



10-2014

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Roles

Linda R. Donatoni: Class of 2010

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Jordan, C. H., Wang, W., Donatoni, L., and Meier, B. P. Mindful eating: Trait and state mindfulness predict healthier eating behavior. *Personality and Individual Differences* 68.1 (October 2014), 107-111.

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Abstract

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Keywords

mindfulness, eating, food attitudes, self-regulation, overweight, obesity

Disciplines

Nutrition | Psychology | Public Health

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In Press at *Personality and Individual Differences*

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Abstract

Obesity and excess weight are significant societal problems. Mindfulness may encourage healthier weight and eating habits. Across four studies, we found a positive relation between mindfulness and healthier eating. Trait mindfulness was associated with less impulsive eating, reduced calorie consumption, and healthier snack choices. In addition, we found a causal effect of mindfulness on healthier eating. An experimental manipulation of state mindfulness led participants to consume fewer calories in a spontaneous eating task. We also found preliminary evidence that mindfulness affects eating behavior by encouraging attitudinal preferences for healthier foods. Taken together, these results provide strong evidence that mindfulness encourages healthier eating, even in the absence of specific instruction in mindful eating. These results suggest that generic mindfulness-based strategies could have ancillary benefits for encouraging healthier eating behavior.

Key Words: mindfulness, eating, food attitudes, self-regulation, overweight, obesity

1. Introduction

Obesity and excess weight are significant societal problems. In a recent large sample of U.S. men and women, 68% were obese (BMI ≥ 30) or overweight (BMI ≥ 25) (Flegal, Carroll, Ogden, & Curtin, 2010). Although rates in European countries are not quite as high, they are increasing (European Commission, 2012). Excessive weight, moreover, is costly: It predicts poorer physical (e.g., diabetes; Malnick & Knobler, 2006) and mental health (e.g., lower well-being; Crandall, Merman, & Hebl, 2009). It is thus important to identify factors that can help people maintain healthier weight and eating habits. One such factor may be mindfulness.

Excessive weight has several causes including physical inactivity, over-consumption of convenient food, and genetics (Stern & Kazaks, 2009). A controllable behavioral cause is excessive calorie consumption. The U.S. had an increased per capita calorie intake from the 1970s to the 1990s, which likely increased obesity rates (Putnam, Kantor, & Allshouse, 2000). Plentiful food may be a culprit because it can lead to mindless eating or eating based on social and situational cues in addition to hunger cues (Wansink, 2006). The quantity and type of food consumed is affected by factors other than hunger, such as portion size (Savage, Fisher, Marini, & Birch, 2009), visibility (Painter, Wansink, & Hieggelke, 2002), and packaging (Stroebele, Ogden, & Hill, 2009). For example, people ate twice as many chocolates (100 more calories) per day when a candy bowl was placed on their desk versus six feet away (Painter et al., 2002).

1.1. Mindfulness

One way to reduce overconsumption may be through cultivating mindfulness, a focused, non-evaluative attention to and awareness of present events (Brown, Ryan, & Creswell, 2007). Mindful people experience their environments less defensively and allow positive and negative thoughts and feelings to occur with less judgment. Mindfulness is

associated with better mental health, relationship satisfaction, and self-regulation (Brown et al., 2007). It is an inherent human capacity that varies across individuals, with some being more mindful than others (e.g., Brown & Ryan, 2003). This capacity, moreover, can be developed through practices such as mindfulness meditation or training, which have been widely incorporated into treatments for anxiety, depression, and stress (e.g., Baer, 2003; Didonna, 2009; Kabat-Zinn, 2003; Teasedale et al., 2000).

1.2. Mindfulness and eating behavior

Mindfulness may encourage healthier eating. Available evidence suggests that mindfulness may facilitate weight management. Mindfulness-based interventions caused weight loss in obese men (Dalen et al., 2010) and women who eat frequently at restaurants (Timmerman & Brown, 2012). These interventions encouraged mindful eating specifically and taught participants about food choices. Similarly, individual differences in “mindful eating” (i.e., “non-judgmental awareness of physical and emotional sensations while eating or in a food-related environment,” Framson et al., 2009, p. 1439) predict lower BMI (Moor, Scott, & McIntosh, 2013). Thus, eating-specific mindfulness may encourage weight management. We examine whether general mindfulness might be similarly effective at least in terms of eating behavior.

