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Incentivizing healthy eating in children: An investigation of the "ripple" and "temporal" effects of a reward-based intervention

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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 removed treatment within-subject design and was conducted at a summer program catering to low-income children between the ages of 5 and 12. The month long experiment—wherein participants were offered a small prize for choosing a fruit cup for dessert after lunch in lieu of cookies—involved 23 children between the ages of 5 and 8. Corroborating existing studies, the introduction of small reward-based incentives in this context 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 day suggests that their impact diminished 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 conclusions.

1. Introduction

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 (CDC, 2015). The consumption of fruits and vegetables is of particular importance, as they are not only key sources of fiber as well as many essential micronutrients, but also help to mitigate weight gain (Ledikwe et al., 2006; Rolls, Ello Martin, & Tohill, 2004; Vioque, Weinbrenner, Castello, Asensio, & Hera, 2008). Most American children ages two years and older do not, however, meet the United States Department of Agriculture's (USDA) recommendations for a diet rich in fruits and vegetables. In contrast, their intake of sodium 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 (CDC, 2015). Research also suggests that diet during childhood is a significant predictor of diet in adulthood, and that pediatric obesity has negative implications for adult health outcomes (Hingle, O'Connor, Dave, & Baranowski, 2010; Nicklaus, 2009; Birch, 1999).

The latest figures available from the CDC indicate that, in the United States, 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 are obese, a problem more acute among black, Hispanic, and low-income children (CDC, 2016). Given their adverse effects on normal development, the associated costs, and influence on long-term eating habits, the targeting of pediatric obesity and children's unhealthy dietary choices are particularly important. Preventative measures designed to induce better eating behaviors earlier in the lifecycle may therefore yield maximum health benefits and establish dietary habits that may persist into adulthood.

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 tangible, material reward in return for the performance of a particular behavior—to *remunerative* approaches—defined here as those in which participants receive some form of a tangible, material reward in exchange for behaving in a desired manner. Although the former have been studied extensively, the latter have

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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), a phenomena sometimes also referred to as the "overjustification effect" or the "negative rebound effect" (Just and Price, 2013). 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 studies employing remunerative incentives find them to have no impact on children's intrinsic motivations (Raju, Rajagopal, & Gilbride, 2010; Corsini, Slater, Harrison, Cooke, & Cox, 2011; Just & Price, 2013; Belot, James, & Nolen, 2013; Loewenstein, Price, & Volpp, 2014; List & Samek, 2015a, 2015b).

Existing studies also suggest that remunerative interventions may be more cost-effective than their non-remunerative counterparts, which tend to be costly, time-consuming, and labor-intensive to put into practice (Evans, Chrsitian, Cleghorn, Greenwood, & Cade, 2012; Hendy, Williams, & Camise, 2005) while producing little, if any, changes in dietary behaviors. Such interventions often involve 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 (Cauwenberghe et al., 2009; Evans et al., 2012; Hendrie, Lease, Bowne, Baird, & Cox, 2016). In contrast, remunerative interventions employing small rewards worth 50 cents or less—even as low as a nickel (USD $0.05)—have been shown to produce large changes in the choice and consumption of fruits and vegetables (Raju et al., 2010; Just & Price, 2013; Belot et al., 2013; Loewenstein, Price, & Volpp, 2014; List & Samek, 2015a, 2015b). Simply affixing such small rewards to an item has also been shown to increase their selection (List & Samek, 2015b), implying that such incentives may be effective at little additional burden, financial or otherwise.

Given the promise of these initial studies, the impact of such rewards over time and their influence on behaviors outside of experimental settings warrant further study. Regarding the former, it may be that the effectiveness of rewards as a motivator in influencing dietary behaviors diminishes over time as the novelty of their introduction wears off. If so, this may imply that the frequency of their use, and the types of rewards used, may matter in designing a long-term effective remunerative intervention. Studies that have attempted to investigate the temporal dimensions of such interventions either suffer from significant data collection issues, employ complex intervention schemes, or use designs that combine multiple treatments. Raju et al. (2010) find effects that fluctuated over the course of their study but recommend a cautious interpretation of their findings as they failed to collect data on 62% of their sample. The interventions tested in Belot et al. (2013) consisted of a piece-rate scheme and a competition scheme in which children had to collect a certain number of stickers to be eligible for a prize at the end of each school week. While the piece rate scheme was found to be ineffective, the competition scheme produced sizeable effects that diminished with time overall, but persisted for the subset of students who had some margin for improvement. Lastly, Loewesnstein et al (2014) found effects that did not fade out over time but used rewards in conjunction with a verbal prompt, making it difficult to attribute any effects to the presence of rewards themselves.

As for the influence of rewards on behaviors in other contexts, no attempts have yet been made 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 (Ransley et al., 2007; Evans et al., 2012; List and Samek, 2015a,b). The introduction of rewards may have three potential effects. They may increase fruit choice and consumption outside of the intervention setting if, for example, children, develop a taste or habit for them. It may also be that such an intervention has no has no effect on dietary behaviors outside of the setting in which it is administered. Lastly, the intervention may reduce the choice and consumption of fruits if children compensate for foregoing junk food earlier in the day by eating more of it in another setting. Of particular importance are behaviors at home where most habits are learned (Campbell et al., 2007; De Bourdeaudhuij, 1997; Dowda, Ainsworth, Addy, Saunders, & Riner, 2001), the external setting of interest in this study.

This study seeks to add to the small body of literature on remunerative approaches targeting children's eating habits by shedding light on these issues in the context of fruit choice. It employs a removed treatment within-subject design and presents the results of a month-long field experiment in which 23 low-income children ages 5 to 8 attending a summer program were offered a small prize for choosing a fruit cup for dessert after lunch in lieu of cookies. The contributions are threefold. First, 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 findings. Second, by surveying parents about their children's dietary behaviors at home, this study attempts to identify the potential impact of reward-based incentives on children's eating behaviors outside of the intervention setting—labeled here as "*ripple*" effects. Third, this study gauges the efficacy of such interventions over time—labeled here as "*temporal*" effects—both between weeks and within weeks.

2. Materials and methods

2.1. Experimental design

This study employs a removed treatment within-subjects design. In within-subjects designs, participants serve as their own controls, thereby reducing the amount of error arising from natural variance between individuals. Such designs are, however, susceptible to various threats to internal validity. The plausibility of these threats is significantly diminished in the context of a treatment removal design (Shadish, Cook, & Campbell, 2001). In such a design, pre-treatment observations are first recorded, after which the treatment is introduced and post-treatment observations recorded. This is then followed by the removal of the treatment and further observation. If it can be demonstrated that the outcome of interest rises and falls with the presence or absence of the intervention, it becomes highly implausible that observed changes could be the result of alternative factors or extraneous events, thereby facilitating causal inferences.

2.2. Location

The field experiment was conducted at a Boys and Girls Club (BGC) location in central New York, and was approved by Syracuse University's Institutional Review Board (IRB) as well as the local branch of the BGC. 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 summer months. During the summer, children are served breakfast and lunch, both of which are provided by the local school district and are standard meals that are also served in school cafeterias during the school year. These meals did not include 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