherine Michelmore, PAIA
Jerry Miner, ECON
Cynthia Morrow, PAIA
Jan Ondrich, ECON
David Popp, PAIA
Stuart Rosenthal, ECON
Michah Rothbart, PAIA
Rebecca Schewe, SOC
Amy Ellen Schwartz, PAIA/ECON
Perry Singleton, ECON
Michael Wasylenko, ECON
Peter Wilcoxen, PAIA

GRADUATE ASSOCIATES

Alejandro Alfaro Aco, PAIA
Emily Cardon, PAIA
Ziqiao Chen, PAIA
Jena Daggett, PAIA
Carlos Diaz, ECON
Alex Falevich, ECON
Wancong Fu, ECON
Emily Gutierrez, PAIA
Jeehee Han, PAIA
Boqian Jiang, ECON
Hyunseok Jung, ECON
Yusun Kim, PAIA
Ling Li, ECON
Michelle Lofton, PAIA
Judson Murchie, PAIA
Brian Ohl, PAIA
Jindong Pang, ECON
Krushna Ranaware, SOC
Laura Rodriquez-Ortiz, PAIA
Fabio Rueda De Vivero, ECON
David Schwegman, PAIA
Shulin Shen, ECON
Iuliia Shybalkina, PAIA
Kelly Stevens, PAIA
Saied Toossi, PAIA
Rebecca Wang, SOC
Xirui Zhang, ECON

STAFF

Kathleen Nasto, Administrative Assistant
Candi Patterson, Computer Consultant
Mary Santy, Administrative Assistant
Laura Walsh, Administrative Assistant
Katrina Wingle, Administrative Specialist

Abstract

Although previous studies have established the effectiveness of using small reward-based incentives in inducing the choice and consumption of healthier foods among children, little is known about their impact outside of experimental settings or their effectiveness over time when administered daily. This paper presents the results of a field experiment conducted to provide insight on these matters. The study employs a pretest-posttest within-subject design and was conducted at a summer program catering to low-income children between the ages of 5 and 12. Corroborating existing studies, the introduction of small reward-based incentives was found to induce large increases in the number of children choosing the healthy dessert options after lunch but disaggregating the results by week and days suggests that their impact diminishes over time. Attempts to ascertain their effect outside of experimental settings did not indicate that the introduction of rewards had any adverse effects, but also did not provide definitive results. Consequently, further research is needed in this regard.

JEL No. C91; C93; J13; I12

Keywords: Field Experiment; Food Choice; Child Behavior; Incentives; Temporal Effects; Ripple Effects; Nutrition

Author: Saied Toossi, Department of Public Administration, Center for Policy Research, Syracuse University. mtoossia@syr.edu

According to the Centers for Disease Control (CDC), healthy eating promotes the optimal growth and development of children while also reducing their risk for developing obesity and other illnesses.[1] Most youth ages 2 years and older do not, however, meet USDA recommendations for a diet rich in fruits, vegetables, whole grains, and fat-free and low-fat dairy products.[1] In contrast, intake of sodium for children and adolescents is more than the recommended maximum daily allowance and 40% of their daily caloric intake comes from added sugars and solid fats, approximately half of which are acquired through the consumption of various junk foods. Consequently, the latest figures available from the CDC indicate that nearly one-in-five children and adolescents between the ages of 2 to 19 are obese. [2] Parsing out the national obesity rate by age reveals that 8.4% of 2- to 5-year-olds, 17.7% of 6- to 11-year-olds, and 20.5% of 12- to 19-year-olds can be categorized as obese.[3] The problem is even more acute among black children, Hispanic children, and children from low-income families.

Although poor eating habits and obesity at any age present concerns in need of attention, the targeting of pediatric obesity and children's unhealthy dietary choices are particularly important given their adverse effects on normal growth and development and the associated short and long-term costs incurred as a result. Furthermore, preventative measures designed to avoid their determinants in early childhood are likely to prove more fruitful, and potentially more cost-effective, in mitigating these consequences than treatment once the problem has taken hold. Research does in fact indicate that diet during childhood is a significant predictor of diet in

[1] https://www.cdc.gov/healthyschools/nutrition/facts.htm

[1] It is recommended that children 2 years and older eat 2½ cups to 6½ cups of fruits and vegetables, and two to three ounces of whole grains each day

[2] https://www.cdc.gov/obesity/data/childhood.html

[3] In children and adolescents age 2 to 19 years, obesity was defined as a body mass index (BMI) at or above the 95th percentile of the sex-specific CDC BMI-for-age growth charts.

adulthood, and that pediatric obesity has negative implications for adult health outcomes (Hingle, 2010; Nicklaus, 2009; Birch, 1999). Early interventions designed to induce better eating behaviors earlier in the lifecycle might therefore yield maximum health benefits and support dietary habits that may persist into adulthood.

As a result, a growing body of research examines the impacts of various interventions on encouraging healthy eating habits in school-aged children. These range from various non-remunerative methods—used here to mean those in which participants are not provided a material reward in return for the performance of a particular behavior—to remunerative approaches—defined here as those by which participants receive some form of material reward in exchange for behaving in a desired manner. Although the former have been studied extensively, the latter have generally been avoided due to concerns that their use may "crowd out" intrinsic motivation for healthy eating behaviors and result in worse outcomes after their removal (Horne et al., 2010). [4] There exists, however, scant evidence in favor of such an adverse effect in the context of fruit and vegetable consumption (Horne et al., 2010), and the handful of studies employing remunerative incentives in the form of small rewards have found them to significantly alter the dietary choices of young children with no impact on their intrinsic motivations.

This study adds to the small body of literature on remunerative approaches targeting children's eating habits and presents the results of a field experiment in which low-income children ages 5 to 12 attending a summer program were offered a small prize for choosing a fruit

[4] The "crowd out effect" is also sometimes referred to as the "overjustification effect" or "negative rebound effect" (Just & Price, 2012)

cup for dessert after lunch in lieu of cookies. The contributions are threefold. First, this study replicates and corroborates the gain-incentive treatment component used in List & Samek (2015) by employing a similar research design in a similar setting. In doing so, this study adds to the contexts in which such experiments have been conducted and, in conjunction with previous studies, serves to bolster the case for the generalizability of existing results.

Second, this study attempts to identify the impact of using reward-based incentives on children's eating behaviors outside of the intervention setting—labeled here as "ripple" effects. Although previous studies have shown that children do respond to such incentives, they have not attempted to discern their impact outside of intervention settings. Health outcomes will ultimately depend on whether any positive impacts on food choice within the intervention setting are off-set or out-weighed by poor eating behaviors in other settings, behaviors that may be exacerbated by the introduction of such incentives (Evans et al., 2012; List and Samek, 2015). Of particular interest are behaviors at home, where most habits are learned (De Bourdeaudhuij, 1997; Campbell et al., 2007; Dowda et al., 2001). Third, this study gauges the "temporal" effect of such interventions. That is to say, their efficacy over time both between weeks and within weeks. Similar studies that have attempted to investigate the persistence of their effects over time either suffer from significant data collection issues (Raju et al., 2010), employ dissimilar intervention schemes (Belot et al., 2013), or use designs that may have introduced substantial bias (Lowenstein et al., 2014). As a result, further research on whether intervention effects remain constant, wane, or grow over time is warranted.

The remainder of the paper proceeds as follows. Section I briefly discusses children's nutritional intake and the factors that contribute to the rejection or acceptance of fruits and

vegetables among young children. Section II provides an overview of the literature, with particular attention paid to the literature on remunerative interventions. This is followed by a description of the research design and analysis in Section III. Results and concluding remarks are then presented in Sections IV and V, respectively.

I. Children's Nutritional Intake

The aforementioned high pediatric obesity rates suggest a lack of exercise and poor dietary habits among young children and adolescents. While it is important that children and adolescents adhere to all the recommendations put forth in the Dietary Guidelines for Americans, the consumption of fruits and vegetables is of particular importance, as they are key sources of fiber as well as many essential micronutrients.[5] Yet there appears to be little sign of improvement in their consumption, a problem exacerbated by the likely adoption of inappropriate feeding behaviors and food choices from significant others.[6] Given that these early eating habits may be predictive of those in adulthood, many children will be unable to cope with the obesogenic environment into which they have been born and in which they grow up (Dovey et al., 2008; Wardle et al., 2003b). Increasing their fruit and vegetable intake at a young age and encouraging the formation of better eating habits could therefore not only aid in their healthy development but also achieve significant long-term public health benefits. Doing so, however, has proven to be easier said than done, as children exhibit a natural tendency to reject fruits and, to an even greater degree, vegetables.

