



## The role of expectations in the effect of food cue exposure on intake



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### ABSTRACT

Pre-exposure to food cues has often been shown to increase food intake, especially in restrained eaters. This study investigated the role of expectations in the effect of such pre-exposure on food intake. A sample of 88 undergraduate women was exposed to visual food cues (photos of grapes and chocolate-chip cookies). In a  $2 \times 2 \times 2$  design, participants were explicitly told to expect that they would be tasting and rating either grapes or chocolate-chip cookies. Participants subsequently completed an ostensible taste test, in which they tasted and rated either grapes or cookies, such that half were given the food that they had been led to expect and the other half were given the other food. Participants' restraint status (restrained versus unrestrained) was based on their scores on the Revised Restraint Scale (Herman & Polivy, 1980). A significant interaction between expected food and restraint status was found. When participants were led to expect that they would be tasting grapes, restrained and unrestrained eaters did not differ in their subsequent consumption (of either grapes or cookies). However, when participants were led to expect that they would be tasting cookies, restrained eaters ate significantly less (of both grapes and cookies) than did unrestrained eaters, even though craving ratings were similarly elevated for both restrained and unrestrained eaters. The findings are consistent with counteractive control theory in that restrained eaters who expected to eat a high caloric food may have been able to activate their dieting goal, thereby limiting their food intake. The findings further point to an important role for expectations in the understanding and regulation of food intake in restrained eaters.

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Food cues abound in contemporary Western societies. People are continually exposed to food cues in shops, fast-food outlets and vending machines, as well as through advertising on television, bill-boards and public transport. Mere exposure to food cues can increase people's food intake. For example, Cornell, Rodin, and Weingarten (1989) showed that pre-exposing participants to pizza or ice-cream increased their subsequent intake of those foods. Similarly, Painter, Wansink, and Hieggelke (2002) reported that office workers ate more chocolates if the chocolates were in plain view on the desk than if they were in a drawer.

A heightened responsivity to food cues is evident in overweight and obese individuals, as well as in restrained eaters, who chronically restrict their food intake in order to lose weight or avoid gaining weight (Herman & Polivy, 2008). Several studies have

shown that seeing, smelling, tasting, or even just thinking about a palatable food increases salivation (Klajner, Herman, Polivy, & Chhabra, 1981; Legoff & Spigelman, 1987), brain reward activity (Coletta et al., 2009; Demos, Kelley, & Heatherton, 2011) and food intake (Coelho, Jansen, Roefs, & Nederkoorn, 2009; Fedoroff, Polivy, & Herman, 1997; Jansen & van den Hout, 1991; Rogers & Hill, 1989) in restrained eaters relative to unrestrained eaters. It has been suggested that exposure to food cues stimulates disinhibited eating in restrained eaters because it elicits a specific craving for the cued food (Fedoroff, Polivy, & Herman, 2003; Polivy, Coleman, & Herman, 2005).

However, not all studies have observed increased food intake in response to food-cue pre-exposure in restrained eaters (Coelho, Polivy, Herman, & Pliner, 2009). In fact, under certain circumstances, restrained eaters do not overeat following pre-exposure to food cues namely, when they are reminded of their dieting goal. For example, in line with previous food-cue pre-exposure studies, Papias and Hamstra (2010) found that restrained eaters sampled

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more meatball snacks than did unrestrained eaters when exposed to the smell of grilled chicken at a butcher's shop. However, when a poster for a low-calorie recipe (designed to prime their dieting goal) was displayed on the entrance door to the shop, restrained eaters consumed no more of the snacks than did unrestrained eaters. Likewise, other studies have shown that restrained eaters who use implementation intentions to activate their dieting goal when exposed to tempting food cues (e.g., "if I see chocolate, I will think of my diet") reported consuming fewer high-caloric snacks over subsequent days relative to a comparison control group (Kroese, Adriaanse, Evers, & De Ridder, 2011; van Koningsbruggen, Stroebe, Papies, & Aarts, 2011).

The eating behaviour of restrained eaters is governed not only by pre-exposure to food cues, but also by their beliefs and expectations. For example, Spencer and Fremouw (1979) showed that restrained eaters ate more ice-cream in an ad-libitum taste test after a preload drink when they were led to believe that the drink was high-caloric than when they were led to believe that it was low-caloric; the belief manipulation did not affect ice-cream consumption of unrestrained eaters. Likewise, Heatherton, Polivy and Herman (1989) found that restrained eaters ate more ice-cream after taking a 'vitamin' (placebo) pill that they were told would make them feel hungry than when they were told that it would make them feel full; unrestrained eaters, by contrast, showed the opposite pattern of consumption behaviour. These findings point to a role for expectations in the eating behaviour of restrained eaters.

