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Research report

A brief mindfulness intervention reduces unhealthy eating when hungry, but not the portion size effect ☆

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ABSTRACT

Objective: The present research examined the effects of a mindfulness-based intervention to foster healthy eating. Specifically, we tested whether a brief mindfulness manipulation can prevent the portion size effect, and reduce overeating on unhealthy snacks when hungry. *Methods:* 110 undergraduate participants (M_{Age} = 20.9 ± 2.3; M_{BMI} = 22.3 ± 2.5) were served a small or a large portion of chocolate chip cookies after listening to an audio book or performing a mindfulness exercise (i.e., body scan). Current level of hunger was assessed unobtrusively on a visual analog scale before the eating situation. *Main outcome measure:* Calorie intake from chocolate chip cookies. *Results:* When presented with a large compared to a small portion, participants consumed more cookies (+83 kcal). This was not affected by the mindfulness intervention or by hunger. However, while control participants ate more unhealthy food when hungry than when not hungry (+67 kcal), participants in the mindfulness condition did not (+1 kcal). *Conclusions:* Findings confirm the prevalence and robustness of the portion size effect and suggest that it may be independent from awareness of internal cues. Prevention strategies may benefit more from targeting awareness of the external environment. However, mindfulness-based interventions may be effective to reduce effects of hunger on unhealthy food consumption.

Introduction

Many Western societies face rising numbers of overweight and obesity (WHO, 2010), a phenomenon that may be due to a positive food intake balance of less than 50 calories a day (Hill & Peters, 1998). The ubiquitous availability of tasty high-energy foods, especially snacks, has been recognized as a main contributor to this imbalance and hence the obesity epidemic. The mere presence of attractive high-calorie foods can make it difficult to resist them (Wansink, Painter, & Lee, 2006), even for people who are chronically concerned with controlling their weight (Papies & Hamstra, 2010; Papies, Potjes, Keesman, Schwinghammer, & van Koningsbruggen, in press; Papies & Veling, 2013). Merely perceiving attractive food triggers spontaneous simulations of eating it, including thinking about the taste, texture, and pleasure of eating the food (Papies, 2013), and it activates brain areas for taste and reward as if one were actually eating the food (e.g., Simmons, Martin, & Barsalou, 2005). These simulations of eating and the associated pleasure can trigger approach behavior (Papies, Barsalou, & Custers, 2012), and thus interfere with long-term goals of weight control.

Importantly, not only the availability, but also the portion size of high-calorie snacks has increased considerably over the past 30 years (Piernas & Popkin, 2010). This is highly problematic, as we tend to eat more food out of large than small portions, without compensating for this excess intake in subsequent meals – the so-called portion size effect (for a review see Wansink, 2004). The present research was designed to test a novel intervention strategy to prevent these effects of food temptations to eating behavior.

Research on the mechanisms underlying the portion size effect suggests that the size of the available portion works as an external cue of how much is appropriate to eat, which then determines intake (Wansink, 2004). Such external cues are especially powerful because consumers in industrialized societies are usually in a "zone of biological indifference", with little awareness of internal cues of hunger and satiety (Herman & Polivy, 2005). Portion size cues are so strong that they even override our own needs and preferences: in a study by Wansink and Kim (2005), participants increased their intake by 33.6% when offered a larger food container (i.e., 240 vs. 120 g), despite the fact that the food was stale (i.e., 14 days old popcorn), and even though many of the participants had just eaten lunch (Wansink, 2006). Hence, we suggest

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that helping consumers to be aware of and rely on internal signals of hunger and satiety might reduce the influence of external cues and lead to healthier eating. We test whether this can be achieved by a mindfulness-based intervention.

Mindfulness can be defined as an open, nonjudgmental attention to one's present-moment experiences, including one's behaviors, bodily sensations, thoughts and feelings (Bishop et al., 2004). One of the crucial training components in mindfulness programs is the body scan exercise, which trains participants to move their attention calmly to the different parts of their body, and to notice and accept the sensations they experience in an open and nonjudgmental way. This "mindful" perspective on one's own experiences, which participants are instructed to adopt during the body scan, has been shown to reduce impulsive responding to external stimuli, and to the thoughts that they trigger (Papies et al., 2012). Research on the body scan has shown that this increases awareness of internal cues (Alberts, Thewissen, & Raes, 2012), including cues of satiety and hunger (Kristeller & Wolever, 2010; Van de Veer, vanHerpen, & van Trijp, 2012). It also increases participants' tendency to compensate for the intake of unhealthy food by eating less unhealthy food later (Van de Veer et al., 2012). Here we suggest that this mindfulness exercise may reduce the degree to which we rely on external cues, such as portion size, when deciding how much to eat of an unhealthy snack, and as a result reduce the portion size effect.