[5] Available here: http://health.gov/dietaryguidelines/

[6] The prevalence of obesity among children aged 2 to 5 years did decrease significantly from 13.9% in 2003-2004 to 8.4% in 2011-2012. Source: https://www.cdc.gov/obesity/data/childhood.html

Two factors have been shown to contribute to the rejection or acceptance of fruits and vegetables among young children. These are food neophobia and "picky/fussy" eating. The former is defined as the reluctance to eat—or the avoidance of—new foods. The latter is defined as the consumption of an inadequate variety of foods through rejection of a substantial amount of foods that are both familiar and unfamiliar. Although similar, these are theoretically and behaviorally distinct concepts. While neophobia may be considered as part of "picky/fussy" eating, the reverse is not true (Dovey et al., 2008).

Although the exact reason for the existence of food neophobia is still unknown,[4] its extent is believed to be a function of a child's personality traits[5] and it typically peaks between the ages of two and six, after which it decreases with age (Dovey et al., 2008; Corsini et al., 2011). As a growing body of research indicates, food neophobia can be overcome with repeated exposure to foods that may initially be perceived as unpalatable to young children, a process whereby disliked foods become liked with increasing experience (Wardle et al., 2003a; 2003b). The influence of food neophobia on a person's willingness to try novel foods diminishes from the first taste processed as a positive experience and research suggests that it may require eight to fifteen positive experiences for the successful acceptance of a food item into a child's habitual diet (Sullivan et al., 1990), after which any persistent rejection or increased need for exposure is considered as part of "picky/fussy" eating (Dovey et al., 2008).

[4] The concept of neophobia is derived from Rozin's (1979) "omnivore's dilemma," a process described as an evolutionarily beneficial survival mechanism to help children avoid ingesting potentially poisonous substances. With regards to vegetables, complementary explanations to the evolutionary perspective argue that their blandness and bitterness or their low energy density may also make them less acceptable to children who are predisposed to prefer sweet tastes (Steiner, 1979; Gibson & Wardle, 2003)

[5] Such as whether a child is "sensation seeking" or not as well as their trait anxiety, openness, and neuroticisms.

According to Wardle et al. (2003b, p.156), "taste preferences have been shown to be highly predictive of actual intake, and parents often cite dislike as the primary explanation for children's low vegetable intake." If aversion to a food or food group represents an important barrier to consumption, then interventions aimed at modifying preferences could prove pivotal, as they can help induce the requisite number of positive experiences and overcome "pick/fussy" eating.

II. Literature Review

Non-remunerative approaches require changes to school curricula, time intensive involvement of everyone involved (e.g., teachers, staff, parents, or children), costly materials (e.g., equipment or educational and informational materials), or the alteration of the physical aspects of school, home, or community environments (Hendy et al., 2005; Cauwenberghe et al., 2010; Evans et al., 2012; Hendrie et al., 2016). In contrast, remunerative interventions have been shown to produce equivalent or larger changes in the choice and consumption of fruits and vegetables at little additional burden, financial or otherwise. Such incentives included small rewards worth 50 cents or less (Raju et al., 2010; Just & Price 2013; Belot, James, & Nolen, 2013; Loewenstein, Price, and Volpp, 2016; List & Samek, 2015a, 2015b).

Despite these findings, and in contrast to the dozens of articles published on non-remunerative interventions, there exist relatively few studies exclusively examining remunerative interventions in school or school-like settings.[6] Raju, Rajagopal, and Gilbride (2010)

[6] For literature reviews of studies employing non-remunerative interventions, please refer to Bell and Golley (2015), Cauwenberghe et al. (2010), Evans et al. (2012), and Hendrie et al. (2016). Included in these reviews are also some of the few studies in the nutrition sciences using remunerative approaches—not covered here as their interventions, settings, and research designs were significantly dissimilar to those of this study. These are Hendy et al. (2005), Horne et al. (2010), Corsini et al. (2011), Cooke et al. (2011), and Wardle et al. (2003a). Outside of the nutrition

examine the effectiveness of small rewards, pledges, and competitions in motivating young children to choose healthier food options. Their results indicate that each treatment produced significant increases in fruit and vegetable choice, though the size of the effect varied by age. Similarly, Just and Price (2013) find that providing small rewards, even as low as a nickel, can lead to large increases in the fraction of children who eat fruits and vegetables as part of their school lunch, and that this effect is even larger for low income children. Their cost-benefit analysis suggests that the incentive program produced only a marginal increase in the amount of fruits and vegetables that needed to be served but reduced the amount of waste by 33 percent. Loewenstein, Price, and Volpp (2014) and Belot, James, and Nolen (2013) find similar results using rewards worth fifty cents or less, as do List and Samek (2015a, 2015b) for the choice of white milk over that of chocolate milk and fruit cups over cookies, respectively. Interestingly, while these other studies relied on experimenters to administer the incentives, List and Samek (2015b) finds that simply affixing a prize to white milk cartons significantly increased their likelihood of being chosen over chocolate milk, suggesting that reward-based incentives can be administered easily and without the need for direct interactions with children.

As this overview of the literature suggests, this field of inquiry may be promising in terms of effectiveness, ease of implementation, and cost. There are, however, gaps in the literature that require investigation. While reward-based incentives have been shown to modify eating habits during the intervention period, and even for some time afterwards, no attempts—to the best of my knowledge—have been made to determine their impact on behaviors outside of the

sciences field, six other studies were identified, one in marketing (Raju et al., 2010), and the remainder in economics (Just & Price 2013; Belot, James, & Nolen, 2013; Loewenstein, Price, and Volpp, 2016; List & Samek, 2015a, 2015b).

experimental environment. Whether such interventions produce positive health outcomes ultimately depends not only on how recipients respond to them within the intervention environment, but also in other settings (Evans et al., 2012; Ransley et al., 2007). A child, for example, may compensate for a healthier food choice induced by a reward by consuming less healthy foods at home, thereby negating the impact of such interventions on overall health. Alternatively, their diet may not be affected at all, or they may develop a taste for healthier foods which may then lead to an increase in their consumption at home.

There is also a need to gauge the effects of a reward-based incentive program administered daily over time. Just and Price (2013) and List and Samek (2015a, 2015b) administer their interventions intermittently and are therefore unable to investigate "temporal" effects. While Raju, Rajagopal, and Gilbride (2010) do report their intervention effects by week, they failed to collect data on 62% of their sample, which "warrants caution in interpreting the results" (p.104). Belot, James, and Nolen (2013) also report their intervention effects by week, but employed piece-rate and competition schemes that are incomparable to that used in this study.[7] Finally, Lowesnstein, Price, and Volpp (2014) rewarded the consumption of at least one serving of fruits or vegetables with tokens worth 25 cents that could be redeemed for other prizes at a later time. Although they found no evidence that the effect of their incentives faded out over time, the authors acknowledge that their findings may have been the result of substantial interaction between research assistants and the subjects, which included prompts reminding

[7] In their piece rate scheme, children were given a sticker for choosing at least one fruit or vegetable and, conditional on having collected four stickers throughout the week, were allowed to choose an additional reward on Friday afternoons. Stickers were distributed analogously in their competition scheme but children were put into a group of four on Fridays and the pupil—or in the event of a tie, the pupils—who had the most stickers in that group was able to select an additional reward. They find the piece rate scheme to be generally ineffective, whereas the competition scheme produced large effects that waned over time (Belot, James, and Nolen, 2013).

children to go back and finish their fruit or vegetable if they had not so that they may receive a token.[8]

"Crowding Out" Effect

As mentioned briefly above, there is some debate on the appropriateness of incentivizing positive behaviors. Opponents of the use of remunerative incentives emphasize the "crowding out" effect, arguing that extrinsic incentives crowd out intrinsic motivation for eating healthy, which results in outcomes being worse after the end of the incentive period than prior to the introduction of rewards (Deci et al., 1999). Proponents, on the other hand, argue that habit formation using short term remunerative incentives can, if sufficient enough to overcome the crowding out effect, result in positive behavioral changes even after the incentives are removed. Concerns about the use of rewards to encourage consumption of foods may, however, be counterproductive and unwarranted.

