5-2015

Effect of Exercise on Attentional Bias to Food in Restrained and Emotional Eaters

Emily Tyne O'Gorman

Effect of Exercise on Attentional Bias for Food in Restrained and Emotional Eaters

Emily Tyne O'Gorman

Department of Psychology, The College of William and Mary

Abstract

The goal of the current study was to determine the extent to which exercise or exposure to exercise through exercise-related reading material affect attentional bias to high- and low-calorie foods in restrained and emotional eaters. Ninety-three female undergraduates participated for 20 minutes in either an Exercise condition (n = 32), in which they exercised on a stationary bike; an Exercise magazine condition (n = 30), in which they read a magazine about exercise, or a Neutral magazine condition (n = 31), in which they read a magazine that was not about exercise. Attentional bias was assessed prior to and following the exercise manipulation through a dot probe paradigm that used picture pairs consisting of a high- or low-calorie food and a non-food object. Restrained eaters relative to unrestrained eaters exhibited an attentional bias away from images of high-calorie foods irrespective of time or condition. Non-emotional eaters, on the other hand, exhibited decreased attention bias towards both high- and low-calorie foods following exercise. They also exhibited decreased attentional bias to images of low-calorie foods after reading a neutral magazine. These results suggest responses to high- or low-calorie foods in females depend on levels of dietary restraint and that interventions, such as exercise, differentially affect attentional biases to foods depending on the eating habits of the individual.

Table of Contents

Effect of Exercise on Attentional Bias to Food in Restrained and Emotional Eaters

In this golden age of all things in excess, the idea of food as a necessity for survival is frequently displaced by the idea of food as a reward, treat, or experience. Unfortunately for our waistlines, these rewards come at a price: recent findings suggest that 69% of American adults over the age of 20 are overweight or obese. With this designation comes a plethora of health risks (Centers for Disease Control, 2012). Though pharmacological and surgical techniques are becoming increasingly common, efforts to ward off obesity or decrease weight typically involve a combination of increased physical activity and decreased caloric consumption (Wadden, Brownell, & Foster 2002).

Herman and Mack (1975) first introduced the concept of restrained eating to explain the tendency of some individuals to restrict caloric intake to achieve weight loss or to prevent weight gain. Their efforts are often counterproductive, however, leading restrained eaters to gain weight over time. Various cognitive factors could contribute to restrained eaters' difficulty in maintaining their dieting goals, leading to subsequent weight gain. A study using brain-imaging techniques found that individuals with higher levels of dietary restraint have heightened responses in brain regions implicated in reward-seeking behaviors while drinking a chocolate milkshake (Burger & Stice, 2010). This does not necessarily indicate that restrained eaters like high fat foods better than unrestrained eaters (Veenstra & de Jong, 2010); rather, it suggests that restrained eaters find these foods more rewarding. It is perhaps as a result of this that restrained eaters exhibit significantly greater automatic approach tendencies towards high-fat food cues than unrestrained eaters (Veenstra & de Jong, 2010).

Reward value and automatic approach tendencies are functions of how salient one finds a stimulus. Restrained eaters may find food-related cues more salient than unrestrained eaters,

contributing to their susceptibility to lapses in self-regulation. Some researchers have suggested that restrained eaters are constantly trying to balance two conflicting goals: controlling their weight and satisfying hedonic hunger for desired foods (Stroebe, Papies, & Aarts, 2008). Typically, restrained eaters focus their attention on the goal of weight control, suppressing the goal of obtaining reward through eating. However, triggers, such as exposure to palatable foods (Federoff, Polivy, & Herman, 1997) or advertisements for such foods (Harris, Bargh, & Brownell, 2009), may overwhelm this balance, in effect priming restrained eaters to focus on the hedonic properties of food, such as its palatability and the pleasure derived from eating it (Berridge, 1996). This, in turn, may lead to a lapse in self-regulation (Stroebe et al., 2008).

One trigger that may limit restrained eaters' abilities to self-regulate their intake is negative affect. In a laboratory setting when negative affect was induced, women classified as restrained eaters ate more buttered popcorn than unrestrained eaters or restrained eaters in whom negative affect was not induced (Cools, Schotte, & McNally, 1990). According to affect regulation models, eating serves to reduce negative affect by providing comfort or distracting from negative emotions (Spoor, Bekker, van Strien, & van Heck, 2007). Some researchers, therefore, believe that negative affect results in increased salience of and desire for foods that one finds pleasurable or rewarding (Hepworth, Mogg, Brignell, & Bradley, 2010). Similarly, studies have shown that higher levels of small stressors or daily hassles in one's work-related, interpersonal, and personal life are associated with increased intake of high-fat and high-sugar snacks (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). This response to negative emotions may help explain why there is an increased risk of overweight and obesity in populations with depression (Stice, Presnell, Shaw, & Rohde, 2005). Those who respond to these negative emotional states – such as stress, anger, or sadness – by overeating are referred to as

emotional eaters (van Strien, Frijters, Bergers & Defares, 1986). Overall, emotional eaters have been found to exhibit higher levels of food cravings (Hill, Weaver, & Blundell, 1991) and a significantly greater attentional bias towards food-related cues than non-emotional eaters (Brignell, Griffiths, Bradley, & Mogg, 2009).

