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Affective Associations Mediate the Influence of Cost-Benefit Beliefs on Fruit and Vegetable Consumption

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Abstract

Consumption of fruits and vegetables is far lower than recommended. The behavioral affective associations model posits that affective associations influence behavior and mediate the influence of perceived benefits and barriers on behavioral choices. The purpose of this study was to test the model's predictions about the influence of affective associations and benefits/barriers on fruit and vegetable consumption. Community adults (N=446) reported perceived benefits and barriers to fruit and vegetable consumption, affective associations with fruits and vegetables, and current fruit and vegetable intake. Affective associations predicted behavior and mediated the influence of benefits and barriers on behavior, supporting predictions made by the behavioral affective associations model. This highlights the need to incorporate affective factors in decision-making models and intervention strategies.

KEYWORD TERMS

Decision Making; Health Knowledge; Attitudes; Practice; Health behavior; Affect; Fruit; Vegetables; Humans; Adult; Diet

Fruit and vegetable consumption influences risk for multiple chronic diseases (Mokdad, Marks, Stroup, & Gerberding, 2004), but actual fruit and vegetable consumption is far lower than recommended levels (Guenther, Dodd, Reedy, & Krebs-Smith, 2006). Given this, it is important to understand factors influencing decisions about eating fruits and vegetables. In this paper, we examine the ability of the *behavioral affective associations model* (Kiviniemi, Voss-Humke, & Seifert, 2007) to account for fruit and vegetable consumption. The model focuses on the role of *affective associations* -- feelings, emotions, and affective states individuals associate with particular behaviors. The model makes predictions both about how affective associations relate to behavioral practices and how the effects of affective associations relate to those of more cognitively-based beliefs about both positive and negative outcomes of the behavior (for further discussion see Kiviniemi & Bevins, 2007). We report a study examining the relation between affective associations with fruits and vegetables and fruit and vegetable intake. In addition, we explore how the role of affective associations in determining behavior relates to that of perceived benefits of and barriers to fruit and vegetable consumption.

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A variety of formal theoretical models have been developed to account for decision making about health behaviors (for an overview see Glanz, Rimer, & Lewis, 2002). Although these models differ in terms of the specific constructs posited to influence behavior, most share a set of common features. Of particular relevance, most models focus on a class of cognitive constructs focusing on expected utility beliefs, assuming that deciding whether to engage in a particular behavior involves an estimation of the benefits which would accrue from the behavior and the costs that it would entail (Sutton, 1987). These costs and benefits are then weighed against one another to determine the overall utility of behavioral engagement. In the domain of fruit and vegetable consumption, both perceptions of the benefits to and of the costs of eating fruits and vegetables have been shown to influence individuals' consumption behavior (for a review see Baranowski, Cullen, & Baranowski, 1999).

An important potential influence on decision making that is not well-integrated in current models is the feelings that individuals associate with particular behavioral options, a construct labeled *affective associations* by Kiviniemi et al. (2007; see van der Pligt et al., 1998 for a broader discussion of influences of attitudes on decision making). Individuals have affective associations with specific health-related behavioral choices. With particular relevance in the context of dietary behavior, foods differ in their hedonic value to individuals (Blundell & Finlayson, 2004). Individuals are readily able to identify foods that they associate with positive affect (e.g., feelings of happiness associated with "comfort foods"; Wansink, Cheney, & Chan, 2003). On the other hand, negative affective associations with a food also impact the likelihood of consumption (e.g., feelings of fear about novel foods Birch & Marlin, 1982). Such affective associations have been shown to be separate and distinct from benefit/barrier beliefs and other cognitive beliefs for multiple behaviors including food choices (Aikman, Crites, & Fabrigar, 2006; Letarte, Dub, & Troche, 1997). The idea of affective associations is, in part, akin to the notion of anticipated regret about behavioral actions (Richard, van der Pligt, & de Vries, 1996; Abraham & Sheeran, 2003), affective components of attitudes (Crites, Fabrigar, & Petty, 1994), and affective somatic markers indicating risk associated with a behavioral option (Damasio, 1994; Kiviniemi & Bevins, 2007; for further discussion of the nature of affective associations see Kiviniemi et al., 2007).

Recently, Kiviniemi and colleagues (2007) proposed and empirically tested the *behavioral affective associations model*. The model describes the role of affective associations as influences on health behavior and accounts for the interplay of affective associations and cognitive constructs such as benefit/barrier beliefs in the decision-making process. There are three key tenets to the model. First, affective associations influence behavioral practices; the more positive (less negative) one's affective associations the more likely one is to engage in the behavior. Second, affective associations mediate the impact of cognitive beliefs on behavioral practices. The degree of favorability of one's beliefs about a behavior is one (but not the only) influence on how positive one's affective associations with the behavior are; affective associations in turn influence engagement in the behavior. Finally, affective associations influence behavior both through mediating the effects of cognitive beliefs and through a path independent of beliefs (for further discussion of the model see Kiviniemi & Bevins, 2007).