Deci et al. (1999) themselves make clear that the potential for the crowding out of intrinsic motivation applies only in the context of interesting tasks. According to Horne et al. (2010, p.376), "this is a crucial distinction for the rewards decrement debate as it has been applied to fruit and vegetable consumption: the evidence to date suggests that most children and many adults in the developed world have very low interest in eating fruit and vegetables, in which case there is little or no intrinsic motivation to diminish." If eating is in fact an uninteresting

[8] According to Lowesnstein, Price, and Volpp (2014, p.49): "…the research assistants handing out the tokens were instructed to explain to students why they were distributing the tokens and also reminded children who had not eaten a full serving of fruits or vegetables that if they went back and finished their fruit or vegetable they could receive a token. Thus the change in behavior during the incentive period may result from both the direct effect of the incentives as well as any effects operating through the presence and interaction of students with the data collectors."

task for a young child, there may be little or no intrinsic motivation to undermine. Regardless, none of the aforementioned studies found evidence of a crowd out effect, instead finding that changes in behavior persist for a short period after incentives are removed (Raju et al., 2010; Corsini et al., 2011; Just & Price 2013; Belot, James, & Nolen, 2013; Loewenstein, Price, and Volpp, 2014; List & Samek, 2015a, 2015b).

III. Method

As mentioned above, this study seeks to corroborate previous findings on the effect of reward-based incentives, to assess their impact over time, and provide insight into their influence on behaviors outside of experimental settings. To do so, the study was designed as a pretest-posttest within-subject experiment extended to include a retention test. The intervention setting, incentives employed, and target population were modeled on List and Samek (2015a). Extensions to their design include the administration of reward-based incentives on a daily basis for two weeks to investigate their "temporal" effects and the inclusion of parents to gauge the extent, if any, of their "ripple" effects. The following subsection present a detailed overview of the experimental design.

Location

The field experiment was conducted at a Boys and Girls Club (BGC) location in Syracuse, a city of 144,152 in central New York with a median household income of $31,566 and unemployment rate of 12.5%.[9] The site serves low-income children ages 5 to 12 throughout the year with an after school program when school is in session and an all-day program during the

[9] According to 2014 American Community Survey 5-year estimates. Furthermore, the city's population is 62% White, 32% Black, and 9% Hispanic or Latino.

summer months. During the summer, the site hosts children between 9am and 3pm. Children are served breakfast and lunch, both of which are provided by the Syracuse school district and are standard meals that are also served in school cafeterias during the school year, but not dessert, which was introduced for the first time as a part of this experiment.

School-like settings such as this serve as ideal testing grounds for interventions targeting eating habits among children since schools are in a unique position to promote healthy eating (Bell and Golley, 2015; Hendrie, 2016) and offer opportunities for targeting large numbers of children. Additionally, summer programs may offer greater access to children most likely to benefit from interventions targeting dietary choices to the extent that they serve those from lower socio-economic backgrounds.

[Insert Table 1—See Appendix F]

Participants

Parents with children ages 5 to 8 were asked if they wished to participate in the study, and allow for their children to participate, as they arrived to pick up their children from the program. Mothers were targeted as research indicates that they are the most accurate source of information about the behavior patterns of their children (Hendy et al. 2005).[10] Of eligible parents who personally picked up their child from the site and had them enrolled in the summer program, only one refused to participate. Upon consenting, assent was also obtained from their children, on whom socioeconomic and demographic information was also collected. In sum, 29

[10] Most of the children were picked up by their mothers regardless and, for the large majority of the children, were their sole caretaker. On the rare occasion that a child's father came to pick them up, they were approached but told me to talk to the child's mother the next day.

children, and their parents were recruited for the study, of which 23 were present on at least one day during the field experiment. This sample comprises approximately 61% of all children ages 5 to 8 that were enrolled in the summer program, but likely more on any given day since some children attended sporadically.

Safeguards designed to protect the anonymity of participating children and their parents prevented the collection of more detailed information that, alone or in conjunction with other data, could be used to identify them. Nevertheless, data were collected on age, grade, gender, race, household type, income, and lunch-cost status. Descriptive statistics are presented in **Table 1**. Additionally, since obtaining IRB approval required that the same desserts and incentives be provided to all children attending the summer program, data on the dessert choice of non-participating 5 to 12 year olds was also collected, though without any accompanying identifying, socioeconomic, demographic, or consumption data. For clarity, those children recruited into the study along with their parents, and for whom data was collected in addition to dessert choice, will hereafter be referred to as "participating children."

Timeline & Procedure

[Insert Figure 1—See Appendix F]

On-site enrollment for the experiment began in mid-June of 2016. The recruitment period lasted three weeks, two of which occurred while school was still in session. The third week of recruitment took place during the first week of the site's summer program. Parents were approached as they came to pick up their children, and only those with a child between the ages of 5 and 8 were offered the opportunity to participate. The four-week field experiment commenced immediately after the recruitment period. The first week was composed of pre-

intervention baseline observations, the intervention was implemented the following two weeks, and the final week consisted of post-intervention observations.

Children attending the site were served lunch at approximately 11:30 in the morning.[11] Immediately after lunch,[12] a tray was set out lined with white napkins displaying 24 translucent plastic cups containing fruits on the left-hand side and 24 identical cups containing cookies on the right-hand side (see **Figure 1**). Given that the site served between 45 and 60 students on any given day, additional fruit and cookie cups were prepared and set to the side in order to replenish the supply on the tray if necessary.

During the first week of the experiment, children were told that they could choose between a fruit cup or a cookie cup for dessert. During the following intervention period, children were told that they could again choose between a fruit cup and a cookie cup for dessert, but that they would receive a prize for choosing the former and nothing for choosing the latter. The final post-intervention week mimicked the first week of the experiment, with children being offered a fruit cup or a cookie cup for dessert. Children also had the option of choosing neither. The scripts employed are available in Appendix A.

[Insert Figures 2 & 3—See Appendix F]

[11] Breakfast is usually served at the site at 9am. The children are then given lunch at 11:30am. There may be a concern that some children may be too satiated for dessert, or that they might not consume much of their dessert if they choose one at all. However, this does not appear to be the case as all of the participating children chose a dessert and ate most, if not all, of it.

[12] On one occasion, lunch did not arrive until much later in the morning than usual so the site director had me serve dessert first until lunch could be prepared.

Prizes included small notepads, pencils, pencil sharpeners, rubber balls, rings, airplanes, and finger lights, each worth—on average—roughly 10 cents.[13] These prizes—shown in **Figure 2**—varied in color and design in order to ensure that children would continue to value them throughout the experiment, as per List and Samek (2015) . Children choosing a fruit cup during the intervention period were allowed to choose one prize from among the options listed, which were set on the countertop next to the dessert tray within sight, as can be seen in **Figure 3**.

After lunch, the site director or, in some instances, another staff member would first ask all 5 to 8 year olds to line up by the food counter. As they approached the dessert tray, they were provided the appropriate information for that particular week and asked to make a choice. Once all 5 to 8 year olds had been served, the site director or staff member would ask the 9 to 12-year-old children to line up by the food counter, after which the process was repeated. After the 9 to 12 year olds had been served, the 5 to 8 year olds were once again asked to line up by the counter so that their consumption could be recorded. All of the children were instructed not to throw away their cups until their consumption was recorded.[14] Although dessert choice was recorded for all children, consumption data was only collected for participating children. Data collection forms are available in Appendix B.

Parent Pre-Survey and Post-Surveys and Daily Logs

A novel component of this study is its attempt to identify the impact of remunerative interventions in the experimental setting on children's eating behaviors at home. To do so, this

[13] A total of 744 individual prizes were ordered at a cost of $78.30.

[14] Although the decision of children to consume most or all of the content of their fruit cups does not appear to be influenced by this, knowing that their consumption was being monitored may have influenced them to consumer more than they otherwise would.

study employs both pre and post-intervention surveys and daily logs, both completed by participating parents. The purpose of incorporating both surveys and the daily logs is twofold. First, including both allows for the pre- and a post-survey responses to not only be compared with one another to identify any differences in a child's eating behavior, but also to be compared with the results from the daily logs to corroborate their validity. If, for example, the trend in the daily logs and survey responses are positively correlated, confidence in the accuracy of the responses is enhanced. Second, in the event that one of the methods produces unusable results, perhaps due to respondent related issues, the other may be used as a substitute. In both cases, parents were motivated to complete the surveys and daily logs with a cash incentive.[15]

In order to assess children's eating behaviors as they pertain to fruits at home, parents were asked to complete two surveys, one upon enrollment prior to the implementation of the experiment in order to establish a baseline and the week after its conclusion. To minimize the burden on parents, the surveys were comprised of only six questions, adapted from the Child Eating Behavior Inventory.[16] Similarly, parents were also asked to maintain a daily log of their child's behavior and preferences every day, including weekends, for the duration of the experiment. To minimize burden, parents were asked to answer 6 "yes or no" questions each night of the week.