Given widespread use of mindfulness training and its prominence in self-help books, we examined the impact of trait and manipulated state mindfulness on eating behavior. Mindfulness, even without specific training in mindful eating, may encourage people to better control portion sizes and choose less calorie-dense foods. Identifying such effects would contribute to evidence of the benefits of mindfulness (Brown et al., 2007). It would also fit with calls to examine “therapeutic lifestyle changes” (such as mindfulness meditation) as cost-efficient means of enhancing well-being (Walsh, 2011). Our primary purpose is thus to examine the relationship between general mindfulness and reduced calorie consumption.

One recent study has observed that more mindful individuals self-report consuming smaller serving sizes of calorie-dense foods (Beshara, Hutchinson, & Wilson, 2013). Studies 1 and 2 here provide convergent evidence of the association between mindfulness and eating behavior with a different self-report measure. Studies 3 and 4 extend this work by directly examining consumption behavior and food choices. We also extend this work by testing the causal impact of mindfulness by inducing state mindfulness in Study 3, and begin to examine the psychological mechanisms that may lead mindfulness to encourage healthier eating in Study 4.

2. Studies 1 and 2

We first examine trait mindfulness and uncontrolled eating in college students and a more general population in the U.S. We predicted that dispositional mindfulness, as a general quality of attention and awareness (Brown & Ryan, 2003), would predict reduced reports of uncontrolled eating, reflecting “overall difficulties in the regulation of eating” in response to external factors or hunger (Karlsson, Persson, Sjöström, and Sullivan, 2000, p. 1718).

2.1. Method

2.1.1. Participants

Eighty-nine undergraduates from a small U.S. college (Study 1; 49 females; age $M = 18.67$ years) and 157 individuals from across the U.S. (recruited through MTurk, Study 2; 102 females; age $M = 33.67$ years; located in 38 different U.S. states) completed online questionnaires. Participants’ self-identified ethnicity was Caucasian (92.1%), Black (2.2%), Asian/Pacific Islander (2.2%), Hispanic (1.1%), or other (2.2%) (Study 1); and Caucasian (85.8%), Black (7.5%), Asian/Pacific Islander (3.3%), Hispanic (0.8%), American Indian/Alaskan Native (0.8%), or other (0.8%) (Study 2).

2.1.2. Materials and Methods

Trait mindfulness. Participants completed the Mindful Attention Awareness Scale (MAAS) to measure dispositional mindfulness (Brown & Ryan, 2003). The MAAS consists of 15 items, such as, “I rush through activities without really being attentive to them,” rated on a 6-point scale with endpoints labeled 1 (Almost always) and 6 (Almost never). Items were averaged to reflect greater mindfulness ($\alpha = .84$ and $.91$ in Studies 1 and 2).

Uncontrolled eating. Participants also completed an uncontrolled eating scale (Karlsson et al., 2000). This scale consists of 9 items, including, “Being with someone who is eating often makes me hungry enough to eat also,” and, “When I see a real delicacy, I often get so hungry that I have to eat right away,” rated on a 4-point scale with endpoints labeled (definitely true) and (definitely false). Items were averaged to reflect more uncontrolled eating ($\alpha = .82$ and $.91$ in Studies 1 and 2).

We excluded 37 participants (22 female) from Study 2 (leaving 120 participants) who did not answer the instruction check accurately (a method for examining attention to instructions in online questionnaires). However, the results are equivalent when these individuals are included.

2.2. Results and Discussion

Overall, participants reported moderate mindfulness (Study 1: $M = 3.88$, $SD = .73$; Study 2: $M = 4.02$, $SD = .90$) and uncontrolled eating (Study 1: $M = 2.15$, $SD = .54$; Study 2: $M = 1.91$, $SD = .67$). Consistent with our expectations, trait mindfulness was significantly negatively correlated with uncontrolled eating: Study 1: $r(89) = -.33$; $p = .001$, Study 2: $r(120) = -.24$; $p = .009$, indicating that more mindful individuals report engaging in less uncontrolled eating.

3. Study 3

In Study 3, we extend Studies 1 and 2 in two ways. First, the results of Studies 1 and 2, though noteworthy, were based on self-report data and we therefore examined the relation

between trait mindfulness and consumption behavior. Second, in order to determine if mindfulness causally affects eating behavior, we manipulated state mindfulness with a brief mindfulness induction. We predicted that both trait and induced state mindfulness would predict reduced calorie consumption.

