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Offering Variety: A Subtle Manipulation to Promote Healthy Food Choice Throughout the Day

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Objective: Providing a variety of food generally increases consumption and enjoyment. This effect is typically associated with unhealthy behavior (e.g., overindulgence at a buffet) and studied during a single meal. Two studies tested whether this effect can be leveraged in a subtle, simple manipulation to promote healthy food choices over the course of a day. ***Method:*** In Studies 1 and 2, 188 and 187 participants, respectively, chose between a sweet and a piece of fruit in the afternoon. The fruit was either the same as or different from fruit that was selected in the morning; choice was not given in the morning. Study 1 tested this effect in the domain of expressed preferences and Study 2 examined actual choice. ***Results:*** In both studies, a second piece of fruit was more likely to be selected in the afternoon if it was different from fruit that was selected in the morning. ***Conclusions:*** These results illustrate how a robust effect that is typically associated with unhealthy outcomes can be harnessed to promote healthy food choices and underscore the importance of conceptualizing eating as a series of interrelated behavioral decisions. This work has implications for applied settings, such as cafeterias, and is distinguished from other simple structural manipulations by its focus on sustaining healthy food choice over the course of the day.

Keywords: variety, eating, food choice

Encouraging a healthy diet, which includes the daily consumption of several fruits and vegetables, is a top health priority (U.S. Department of Agriculture & U.S. Department of Health & Human Services, 2010). Diets rich in fruit are helpful in weight management and are associated with lower risk of chronic diseases, such as diabetes, cardiovascular disease, and cancer (Willett & Stampfer, 2013). Considerable resources have been devoted to developing interventions that promote fruit consumption. However, widely implemented interventions, such as providing nutritional information or messages, have failed to raise fruit consumption to recommended levels; less than a third of American adults eat at least two servings of fruit per day (Downs, Loewenstein & Wisdom, 2009; Grimm et al., 2010). At the same time, the dissemination of more intensive interventions, such as face-to-face nutrition counseling, are limited by their high costs and the need for participants to actively opt into these programs (Bowen & Beresford, 2002; Finkelstein, French, Variyam, & Haines, 2004; Steptoe et al., 2003). New intervention strategies that complement extant interventions are needed. Small, subtle environmental changes that "nudge" people to make healthier food choices are emerging as effective and practical intervention strategies in this area (Peters, 2009; Thaler & Sunstein, 2008). In two studies, we demonstrate that a well-documented phenomenon—the variety effect—can be capitalized upon to design a simple intervention that promotes healthy food choices.

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Presenting a variety of food produces a fairly robust effect on consumption; people tend to eat more and enjoy their food more if a variety of food is offered during a meal (i.e., the variety effect; Remick, Polivy, & Pliner, 2009). The variety effect is usually associated with undesirable outcomes, such as overindulgence at buffets or potluck parties (Remick et al., 2009; Wansink, 2010), but the effect has been demonstrated with healthy foods in a few cases (Bucher, van der Horst, & Siegrist, 2011; Meengs, Roe, & Rolls, 2012; Raynor & Osterholt, 2012). Reducing dietary variety has even been used as a strategy for weight loss (Raynor, 2012; Raynor, Niemeier, & Wing, 2006). As a food is repeatedly eaten, it is habituated to and hedonic responses decrease (Hetherington & Rolls, 1996; Raynor & Epstein, 2001). Variety prevents habituation and thus sustains hedonic responses (Raynor & Epstein, 2001). Although research on the variety effect has largely focused on overindulgence in unhealthy foods, the underlying mechanism (i.e., habituation) is not specific to unhealthy foods (Bucher et al., 2011; Meengs et al., 2012).