[15] Parents could earn up to $25 per child. Parents were given $3 for completing the first survey, $5 per completed daily log, and $2 for the final survey.

[16] The Child Eating Behavior Inventory comprises 40 items that are rated on a 5-point scale with response options being "never," "seldom," "sometimes," "often," and "always." It is a parent-report instrument designed to assess childhood eating and mealtime problems. Six of the 40 questions were selected and modified to fit the context in which they were used.

Ideally, daily logs would have been handed out each Monday afternoon as parents came to retrieve their children and returned the following Monday at the same time. Unfortunately, not all children were picked up by their parents every day, if ever. Consequently, some parents never received a daily log, or received one later in the week than preferred. Similarly, not all parents returned their daily logs the following Monday, if at all. As will be discussed in the next section, the response rate for the daily logs was not sufficiently large enough to allow for any meaningful analysis. Consequently, the daily logs were dropped from the analysis. The response rate to the surveys, on the other hand, does allow for some interpretation. Sample surveys and daily logs are available in Appendix C.

Desserts

[Insert Table 2—See Appendix F]

The healthy dessert in this experiment consisted of a fruit cup, while the unhealthy dessert consisted of a cookie cup. Fruits are nutrient-dense and are therefore recommended by the USDA for their health benefits. In fact, the USDA recommends that individuals increase their fruit consumption as part of a healthy eating pattern.[17] In contrast, cookies provide little nutrients and are high in sugar content. Fruits cups weighed approximately 85 grams,[18] 5 grams

[17] See USDA website:
http://www.cnpp.usda.gov/sites/default/files/dietary_guidelines_for_americans/ExecSumm.pdf

[18] Each fruit cup contained roughly 4 diced pieces of an apple or pear, 5 grapes, and 4 pieces of banana, in that order (~85 grams). Each cookie cup consisted of one and a half cookies (if chocolate chip) or two cookies (if Oreos). That the fruit cups may appear more full than the cookie cups may be a potential source of bias. Some children may have, for example, preferred the cookie cups for dessert simply because they are satiated and do not wish to eat a lot for dessert. This would be a source of downward bias for the effect of the intervention. On the other hand, children may wish to choose the cup they believe offers the most food. If so, then this would bias the results upwards. It's hard to imagine that this is the case though, as children are unlikely to do such cost-benefit analysis and, after just having ate lunch, it's unlikely that they are still so hungry that they would choose fruit cups simply because they contain more food. In fact, children can sometimes get a second serving of lunch if they choose to, and some do. The inclusion of a baseline observation week in the analysis should, however, account for such effects.

more than the minimum serving size recommended by any governmental agency in the OECD (Evans et al., 2012).[19] Measures were taken to ensure the students' familiarity with both types of desserts served and to maintain their continued interest in them. To ensure equal familiarity with both desserts, fruits and cookies were chosen such that they would be universally recognizable. Apples, pears, grapes, and bananas were served as the fruit options and chocolate chip and Oreo cookies were served as the cookie options. Combinations of fruits served varied by type and color, as did cookies, in order to mitigate the risk of children losing interest in the food items, as depicted in **Table 2**.

Data Analysis

The analysis employs standard experimental methods, supplemented by econometric analysis. Changes in children's dessert choice between weeks is first analyzed using paired sample t-tests.[20] This is done for the full sample, which includes all children attending the site, as well as the restricted sample, which includes only participating children. The longitudinal nature of the data collection for the latter produced 460 child-day observations, thereby facilitating the use of regression analysis.

[Insert Table 3—See Appendix F]

The comparison of means tests in the proportion of fruit cups chosen by participating children are supplemented by logit regressions with dessert choice as the dependent variable—where dessert choice equals 1 if a child chose a fruit cup and 0 if they chose a cookie cup or

[19] USDA recommendations differ by type of fruit and how it is served. Consequently, no one standard applies to an assortment of fruits. Therefore, the minimum OECD requirement, in grams, was used for each serving.

[20] A paired t-test measures whether means from a within-subjects test group vary over 2 test conditions and is commonly used to compare a sample group's scores before and after an intervention. It therefore takes into account that paired observations are dependent. Also, a paired t-test does not require both samples to have equal variance.

neither—and a treatment dummy as the independent variable of interest, conditional on attendance. The logit regression includes individual fixed-effects with standard errors clustered at the individual level.[21] The results of a linear probability model with individual-fixed effects and standard errors clustered at the individual level are also presented to facilitate the reporting and interpretation of marginal effects.[22]

IV. Results

Summary

Table 3 presents a set of summary statistics pertaining to attendance, dessert choice, and consumption for participating children. Roughly 78% of the 460 child-day observations were those for which the children were present on site. In sum, participating children made a total of 358 decisions during the four weeks of the experiment, of which 50.84% resulted in the choice of a fruit cup and 46.65% that of a cookie cup. Surprisingly, among those who chose a dessert, consumption was near universal, with 95% of those choosing either a fruit or a cookie cup consuming the contents in their entirety.[23] Cheating was not observed by myself nor by any members of the staff. In fact, many children would often request a second serving and, in the few

[21] Specifically, a conditional logit model was used to facilitate the use of both fixed-effects and clustering in Stata (clogit). The logit command in Stata allows for either the use of fixed-effects or clustering, but not both. The results are, however, robust to specification the type of command use and specification (i.e. logit regression with fixed effects but without clustering and vice versa, as compared to a conditional logit regression with both fixed effects and clustering). As a robustness check, the analysis was conducted using conditional logit and logit models (see **AT 1** in Appendix D). Results did not different significantly.

[22] To check the robustness of the estimates, conditional logit coefficients were converted to marginal effects, with little difference in magnitudes.

[23] Cataloging consumption was sometimes difficult given that some kids threw away their cups before they could be observed. In such instances, the child, or an adult supervisor, was asked about how much of the content of the cups the child had consumed. These cases were rare, however, and there is nothing to suggest that the children lied about their consumption when asked. In almost every instance, every child who chose a dessert ate it in its entirety.

instances where they may have dropped the contents of their cup, they would ask for them to be replenished.

[Insert Table 4—See Appendix F]

[Insert Figure 4—See Appendix F]

As shown in **Table 4**, total dessert choice decisions when including all children—those participating and not (ages 5 to 12)—amounted to 945, of which 45.29% resulted in the choice of a fruit cup and 53.76% that of a cookie cup. Of these decisions, 516 were made during the intervention weeks (Weeks 2 & 3), and 322 resulted in the choice of a fruit cup. Therefore, 322 prizes were handed out. Descriptive statistics suggest that non-school related prizes were the most desirable, particularly the finger-lights and the rubber balls, which constituted approximately 44% and 34% of all prize selections respectively.

Baseline, Treatment, and Post-Treatment Week Comparisons on selection

The change in dessert choice between fruit cups and cookie cups among all children (ages 5 to 12) who chose a dessert, averaged across days for each week, is depicted in **Figure 4**. As is clearly visible, there were large changes between Week 1 and the intervention weeks, and between the intervention weeks and week 4. The statistical significance of these differences is assessed using paired sample t-tests (two tailed). Between Week 1, the baseline period, and Week 2, the introduction of the incentives, the average proportion of fruit cup choice increased from 28% to 73% (p-value < .01). This proportion declined between intervention weeks to 54% in Week 3 (p-value < .01). The removal of the incentives resulted in a further drop in the proportion choosing fruit cups in Week 4 to 22% (p-value < .01). A comparison of the proportion choosing fruit cups in Week 1 relative to Week 4—28% and 22% respectively—did not produce a

statistically significant difference (*p*-value > .10), indicating the absence of a "crowding out" effect.

[Insert Figure 5—See Appendix F]

[Insert Table 5—See Appendix F]

Restricting the sample to participating children in the study reveals similar trends. The change in dessert choice among participants who chose a dessert, averaged across days for each week, is depicted in **Figure 5**. The proportion of children choosing fruit cups increased from 32% in Week 1 to 81% in Week 2 (*p*-value < .01), from 81% to 64% between Weeks 2 and 3 (*p*-value < .05), and from 64% to 29% between Weeks 3 and 4 (*p*-value < .01). There is no evidence of a "crowding out" effect, as indicated by the statistical-insignificance of the difference in proportion choosing desserts between Weeks 1 and 4, which were 32% and 29% respectively (*p*-value > .10).

