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What works better? Food cue exposure aiming at the habituation of eating desires or food cue exposure aiming at the violation of overeating expectancies?

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ABSTRACT

Objective: This study tested the role of habituation of eating desires and violation of overeating expectancies during food cue exposure in obese women.
Method: 52 obese females were randomised into a two-session exposure condition aimed at habituation, a two-session exposure condition aimed at expectancy violation, or a no-treatment control condition. Eating in the absence of hunger of foods included during cue exposure (i.e., exposed foods) and foods not included during cue exposure (i.e., non-exposed foods), and duration of exposure were measured.
Results: Both cue exposure conditions ate significantly less of the exposed foods compared to the control condition, though there were no differences between both types of exposure. No differences were found between conditions regarding the eating of non-exposed foods. In addition, the duration of exposure was not different between both cue exposure conditions.
Conclusions: While food cue exposure in obese women led to less eating of exposed foods, focusing on either habituation of eating desires or expectancy violation did not matter. It is discussed why exposure works.

1. Introduction

Worldwide, the obesity prevalence has reached dramatic proportions, and the necessity for effective interventions is high (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). The fact that weight loss interventions that aim at a negative energy balance, by reducing energy intake and increasing energy expenditure, have disappointing effects on successful weight loss fuels the search for effective interventions (e.g., Curioni & Lourenco, 2005; Franz et al., 2007). A major cause for weight gain is the eating for hedonic purposes instead of physiological needs, also referred to as eating in the absence of hunger (EAH; Kral et al., 2013; Lowe & Butryn, 2007). EAH can be promoted by several factors, including exposure to food-related cues; these cues can initiate preparatory processes for food intake, including psychological (e.g., eating desires) and physiological responses (e.g., salivary production; Jansen, 1998). Indeed, this so-called cue reactivity has shown to be higher in overweight versus normal weight individuals (Ferriday & Brunstrom, 2011), significantly correlated to food intake in overweight individuals (Jansen et al., 2003), prospectively related to weight gain (Boswell & Kober, 2016), and significantly reduced in successful dieters (who were previously obese) versus unsuccessful dieters (Jansen, Stegerman, Roefs, Nederkoorn, & Havermans, 2010). Hence, it might be important to tackle cue reactivity in interventions in order to achieve successful weight loss.

Cue reactivity might (at least partly) be learned through classical conditioning (Jansen, 1998; Jansen, Schyns, Bongers, & van den Akker, 2016): when specific cues, such as the smell or sight of food, become associated with food intake (unconditioned stimulus; US) through repeated pairings, these become predictors, or conditioned stimuli (CS), of food intake and capable of initiating cue reactivity (conditioned response; CR). Several human laboratory studies found evidence that associations between food intake (US) and initially neutral stimuli (CS) are easily learned, and that – as a result of this learning process - CSs easily acquire the ability to elicit conditioned eating desires (e.g., Bongers, van den Akker, Havermans, & Jansen, 2015; van den Akker, Jansen, Frentz, & Havermans, 2013). Because many eating desires are so easily acquired through classical conditioning, extinction of such associations might be the appropriate way to decrease the learned cue reactivity. Exactly this is the aim of food cue exposure: to expose participants to CSs, such as the smell and sight of food, while food intake (US) is prevented. Doing this repeatedly enables the development of a new association: the CS does not lead to the US (Bouton & King, 1983;

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Bouton, 1993; Jansen, 1998). Exposure therapy is theorized to be most effective when inhibitory learning is maximal; the new CS-noUS association should become stronger than the old CS-US association (Craske et al., 2008). Pilot studies have shown that food cue exposure successfully reduces food cravings and binge eating in bulimia nervosa patients (Jansen, Broekmate, & Heymans, 1992; Jansen, Van den Hout, De Loof, Zandbergen, & Griez, 1989; Martinez-mallen et al., 2007; Toro et al., 2003; see also; Jansen et al., 2016). Further, studies in overweight adult samples have shown that cue exposure is effective in preventing weight regain after successful weight loss (Mount, Neziroglu, & Taylor, 1990), as well as in diminishing EAH of foods that were specifically included in therapy (i.e., exposed foods; Schyns, Roefs, Mulkens, & Jansen, 2016).

Although food cue exposure indeed seems beneficial for overeating (Schyns et al., 2016), there is little research available on its working mechanism: why is it effective? According to the influential Emotional processing Theory, habituation of fear during exposure therapy provides important information as input for changing the pathological fear structure (i.e., emotional processing). Habituation therefore serves as an index of emotional processing during exposure therapy, and should predict treatment outcome (Foa & Kozak, 1986; Foa & McNally, 1996). However, Craske et al. (2008) argue that the degree of habituation during exposure therapy is not consistently related to better treatment outcome. This seems to be true for food cue exposure as well; habituation of cue reactivity was not related to better outcomes (Schyns, Roefs, Smulders, & Jansen, 2018; Schyns et al., 2016). These findings might have important clinical implications: therapists should no longer focus on diminishing eating desires during exposure sessions. However, this automatically leads to the question what the alternative focus of cue exposure sessions *should* be.