Kiviniemi et al. (2007) reported an initial demonstration of empirical support for the tenets of the model in the context of physical activity behavior. Affective associations with physical activity were a significant predictor of self-reported activity behavior. Moreover, affective associations mediated the influence on behavior of constructs from the theory of planned behavior and the health belief model. Finally, affective associations influenced behavior both by mediating the beliefs/behavior relation and through a pathway unrelated to beliefs; both of these components of affective associations were related to behavioral practices.

In general, health decision-making models are applied across a range of health behaviors. Given that the previous work on the role of affective associations as an influence on health decision making has focused on physical activity behavior, a primary goal for this study was to examine the generalizability of influences of affective associations on behavior by exploring the role of affective associations as influences on fruit and vegetable consumption.

More specifically, we tested three hypotheses derived from the key tenets of the behavioral affective associations model: more positive affective associations with fruits and vegetables would be associated with greater levels of fruit and vegetable consumption, affective associations would mediate the influence of benefits and barriers on fruit and vegetable intake, and affective associations with fruits and vegetables would influence behavior both by mediating the influence of benefits and barriers and by directly impacting behavior independent of benefits and barriers.

To test these hypotheses, we assessed adults' perceptions of the benefits of and barriers to eating fruits and vegetables, affective associations with fruits and vegetables, and current fruit and vegetable consumption. We then examined the relation between affective associations and consumption behavior, as well as the interplay of benefits, barriers, and affective associations as influences on behavior.

Methods

Participants were 446 adults from the Lincoln, NE metropolitan area. A sampling list of 1,000 telephone numbers was randomly generated from all listed numbers in the area. The 839 numbers determined to be households were called to recruit participants. The overall response rate was 53.2%. 255 households (30.4%) were contacted but declined to participate; the remainder could not be contacted.

A telephone survey procedure was used; the procedure was approved by the Institutional Review Board at the University of Nebraska-Lincoln. Because the sampling frame consisted of households but the data collection unit was individuals, an adult household member was randomly selected to participate (Salmon & Nichols, 1983). Questions were randomized such that for some participants behavior report questions appeared prior to benefit/barrier and affective associations questions, whereas for the remainder benefit/barrier and affective associations questions appeared prior to behavior questions[1]. The average completion time was 18 minutes.

Measures

Perceived benefits of and barriers to eating fruits and vegetables were assessed using items from Ling and Horwath's (2001) decisional balance scale (Benefits, 4 items, e.g., "A benefit of eating fruit and vegetables is that they would give me more vitamins and minerals"; Barriers, 2 items[2], e.g., "When I don't eat fruits and vegetables, it is because preparing and cooking them would be time consuming"). For each item, participants responded using a 5-point Likert-type scale with endpoints of 1=strongly agree and 5=strongly disagree. Items were recoded such that higher numbers indicated higher benefits or barriers. The means of the recoded items served as the measure of perceived benefits and barriers (Benefits: Cronbach's α=0.77; Barriers: α=0.60).

[1]Unfortunately the survey software does not record question order.

[2]The questionnaire contained four items. However, they had very low reliability (α=0.46). Item-total correlation analysis revealed that the two items selected for use were correlated highly with one another but that the remaining two were uncorrelated.

Affective associations were assessed with six items modified from the affective components subscale of Crites et al.'s (1994) affective associations with attitudes objects measure. The measure was selected because it is designed to provide a general measure of affective associations across a range of attitude objects, has been used successfully to assess affective associations with a variety of health behaviors (e.g., Kiviniemi et al., 2007; Trafimow & Sheeran, 1998), including affective associations with food items (Aikman et al., 2006).

Participants were given the question prompt "When I think about eating fruits and vegetables, I feel_____" followed by three positive (happy, joy, delighted) and three negative (sad, annoyed, sorrow) affect words. Each item was rated on a 5-point Likert-type scale with endpoints of 1=strongly agree and 5=strongly disagree. The three negative affect items were recoded and the mean of the six items served as the measure of affective associations (Cronbach's α=0.83).

Current behavior was assessed using the National Cancer Institute's brief fruit and vegetable servings questionnaire (Thompson et al., 1999). Results from such brief screeners are strongly correlated with more in-depth dietary recall assessments (Field et al., 1998) and have been shown to be effective for assessment of relative levels of intake across individuals (Thompson et al., 2000).