The results from the logit and linear probability model regressions, which corroborate these results, are depicted in **Table 5**. Models 1 and 3 are conditional logit models whereas Models 2 and 4 are linear probability models. Individual fixed-effects are used and standard errors are clustered at the individual level in each. To identify the effect of the reward-based incentives in inducing the choice of fruit cups over that of cookie cups, the sample is restricted to observations collected in Weeks 1, 2, and 3 for models 1 and 2, and the treatment dummy is a binary variable that takes the value of 0 if the intervention was absent and 1 if present. To ascertain the effect of their removal, the sample used for models 3 and 4 is restricted to observations collected in Weeks 2, 3, and 4, and the treatment dummy takes the value of 1 if the intervention is absent and 0 if present. The coefficients on the variables of interest are statistically significant in each specification. The linear probability models show that the effects of the

intervention are large in magnitude, with its introduction increasing the likelihood of a child choosing a fruit cup by 37 percentage-points and its removal reducing that likelihood by 43 percentage-points.[24]

[Insert Table 6—See Appendix F]

[Insert Figure 6—See Appendix F]

[Insert Table 7—See Appendix F]

Separating the treatment effect by week also highlights the waning effect the incentives over time. As shown in **Table 6**, the introduction of incentives increased the likelihood of a fruit cup being chosen by 45 percentage-points in the first week of the intervention (Week 2). By the second week (Week 3), this effect dropped to 28 percentage-points. Further analysis also indicates that the effect of the incentives wane not only between intervention weeks but within intervention weeks as well, as the trend in **Figure 6** implies.[25] The effect of the incentives are strongest during the first half of the first intervention week (Week 2: Monday, Tuesday, and Wednesday), in which they increase the likelihood of choosing a fruit cup by 49 percentage-points. The effect then declines steadily to 26 percentage-points by the second half of the second intervention week (Week 3: Thursday and Friday). The null hypotheses of equality between the coefficients were tested and the *p*-values are shown in **Table 7**.

[24] Three of the participating children had parents that were employed on site. Dropping these children and conducting the same analysis did not change the results (See **AT 2** in Appendix D). Therefore, the analysis was conducted with all of the children in the sample.

[25] Trends for the sample including all children are shown in **Figure AF1** in Appendix E

Effect of Intervention on Children's Preferences at Home

The introduction of the reward-based incentives may have three potential effects on children's fruit eating behaviors at home. They may increase fruit choice and consumption if, for example, children, develop a taste or habit for them. It may also be that the such an intervention has no effects outside of the setting in which it was administered. Lastly, the benefits from any increases in fruit choice and consumption accrued through the use of reward-based incentives may reduce fruit choice and consumption from their levels prior to their introduction if children compensate for foregoing junk food earlier in the day by eating more of it at home. Survey responses did not produce evidence of either a positive or negative "ripple" effect.

Both pre-intervention and post-intervention Child Eating Behavior surveys were attained for 16 children of the 23 children, constituting a response rate of ~70%. The survey scores across individuals for each period were aggregated (i.e. the sum of the total survey score for each child; minimum score possible = 5, maximum score possible = 30). The post-intervention aggregate score of 389 declined relative to the pre-intervention aggregate score of 422.[26] This could suggest that—as a whole—parents felt worse about their children's eating behaviors with regards to fruits. However, results from a paired t-test comparison of means indicate that the null hypothesis of no difference in means cannot be rejected (two-tailed *p*-value > .10). Consequently, there is no statistical evidence that children's eating behaviors outside of the experimental setting were affected in any way due to the intervention.

[26] This is depicted visually in **Figure AF2** in Appendix E.

Unfortunately, and as mentioned above, while they did not contradict the survey findings, daily logs for each week were attained for only seven of the children, thereby precluding any meaningful analysis or comparison with the survey results. This was, however, a contingency, that was planned for by having both pre- and post-surveys and daily logs. Although the results of the survey response analysis cannot be fully corroborated by a secondary measure, they nonetheless do offer some insight on changing preferences outside of the experimental setting.

V. Discussion

The usual caveats to such experimental findings apply. Two obvious limitations of this study include its small sample size and the lack of a control group. As a result, the generalizability of the results presented here are limited. On the other hand, the smaller scale pretest-posttest within-subject design did allow for the administering of the intervention every weekday for two weeks, an endeavor that would have been cost-prohibitive on a larger scale. Furthermore, by adding yet another context in which remunerative interventions have been tested, the results of this study together with those of others bolsters the case for their efficacy among young children and provides suggestive evidence for the absence of any adverse “ripple” effects.

There may also exist threats to internal validity that require consideration. The three most likely sources of bias are “experimenter effects,” “peer effects,” and “history” effects. The first may have biased the fruit cup selection and consumption upward if my presence motivated the children to do so at higher rates than they otherwise would. To the extent possible, such an effect was mitigated with the inclusion of a baseline observation week, which would have accounted for any upward bias, and by restricting interactions with the subjects to the bare minimum necessary to execute the study. Peer effects, on the other hand, are likely and unavoidable, as

they would be in school settings. However, to the extent that peer effects bias the results upwards, they can be thought of as a desirable source of bias if they serve to increase fruit cup selection and consumption, which is the desired objective. In so far as their presence has biased the results of this study downward, the magnitude of the intervention effect implies that such an impact is not large enough to nullify the estimated effects. Last, history effects may be present if factors external to the experiment occurred concurrent to the intervention being introduced and removed that also impacted fruit cup choice and consumption. There is no indication this was the case, however, since there were no changes in the sites operations or in the school districts provision of meals during this time. Since participating children were eight years old and younger, any confounding external factors would have had to occur at home, but it is hard to imagine what would have changed significantly over the course of the four-week experiment and there is nothing to suggest that anything did.

Having addressed these concerns, the introduction of small reward-based incentives dramatically increased the proportion of children choosing a fruit cup in lieu of a cookie cup for dessert after lunch, both among participating children and all attending children, thereby corroborating the findings of existing studies. Though the presence of small rewards in general appeared to excite and motivate the children, non-school related rewards appeared to be the most popular among the options available for those that chose a fruit cup. Further analysis also indicates that, at least in this context, the effect of reward-based incentives wanes over time, not only between weeks but also within weeks. The effect of the incentives on the likelihood of choosing a fruit cup declined by 37% between Weeks 2 and 3. Similarly, between the first half of Week 2 and the second half of Week 3, the effect of the incentives declined by nearly half.

Together, all of the above mentioned findings suggest that—at least in this context—small reward-based incentives are effective for low-income children up to the age of 12, though their effect exhibits a negative trend and depends on the types of rewards offered. Future investigations of reward-based interventions administered daily are encouraged to provide more insight on the former. If the findings here are corroborated, it would suggest that any reward-based intervention should be administered intermittently to maintain its effect over time. The latter suggests that rewards that excite students should be chosen for maximum effect and that there should be variation in the types of rewards available so as to maintain children's interest in them. To the extent that the negative trend observed in the intervention effect is a byproduct of children losing interest in the incentives being offered, then optimal variation in prizes may have an offsetting effect. Future research is therefore also needed to ascertain the types of prizes likely to elicit the greatest response and the requisite variation necessary to maintain interest.

As for the evidence pertaining to "ripple" effects, the findings presented here are likely not definitive. Although the survey results suggest that there may be no external effects related to the introduction of reward-based incentives in school or school-like settings, the response rate and the lack of a second measure to corroborate the veracity of the responses leave much to be desired.[24] Like participant responses to all surveys of the kind administered as part of this field experiment, it us up to the reader to judge for themselves whether answers are reliable or not. With that said, the presence of negative "ripple" effects may, however, be less of a concern among children from low-income families, as studies suggest that such children consume fewer

[24] Many of the parents completed the pre- and post-surveys as they stopped by the site to pick up their children. Some of them were often in a hurry and this may have resulted in unreliable responses.

fruits and vegetables at home (Krebs-Smith et al. 1996; Munoz et al. 1997). Anecdotal evidence collected as part of conversations with various staff members and non-staff familiar with the community that the site served also suggest that the children in this study—nearly all of whom were from low-income income households—did not consume many fruits and vegetables at home, if any healthy food at all.[27] Nevertheless, future research should focus on assessing the effect of rewards-based incentives outside of intervention-settings more rigorously.

There is also a greater need for long-term studies, not only to assess the temporal effects of reward-based interventions but also habit formation and "ripple" effects, two phenomena that may be interrelated. If children were to develop a habit for healthier eating behaviors within intervention settings, this may then translate to better dietary choices in other environments as well. Finally, more studies focused specifically on vegetable choice and consumption are needed. Interventions targeting fruits have been more likely to be successful, as opposed to vegetables, inducing the choice and consumption of which has proved more difficult.

