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Effects of hunger and visuo-spatial interference on imagery-induced food cravings

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Abstract

The present study investigated the effects of hunger and visuo-spatial interference on imagery-induced food cravings. Forty-two women were randomly assigned to a hungry (no food for prior 4 h) or not hungry condition. Participants were asked to form and maintain images of desired foods while looking at a blank computer screen (control condition) or performing a task designed to load the visuo-spatial sketchpad of working memory (dynamic visual noise). They then rated the vividness of their images and their craving intensity. Although hungry participants reported stronger food cravings, dynamic visual noise made images less vivid and cravings less intense, irrespective of participant hunger status. Thus concurrent visuo-spatial processing may offer a useful technique for treating problematic food cravings that are predominantly psychological in origin, as well as those that are hunger-driven.

Keywords: Food cravings; Hunger; Imagery; Working memory; Visuo-spatial sketchpad

Introduction

Food cravings refer to intense desires or longings that are specific to the individual and that serve to motivate them to seek out and ingest a particular food (Cepeda-Benito and Gleaves, 2001). Such cravings are a common occurrence. For example, Weingarten and Elston (1991) reported that up to 97% of female and 68% of male college students experienced food cravings. Although food cravings are typically not pathological in nature, high levels of craving have been associated with dietary restraint, compulsive eating (Federoff, Polivy, & Herman, 2003; Green, 2001), obesity (Greeno, Wing, & Shiffman, 2000; Wurtman & Wurtman, 1995), and binge eating, especially in individuals with bulimia nervosa (Gendall, Joyce, Sullivan, & Bulik, 1998; Mitchell, Hatsukami, Eckert, & Pyle, 1985; Waters, Hill, & Waller, 2001). It is these potentially serious consequences that make investigation of the mechanisms underlying food craving crucial.

While most researchers agree that cravings have at least some physiological basis, serving as a signal from the body that a nutritional deficiency and/or energy depletion needs to be redressed (Gibson & Desmond, 1999; Hill & Heaton-Brown, 1994; Weingarten & Elston, 1990), research has also established that hunger is not a necessary condition for the occurrence of food cravings. For example, Cornell, Rodin and Weingarten (1989) found that participants both reported cravings for and consumed pizza and ice cream upon presentation of these foods, irrespective of whether they were hungry or satiated. Similarly, Lambert, Nearl, Noyes, Parker, and Worrel (1991, 1992) have replicated this finding for chocolate. Thus physiological factors do not provide the entire origin of food cravings. Instead, the psychological literature cites an association between craving and negative mood states, such as depression (Dye, Warner, & Bancroft, 1995), anxiety (Jansen, 1998) and stress (Weingarten & Elston, 1991). Additionally, indulging a craving may initially produce a rush of positive affect, but is often followed by feelings of guilt and shame (Macdiarmid & Hetherington, 1995).

More recent investigations from a cognitive perspective suggest that there is an imagery basis to food cravings. For example, Green, Rogers, and Elliman (2000) elicited food cravings in the laboratory via the use of imagery, and found that such cravings interfered with cognitive performance. Evidence from the surveys of May, Andrade, Panabokke, and Kavanagh (2004) and Tiggemann and Kemps (in press) corroborates that mental imagery is an important component of everyday cravings. In fact, Kavanagh, Andrade, and May (2005) have proposed a cognitive model of craving that

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assumes imagery to be at the core of the craving experience. In support, Harvey, Kemps, and Tiggemann (2005) document a positive relationship between the vividness of visual imagery and the intensity of the food craving experience.

In recent years, imagery has been conceptualised within a working memory framework (Pearson, 2001). The most widely adopted model of working memory is that proposed by Baddeley and Hitch (1974) and Baddeley (2000), comprising a central executive and two limited-capacity subsystems, the visuo-spatial sketchpad and the phonological loop. The visuo-spatial sketchpad and phonological loop are responsible for the generation and maintenance of visual and auditory images, respectively. Because of their limited capacity, a reduction in processing efficiency occurs when additional load is placed upon the visuo-spatial sketchpad (phonological loop), such that information already in storage cannot be effectively retained when two tasks are competing for the same processing resources.

