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Evaluations of the health benefits of eating more fruit depend on the amount of fruit previously eaten, variety, and timing

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ABSTRACT

Though research has demonstrated that people generally perceive fruits to be healthy foods, little is known about how people think about the health benefits associated with eating increasing quantities of fruit. The purpose of this paper is to examine how evaluations of healthiness change as participants consider eating increasing quantities of fruit, and to explore how additional contextual features (i.e., variety and timing) can be leveraged to improve evaluations. In two within-subjects experiments, participants rated how good or bad for one's health it would be to eat increasing quantities of either the same fruit or a variety of fruits. In study 1, all participants were instructed to imagine eating the fruit over the course of the day. In study 2, the temporal distribution of the fruit (throughout the day, during a single meal) was manipulated. In general, both studies demonstrated that evaluations of overall healthiness for eating increasing quantities of the same fruit tended to diminish beyond two pieces of fruit, whereas the overall healthiness of eating increasing quantities of a variety of fruit remained stable. Study 2 demonstrated that evaluations of healthiness increased as additional fruit was considered when a variety of fruit was imagined to be eaten throughout the day. Thus, the health benefits that people assign to eating increasing quantities of fruit seem to increase, but only if eating a variety of fruits throughout the day is considered. This study suggests that evaluations of the healthiness of fruit are not made in isolation; evaluations of healthiness are contextualized by what has been eaten previously and when it was eaten.

Diets rich in fruit can help with weight management and are linked to lower risk for chronic diseases, such as diabetes, cardiovascular disease, and some cancers (Willett & Stampfer, 2013). However, less than a third of American adults eat two or more servings of fruit per day (Downs, Loewenstein & Wisdom, 2009; Grimm et al., 2010) and considerable efforts have been made to encourage people to eat more fruit (Rekhy & McConchie, 2014). Though research has demonstrated that people largely consider fruits to be healthy foods (Paquette, 2005; Pawlak & Colby, 2009), little is known about how people think about the health benefits associated with eating increasing quantities of fruit. Specifically, it is unclear how much added health benefit, if any, people perceive to be derived from eating a second or third piece of fruit. For example, is eating two pieces of fruit perceived to be twice as healthy as eating one? Does the experience of having eaten an apple influence one's evaluations of how healthy it is to eat an orange? If message campaigns aimed at boosting fruit consumption are to be successful, people must, at minimum, believe that eating additional pieces of fruit will benefit their health. The purpose of this paper is to examine how evaluations of how healthy it is to eat fruit change as participants consider eating increasing quantities of fruit, and to explore how additional contextual features (i.e., variety and timing) can be leveraged to improve evaluations.

Emerging research highlights the importance of studying how people think about eating-related decisions, particularly when they are not eating, because most meals are planned and planning is tied to subsequent consumption (Brunstrom, 2014; Fay et al., 2011).

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Similarly, established health behavior theories and accompanying empirical studies have identified subjective evaluations of behaviors as critical behavioral determinants; in general, the more favorably a behavior is evaluated, the more likely it is to be performed (Ajzen, 1985; Godin & Kok, 1996; Milne, Sheeran, & Orbell, 2000; Pligt & De Vries, 1998). The influence of evaluations in the context of eating is well documented (Shepherd & Towler, 1992). For example, research suggests that evaluations of the healthiness of a food or drink are associated with how much one consumes (Provencher, Polivy, & Herman, 2009; Saliba & Moran, 2010).

Research has also demonstrated that eating-related decisions do not necessarily occur in isolation; rather, these decisions can be interdependent (Higgs & Woodward, 2009; Higgs, 2008). Identifying how evaluations change as eating more fruit is considered is important because (a) it acknowledges the interdependence of eating-related choices thereby offering a more realistic picture of how people evaluate the health benefits of eating fruit, and (b) dietary guidelines typically suggest that people should eat more than one piece of fruit per day. A large body of empirical evidence from the decision-making literature indicates that, as predicted by prospect theory (Kahneman & Tversky, 1979), the perceived positive value (i.e., benefit) associated with accumulating gains grows in an asymptotic, rather than linear, function. This pattern has been observed in various contexts, including health-promoting behaviors (Kiviniemi & Rothman, 2008), and suggests that less additional health benefit may be associated with eating additional pieces of fruit. Accordingly, upon having eaten a piece of fruit, individuals may see less value in eating more. This may be problematic because the adoption and maintenance of healthy diets requires individuals to make healthy food choices repeatedly.