3.1. Method

3.1.1. Participants

Sixty undergraduates from a small U.S. college (30 females; age $M = 19.82$ years) participated for \$10. Participants' self-identified ethnicity was Caucasian (81.7%), Black (10.0%), Hispanic (5.0%), Asian/Pacific Islander (1.7%), or other (1.7%).

3.1.2. Materials and Methods

Trait mindfulness. A few days prior to the study, participants completed the MAAS online ($\alpha = .88$, $M = 3.89$, $SD = .75$).

Mindfulness induction. Participants came individually to a lab and were randomly assigned to a mindfulness or control task. Participants used an exercise mat and followed a 15-minute audio relaxation task. Those in the mindfulness condition heard part of a mindfulness body scan (Kabat-Zinn, 2002) that had them focus on their breathing, sensations, and various body parts sequentially. Others have used similar tasks to induce state mindfulness in a brief laboratory session (Cropley, Ussher, & Charitou, 2007; Ostafin & Kassman, 2012). Control participants heard a recording of similar length that guided them to relax without mindfulness instructions. Neither recording made reference to eating behavior.

Calorie consumption measure. After the manipulation, participants were asked to taste and rate foods in a secondary task. Participants sat at a table with three bowls filled with M&Ms, bite-size pretzels, and raw almonds. They were told to "eat as many [M&Ms/pretzels/almonds] as you like" and then indicate how much they liked the food, how flavorful it was, and how pleasant its texture was on a scale from 1 (*Not at all*) to 5 (*A lot*).

Each bowl was pre-weighed so that participants received the same amount. The rating task disguised the true purpose, which was to measure consumption amounts. This type of task has been used by others to surreptitiously assess consumption (e.g., Allan, Johnston, & Campbell, 2010). After the rating task, participants indicated how many hours it had been since they last ate and were debriefed. Post-consumption weight of the food bowls was measured.

We removed four participants who had food allergies, fell asleep during the manipulation, or left the lab room before the manipulation was complete (leaving 56 participants). The results are equivalent if these participants are retained.

3.2. Results and Discussion

The time since participants reported last eating ($M_s = 5.33$ & 5.24 hours) and trait mindfulness ($M_s = 3.84$ & 3.94) did not differ between conditions, $F_s < 1$. The amount of food eaten was converted into calories. The amount of calories eaten varied greatly on the upper end, which caused a positively skewed distribution (skewness = $.83$; $SE = .31$). A square-root transformation reduced the skew (skewness = $.17$; $SE = .31$). Means are reported in raw values to facilitate comprehension.

Participants in the mindful condition ate 24% fewer calories ($M = 149.17$; $SD = 91.11$) than control participants ($M = 197.58$; $SD = 90.24$), $t(54) = -2.24$, $p = .029$, $d = .60$. Trait mindfulness was also negatively correlated with calorie consumption, $r(56) = -.27$, $p = .045$. A regression analysis revealed no significant interaction between condition and trait mindfulness (centered), $t(52) = -.78$, $p = .44$. Thus, a brief state mindfulness induction and trait mindfulness were associated with less calorie consumption in a spontaneous eating task. These results replicate and extend those of Studies 1 and 2. Notably, the results for state mindfulness suggest a causal link between mindfulness and consumption behavior.

4. Study 4

In Study 4, we sought further convergent evidence that mindfulness reduces calorie consumption. To do so, we had participants choose between more or less calorie-dense snacks. We expected more mindful people to more often choose fruit than sweets. The fruit we offered participants contained fewer calories and less fat than the sweets. We also examined two potential mechanisms for the association between mindfulness and snack choices.

First, we further examined the possibility that mindfulness affects people's attitudinal food preferences. Individuals trained with a mindfulness-based intervention for eating disorders often report experiencing food differently; they perceive calorie-dense foods as "less appealing (saltier or greasier or less flavorful) than anticipated" (Kristeller & Wolever, 2011, p. 55). We examine whether people higher in dispositional mindfulness, who have not received specific training in mindful eating, similarly express less preference for calorie-dense foods. If so, attitudinal preferences may contribute to healthier food choices.