It could be argued that pre-exposure to a food cue itself sets up an implicit expectation that the food is going to be eaten. In support, priming studies have shown that pre-exposing participants to food cues increases the accessibility of food-related and eating-related thoughts, particularly among restrained eaters (Hofmann, van Koningsbruggen, Stroebe, Ramanathan, & Aarts, 2010; Papies, Stroebe, & Aarts, 2007, 2008; Roefs, Herman, MacLeod, Smulders, & Jansen, 2005). However, other studies have shown that food cue pre-exposure, by contrast, increases the cognitive accessibility of the dieting goal (Anschutz, van Strien & Engels, 2011; Fishbach, Friedman, & Kruglanski, 2003; Papies, Stroebe, & Aarts, 2009). In particular, Fishbach et al. (2003) reported that following pre-exposure to a variety of tempting food cues, restrained eaters were faster to respond to the word "diet" in a lexical decision task and were more likely to subsequently choose an apple over a chocolate bar.

The aim of the present study was to disentangle expectations from food cue pre-exposure by making expectations about consumption explicit. Indeed, to the best of our knowledge, this study is the first to actually experimentally manipulate expectations independent of cue exposure. Moreover, unlike previous studies that manipulated participants' beliefs about a preload that they had already consumed, here we manipulated expectations about future consumption. A manipulation that can be implemented prior to any consumption of food has potentially a greater chance of affecting food intake.

To this end, undergraduate women were pre-exposed to visual food cues (pictures of grapes and mini chocolate-chip cookies). Unlike previous cue-exposure studies, participants were explicitly told to expect that they would be tasting one of these foods, and also which one; half the sample was told to expect grapes, the other half, cookies. Participants subsequently completed an ostensible taste test, in which they tasted and rated either grapes or cookies, such that half were given the food that they had been led to expect and the other half were given the other food. Grapes and mini chocolate-chip cookies were chosen because they are generally well-liked and are bite-sized to facilitate eating. In addition to measuring food intake, we also collected ratings of craving before and after exposure to the food cues to ascertain whether food

intake was in any way driven by a craving for the cued foods. Participants' restraint status (restrained versus unrestrained) was based on their scores on the Revised Restraint Scale (Herman & Polivy, 1980). The study protocol was approved by Flinders University's Social and Behavioural Research Ethics Committee.

## 1. Method

### 1.1. Participants

Participants were 88 women recruited from undergraduate student volunteers at Flinders University. The experiment was advertised on campus notice boards and the School of Psychology's online recruitment system as a marketing study about people's reactions to food. Participants received either course credit or a \$10 honorarium in exchange for taking part in the study. To equalise hunger levels, participants were instructed not to eat or drink anything (except water) for 2 h before the testing session. Participants also rated their level of hunger on a 100-mm visual analogue scale, ranging from "not hungry at all" to "extremely hungry". Mean hunger ratings were relatively low ( $M = 37.76$ ,  $SD = 23.31$ ). The sample was between 18 and 30 years old ( $M = 21.74$ ,  $SD = 3.40$ ). Mean body mass index (BMI), based on measured participants' height and weight, was 21.97 ( $SD = 3.75$ ), which is in the healthy weight range (18.5–24.5 kg/m<sup>2</sup>). Descriptive statistics for sample characteristics are shown in Table 1. A series of 2 (expected food: grapes, cookies)  $\times$  2 (food tasted: grapes, cookies)  $\times$  2 (restraint: unrestrained eaters, restrained eaters) ANOVAs showed only a significant main effect of restraint on BMI,  $F(1, 80) = 14.96$ ,  $p < 0.001$ , partial  $\eta^2 = 0.16$ , such that restrained eaters ( $M = 23.36$ ,  $SD = 4.20$ ) had a higher BMI than did unrestrained eaters ( $M = 20.38$ ,  $SD = 2.34$ ).

### 1.2. Design

The experiment used a 2 (expected food: grapes, cookies)  $\times$  2 (food tasted: grapes, cookies)  $\times$  2 (restraint: unrestrained eaters, restrained eaters) between-subjects design. Participants were randomly assigned to the expected food  $\times$  food tasted conditions. The outcome variables were cravings and food intake (in calories) for grapes and cookies.

### 1.3. Materials

#### 1.3.1. Craving

Participants rated their current cravings for grapes and chocolate-chip cookies separately on three 100-mm visual analogue scales. The scales ranged from "not at all" to "extremely", and asked participants: (1) "How strongly do you desire grapes/chocolate-chip cookies right now?", (2) "How much do you crave grapes/chocolate-chip cookies right now?", and (3) "To what extent do you feel an urge to eat grapes/chocolate-chip cookies right now?" Ratings across the three scales were highly inter-correlated ( $0.84 \leq r \leq 0.95$ ), and thus were averaged to form one craving variable.

#### 1.3.2. Restraint

Restraint status was determined by the Revised Restraint Scale (RRS, Herman & Polivy, 1980), administered at the end of the testing session. This measure consists of 10 items related to eating behaviour and dieting habits (e.g., "How often are you dieting?") which are rated on 4- or 5-point scales. Total scores range from 0 to 35, with higher scores indicating higher degrees of dietary restraint. The sample was divided into restrained and unrestrained eaters based on the established cut-off scores of  $\leq 14$  (unrestrained

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