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Non-Food Odorants Reduce Chocolate Cravings

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Abstract

The present study compared the relative effectiveness of simple, commercially available food and non-food olfactory tasks on chocolate craving reduction. Chocolate cravings were induced by a series of coloured photographs and 67 undergraduate women were asked to smell one of three odours (green apple, jasmine, or water). The non-food odorant (jasmine) significantly reduced chocolate cravings relative to both the food and control odorants. Thus simple non-food odorants offer potential scope as a technique for curbing unwanted food cravings.

Keywords: craving; chocolate; food; odour; craving reduction

The term 'craving' describes a motivational state in which an individual feels compelled to seek and ingest a particular substance (Baker, Morse & Sherman, 1986). Although the term is usually applied to drugs, the construct applies to any substance, including various food stuffs. Thus food cravings refer to an intense desire or urge to eat a specific food (Weingarten & Elston, 1990), and it is this specificity that distinguishes a food craving from generalized hunger (Pelchat, 2002). In Western cultures by far the most commonly craved food, especially for women, is chocolate (Hetherington & Macdiarmid, 1993).

Although occasional food cravings occur among a large proportion of the general population without any problem (Lafay et al., 2001), recurrent food craving episodes can be maladaptive for some individuals. In particular, cravings for chocolate can be especially problematic. Chocolate is considered an indulgence that should be eaten with restraint (Rogers, 1994), and avoided altogether in many weight-loss diets (Knight & Boland, 1989). However, attempting to resist chocolate only increases the desire for it (Rogers & Smit, 2000), which is likely to result in unwanted consumption and subsequent feelings of guilt (Macdiarmid & Hetherington, 1995). Chocolate cravings have also been linked to binge eating in women with bulimia nervosa (Mitchell, Hatsukami, Eckert & Pyle, 1985) and to overeating in obese women (Bjoervell, Roennberg & Roessner, 1985). Thus there is a societal need to develop techniques for curbing problematic chocolate cravings.

Recent research has demonstrated that performing a visual or olfactory imagery task can reduce food cravings. For example, Kemps and colleagues (Harvey, Kemps & Tiggemann, 2005; Kemps & Tiggemann, 2007) showed that scripts that asked participants to imagine common sights (e.g., a rainbow) or smells (e.g., eucalyptus) reduced cravings for food and chocolate in a way that imagining everyday

sounds (e.g., a siren) did not. Similar reduction effects have been reported for cigarette (May, Andrade, Panabokke & Kavanagh, 2010; Versland & Rosenberg, 2007) and caffeine craving (Kemps & Tiggemann, 2009). These results are consistent with the proposition that mental imagery is a key component of food craving, and that craving-related imagery is predominantly visual and olfactory in nature (May, Andrade, Panabokke & Kavanagh, 2004; Tiggemann & Kemps, 2005). According to the logic of the Elaborated Intrusion Theory of Desire (Kavanagh, Andrade & May, 2005), visual and olfactory imagery tasks reduce food cravings by introducing information in the same sensory modality as the imagery associated with the craving, thereby competing for limited cognitive resources.

However, tasks that involve forming mental images are time-consuming and cognitively effortful, and hence unlikely to provide any practical tool. Instead, simpler and less demanding tasks are required. Indeed, simple visual tasks, such as watching a flickering pattern of random black and white dots ('dynamic visual noise'), have been shown to reduce food cravings (for a review, see Kemps & Tiggemann, 2010). More recently, a simple olfactory task involving smelling a 'random' odour has likewise been shown to reduce cravings for both savoury and sweet foods, including chocolate, relative to a comparable auditory interference task and a no-task control condition (Kemps & Tiggemann, under review). Earlier, Sayette and Parrott (1999) demonstrated that a brief odour exposure reduced cigarette cravings in smokers.

The 'random' odour used to successfully reduce food cravings above is a chemical product that is not widely available. The use of a commercially available odorant in its stead would have much greater practical applicability. In addition, there remains the practical question as to what kind of odour is maximally effective. There is a wide range of commercially available odorants from which to choose, both food-

related (e.g., vanilla, lemon) and non-food related (e.g., eucalyptus, lavender). The current experiment presents a preliminary investigation into the craving reducing effects of such food and non-food odours in a non-clinical sample. In particular, we aimed to compare the effects of a food (green apple) and a non-food (jasmine) odour on chocolate craving. We reasoned that a food odour would be more likely to augment cravings, as the smell of food, e.g., freshly baked biscuits, is one technique for eliciting food cravings (Fedoroff, Polivy & Herman, 1997, 2003). A non-food odour, on the other hand, would not be compromised in this way. Accordingly, we predicted that the non-food odour would be more effective than the food odour in reducing chocolate cravings.