Within the context of eating, variety can be operationalized within-meal or across-meal (Meiselman, de Graaf, & Lesher, 2000). Within-meal variety pertains to the diversity of foods available during a single meal (e.g., the number of different foods available at breakfast), whereas across-meal variety refers to the diversity of foods available across several meals (e.g., the number of foods available at lunch that were not available at breakfast). Most demonstrations of the variety effect involve eating behavior during a single, brief laboratory session, and thus pertain to within-meal variety (see Remick et al., 2009 for review). Although it is important to understand the factors that influence eating during a single meal, meals are not necessarily discrete episodes; over a period of time, such as a day, meals can be construed as a series of interrelated behavioral episodes (i.e., what is eaten now can influence what is eaten later). This temporal perspective of eating

behavior is well established in physiology, but is only beginning to emerge in the psychological literature (Almiron-Roig et al., 2013; Higgs, 2008), and offers a more realistic depiction of eating behavior.

Although across-meal variety heeds the interdependence of meals, research on across-meal variety is limited. Most demonstrations of this effect have occurred under highly controlled, atypical conditions (e.g., refugees in refugee camps, Rolls & de Waal, 1985; overweight and obese individuals enrolled in weight loss treatment, Raynor et al., 2006). In the few instances that community samples have been studied, participants were assigned to eat specific foods for several consecutive days, so little is known about how the variety effect unfolds in less constrained situations (e.g., Meiselman et al., 2000; Raynor & Wing, 2006). This methodology has led some investigators to question the generalizability of the across-meal variety effect because behavior often differs across situations in which individuals are granted and denied autonomy (Remick et al., 2009; Ryan & Deci, 2000). Moreover, in these studies, the quantity of food that is eaten and ratings of palatability are consistently the outcomes of interest (see Remick et al., 2009). Little is known about the impact of across-meal variety on food choice, despite food selection being a crucial decision during eating (Sobal & Bisogni, 2009).

From a pragmatic point of view, one of the challenges encountered in promoting fruit consumption is that the behavior must be repeated several times throughout the day; nutrition guidelines recommend the consumption of multiple fruits each day (U.S. Department of Agriculture & U.S. Department of Health & Human Services, 2010), and people are unlikely to consume all servings during a single meal. Thus, creating across-meal variety is an ideal and pragmatic strategy for promoting healthy food choices. In two studies, we tested the hypothesis that people are more likely to choose a second piece of fruit over a sweet if it is different from, rather than the same as, fruit that was eaten earlier in the day.

Study 1

Method

Participants. Participants were 188 undergraduates (66.5% women, mean age = 21.0 years) who were approached individually by a research assistant at various locations on campus (e.g., library, student union). An additional 21 individuals were approached but declined to participate. Demographics did not significantly differ across conditions. There were no eligibility criteria, and participants were not compensated.

Design. A 2 (diversity of fruit: same, variety) × 2 (alternative: cookie, nothing) × 2 (directions: should eat, will eat) between-subjects design was used.

Procedure. After reading the consent letter, participants read a vignette about a fictional female student who had eaten a piece of fruit and cereal for breakfast and was now making a decision between taking an apple or an alternative during lunch in the cafeteria. Three aspects of the scenario were manipulated. First, diversity of fruit was manipulated by the description of the piece of fruit that was eaten during breakfast. In the same condition, the student had eaten an apple during breakfast, whereas in the variety condition she had eaten a banana. Second, to determine whether the effect of variety is constrained when participants can select a particularly tempting alternative, the alternative choice to fruit was manipulated; participants were randomly assigned to choose between an apple and a cookie, or an apple and taking nothing. Third, the language used to pose the choice question was manipulated. A random half of the participants were asked what the student should choose and the other half were asked what the student will choose because thinking about what should be chosen may prompt the selection of a healthy choice (i.e., fruit), regardless of the presence of variety. Demographic information was also collected. The sample size of each cell was as follows: 22 participants in the same/cookie/should condition; 24 in same/cookie/will; 24 in same/nothing/should; 25 in same/nothing/will; 23 in variety/cookie/should; 25 in variety/cookie/will; 21 in variety/nothing/should; and 24 in variety/nothing/will. The Institutional Review Board at the University of Minnesota approved this study.