[27] The food supervisor expressed to me that her main concern was that the children have something to eat—that they feel full. In another instance, she and another staff member expressed that some of the kids probably don't get any dinner at home and if they do, it's usually junk food (hot dogs, noodles, and pork and beans are some of the foodstuffs they mentioned). The site-director and another woman (who was not employed at the site) both conveyed to me that for a lot of the enrolled children, the meals they receive on site are the only reliable source of nutrition they have. The woman, the legal guardian of one of the children who was too old to participate in the study, confessed to me that her biological parents are inattentive and sometimes do not feed her. She recounted one instance where the child told her, upon picking her up in the evening, that she had had nothing to consume all day other than soda because there was no food in her house. Finally, on one occasion, I was able to observe the home-packed lunch of a lactose-intolerant child on pizza day. The lunch consisted of chips, a Rice Krispy treat, another dessert bar (a brand I did not recognize), ramen noodles, and a banana.

References

Bell, L.K., and Golley, R. 2015. "Interventions for Improving Young Children's Dietary Intake through Early Childhood Settings: A Systematic Review." *International Journal of Child Health and Nutrition*, Vol. 4: 14-32.

Belot, M., James J., and Nolen P. 2013. "Changing Eating Habits: A Field Experiment in Primary Schools." Discussion Paper Series, Number 219, University of Edinburgh.

Birch, L.L. 1999. "Development of Food Preferences." Annual Review of Nutrition, 19: 41-62.

Cauwenberghe, E.V., Maes, L., Spittaels, H., van Lenthe, F., Brug, J., Oppert, J., and Bourdeaudhuij I. 2009. "Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature." *British Journal of Nutrition*, Vol. 103: 781-797.

Cooke, L. J., Chambers, L. C., Añez, E. V., Croker, H. A., Boniface, D., Yeomans, M. R., & Wardle, J. 2011. "Eating for pleasure or profit: The effect of incentives on children's enjoyment of vegetables." *Psychological Science*, 22(2): 190-196.

Corsini, N., Slater, A., Harrison, A., Cooke, L., and Cox, D.N. 2011. "Rewards can be used effectively with repeated exposure to increase liking of vegetables in 4-6-year-old children." *Public Health Nutrition*, 16(5): 942-951.

Dovey, T.M., Staples, P.A., Gibson, E.L., and Halford, Jason, C.G. 2008. "Food neophobia and 'picky/fussy' eating in children: A review." *Appetite*, Vol. 50: 181-193.

Evans, C., Chrsitian, M.S., Cleghorn, C.L., Greenwood, D.C., and Cade, J.E. 2012. "Systematic review and meta-analysis of school-based interventions to improve daily fruit and vegetable intake in children aged 5 to 12 y." *American Journal of Clinical Nutrition*, Vol 96: 889-901.

Hendrie, G.A., Lease, H.J., Bowne, J., Baird, D.L., and Cox, D.N. 2016. "Strategies to increase children's vegetable intake in home and community settings: a systematic review of literature." *Material and Child Nutrition*: 1-22.

Hendy, H.M., Williams, K.E., and Camise, T.S. 2005. "'Kids Choice' School lunch program increases children's fruit and vegetable acceptance." *Appetite*, Vol. 45: 250-263.

Hingle, M.D., O'Connor, T.M., Dave, J.M., Baranowski, T. 2010. "Parental Involvement in Interventions to Improve Child Dietary Intake: A Systematic Review." *Prev Med*, 51(2):103-11.

Horne, P.J., Greehalgh, J., Erjavec, M., Lowe, C.F., Viktor, S., and Whitaker, C.J. 2010. "Increasing pre-school children's consumption of fruit and vegetables. A modelling and rewards intervention." *Appetite*, Vol. 56: 375-385.

Just D. and Price J. 2013. “Using Incentives to Encourage Healthy Eating in Children.” *Journal of Human Resources*, 48(4): 885-872.

Krebs-Smith, Susan, Annetta Cook, Amy Subar, Linda Cleveland, James Friday, and Lisa Kahle. 1996. “Fruit and Vegetable Intakes of Children and Adolescents in the United States.” *Archives of Pediatrics and Adolescent Medicine* 150(1):81–86.

List, John A. and Samek, Anya S. 2015b. “A Field Experiment on the Impact of Incentives on Milk Choice in the Lunchroom.” *Public Finance Review*, 1-24.

List, John A. and Samek, Anya S. 2015a. “The Behavioralist As Nutritionist: Leveraging Behavioral Economics To Improve Child Food Choice And Consumption.” *Journal of Health Economics*, 39: 135-146.

Loewenstein, George and Price, Joseph and Volpp, Kevin. 2014. “Habit Formation in Children: Evidence from Incentives for Healthy Eating.” Available at SSRN: http://ssrn.com/abstract=2497104 or http://dx.doi.org/10.2139/ssrn.2497104

Muñoz, Kathryn, Susan Krebs- Smith, Rachel Ballard- Barbash, and Linda Cleveland. 1997. “Food Intakes of U.S. Children and Adolescents Compared With Recommendations.” *Pediatrics* 100(3):323–29.

Nicklaus, S. 2009. “Development of food variety in children.” Appetite, 52(253): 253–255.

Raju, S., Rajagopal, P., and Gilbride, T. 2010. “Marketing Healthful Eating to Children: The Effectiveness of Incentives, Pledges, and Competitions.” *Journal of Marketing*, 74: 93 106.

Ransley, J.K., Greenwood, D.C., Cade, J.E., Blenkinsop, S., Schagen, I., Teeman, D., Scott, E., White, G., and Schagen, S. 2007. “Does the school fruit and vegetable scheme improve children’s diet? A non-randomized controlled trial.” *Journal of Epidemial Community Health*, Vol. 61: 699-703.

Rozin, P. 1979. “Preference and affect in food selection.” In J. H. A. Kroeze (Ed.), Preference, Behaviour & Chemoreception, London: Information Retrieval Limited: 289–297.

Sullivan, SA, and Birch, LL. 1990. “Pass the sugar, pass the salt: experience dictates preference.” *Developmental Psychology*, 26: 546-551.

Wardle, J., Cooke, L.J., Gibson, E.L., Sapochnik, M., Sheiham, A., and Lawson, M. 2003b. “Increasing children’s acceptance of vegetables; a randomized trial of parent-led exposure.” *Appetite*, Vol. 40: 155-162.

Wardle, J., Herrera, M-L., Cooke, L., and Gibson, E.L. 2003a. “Modifying children’s food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable.” *European Journal of Clinical Nutrition*, Vol. 57: 341-348.

Appendices

Appendix A - Scripts

Pre and Post-intervention Script

Context: after lunch is served and eaten, the dessert options will be brought out, at which point the following will be announced:

> "If you want dessert, please line up at the counter. Make sure you have your name tag on if you have one. If you don't want to wear a name tag, you can just say your name at the counter."

As each child steps forward to choose a dessert, they will be informed of their options:

> "You can choose between a fruit cup or a [insert type of cookie]. Which snack do you want?"

Once each child has chosen a dessert, their choice will be recorded and time will be allotted for them to consume it if they wish. After dessert time is over, children will then be prompted to line up to throw away their trash:

> "Dessert time is over. Please line up by the trash can to throw away your garbage."

Children's consumption will then be recorded as the children step forward to toss away their trash.

Script for administering the intervention

Context: after lunch is served and eaten, the dessert options along with prizes will be brought out, at which point the following will be announced:

> "If you want dessert, please line up at the counter. Make sure you have your name tag on if you have one. If you don't want to wear a name tag, you can just say your name at the counter."

As each child steps forward to choose a dessert, they will be informed of their snack options and associated prizes as such:

> "You can choose between a fruit cup or a [insert type of cookie]. If you choose a fruit cup, you can choose any one of these prizes." [points to prizes] "If you choose a [insert type of cookie], you don't get a prize. Which snack do you want?"

Once each child has chosen a dessert and its associated prize, if any, their choice will be recorded and time will be allotted for them to consume it if they wish. After dessert time is over, children will then be prompted to line up to throw away their trash:

> "Dessert time is over. Please line up by the trash can to throw away your garbage."

Children's consumption will then be recorded as the children step forward to toss away their trash.