Second, we test whether the self-regulatory capacity of more mindful individuals contributes to healthier food choices. Problem behaviors like overconsumption of unhealthy foods are often linked to self-regulation failures (Stroebe, 2008), and trait mindfulness is associated with greater self-control strength (Brown et al., 2007). Thus, mindfulness may be associated with healthier food choices because more mindful individuals' self-control strength allows them to better resist impulses to eat unhealthy food. We examine the role of individual differences in self-control strength in the relation between mindfulness and food choice. We also examine whether mindfulness buffers the effects of ego-depletion on food choice. When people exert self-control in one situation, it impairs their ability to exert self-control in subsequent situations (Baumeister, Bratlavsky, Muraven & Tice, 1998). We thus manipulated ego-depletion to examine whether mindfulness buffers people from the effects of ego-depletion on food choice.

We expected more mindful people to more often choose fruit than sweets as a snack. We further expected that this effect may be due to stronger attitudinal preferences for fruits (than sweets) or greater self-control strength.

4.1. Method

4.1.1. Participants

One hundred undergraduates at a Canadian university (72 female; age $M = 18.84$ years) participated for course credit. Participants' self-identified ethnicity was European (53%), Asian/Pacific Islander (24%), African/Caribbean (4%), Latin, Central, or South American/Hispanic (4%), Middle Eastern (2%), or other (13%).

4.1.2. Materials and Methods

Participants completed the study individually. It was described as an investigation of food preferences and personality.

Trait mindfulness. Participants completed the MAAS ($\alpha = .80$, $M = 3.78$, $SD = .63$) as in the previous studies.

Attitudes toward fruits and sweets. Participants completed measures to assess attitudes toward fruits and sweets. They used a feeling thermometer scale with endpoints labeled 0° (extremely unfavorable) to 100° (extremely favorable). They reported attitudes toward cake, chocolate, candy, cookies, and chocolate bars as exemplars of sweets ($\alpha = .84$, $M = 73.73$, $SD = 16.56$), and oranges, apples, bananas, grapes, and pears as exemplars of fruits ($\alpha = .72$, $M = 70.32$, $SD = 13.01$).

Trait self-control. As a measure of self-control strength (Tangney, Baumeister, & Boone, 2004), participants rated 36 items, including, "I am good at resisting temptation," and "I do certain things that are bad for me, if they are fun" (reversed; $\alpha = .85$, $M = 3.26$, $SD = .44$), on a 5-point scale with endpoints labeled 1 (Not at all) and 5 (Very much).

Ego-depletion manipulation. Participants completed a standard ego-depletion manipulation (the e-crossing task) to deplete self-control capacity (Baumeister et al., 1998). Participants received two pages from a demanding statistics text. All participants crossed out every instance of the letter e on the first page. Control participants continued this easy task on the second page, but depletion condition participants crossed out every e except when a vowel appeared immediately after it or two letters before it. This task impairs performance on subsequent tasks requiring self-control (Baumeister et al., 1998). As a manipulation check, participants responded to three items measuring how much effort the task required (e.g., “How effortful was it to comply with the instructions for doing the task?”) on a 9-point scale ranging from 1 (Not at all) to 9 (Extremely).

Behavioral snack choice. At the end of the study, participants were offered a snack as “thanks” for participating. They could choose a fruit (apple or orange) or sweet (Kit Kat or cookies). Snack choice was coded 0 = sweet, 1 = fruit.

We excluded one participant for significant missing data, leaving 99 participants.

4.2. Results and Discussion

Overall, participants preferred fruits and sweets equally (48.5% chose sweets). Preliminary analyses revealed gender was related to mindfulness, such that men ($M = 4.10$, $SD = .51$) were more mindful than women ($M = 3.67$, $SD = .63$), $t(97) = 3.184$, $p = .002$. This gender difference likely reflects sampling variability. It is not typically observed in research using the MAAS (e.g., Brown & Ryan, 2003) and was not observed in Studies 1-3. We thus control gender in analyses involving mindfulness. No other gender effects emerged. As expected, ego-depletion participants reported expending more effort on the e-crossing task ($M = 6.43$, $SD = 1.46$) than control participants ($M = 5.31$, $SD = 1.73$), $F(1, 97) = 12.17$, $p = .001$.

