Retraining of automatic action tendencies in individuals with obesity: A randomized controlled trial

Hannah Ferentzi[a,1], Hannah Scheibner[b,1], Reinout Wiers[b], Eni S. Becker[a], Johannes Lindenmeyer[c], Sylvia Beisel[c], Mike Rinck[a,*]

[a] *Behavioural Science Institute, Radboud University Nijmegen, The Netherlands*
[b] *University of Amsterdam, The Netherlands*
[c] *Salus Clinic Lindow, Germany*

ABSTRACT

Obesity is a major health concern, characterized by an automatically activated tendency to (over)-eat. Recent research suggests that an effective way to counteract automatic approach tendencies in unhealthy consumption behavior might be approach bias modification. Therefore, we investigated an approach-avoidance training for unhealthy food cues in 189 patients with obesity of a psychosomatic inpatient clinic who were participating in a nutrition advice program. Patients in the active training group were trained to make avoidance movements (pushing a joystick) in response to unhealthy food pictures and approach movements (pulling the joystick) in response to positive pictures, while the control group received sham training (approaching and avoiding both picture types). Approach-avoidance bias, body mass index, eating pathology and food-specific implicit associations were assessed before and after the training. In line with our hypothesis, approach-avoidance bias improved in the active training group after the training, in comparison to the sham training group. Moreover, this effect generalized to new, untrained stimuli. However, no effects of the training were found in a food-specific Single-Target Implicit Association Test, or on eating pathology questionnaires or body mass index. While the training results are promising, the effect of approach-avoidance bias modification on relevant behavior in obesity has yet to be established before it may be implemented as an add-on treatment.

1. Introduction

Obesity, indicated by a body mass index (BMI) of 30 or higher, has become a major health concern. In 2014, 21.5% of the men and 24.5% of the women in Europe, and 21.9% of men and 18.5% of women in Germany were classified as obese. In the US, it was as much as about one third of the adult population (WHO, 2015). These numbers are alarming, because obesity increases the risk of numerous diseases (Guh et al., 2009). It is also linked to psychological problems, such as stigmatization (Warschburger, 2011) and low self-esteem (Strauss, 2000). At the societal level, obesity leads to substantial financial expenses (Powers, Rehrig, & Jones, 2007). Consequently, studying treatments for obesity is an important task in clinical research.

Why do individuals with obesity engage in unhealthy food consumption (e.g., binging on chocolate) that causes substantial psychological discomfort (e.g., bad conscience) and clearly adverse health consequences in the long run? Even if aware of the consequences,

individuals with obesity show substantial problems controlling the intake of freely available food (Trinko, Sears, Guarnieri, & DiLeone, 2007). This repeated, often uncontrollable or excessive intake of food promises short-term reward at the expense of long-term well-being and seems to parallel addictive behavior. Research indeed supports the notion that obesity and addiction share key behavioral and neurological similarities.

Berridge (2009) argued that the paradox of unhealthy consumption, in addiction and obesity alike, can be explained by two related, but dissociable processes: "liking" and "wanting". Liking is an affective state based on the hedonic enjoyment of food (Stahl, Unkelbach, & Corneille, 2009) and plays an important role in initiating a reinforcing value. "Wanting" can be referred to as craving of a certain rewarding stimulus, independent of liking the stimulus. Wanting is the central mechanism for the initiation of behavior to obtain rewarding stimuli. This idea originally stems from the incentive sensitization theory of addiction (Berridge, 2009; Berthoud, 2007), but has also been applied

to obesity. The theory describes the idea that stimuli become incentives by repeated exposure, based on conditioning processes. This leads to an abnormally strengthened association between cues (in the case of obesity, palatable food) and their positive motivational value. At the behavioral level, this results in repeated, often uncontrollable and excessive intake of food (Berridge, 2009).

The automatic and cue-driven nature of this incentive sensitization process has also been shown for eating behavior. For example, Veenstra and de Jong (2010) demonstrated that restrained eaters show increased automatic approach tendencies towards food. Similarly, Havermans, Giesen, Houben, and Jansen (2011) found that men with obesity have a pronounced approach tendency towards high-caloric food. Stice, Lawrence, Kemps, and Veling (2016) recently concluded that interventions which target the automatic approach response to high-caloric food cues might be an effective means to achieve long-term weight loss. To counteract automatic approach reactions in unhealthy consumption behavior, researchers have used the approach-avoidance task (AAT) developed by Rinck and Becker (2007). In the original assessment AAT, participants pull and push a joystick in response to positive and negative cues, while their reaction times are registered. In the training version of the task, also called approach bias modification, participants learn to repeatedly push pictures of addiction cues away while pulling control pictures towards themselves. The goal of this training is to weaken automatic approach tendencies towards addiction cues, and it should ultimately lead to reduced approach of addictive stimuli in real life.

Approach bias modification has been adapted to unhealthy food consumption in recent years, and the results are promising. A recent review concludes that approach bias modification is effective at re-training approach biases for several appetitive cues (in particular, alcohol and unhealthy food consumption) and that successful reduction of approach bias generally also changes unhealthy consumption behavior subsequently (Kakoschke, Kemps, & Tiggemann, 2017).