Appendix B – Data Collection Forms

Snack Choice Data Collection Sheet [insert date and day of collection here]				
Site: [name]	**Snack Choice**			
Childs Name	**Fruit Cup**	**Cookie**	**Neither**	**Absent**
[insert name]	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐

Consumption Data Collection Sheet [insert date and day of collection here]							
Site: [name]	**Consumption**						
Childs Name	**None**	**1/4**	**1/2**	**3/4**	**All**	**No Snack**	**Absent**
[insert name]	☐	☐	☐	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐	☐	☐	☐
[insert name]	☐	☐	☐	☐	☐	☐	☐

Appendix C – Sample Surveys and Daily Logs

Sample Survey

How often does this happen?	Never 1	Seldom 2	Sometimes 3	Often 4	Always 5	Are you Satisfied With this?
My child enjoys eating fruits	1	2	3	4	5	Yes No
My child asks for fruits	1	2	3	4	5	Yes No
My child feeds him/her-self fruits	1	2	3	4	5	Yes No
I feel confident my child eats enough fruits	1	2	3	4	5	Yes No
My child asks for fruits between meals	1	2	3	4	5	Yes No
My child eats fruits	1	2	3	4	5	Yes No

Sample Daily Log

DAY 1 - MONDAY	Circle One	
1. Did your child happen to show a preference for fruits instead of other snacks today, or not?	Yes	No
2. Did your child happen to ask for fruits today, or not?	Yes	No
2a. If so, did they have fruits at that time?	Yes	No
3. Did you happen to offer your child fruits today, or not?	Yes	No
3a. If so, did they accept fruits at that time?	Yes	No
4. Did your child eat fruits today?	Yes	No

Appendix D – Robustness Checks

AT 2: Treatment & Treatment Removal Effects: Present Children

	Treatment Effect				Removal of Treatment Effect			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intervention	2.090***	2.090***	2.132***	0.372***				
	(0.410)	(0.355)	(0.393)	(0.0732)				
Post-Intervention					-2.507***	-2.507***	-2.445***	-0.429***
					(0.471)	(0.399)	(0.448)	(0.0768)
Constant			-1.131*	-0.196***			1.063**	0.209***
			(0.476)	(0.0549)			(0.336)	(0.0236)
Observations	257	257	275	275	264	264	266	266

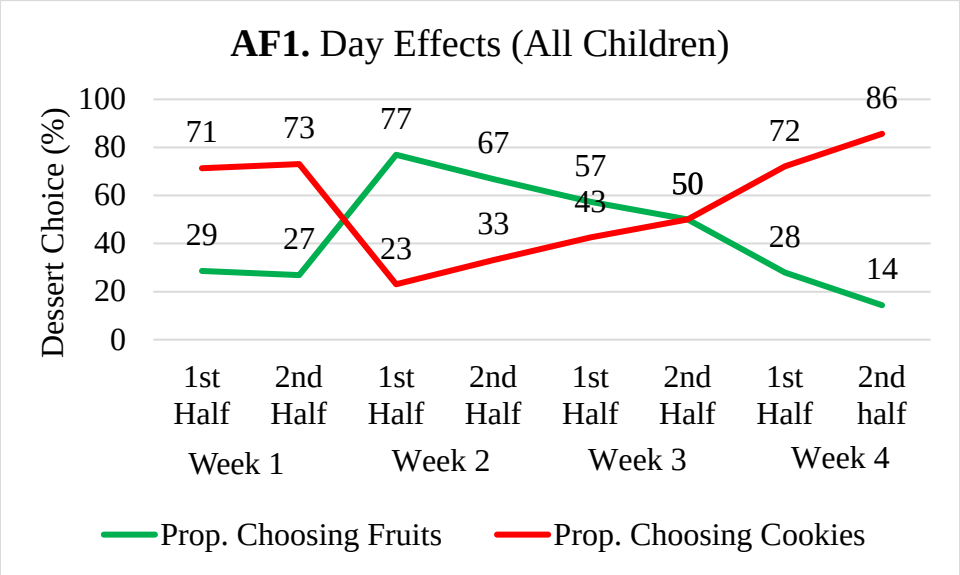
Note: Model's (1) & (5) are conditional logit with fixed-effects and clustered standard errors (both at the individual level); Model's (2) & (6) are logit with individual fixed-effects; Model's (3) & (7) are logit with standard errors clustered at the individual level; Model's (4) & (8) are linear probability models with fixed-effects and clustered standard errors (both at the individual level). Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

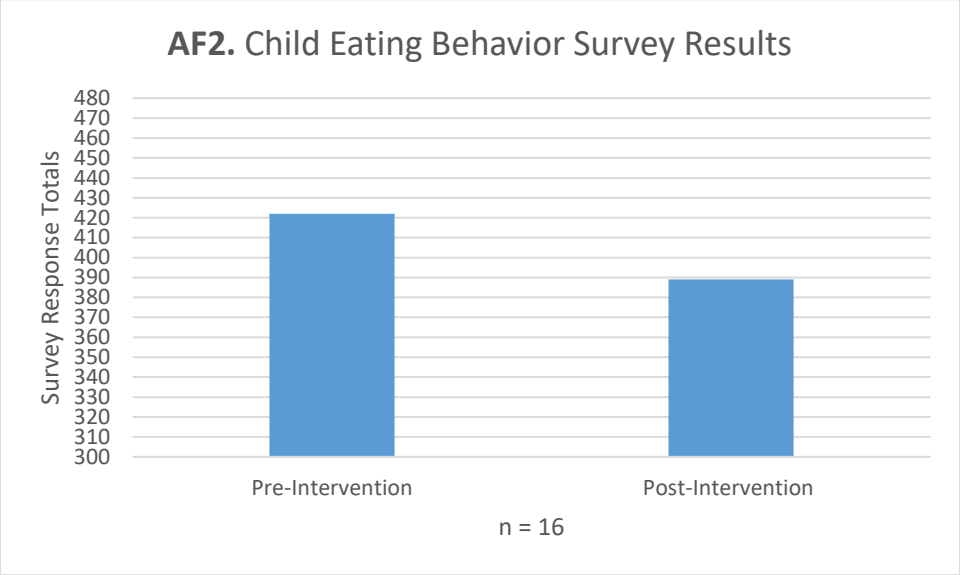
AT 1: Treatment & Removal of Treatment Effects: Present children whose parents were not employed on site

	Treatment Effect				Treatment Removal Effect			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intervention	2.343***	2.343***	2.376***	0.386***				
	(0.430)	(0.421)	(0.405)	(0.0765)				
Post-Intervention					-2.763***	-2.763***	-2.656***	-0.437***
					(0.587)	(0.475)	(0.546)	(0.0895)
Constant			-1.286*	-0.206***			1.158**	0.211***
			(0.550)	(0.0573)			(0.410)	(0.0275)
Observations	214	214	232	232	223	223	225	225

Note: Model's (1) & (5) are conditional logit with fixed-effects and clustered standard errors (both at the individual level); Model's (2) & (6) are logit with individual fixed-effects; Model's (3) & (7) are logit with standard errors clustered at the individual level; Model's (4) & (8) are linear probability models with fixed-effects and clustered standard errors (both at the individual level). Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix E – Figures





Appendix F

Table 1. Descriptive Statistics

Characteristics	Frequency	Percent of Total
AGE		
5	5	21.74%
6	3	13.04%
7	10	43.48%
8	5	21.74%
Gender		
Female	9	39.13%
Male	14	60.87%
Race		
Black	17	73.91%
White	1	8.70%
Mixed (Black & White)	2	13.04%
Other	3	4.35%
Ethnicity		
Hispanic	2	8.70%
Non-Hispanic	21	91.3%
Household Type		
Single Mother	15	65.22%
Both Parents	7	30.43%
Alternate Custody	1	4.35%
Household Income		
<10,000	11	47.82%
10,001 – 20,000	8	34.78%
20,001 – 30,000	1	4.35%
40,001 – 50,000	3	13.04%
Number of Siblings		
0	6	26.09%
1	9	39.13%
2	2	8.70%
3	3	13.04%
4	3	13.04%
Free Lunch	23	100%

Figure 1.

Figure 2.

Figure 3.

Table 2. Dessert Combinations

	Dessert Combination								Attendance	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Participants	All
Week 1†										
Mon. (7/11)	X								18	€
Tues. (7/12)	X								19	42
Wed. (7/13)	X								18	39
Thurs. (7/14)		X							18	44
Fri. (7/15)	X								19	42
Week 2*										
Mon. (7/18)			X						20	48
Tues. (7/19)				X					20	50
Wed. (7/20)					X				18	51
Thurs. (7/21)						X			19	54
Fri. (7/22)		X							20	49
Week 3*										
Mon. (7/25)							X		16	45
Tues. (7/26)								X	19	55
Wed. (7/27)					X				18	58
Thurs. (7/28)				X					16	53
Fri. (7/29)			X						17	53
Week 4‡										
Mon. (8/1)		X					X		15	49
Tues. (8/2)									18	47
Wed. (8/3)						X			19	52
Thurs. (8/4)	X								16	52
Fri. (8/5)								X	15	44

Notes: Dessert combinations are as follows: (1) Apples, bananas, purple grapes, and chocolate chip cookies; (2) Apples, bananas, green grapes, and chocolate chip cookies; (3) Pears, bananas, purple grapes, and chocolate chip cookies; (4) Apples, bananas, green grapes and Oreo cookies; (5) Apples, bananas, purple grapes, and Oreo cookies; (6) Pears, green grapes, purple grapes, and chocolate chip cookies; (7) Pears, purple grapes, bananas, and Oreo cookies; (8) Pears, green grapes, bananas, and chocolate chip cookies.