We were interested in whether mindfulness predicted snack choice and whether ego-depletion affected less mindful participants more than more mindful participants. We thus conducted a step-wise logistic regression, with snack choice as the outcome variable. We regressed snack choice on trait mindfulness (centered), condition (effect coded: 1 = ego-depletion, -1 = control), and their interaction, while controlling gender. Gender, mindfulness, and condition were entered at step 1, with the interaction added at step 2. As expected, mindfulness predicted snack choice, $\beta = .74$, Wald $\chi^2 = 4.02$, $p = .045$. Participants high in mindfulness (+1 *SD*) chose fruit more often ($y' = 57\%$) than those low in mindfulness (-1 *SD*; $y' = 34\%$). Ego-depletion, however, did not affect snack choice, $\beta = .23$, Wald $\chi^2 = 1.19$, *ns*. Those in the ego-depletion condition (51%) were as likely as control participants (44%) to choose fruit. The interaction between mindfulness and ego-depletion was also non-significant, $\beta = .04$, Wald $\chi^2 = .02$, *ns*. Thus, mindfulness predicted snack choice, but there was no indication that this effect was due to differences in self-control. Consistent with this view, individual differences in self-control strength did not predict snack choice, $r(99) = .12$, $p = .236$, although they related positively to mindfulness, $r(99) = .53$, $p < .001$.

We also examined whether the relation between mindfulness and snack choice was due to attitudinal preferences. Consistent with this possibility, mindfulness was negatively related to attitudes toward sweets, $r(99) = -.24$, $p = .017$, and positively related to attitudes toward fruit, $r(99) = .27$, $p < .001$. In addition, choosing fruit (rather than sweets) was negatively related to attitudes toward sweets, $r(99) = -.35$, $p < .001$, and positively, though non-significantly, related to attitudes toward fruit, $r(99) = .13$, *ns*.

We calculated a difference score to represent attitudinal preference for fruit over sweets (by subtracting attitudes toward sweets from attitudes toward fruits) in order to test whether attitudinal preferences mediated the effect of mindfulness on snack choice. We focused on attitudinal preferences (for fruit over sweets) to correspond more closely to the

behavioral choice measure (which is inherently a measure of preference as participants had to choose between fruits and sweets). We conducted a bootstrapping mediation analysis with 5000 re-sampling iterations (Preacher & Hayes, 2004; Figure 1). We included gender and ego-depletion to control their effects. This analysis revealed a significant effect of mindfulness on preference for fruit (the mediator), $\beta = .38, p < .001$, and a significant effect of preference for fruit on snack choice (the outcome), $\beta = .79, p = .003$. There was also a significant indirect effect of mindfulness on snack choice, mediated through preference for fruit, $\beta = .30, p = .025$ (95% CI: lower bound = .07, upper bound = .72). The data are thus consistent with attitudinal preferences mediating the relation between trait mindfulness and snack choice.

Study 4 thus demonstrates that mindfulness is associated with healthier snack choices. More mindful people were more likely to choose fruit than sweets, compared to less mindful people. More mindful participants also reported more positive attitudes toward fruit and less positive attitudes toward sweets. This preference for fruit mediated the effect of mindfulness on snack choice. There was, however, no evidence that more mindful individuals' snack choices were related to self-control strength or capacity.

5. General Discussion

Across four studies, we established that mindfulness predicts reduced calorie consumption. Dispositional mindfulness was associated with reports of less uncontrolled eating, reduced calorie consumption in a spontaneous eating task, and greater likelihood of choosing fruit than sweets as a snack. In addition, we found evidence that general mindfulness causally affects eating behavior: An experimental manipulation of state mindfulness led participants to consume fewer calories. Notably, this mindfulness induction made no reference to food or eating behavior. Taken together, these results provide strong evidence that mindfulness encourages healthier eating, even in the absence of specific

instruction in mindful eating. Mindfulness may thus be a pertinent factor in a theoretical understanding of eating behavior. These results, moreover, tentatively suggest that generic mindfulness-based strategies could have ancillary benefits for enhancing healthy eating.

These findings extend recent evidence that more mindful individuals self-report less consumption of calorie-dense foods (Beshara, Hutchinson, & Wilson, 2013). Studies 1 and 2 demonstrate a convergent relation between mindfulness and reports of uncontrolled eating. Studies 3 and 4 extend this work by directly examining eating behavior, which has not been previously examined. Together, these findings offer compelling evidence that dispositional mindfulness is associated with reduced calorie consumption. We also found evidence that mindfulness causes reduced calorie consumption, by inducing state mindfulness in Study 3.

Our results further provide preliminary evidence that mindfulness encourages healthier eating by affecting attitudes toward different foods. Study 4 demonstrated that more mindful people have stronger preferences for fruits than sweets relative to less mindful people. This finding is consistent with the idea that mindful eating causes less healthy foods to become less appealing (Kristeller & Wolever, 2012). The relation between dispositional mindfulness and healthier snack choices was mediated by preferences for fruit over sweets.