An important internal cue that affects eating is the experience of how hungry we feel. Hunger typically boosts the perceived attractiveness especially of high-calorie foods (Lozano, Crites, & Aikman, 1999; Siep et al., 2009), leads to automatic approach responses (Seibt, Häfner, & Deutsch, 2007), and increases choices and intake of unhealthy, but not healthy food (Papies, Pronk, Keesman, & Barsalou, in preparation). Thus, on the one hand, when awareness of internal cues increases, intake of unhealthy food may be higher when participants are hungry compared to when they are not hungry. On the other hand, however, recent research in eating behaviors has shown that mindfulness-based interventions can eliminate impulsive reactions toward unhealthy food (Hamilton, Fawson, May, Andrade, & Kavanagh, 2013; Papies et al., 2012), lead to healthier food choices (Dalen et al., 2010) and decrease actual intake of unhealthy food when hungry (Papies et al., in preparation). In order to test these competing hypotheses, we included a measure of hunger in the current study and examined how a mindfulness-based intervention affects the impact of hunger on the consumption of chocolate chip cookies as an afternoon snack.

Method

Participants

Participants were a convenience sample of students of Tilburg University who received course credit or € 8 for participation. Three participants were excluded for reporting falling asleep and four for reporting they thought they might have fallen asleep (all in the body scan condition), three for not following all the instructions and one because of a cookie allergy, resulting in a sample of 110 students (M_{Age} = 20.9 ± 2.3; M_{BMI} = 22.3 ± 2.5). Power analysis shows that with an effect size of 0.25 and an alpha level of 0.05, we needed a total sample of 95 participants (approximately 24 participants per condition) to obtain a power of 0.8 (Cohen, 1988).

Design

The study used a 2 (Portion size: small vs. large) × 2 (Intervention: control vs. body scan) between-subjects design, with self-reported hunger as an additional continuous variable. Participants were assigned to conditions based on a Latin square randomization: small portion – audio book (n = 25, 5 male), small portion – body scan (n = 30, 11 male), large portion – audio book (n = 30, 9 male) and large portion – body scan (n = 25, 7 male). The study was approved by Tilburg University's Ethics committee.

Portion size and foods

Participants were served two types of chocolate chip cookies (Choc chip mini's, Verkade, Zaandam, Netherlands and Prince Mini Stars, Kraft Foods/Lu, Northfield, Illinois, US), which were chosen as the afternoon snack based on a pilot study (N = 10). Portion size was based on national data regarding average intake amount of cookies during an afternoon snack (i.e., 30 g, Dutch National Food Consumption Survey 2007–2010). This amount was increased to determine the small portion, so that intake would not be artificially limited to the amount initially served. Thus, the small portion weighed 51 g (247.5 kcal) and contained 10 cookies, five of each type. The large portion was three times as large (153 g, 30 cookies, 742.5 kcal). Cookies in both conditions were served on a white plastic plate. All participants were served the same amount of water (15 cl) in a plastic cup. Food and beverage intake were assessed with a food scale and computed by subtracting intake from amount served (within 1 g; Digital Kitchen Scales, Brabantia). Amount of food consumed was operationalized as calorie intake, obtained by converting amount of grams consumed into kcal according to the manufacturer's package information. None of the participants asked for a refill (water or cookies).

Intervention

Participants listened to the introduction of the audio book "The Digital Fortress" by Dan Brown (i.e., the first 14 min) or to the body scan, a typical mindfulness exercise. The book was chosen because it is unrelated to body-, weight- or food-specific themes. The body scan meditation instructions were created according to the typical structure of a body scan (Cropley, Ussher, & Charitou, 2007) and written by the authors based on a synthesis of body scan instructions. This exercise guides attention to the different parts of the body and instructs participants to simply observe all sensations in an open and nonjudgmental way. Importantly, no mention was made of mindfulness or meditation. The instructions were paced such that participants had ample time to move their attention to the various body parts and observe their thoughts and body sensations in a nonjudgmental manner. The body scan lasted 14 min. in total, and was read by a female voice and recorded digitally. The clarity of the body scan instructions was tested in a pilot study (N = 33).

Procedure

The study was advertised as two different experiments, but did not mention mindfulness or snacking. It took place between 2 and 5 pm, and lasted approximately 45 min. Upon arrival, participants were seated in individual cubicles. They were asked to put on headphones and to follow the instructions on their computer screen. Depending on condition, they listened to the audio book or to the instructions for a body scan exercise. Then participants answered questions about their mood and the audio recording to support the cover story (i.e., study on information processing). These questions were also used to unobtrusively include a measure of their current levels of hunger and thirst (on visual analog scales, Marchiori, Waroquier, & Klein, 2011).

Next, the experimenter started what was presented as the next experiment (i.e., a study on consumer experience). Participants were served a glass of water and a plate containing two types of