Participants reported their consumption of seven different categories of fruits and vegetables (e.g., "About how often did you eat green salad in the past month?"). Participants were given 10 response categories: "never", "1 to 3 times last month", "1 to 2 times per week", " 3 to 4 times per week", "5 to 6 times per week", "1 time per day", "2 times per day", "3 times per day", "4 times per day", and "5 times per day or more." Responses were used to compute servings per day for each category using the transformation algorithm described by NCI (2007, e.g., 3–4 times per week = 0.5 servings/day). The servings per day scores for each individual item were summed to create a summary fruit and vegetable consumption variable.

Analysis

We first examined the bivariate relations of benefits, barriers, affective associations, and fruit and vegetable consumption using regression techniques. The hypothesized meditational model was tested using bias-corrected bootstrapping estimates of the significance of the meditational effects (Preacher & Hayes, 2008). In this model, both benefits and barriers were modeled as observed exogenous independent variables and affective associations was modeled as an intervening mediator variable. For benefits and barriers, both direct paths to consumption and indirect paths through affective associations were modeled. The test of the meditational hypothesis in this modeling strategy is a significant indirect effect. These analytic techniques were also used to test the potential alternative hypothesis that affective associations might serve as a distal causal variable and benefits and barriers as mediators.

Finally, to test the prediction that affective associations would have an independent effect on behavior in addition to their role as a mediator of benefits and barriers, we partitioned the variance in affective associations scores into components related to and independent of benefits and barriers. This was done by estimating a regression equation in which benefits and barriers were simultaneously entered as predictors of affective associations. Both the predicted affective associations score and the residual score from this analysis were saved as separate new variables. The predicted score represents that portion of affective associations which are related to benefits/barriers and therefore would potentially influence behavior through the mediational pathway, whereas the residual score represents that portion of variance unrelated to and therefore independent of benefit/barrier beliefs. We then estimated a regression equation with fruit and vegetable consumption behavior as the criterion variable and cognitive beliefs-

related and independent affective associations as predictors. The significance of the slopes of the related and independent variance components serves as the key test of the third hypothesis.

Results

Participants in the study were 59% female and 96% white, non-Hispanic. Participants' mean age was 55 years old, and most participants reported at least some college education. On average, participants reported consuming 3.6 servings of fruits and vegetables per day.

The first hypothesis was that, when examined independently affective associations would be associated with fruit and vegetable consumption. Those with more positive affective associations with fruit and vegetable consumption reported more daily servings of fruits and vegetables, $\beta = 0.21$, $t\ (437) = 4.42$, $p < .001$. In addition, those who had higher perceived benefits of fruit and vegetable consumption reported greater consumption, $\beta = 0.15$, $t\ (437) = 3.01$, $p < .01$. Conversely, those who reported more perceived barriers reported lower daily servings, $\beta = -0.20$, $t\ (434) = -4.26$, $p < .001$.

The second hypothesis was that affective associations with fruit and vegetable consumption would mediate the effects of benefits and barriers on daily intake of fruits and vegetables. For both benefits and barriers, the indirect effects through affective associations were significant; benefits indirect effect = 0.28, $z = 2.24$, $p < .05$; barriers indirect effect=−0.12, $z = -2.14$, $p < .05$ (the indirect effect reported is the product of the IV-MV and MV-DV paths; see MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). In the case of benefits, when this indirect effect was modeled there was no direct effect of benefits on consumption, $b = 0.19$, $z = 0.82$, *ns.* For barriers, there was a significant direct effect in addition to the indirect effect, $b = -0.52$, $z = -2.65$, $p < .01$.

For benefits, there was no evidence to support the alternative hypothesis that affective associations serve as the distal variable and benefits and barriers as mediators. In this path model, there were no significant indirect effects, indirect effect = 0.089, $z = 0.82$, *ns*. For barriers, there was a significant indirect effect, indirect effect = 0.20, $z = 2.28$, $p < .05$.

The final hypothesis was that affective associations would influence behavior both by serving as a mediator of the impact of benefit/barrier beliefs on behavior and through a separate pathway independent of beliefs. Both the portion of variance in affective associations which was related to beliefs and that portion unrelated to beliefs significantly predicted fruit and vegetable consumption behavior, $\beta s = 0.21$ and 0.11, respectively, both ts (436) > 2.49, ps < .01, supporting this hypothesis.