In contrast, we found no support for the possibility that the self-control strength of more mindful individuals affects healthier eating. In Study 4, more mindful people reported greater self-control strength, but this factor was not related to snack choice. The results for self-regulatory capacity were also equivocal. Ego-depletion did not affect snack choice in Study 4, so whether mindfulness buffers people from the effects of ego-depletion could not be tested. These results nevertheless suggest that greater self-regulatory strength or capacity is not necessary for mindfulness to encourage healthier eating behavior. More mindful people, in Study 4, likely did not need to exert significant self-control, because they explicitly preferred the healthier snack option more than less mindful people.

Self-regulation strength may, however, play a role in other contexts where mindful individuals face greater temptation. Unhealthy eating may often result from a lack of self-regulation (Stroebe, 2008), which should be reduced by mindfulness. Indeed, we found that mindfulness was negatively related to reports of uncontrolled eating. The role of self-control strength in the relation between mindfulness and healthier eating thus deserves further attention. One possibility is that the greater self-control strength of more mindful individuals reduces impulsive eating in response to emotional stressors (e.g., Kristeller & Wolever, 2012). Thus mindfulness might buffer the effects of negative mood on consumption behavior.

6. Conclusions

The current studies provide convergent evidence, across diverse measures, that mindfulness encourages healthier eating through reduced calorie consumption. We found that mindfulness causally impacts eating behavior; briefly induced state mindfulness reduced calorie consumption in a spontaneous eating task. Thus, mindfulness, even in the absence of specific training in mindful eating, can encourage healthier eating practices. Given high rates of obesity and excess weight, ways to encourage healthier eating should be sought. The present findings suggest that generic mindfulness training or meditation practices may have the ancillary benefit of encouraging reduced calorie consumption. Even individuals who are not overly concerned with weight or body image may benefit from cultivating greater mindfulness. Mindfulness-based practices may thus constitute a “therapeutic lifestyle change” (Walsh, 2011) that can enhance health and well-being.

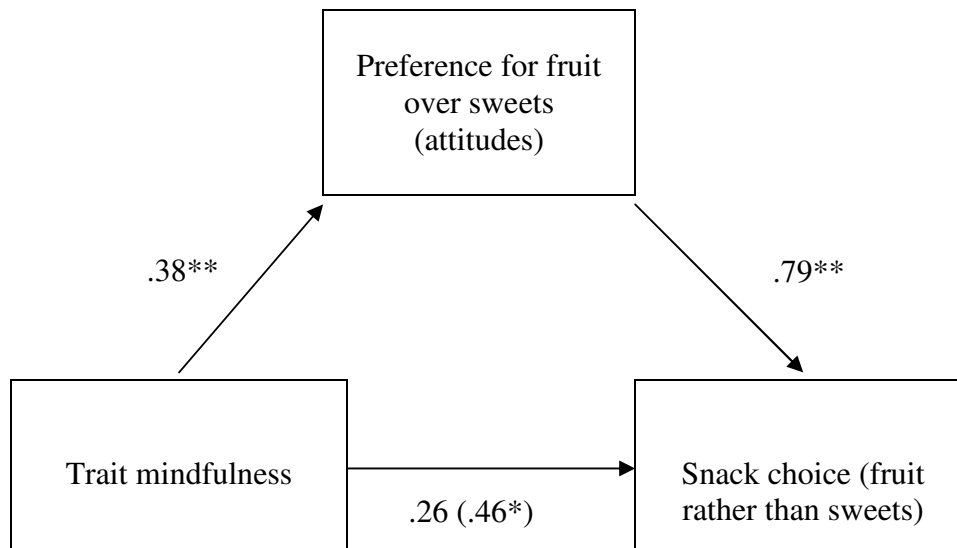
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Indirect effect: $\beta = .30, p = .025$ [95% CI: lower bound = .07, upper bound = .72]

Figure 1. Effect of mindfulness on snack choice mediated by preference for fruit over sweets (attitudes). Path values represent standardized coefficients. Snack choice was coded such that sweets = 0 and fruit = 1. The value in parentheses represents the total effect of mindfulness on snack choice prior to the inclusion of the mediating variable. The value outside of parentheses represents the direct effect of mindfulness on food choice after the mediator was included. * $p < .05$, ** $p < .001$.