Results and Discussion

A binary logistic regression revealed that the main effect of alternative was not significant ($p = .78$); the likelihood of choosing fruit did not differ when the alternative was a cookie or taking nothing. Thus, this variable was dropped from further analyses. A binary logistic revealed significant main effects of directions ($B = 1.64$, $p = .002$) and diversity of fruit ($B = 1.70$, $p < .001$). Participants who were asked what should be taken to eat were more likely to choose an apple than those who were asked what will be taken to eat (odds ratio [OR] = 5.16), with 72.22% and 36.73% of participants choosing an apple in the should eat and will eat conditions, respectively. Participants in the variety condition were more likely than those in the same condition to choose an apple ($OR = 5.45$), with 69.89% and 37.89% of participants choosing an apple in the variety and same conditions, respectively. The effect of diversity of fruit was consistent across the should eat and will eat conditions ($p = .78$, although the power to test this interaction was limited; Figure 1).

As expected, participants were more likely to choose a second piece of fruit at lunch for a hypothetical student when the fruit was different from the fruit eaten at breakfast; preference for fruit increased over fivefold in response to a very subtle and simple manipulation. This effect is robust across choice situations; the nature of the alternative to the piece of fruit—a tasty cookie or not taking food—did not affect choice. Although participants were

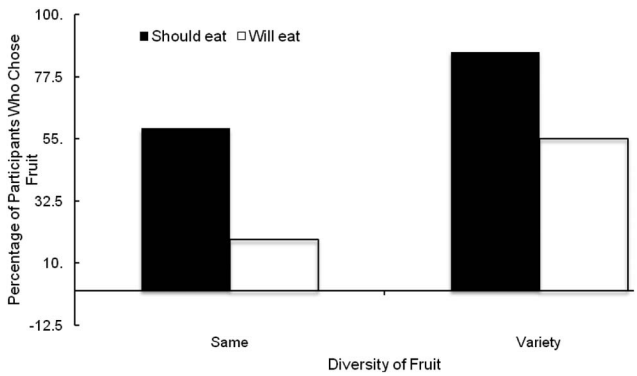

Figure 1. Percentage of participants who chose an apple over the alternative across the diversity of fruit and directions conditions.

more likely to choose the fruit when asked what the student should choose to eat, this effect was independent of the effect of variety. The discrepancy between the will eat and should eat conditions provides assurance that participants in the will eat condition were not merely responding in a socially desirable way by consistently choosing the socially desirable, healthy option.

The beneficial outcomes of making healthy choices require people to act on their preferences. Because there is often a gap between people's preferences and their actions (Sheeran, 2002), it is critical to assess whether strategies that elicit changes in preferences also affect behavior (Baumeister, Vohs, & Funder, 2007; Kaptein, 2011). Thus, we sought to test whether manipulating variety can affect the likelihood that people will take a second piece of fruit later in the day. Specifically, participants were given a banana as a morning snack, and then had the opportunity to choose between jellybeans and either a banana or an apple in the afternoon. We predicted that participants would be more likely to choose a second piece of fruit over jellybeans in the afternoon if the fruit differed from fruit that was taken in the morning.

Study 2

Method

Participants. One hundred ninety undergraduate students (68.6% women, mean age = 19.90) participated in exchange for course credit. Any individual who responded to the advertisement for the study, which listed the times of the lab sessions, was invited to participate. Demographics did not differ across condition. Three participants were excluded from analysis for disregarding instructions by taking more than one snack.

Design. A single factor between-subjects design with two conditions (diversity of fruit: same, variety) was used.

Procedure. All participants reported to the laboratory between 9:00–10:00 a.m. and read the consent letter. Prior to entering a private room, participants were informed that there was a snack on the table, they must take a snack, and they may take only one snack. They were also given a brief questionnaire, which asked them to write down the snack that they took and complete four Likert scale items about their current mood. The mood questions were intended to prevent participants from guessing the true nature of the study. Upon entering the room, participants saw a bowl of six bananas and completed the questionnaire. After completing the questionnaire, participants took their snack and left the laboratory. Participants returned to the laboratory between 2:30–4:00 p.m. The procedure and instructions for the afternoon session were identical to those of the morning session, with the exception of the snack offered. Participants were block randomized to either the *same* condition ($n = 86$), in which they were presented with a bowl of 6 bananas and a bowl of 6 small bags of jelly beans, or the *variety* condition ($n = 101$), in which they were presented with a bowl of 6 apples and a bowl of 6 small bags of jelly beans. Before a new participant entered the private room, research assistants counted the items in each bowl as a check on participants' reports of their choice. Later that night, participants completed an online questionnaire, which collected demographics. Other measures were also collected during the online survey (e.g., eating habits, trait self-control), but are not germane to the analyses presented here. The Institutional Review Board at the University of Minnesota approved this study.