Discussion

The results reported here consistently supported the hypotheses. Affective associations predicted fruit and vegetable consumption, mediated the effects of benefit/barrier beliefs on consumption, and influenced behavior both as a mediator of and independent of benefit/barrier beliefs. The cross-sectional design precludes making strong causal statements about the relations between constructs. However, there are several factors that support the mediational model specified here and argue against alternative model specifications. First, both benefit/barrier beliefs and affective factors have been shown to be causally antecedent to health behavior (Courneya, Friedenreich, Arthur, & Bobick, 1999; McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003), supporting the specified causal effect of affective associations and of benefit/barrier beliefs on behavior and arguing against a possible alternative model specification in which behavior causes affective associations. Second, although it would be plausible to posit that affective associations might be causally antecedent to benefit/barrier beliefs (given evidence for the primacy of affect and the development of cognitively-based

explanations for actions following intuitive judgments, e.g., Haidt, 2001; Zajonc, 1980), such an explanation is not consistent with the reported results. For perceived benefits, there is not statistical evidence to support this alternative hypothesis. In the case of barriers, the fact that the barrier-behavior relation is only partially mediated by affective associations precludes fully ruling out the alternate model. However, we would argue that the mediational model specified in the behavioral affective associations model is a more plausible account for the data; accepting the alternate model in the case of barriers would require the assumption that the decision making mechanisms by which barriers influence behavior are qualitatively different from those for benefits; this seems less plausible. However, we note that the alternate explanation cannot be fully ruled out for perceived barriers and studies testing both models should be conducted.

Why might it be the case that affective associations mediate the relation between benefits, barriers, and behavior? Some models of affect and behavior suggest that affect can serve as an automatic signal of the degree of utility or potential danger associated with a behavioral choice (e.g., Damasio, 1994). Such automatic signaling can be adaptive in that it allows decisions and behavioral responses to be made quickly and without the need for conscious effort on the part of the individual. This may be particularly true for repeated behaviors such as fruit and vegetable consumption, where the cognitive effort required to weigh benefits and barriers over time would hamper optimal self-regulation. There is, of course, a downside. To the extent that affective associations can automatically guide behavior, individuals may not always consciously regulate their behavioral practices. Such automatic processes might help to explain the limited effectiveness of interventions to change behavior. If pre-existing affective associations are guiding behavior with little or no conscious effort on the part of the person, attempts to alter behavior by shifting benefit/barrier beliefs may have little or no effect.

The central and proximal role of affective associations suggests a possible reason for the limited success of fruit and vegetable intervention strategies based on changing beliefs about benefits and barriers. Because beliefs are an indirect influence on behavioral practices, interventions designed to change those beliefs would only have an indirect influence on behavior. Given that there is not a one-to-one correspondence between beliefs and affective associations, cognitively-based interventions may have only a limited “downstream” effect on behavioral practices. Intervention techniques designed to directly alter affective associations might be a more direct and promising route to influencing behavior change. Affectively-based intervention approaches may have promise for encouraging healthier behavioral patterns in fruit and vegetable consumption and potentially other domains.

Naturally, there are limitations to the study which should be noted. First, as noted earlier the study design was cross-sectional. Although both past literature and the findings from this study are consistent with the idea that cognitive beliefs cause affective associations which, in turn, drive behavior, the cross-sectional design precludes drawing strong causal conclusions. Longitudinal studies of the interplay of affective associations, beliefs, and behavior would allow for stronger tests of causal relations, as would experimental studies manipulating specific variables in the model to assess their effects on other variables. Second, it is important to note that the vast majority of participants in the study were white, Midwestern Americans. The results reported here may not generalize to other population groups. In addition, we only operationalized two of a large number of potential cognitive influences on behavior; examination of other cognitive constructs is an important direction for future work, as is examination of other measures of benefits and barriers which might have higher reliability. Fourth, our operationalization of affective associations utilized a measure designed to assess affective associations in ways applicable to a variety of attitude objects. It may be the case that there are affective associations specific tor fruit and vegetable consumption which are not addressed fully by this measure. Finally, the operationalization of fruit and vegetable behavior in this study was based on a self-report instrument screening for fruit and vegetable

consumption patterns. Such screeners have been shown to be reliable and valid measures of behavior and to relate to behavior reports from more in-depth, objective methods, especially when the objective is looking at differences in consumption across individuals rather than precise measure of consumption patterns (Thompson et al., 2000). It is, however, important to note that the screener shares the limitations of self-report measures of behavioral practices (Thompson & Byers, 1994).

This study demonstrates that affective associations with fruit and vegetable consumption play a strong and central role in the decisions individuals make about their eating behavior. Affective associations serve as a proximal influence on behavior and mediate the impact of benefit/barrier beliefs about fruit and vegetable consumption. These findings have consequences for both our understanding of the decision-making processes involved in individuals' health behavior choices and for developing interventions to encourage healthier behavioral practices.

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