Craske, Treanor, Conway, Zbozinek, and Vervliet (2014) argue that one should focus on the explicit violation of CS-US expectancies during exposure (Craske et al., 2014). Instead of waiting until fear declines during exposure, therapists should carefully introduce CSs (e.g., high heart-rate) that maximize the mismatch between the expectancy of the US to take place (e.g., heart attack) and the actual outcome (e.g., the absence of the heart attack; noUS), thereby strengthening the CS-noUS association. Using this method, exposure sessions can be stopped when the feared outcome is no longer expected, which might take less time than waiting until fear levels habituate. Exposure sessions for panic disorder with agoraphobia focusing on expectancy violation have shown to result in better treatment outcome compared to exposure sessions focusing on habituation (Salkovskis, Hackmann, Wells, Gelder, & Clark, 2006), and continuing exposure therapy until the expectancy of the feared outcome was 5% or less was superior to exposure therapy that ended at higher expectancies (Deacon et al., 2013). Expectancy violation during exposure seems well-translatable to food cue exposure, as expectancies of overeating and loss of control can be violated (Jansen et al., 2016; van den Akker, Schyns, & Jansen, 2016). Indeed, lower expectancies after food cue exposure have found to be related to less EAH of exposed foods (Schyns et al., 2016).

The aim of the present study is to investigate whether focusing food cue exposure on violation of expectancies is more effective to reduce kcal intake of exposed and non-exposed foods than focusing on habituation of eating desires. Two exposure conditions are compared: one exposure condition focuses two sessions on the habituation of eating desires (Exposure focused on Habituation; ExpHAB), and the other exposure condition focuses two sessions on the violation of overeating expectancies (Exposure focused on Expectancy Violation; ExpEV). Participants are randomly assigned to either the ExpHAB condition, the ExpEV condition, or a no-treatment control condition. It is hypothesized that 1) the ExpEV condition eats less of exposed and non-exposed foods than the ExpHAB condition, while kcal intake in the control condition will be lower compared to both the ExpEV and ExpHAB conditions, and that 2) shorter exposure times are needed for the violation of expectancies (ExpEV) than for the habituation of eating desires (ExpHAB).

2. Methods

2.1. Participants

Female obese participants (BMI > 30) who were motivated to lose weight, aged 18–65 years, were recruited through advertisements. The exclusion criteria were: suffering from self-reported smelling problems (indication of anosmia), pregnancy, currently receiving psychotherapeutic or psychopharmacological treatment, and bariatric surgery (pre and post-operative). Participants were randomly assigned to the ExpHAB condition (n = 17), the ExpEV condition (n = 18), or the control condition (n = 17). No participants dropped out during the study. The study was approved by the Ethical Committee of the Faculty of Psychology and Neuroscience of Maastricht University.

2.2. Procedure

Two exposure sessions were planned on two separate days within one workweek. Prior to session one, the participant was instructed to buy four highly palatable snack foods that were perceived as the 'favourite foods' and difficult to refrain from. The participant was instructed to bring three normal-sized packages of each food item to the first session. To standardize hunger, the participant was also instructed to consume a small meal 2 h prior to each appointment.

A summary of the timing of the main study assessments and design is displayed in Fig. 1. After arrival in the laboratory on day 1, the participant immediately handed in the food items and gave informed consent, followed by rating baseline hunger and desire to eat. In order to induce a state of absence of hunger during food cue exposure, the participant received a prepacked cup of yoghurt and muesli in a flavour of choice (neutral, honey, strawberry, peach, berries; ~170 g, ~233 kcal). If a participant was lactose-intolerant, she received two muesli bars in a flavour of choice (neutral, cranberry, hazelnut, golden syrup; 2 bars: ~54 g, ~231 kcal). The participant was instructed to finish the entire cup or both bars, and to fill out a questionnaire about its taste and quality, followed by 15 min of satiation time. After these 15 min, the participant again rated hunger, as well as tailored food-specific overeating expectancies and the palatability of the food items. Then, the intervention started at this point: both exposure conditions (ExpEV and ExpHAB) received food cue exposure for at least 10 and maximally 40 min, dependent on whether the target of the specific intervention (habituation or expectancy violation) was reached (see 2.3). On the second day, the participant started with the measurement of baseline hunger and eating desire, followed by the muesli snack and 15 min of satiation. After 15 min, hunger was rated and the second food cue exposure session took place. After the exposure in session two, the participant received another muesli snack to ensure that the participant remained in the absence of hunger during test (though the participant was allowed to not finish the second muesli snack if it was too much), once more followed by 15 min of satiation time and ratings of hunger and eating desires. The participant then rated the food-specific overeating expectancies, followed by the bogus taste test. Thereafter, the abstinence check of food items was completed and the participant's weight and height was measured.

Participants in the control condition followed the only the second part of the program on day two, in which each participant received a muesli snack (including satiation time and hunger rating) and completed food-specific overeating expectancies, current desire to eat, the bogus taste test, abstinence and palatability check, and the measurement of weight and height. Participants in the exposure condition were instructed on the first day that they were not allowed to eat the four food items until the appointment on day 2 was completed; participants in the control condition received this instruction one to five days before the first appointment. Participants received € 50,- for participation and a refund for the purchased foods. To keep recruitment advertisements similar for all conditions (i.e., receiving a training), the control