Method

Participants

Participants were 67 female undergraduate students at Flinders University who took part for course requirements and credit. They were aged between 18 and 35 years ($M = 21.12$, $SD = 4.11$). We specifically recruited a sample of young women, because food cravings are more prevalent in women than in men (Weingarten & Elston, 1991), and decrease in frequency and intensity with age (Pelchat, 1997). As food cravings are less frequent and less intense in a state of satiety (Cornell, Rodin & Weingarten, 1989; Hill, Weaver & Blundell, 1991), participants were instructed to abstain from eating and drinking (water was allowed) for two hours prior to testing. All participants also reported that they liked chocolate, in response to the yes/no question “Do you like chocolate?”.

Design

The experiment used a within-subjects design with one independent variable, odour condition, and one dependent variable, chocolate craving. The three levels of odour condition (control, food, non-food) were presented in counterbalanced order.

Materials

Craving Induction. The stimuli were 30 digital coloured photographs depicting attractive images of ten categories of chocolate-containing food: chocolate cake (whole), chocolate cake (slice), chocolate bar, chocolate brownie, chocolate pudding, chocolate muffin, chocolate ice-cream, chocolate biscuit, chocolate mousse and chocolate doughnut. There were three different pictures per food category. The photographs were presented as a series of Powerpoint slides and divided into three equivalent sets each comprising one picture from each of the ten categories. Stimulus sets were counterbalanced across odour conditions. Stimuli within each set were presented in a single random order.

We conducted a pilot study to select the photographic stimuli. We sourced 186 photographs depicting chocolate-containing food from the internet. Twelve female participants, aged 25 to 33 years ($M = 28.27$, $SD = 2.83$), rated each photograph on how representative, or prototypical, it was of the relevant food category on a scale ranging from 0 ('not at all representative') to 10 ('ideal representation'). The three most representative or prototypical photographs from each category were included in the experiment. Average ratings of the chosen photos ranged from 6.50 ($SD = 2.32$) to 9.17 ($SD = 1.11$).

Odours. Odours were chosen to be familiar everyday ones. In the food odour condition, participants smelled green apple, and in the non-food odour condition they smelled jasmine. These particular odours were selected through a pilot study. We presented 20 female participants, aged 18 to 35 years ($M = 25.95$, $SD = 4.90$), with 8 fragranced oils (cinnamon, vanilla, green apple, banana, gardenia, sandalwood, jasmine and lavender). Participants smelled each odour and rated it both on food-relatedness and pleasantness. The food-relatedness scale ranged from 0 ('not at all reminiscent of food') to 10 ('very much reminiscent of food'). The pleasantness scale similarly ranged from 0 ('extremely unpleasant') to 10 ('extremely pleasant'). Green apple had the highest mean food-relatedness rating ($M = 7.20$, $SD = 2.33$), and jasmine the lowest ($M = 1.15$, $SD = 1.73$). Mean pleasantness ratings for the two odours were high (green apple: $M = 7.05$, $SD = 2.42$; jasmine: $M = 7.75$, $SD = 1.55$), and not significantly different from one another, $t(19) = 1.01$, $p > .05$. Following Sayette and Parrott (1999), participants in the control condition smelled a neutral (non)odour, namely water. This controlled for potential effects of effort ('sniffing') and involvement in the task.

Procedure

Participants were tested individually in a quiet room in the Applied Cognitive Psychology Laboratory in a session of 30 min. duration. They were seated approximately 50 cm in front of an IBM compatible computer with a 17-inch monitor. Participants completed a total of 30 trials, comprising 10 pictures for each of the three odour conditions. On each trial, a stimulus picture was presented for 5 s. Participants were instructed to retain an image of the picture for a further 8 s. They then rated their chocolate craving intensity on a 100-mm visual analogue scale, ranging from "no

desire or urge to eat chocolate” to “extremely strong desire or urge to eat chocolate”.