† Baseline week

* Intervention Week

‡ Post-intervention week

€ The collection of the dessert choice decisions nonparticipants did not begin until 7/12.

Table 3. Summary Statistics for Participating Children

	Observations			
	Present		Absent	Total
Attendance	358		102	460
Proportion	77.83%		22.17%	100%
		Dessert Choice		
	Fruit Cup	Cookie Cup	Neither	Total
Present	182	167	9	358
Proportion	50.84%	46.65%	2.51%	100%
		Consumption		
	¼ Cup	½ Cup	¾ Cup	All	Total
Chose Dessert	2	2	12	332	348[a]
Proportion	0.57%	0.57%	3.45%	95.40%	100%

Note: [a] Of 358 decisions, 349 resulted in the choice of a dessert. However, total consumption observations sum to 348 as one child dropped their fruit cup and did not ask for it to be replenished. This child had dropped the contents of dessert cups several times during the duration of the experiment, but had asked for it to be replenished each time, with this time being the sole exception.

Table 4. Summary Statistics for all Children

	Dessert Choice			
	Fruit Cup	Cookie Cup	Neither	Total
Weeks 1 – 4	428	508	9	945
Proportion	45.29%	53.76%	0.95%	100%
Weeks 2 – 3	322	188	6	516
Proportion	62.40%	36.43%	1.16%	100%

	Prize Selection (Weeks 2 & 3)							
	Pencil Sharpeners	Pamphlets	Pencils	Rings	Gliders	Rubber Balls	Finger Lights	Total
Chose Fruit Cup	11	8	8	10	37	108	140	322
Proportion	3.42%	2.48%	2.48%	3.12%	11.49%	33.54%	43.48%	100%

Note: The total number of prizes ordered were as follows: 72 pencil sharpeners,72 pamphlets, 144 plastic rings, 100 pencils, 72 gliders, 144 rubber balls, and 140 finger lights.

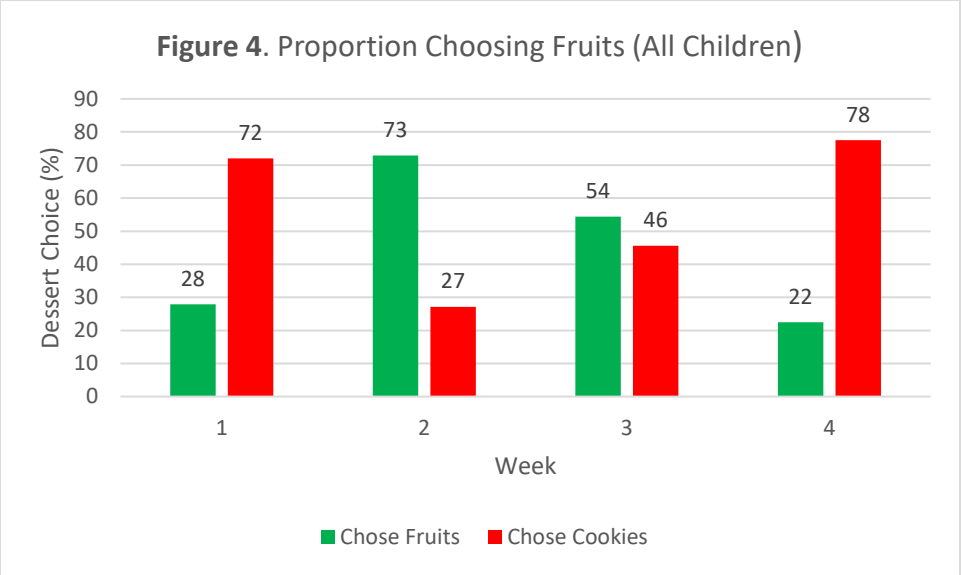


Figure 4. Proportion Choosing Fruits (All Children)
Dessert Choice (%)
90
80
70
60
50
40
30
20
10
0
28
72
73
27
54
46
22
78
1
2
3
4
Week
Chose Fruits
Chose Cookies

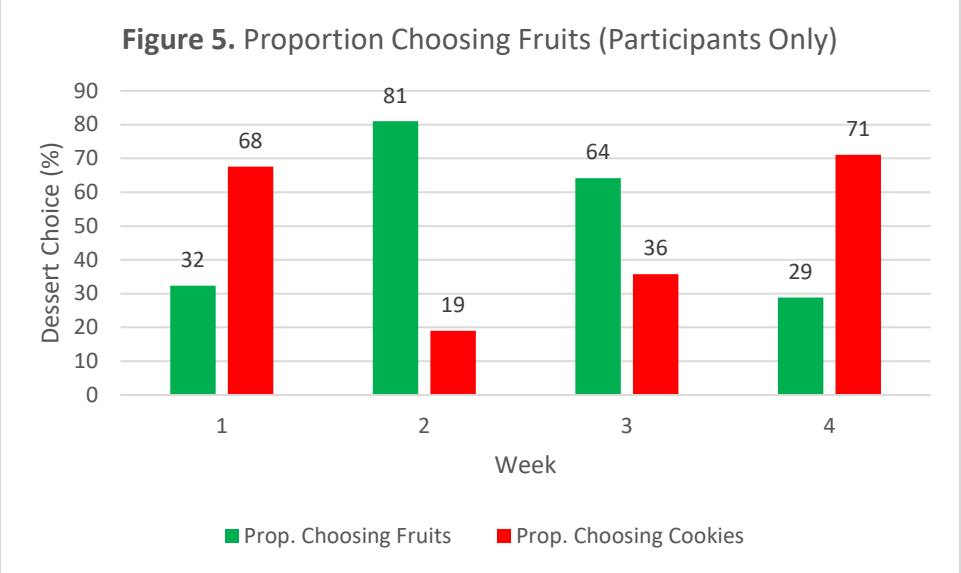


Figure 5. Proportion Choosing Fruits (Participants Only)
Dessert Choice (%)
90
80
70
60
50
40
30
20
10
0
32
68
81
19
64
36
29
71
1
2
3
4
Week
Prop. Choosing Fruits
Prop. Choosing Cookies

Table 5. Intervention and Post-Intervention Effects

	Treatment Effect		Removal of Treatment Effect	
	(1)	(2)	(3)	(4)
Intervention	2.090***	0.372***		
	(0.410)	(0.0732)		
Post-Intervention			-2.507***	-0.429***
			(0.471)	(0.0768)
Constant		-0.196***		0.209***
		(0.0549)		(0.0236)
Observations	257	275	264	266

Note: Models (1) & (3) are conditional logit models with fixed-effects and clustered standard errors (both at the individual level); Models (2) (&4) are linear probability models with fixed-effects and clustered standard errors (both at the individual level). Standard errors in parentheses $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. Week and Day Intervention Effects

	(1)	(2)
Week 1 (Omitted)	Week Effects	Day Effects
Week 2	0.451***	
	(0.0734)	
Week 3	0.283**	
	(0.0885)	
Week 2 – *first half*		0.494***
		(0.0860)
Week 2 – *second half*		0.387***
		(0.0845)
Week 3 – *first half*		0.296**
		(0.0920)
Week 3 – *second half*		0.264*
		(0.114)
Constant	-0.199***	-0.198***
	(0.0544)	(0.0545)
Observations	275	275

Note: Model's (1) & (2) are linear probability models with fixed-effects and clustered standard errors (both at the individual level). In the baseline week is omitted in model (1) and, similarly, the baseline days are omitted in model (2). Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7. Comparison of Coefficients

		Week 2		Week 3	
	Week 2	*1st half*	*2nd half*	*1st half*	*2nd half*
Week 1	.017	–	–	–	–
Week 2					
1st half	–	–	0.231	0.035	0.051
2nd half	–	–	–	0.107	0.282
Week 3					
1st half	–	–	–	–	0.749
2nd half	–	–	–	–	–

Note: *t*-Tests were used to compare differences in coefficients for statistical significance and the *p*-values are reported. The first half of each week is comprised of Monday, Tuesday, and Wednesday. The second half is comprised of Thursday and Friday.