Variety may also influence evaluations of the healthiness of fruit. Presenting a variety of food produces a fairly robust effect on enjoyment and consumption; people tend to enjoy their meal more and eat more if a variety of food is offered during a meal than if one type of food is offered (Raynor & Osterholt, 2012; Remick, Polivy, & Pliner, 2009; Rolls et al., 1981). This effect also holds across meals; enjoyment of food is sustained when a variety of foods is provided over the span of several days (Remick et al., 2009). Moreover, people appear to anticipate and account for the variety effect when imagining eating a meal or snack (Wilkinson, Hinton, Fay, Rogers, & Brunstrom, 2013). The effect of variety is not moderated by gender or body weight (Remick et al., 2009) and has been demonstrated with many types of food, including fruit (Burns & Rothman, 2015; Raynor & Osterholt, 2012; Remick et al., 2009). For instance, people are more likely to choose a piece of fruit over candy when the fruit is different from, rather than the same as, fruit that was offered earlier in the day (Burns & Rothman, 2015).

The objective of these two experimental studies was to examine how evaluations of healthiness change as participants consider eating additional pieces of fruit in the presence and absence of variety. The effect of thinking about eating fruit over the course of a day, rather than during a single meal, was also examined because adherence to a healthy diet requires people to make healthy food choices throughout the day. Food items were described with text, rather than presented or tasted, to maintain focus on how people think about eating increasing quantities of fruit. A variety $\times$ quantity of fruit interaction was expected. Specifically, in accordance with prospect theory, evaluations of healthiness were expected to plateau as eating increasing quantities of the same fruit were considered. However, evaluations of healthiness were expected to increase, rather than plateau, as increasing quantities of a variety of fruit were considered. The effect of thinking about consuming fruit throughout the day relative to during a single meal was explored.

1. Study 1

1.1. Method

1.1.1. Participants

Fifty-five undergraduate students (61.8% female, $M_{age} = 21.98$) participated in exchange for psychology course credit. On average, participants: had a body mass index (BMI) that fell into the normal range ($M = 23.99$, $SD = 3.58$) based on self-reported height and weight; reported a moderate liking of the fruit types that were used in the study ($M = 3.74$, $SD = 2.00$ on possible range -6 to $+6$); and a midrange score of the restrained eating subscale of the Dutch Eating Behavior Questionnaire ($M = 2.75$, $SD = 0.94$; possible range 1–5; Van Strien, Frijters, Bergers, & Defares, 1986). Informed consent was obtained prior to the study.

1.1.2. Design

A 5 (quantity: 1, 2, 3, 4, 5) $\times$ 2 (variety: same, variety) $\times$ 5 (fruit type: apple, pear, orange, banana, peach) within-subjects design was used. The presentation of the same and variety conditions was counterbalanced. A within-subject design was selected because it partitions between-subject differences that may affect evaluations of healthiness from error variance thereby increasing power. A priori power calculations indicated that a sample size of 48 was needed to detect a medium-sized ($\eta_p^2 = 0.06$) quantity $\times$ variety interaction effect in this specific 3-way repeated measures design with 80% power if alpha was set to 0.05 (Campbell & Thompson, 2012).

1.1.3. Procedure

Participants were informed that the purpose of the study was to determine what people think about eating different types and quantities of foods. Next, they were presented with a questionnaire packet. Participants were instructed to rate "Over the course of one day, how good or bad for your health it would be to eat:" the fruit listed in each of 50 behavioral descriptions (described below). Ratings were made on a 13-point scale (-6 *Very bad*, 6 *Very good*). Instructions also stated that participants should disregard how much they liked or disliked the fruit listed in each behavioral description when making ratings. These instructions were reiterated on each page of the questionnaire packet. After all ratings were made, measures used to describe the sample were administered, which included liking for each type of fruit [*Please rate how much you like or dislike each of these foods*: apples; oranges; pears; bananas; peaches, -6 = *Strongly Dislike*, 0 = *Neutral*, 6 = *Strongly Like*], restrained eating (restrained eating subscale of the Dutch Eating Behavior Questionnaire; Van Strien et al., 1986), and self-reported height, weight, age and sex. Participants were not debriefed, rather relevant information was provided at the beginning of the study. The procedure was approved by the Institutional Review Board at the University of Minnesota. Bivariate correlations between participant characteristics and evaluations of healthiness for a single piece of each type of fruit are presented in Supplementary material 1.

1.1.4. Behavioral descriptions

Each behavioral description contained a list of fruit that was manipulated along three independent dimensions: quantity of fruit (1–5), variety of fruit (same, variety), and type of fruit (apple, pear, orange, banana, peach). Five behavioral descriptions were presented on each page of the questionnaire packet (see Supplementary material 2).

1.1.4.1. Quantity manipulation. On each page of the questionnaire, the quantity of fruit listed in each behavioral description increased