This methodology has been shown to effectively elicit chocolate cravings in the laboratory (Kemps, Tiggemann & Hart, 2005).

During the retention interval, participants were given the relevant odour to smell. The experimenter opened an opaque vial containing the oil (or water) and held it under the participant’s nose. Odours were refreshed each new day of testing to ensure smells did not change or become stale over time.

Results

Chocolate craving ratings were averaged over the 10 trials for each odour condition. These were analysed by a repeated measures ANOVA, with post-hoc comparisons using a Bonferroni correction for multiple comparisons. An alpha level of .05 was used to determine significance. Calculations of effect size were based on Cohen’s *d*, with cut-off values of .20, .50, and .80 for small, medium and large effects, respectively (Cohen, 1988). Descriptive statistics are shown in Table 1.

As can be seen in the table, participants reported moderate levels of chocolate craving, around the mid-point of the scale. The ANOVA showed that there was a significant effect of odour condition, $F(2, 130) = 3.35, p < .05, d = .45$. As predicted, chocolate craving ratings were significantly lower in the condition in which participants smelled jasmine than in the green apple, $p < .05$, and water, $p < .05$, conditions. Ratings in the green apple and control conditions did not differ from each other, $p > .05$.

Discussion

The study has demonstrated (to our knowledge for the first time) that a commercially available non-food odour, jasmine, clearly reduced chocolate cravings, relative to both the neutral control odour of water and the food odour of green apple. This is consistent with our prediction that a non-food odour would be more effective at reducing food cravings than a food odour, based on the rationale that exposure to a food odour can elicit craving (Fedoroff et al., 1997, 2003). Further, the finding has been demonstrated with cravings for chocolate, the most commonly and strongly craved substance. In addition, the comparison with water reassures that the observed craving-reducing effect is not due to the act of sniffing per se.

At a practical level, simply sniffing an odour provides a much less cognitively demanding alternative to forming elaborate mental images of odours, which has been shown to reduce food cravings (Kemps & Tiggemann, 2007). Hence it has greater potential for acceptance and adoption as a craving reducing technique. Further, using a commercially available odour, as opposed to a “random” chemically-constructed odour, carries the advantage of ready accessibility. For example, people could potentially purchase such an odorant locally, carry it around with them and smell it whenever they have a food craving. The present findings showed that a non-food odorant would be maximally effective. Thus this could provide a particularly useable tool for curbing unwanted food cravings and resultant (over)eating, implicated in both weight gain and binge eating disorder (McManus & Waller, 1995; Schlundt, Virts, Sbrocco & Pope-Cordle, 1993).

In this experiment cravings were induced visually by showing participants pictures of chocolate. This has a high degree of ecological validity as people are often

exposed to such visual food cues through billboards, magazine advertisements and television commercials. The finding that an olfactory task can reduce chocolate cravings that were induced visually provides evidence that it is the sensory modality of the craving itself, rather than that of the craving induction procedure, that is important. Nevertheless, future research could investigate cravings that have been elicited through exposure to the smell of food.

Like all studies, the present research carries a number of limitations. First, participants were all female university students of mostly normal weight. In line with previous empirical data for female undergraduate students (Kemps et al., 2005), mean chocolate craving scores of the current sample were around the mid-point of the scale. Future research needs to replicate the present findings in samples of individuals for whom chocolate cravings are problematic, i.e., “chocoholics”, as well as binge eaters, overweight or obese individuals who are trying to lose weight, and individuals affected by eating disorders (Gendall, Joyce, Sullivan & Bulik, 1998; McManus & Waller, 1995; Sitton, 1991). Second, this initial investigation into the craving reducing effects of commercially available odorants was limited to just one food and one non-food odour. Future research should test a wider range of food and non-food odours to ensure that the results generalise to other odorants.

Despite these limitations, the experiment makes a useful contribution to the growing literature on food craving. We have demonstrated that the simple act of sniffing a non-food odour can reduce laboratory-induced cravings for chocolate. Future work will need to investigate the potential of such simple olfactory techniques to curb real unwanted cravings.

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Table 1

Means and standard deviations for chocolate craving ratings for the three odour conditions

	<i>M</i>	<i>SD</i>
Water	49.21	24.10
Green apple	46.93	25.39
Jasmine	42.90	24.88