Applying this reasoning, Kemps, Tiggemann, Woods, and Soekov (2004) demonstrated that loading the visuo-spatial sketchpad with a concurrent task while imagining popular foods (e.g. chocolate and cake) triggered by pictures reduced the vividness of participants' food images, and correspondingly their level of craving. One such concurrent task was dynamic visual noise, which involved watching a flickering pattern of random black and white dots (Quinn & McConnell, 1996). Kemps, Tiggemann, and Hart (2005) subsequently showed that chocolate cravings were reduced more by concurrent dynamic visual noise than by a concurrent auditory task, demonstrating that interfering with the operation of the visuo-spatial sketchpad is a more effective way of reducing cravings than is interfering with the functioning of the phonological loop.

An important issue that has not been considered in this context is hunger. In particular, it is not clear how much of the craving in the previous studies may have been due to hunger. Although there is some ambiguity in the general craving literature as to the precise role of hunger in food cravings (Cornell et al., 1989; Denton, 1984; Hill, Weaver, & Blundell, 1991; Kassel & Shiffman, 1992; Lambert et al., 1991, 1992), the distinction between cravings that are and are not derived from hunger may be a particularly important one, given that cravings arising for reasons other than hunger have the greater potential for problematic consequences. Accordingly, the current study sought to extend previous research by testing the efficacy of concurrent dynamic visual noise for reducing food cravings that were hunger driven as well as those that were not.

The present study also sought to simulate a more naturalistic craving experience by asking participants to nominate their own craved foods, rather than using pictorial representations of specific yet commonly craved foods as in previous studies. It is possible that generally popular foods would not be craved by all individuals, and also that what is craved at any time may differ according to hunger status. Thus, stimuli were carefully tailored to the craving experience of the individual at the specific point in time. In addition, the current study included measures of habitual food craving, restrained eating and general imaging ability as potential covariates.

Method

Participants

Participants were 42 first year female psychology students from Flinders University, who volunteered to take part in the study in exchange for credit towards their degree. They ranged in age from 18 to 33 years. On registering interest, students were randomly assigned to either a hungry or not hungry condition and provided with the appropriate pre-testing preparatory instructions. Those in the hungry condition were asked to refrain from eating or drinking anything but water for at least 4 h prior to the testing session. Those in the not hungry condition were asked to eat immediately prior to the session. Initial hunger ratings (100 mm visual analogue scale) taken at the commencement of the testing session indicated two distinct groups, $t(40)=8.5$, $p<0.001$. Those in the hungry condition reported much greater hunger ($M=60.1$, SD $=23.4$) than those in the not hungry condition ($M=10.1$, SD $=13.4$).

Design

The study utilised a 2×2 mixed factorial experimental design with the between-subjects factor of hunger status (2, hungry, not hungry) and the within-subjects factor of concurrent task (2, control, dynamic visual noise).

Procedure

Participants were tested individually, in a session lasting approximately 30 min. They first performed the imagery task and concurrent tasks and then completed self-report ratings of habitual food craving, restrained eating and imaging ability. Participants' height and weight measurements were obtained and used to calculate body mass index (weight in kilogram/height in meter squared).

Imagery task. Participants were asked to provide a list of the three foods that they would like to eat most 'right now'. These foods then served as the stimuli for the imagery task. The most commonly reported foods were pasta (26%), chocolate (24%), and ice cream (11%). No difference in pattern was detected for the nominated foods by hunger status group. Participants provided baseline ratings of imagery vividness and craving intensity for each food using 100 mm visual analogue scales. For imagery vividness ratings, anchors ranged from 'no image at all' to 'image perfectly clear—as vivid as normal vision'. For craving intensity ratings, the anchor points were 'no desire or urge to eat this food' to 'extremely strong desire or urge to eat this food'. The baseline ratings of craving intensity provided a means of ranking the foods from most craved through to least craved, which were then used to counterbalance the order of foods and concurrent tasks for each trial. There was one trial for each of the three nominated foods per concurrent task condition.