Results and Discussion

A significant chi-square test indicated that participants in the variety and same conditions significantly differed in their choices, $\chi^2(1) = 4.31$, $p = .038$. Specifically, 59.4% (60/101) of participants in the variety condition chose fruit during the afternoon session compared with 44.2% (38/86) of participants in the same condition ($OR = 1.85$).

Providing people with a variety of fruit options throughout the day had a meaningful effect on behavior; participants were more likely to choose fruit over jellybeans in the afternoon if it differed from the type of fruit that was offered and taken in the morning. Offering a variety of fruit over the course of a day increased the likelihood of making a healthy food choice, even when an attractive, less healthy alternative was available.

General Discussion

Research on the variety effect has typically focused on undesirable outcomes, such as excessive consumption of unhealthy foods (Raynor, 2012; Remick et al., 2009; Wansink, 2010). However, the results of the present studies demonstrate that this effect can be leveraged to promote healthy food choices. In both studies, a second piece of fruit was more likely to be chosen over a sweet later in the day if it differed from the fruit that was eaten earlier.

Low rates of fruit consumption have been attributed to many factors, including lack of knowledge, cost, and availability, but even among educated groups with access to fruit, consumption levels fall below recommended levels (Dong & Lin, 2009). Accordingly, changing the choice architecture of the settings in which food is chosen in an effort to nudge healthier choices has emerged as a popular intervention strategy (Thaler & Sunstein, 2009). For instance, placing healthier foods before unhealthy foods in cafeteria lines increases the sale of the healthier options (Hanks, Just, Smith & Wansink, 2012), and putting a candy dish beyond arm's reach decreases candy intake (Wansink, Painter, & Yee, 2006). The intervention presented here is distinguished from other simple structural interventions by its focus on sustaining healthy food choice over the course of the day. Most extant subtle, nudge-type interventions view meals as discrete episodes. However, meals are often interrelated; decisions about what to eat and how much to eat are influenced by prior meals (Almiron-Roig et al., 2013; Higgs, 2008). More broadly, this work underscores the potential to design simple interventions that heed the pragmatic need to sustain healthy food choices over time.

This work also extends our basic understanding of the variety effect. Empirical tests of the variety effect have typically demonstrated the effect of variety on ratings of liking for a food or quantity eaten; both of these outcomes pertain to *how much* one eats. However, deciding *what* to eat is an equally important decision (Sobal & Bisogni, 2009). Thus, this work extends previous research by demonstrating that variety impacts eating behavior at this understudied, yet crucial, decision point. Similarly, these studies build on recent work demonstrating that the variety effect does not necessarily lead to unhealthy behaviors (Bucher et al., 2011; Meengs et al., 2012; Raynor & Osterholt, 2012).

Our understanding of across-meal variety is also furthered by these results. In an effort to maintain experimental control, past research on across-meal variety has imposed strict constraints on participants' diets, which may have inadvertently undermined their sense of autonomy (Remick et al., 2009). Because behavior often differs across conditions in which autonomy is and is not undermined, some authors have speculated that the across-meal variety effect would not hold if participants were allowed to choose their foods (Remick et al., 2009). By making a choice between fruit and a sweet, participants were, by definition, granted autonomy. Thus, the results of these studies begin to alleviate these concerns by showing that the across-meal variety effect holds in a relatively autonomous context.