However, whether successful approach bias modification also influences eating behavior is still subject of scientific controversy, as there are mixed results. For instance, Schumacher, Kemps, and Tiggemann (2016) found that a chocolate-approach-avoidance training influenced approach tendencies and eating behavior in a subsequent taste test, whereas Becker, Jostmann, Wiers, and Holland (2015) found neither a significant change of approach-avoidance bias nor an effect on eating behavior. Stice et al. (2016) speculate that the mixed results observed so far might be explained by the nature of the control condition. While Schumacher et al. (2016) used a control condition in which participants were trained to approach high-caloric foods, Becker et al. (2015) used a sham training control condition without contingency.

Importantly, most studies that investigated the approach bias modification as a means to change unhealthy eating behavior were conducted with university students unselected for body weight, and they assessed only short-term effects of the trainings (Becker et al., 2015; Fishbach & Shah, 2006; Kemps, Tiggemann, Martin, & Elliott, 2013; Schumacher et al., 2016). This is unfortunate because the ultimate goal of these trainings is their application in individuals suffering from obesity, to achieve long-term changes in eating behavior and long-term weight reductions.

Therefore, we conducted a study in which we selected participants according to their body mass index (BMI; ≥ 30) at a German inpatient clinic for psychosomatic disorders. Moreover, we used a control condition in which participants received a sham training without contingencies. We developed a food-specific approach bias modification training which followed the principles of a successful alcohol-specific approach bias modification developed by Wiers and colleagues (Eberl et al., 2013; Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011; Wiers, Rinck, Kordts, Houben, & Strack, 2010). Instead of focusing on a specific type of food (e.g., chocolate), we used pictures that represented diverse categories of unhealthy, high-caloric food (e.g., hamburgers,

French fries, chocolate, cake), in order to enhance ecological validity of the training. Diverse categories of positive non-food pictures (e.g., cute animals, landscapes, leisure activities in nature, social interactions) were used as to-be-approached stimuli of the training. Unlike other studies, we did not employ "healthy food" pictures as the to-be-approached stimulus category because this would not have been in line with the purpose of the nutrition advice program to which the training was an add-on. Positive pictures rather than neutral pictures were used because other studies had shown a generally beneficial effect of an approach-positive training (Becker et al., 2016).

Based on the above-mentioned findings of automatized behavioral tendencies towards food in obesity and recent studies demonstrating successful modification of the bias, we hypothesized that the bias of patients with obesity can be re-trained. Specifically, our first primary outcome variable was response speed in the AAT: We expected faster avoidance and slower approach of trained food stimuli as a result of the training. According to MacLeod, Koster, and Fox (2009), when conducting bias modification research, it is crucial to confirm that the effects generalize to new stimuli, as well as to new measures of the targeted cognitive process. Therefore, we hypothesized that the training would generalize to new, untrained pictures. Accordingly, our second primary outcome variable was AAT response speed for pictures not used in the training. For these new food pictures, we also expected the training to cause faster avoidance and slower approach.

Moreover, in a study that applied a very similar training in alcohol-addicted inpatients (Wiers et al., 2011), a transfer effect of the pictorial approach-avoidance training to implicit approach-avoidance associations for new, verbal stimuli was found. Therefore, as a secondary outcome, we also tested for such a transfer effect, using a Single Target Implicit Association Test of approach-avoidance associations for words (STI-IAT; Karpinski & Steinman, 2006). Finally, based on findings that approach bias modification potentially yields behavior change (e.g., Schumacher et al., 2016), we tested whether the training would affect variables related to eating behavior. Therefore, additional secondary outcome variables were changes in weight and in self-reported eating pathology during the stay at the clinic.

To sum up, half of the participants in our experiment were trained to push away high-caloric food pictures and pull positive pictures closer; the other half pushed and pulled both picture types equally often. As primary outcome, we hypothesized that the training would change the bias for the trained pictures as well as for new pictures. As secondary outcomes, we tested whether the bias change would generalize to approach-avoidance associations for words tested with a STI-IAT, and whether the training would affect weight loss and eating pathology.

2. Methods

2.1. Participants and design

Participants were 189 patients with obesity (BMI ≥ 30) of the salus clinic in Lindow, Germany. A BMI of less than 30 and a primary diagnosis of alcohol dependence were the only exclusion criteria. The training was an add-on to the standard nutrition advice program of the clinic, which is given in addition to the treatment of the patients' primary disorder. Of the participants, 15 dropped out of the training or were discharged from the clinic before completion of the training, another 14 participants had to be excluded due to technical difficulties, and another 31 participants were excluded because they made more than 40% errors on one of the two assessment AATs. The remaining 129 participants (63 female and 66 male) were on average 48 years old (SD = 9.45, range 22–64) and had an average BMI of 34.4 (SD = 4.25, range 29.5–51.3). All analyses reported below are based on this sample of 129 training completers because our primary outcome variables required complete AAT data.

The patients were in treatment for psychosomatic disorders; their