As work in this area continues, identifying mediators should be prioritized because identifying mediators is an essential element in the evaluation and refinement of interventions (Michie & Abraham, 2004). The mediator that has most frequently been proffered for the variety effect is disrupting habituation. Habituation is a process of learning whereby responses to a stimulus decrease as it is repeatedly presented (Epstein, Temple, Roemmich & Bouton, 2009; Raynor & Epstein, 2001). When someone habituates to a food, a number of responses may decrease, including physiological (e.g., salivation), behavioral (e.g., eating), and cognitive (e.g., enjoyment) responses. The within-meal variety effect is posited to occur because responses that occur outside of cognitive awareness are sustained (e.g., salivation; Raynor & Epstein, 2001; Remick et al., 2009). In contrast, an abated decline of responses that the eater is aware of is suspected to mediate the across-meal variety effect (Hetherington, Foster, Newman, Anderson, & Norton, 2006; Hetherington, Pirie, & Nabb, 2002; Remick et al., 2009). A limited amount of research suggests that cognitive processes such as memory about previously eating the food (Hetherington et al., 2002, 2006), beliefs about how frequently a food should be eaten (Rolls, 1986), and the perceived health value of food (Burns & Rothman, 2011) are involved.

Although the effect size (i.e., odds ratio) for the variety effect decreased from Study 1 to Study 2, the pattern of results is consistent across expressed preferences and behavior. Across the two studies, the same decision was made in a "cold" state, in which the hedonic cues associated with food were not immediately available (i.e., Study 1), and a "hot" state, in which such cues were present (i.e., Study 2). Often times, cold state judgments reflect intentions to pursue long term, aspirational goals (e.g., to eat healthily, to get good grades), which are often derailed when judgments are made in hot states (Loewenstein, 2005). Accordingly, an empathy gap or intention-behavior gap typically emerges; intentions are not translated into behavior (Loewenstein, 2005; Sheeran, 2002). Identifying the mediators of the obtained results may also inform work on the intention-behavior gap by specifying mechanisms that drive decisions, yet remain consistent, across hot and cold states.

Although we sought to test the variety effect in a relatively common situation, the need to maintain experimental control and track participants' choices created a situation that was not entirely analogous to participants' daily lives. In the future, this intervention should be tested in more naturalistic settings (e.g., cafeterias). Also, because our primary focus was on food choice and we did not want participants to be aware of the true nature of the study, the quantity of food consumed was not monitored. It is possible that participants discarded their snack after choosing it. As this line of research evolves, it should focus on developing creative methodologies that preserve experimental realism while allowing consumption to be monitored. Finally, participant characteristics that may relate to eating behavior (e.g., body weight) were not measured because past work has demonstrated that the variety effect is not moderated by dietary restraint or body weight (Remick et al., 2009). However, because most of the work on the variety effect has examined consumption of unhealthy foods, future work should seek to determine whether these characteristics moderate the variety effect in the domain of healthy foods.

These findings suggest that healthier food choices can be encouraged by offering different types of fruit at different times of the day in settings in which food choices are made across the day, such as workplace cafeterias. For instance, apples could be made available in the morning and bananas could be made available in the afternoon. Future work should also examine whether the observed pattern of results extends to children. School cafeterias are important sites for interventions that seek to reduce the high rates of childhood obesity in the United States because many children eat breakfast and lunch at school and schools have intensive and continuous contact with most children (Jaime & Lock, 2009; Kopla, Liverman & Kraak, 2005; Story, Nanney & Schwartz, 2009). Many efforts are being made to improve the quality of school snacks and meals by offering healthier food options, such as fruits and vegetables, to students (Jaime & Lock, 2009). Although having healthy foods available is necessary in improving the diet of schoolchildren, it is not sufficient; students must also choose and eat these foods (Sobal & Bisogni, 2009). The results of these studies suggest that students may be more likely to choose more fruit over the course of a day if a variety is presented to them. Interventions that nudge healthy choices within *and* across meals should also be tested because both strategies demonstrate modest effects that may be additive. For example, during breakfast, one type of fruit should be presented within arm's reach, and a different type of fruit should be offered in its place during lunch. This intervention design could also be used to increase the consumption of other healthy foods (e.g., vegetables, whole grains).

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