Attentional bias refers to preferential orientation of attention towards and/or difficulty shifting attention away from certain stimuli in the environment. It is considered to be an automatic process that occurs outside of conscious awareness. Attentional bias towards food has been linked to increased hunger, craving for food, and risk of obesity (Werthmann, Field, Roefs, Nederkoorn, & Jansen, 2014; Yokum et al., 2011). For example, in one study examining the relationship between craving and attentional bias, habitual chocolate-cravers were found to exhibit greater attentional bias towards chocolate-related visual cues than they did towards non-chocolate related cues and relative to non-chocolate-cravers (Kemps & Tiggemann, 2009). This phenomenon was observed following attentional training in the lab as well. Participants who were trained to orient towards chocolate cues through an anti-saccade task then consumed more chocolate relative to those who had been trained to orient their attention towards neutral stimuli (Werthmann et al., 2014).

Although some studies have shown that restrained eaters exhibit attentional biases for food-related stimuli (Brignell et al., 2009; Polivy & Herman, 2008; Cogan & Ernsberger, 1999), this finding is inconsistent. In one study, though restrained eaters exhibited greater reward sensitivity to and cognitive bias for food-related stimuli relative to unrestrained eaters, the groups did not differ in their attentional biases for food-related stimuli on a visual probe task (Ahern, Field, Yokum, Bohon, & Stice, 2010). Boon, Vogelzang, and Jansen (2000) also found no difference in attention towards or avoidance of food words between restrained and unrestrained

eaters in a dot probe task. In combination, studies in the current literature present an inconsistent picture that leaves unanswered questions as to the association between restrained eating and attentional bias for foods.

Other research has shown that various priming mechanisms can be used to shift restrained eaters' attentional biases to food-related cues. For example, restrained eaters' attentional bias towards hedonically relevant food-related stimuli has been shown to increase following exposure to palatable food cues (Papies et al., 2008). Papies et al. (2008) found that restrained eaters who are pre-exposed to palatable food cues subsequently display biased attention towards pictures of palatable, energy-dense foods that are typically off-limits to dieters. However, this effect was not observed following pre-exposure to neutral cues, rather than to palatable food cues (Papies et al., 2008). Further, pre-exposure to the idea of weight-control and dieting may counteract the effects of pre-exposure to the hedonic properties of food in restrained eaters. Presumably this is because, while food may be instantly gratifying, dieting is more gratifying in the long-term. Reminding restrained eaters of this long-term goal increases the likelihood that they will focus on the goal of dieting, rather than on the incompatible goal of seeking reward from food (Stroebe et al., 2008).

Much less research has been conducted to determine whether priming mechanisms can affect emotional eaters' attentional biases towards food-related stimuli. However, one study manipulated mood and found that, after a manipulation that induced negative mood, women experienced increased attentional biases towards food-related images relative to neutral images. Women who were not exposed to the negative mood induction, however, did not experience these increases in attentional bias (Hepworth, Mogg, Brignell, & Bradley, 2010).

Given the above discussion of the influence of various priming mechanisms (e.g. diet-related cues, negative mood induction, attentional training), it makes sense that there has also been an interest in examining whether other stimuli associated with weight loss, such as exercise, may be correlated with reductions in cravings for and attentional bias toward addictive substances and associated cues in animal models (Ehringer, Hoft, Zunhammer, 2009) and humans (e.g. Oh & Taylor, 2014). With respect to food, Taylor and Oliver (2008) found that a brief bout of exercise significantly reduced chocolate cravings in participants immediately following exercise and 10 minutes after exercise cessation. In a later study, Oh and Taylor (2013) found that a 15-minute self-paced walk on a treadmill – relative to a 15-minute period of sedentary rest – significantly reduced attentional bias to chocolate cues and cravings for chocolate in females, regardless of body mass index (BMI) and whether they were currently abstaining from eating chocolate. In line with findings from the earlier study, participants' self-report in this study indicated that cravings were progressively reduced from baseline at mid-exercise and immediately, five minutes, and ten minutes after exercise (Oh & Taylor, 2013).

It has been theorized that exercise may act as a "replacement" for the reward that food provides (Oh & Taylor, 2013). Like palatable foods, exercise activates the dopaminergic pathways and other neural substrates, thereby acting as a reward and rendering less incentive to seek reward elsewhere. Following aerobic exercise, there is a decrease in the reinforcing value of energy-dense foods relative to pre-exercise measures (McNeil, Cadieux, Finlayson, Blundell, & Doucet, 2015; Panek, Jones, & Temple, 2014). Sedentary time does not carry with it the rewarding properties of reduction of psychophysiological response to stress or mood regulation. As such, sedentary individuals may compensate by seeking reward elsewhere, for example, in high-calorie foods (Taylor & Oliver, 2008).

A second theory that may explain the reduction in attentional bias following exercise is the transient hypofrontality hypothesis. During aerobic exercise, the brain receives the same amount of blood that it would under normal circumstances, even though the brain regions responsible for exercise performance or maintenance of physiological homeostasis during exercise require more blood and energy than they would under normal circumstances. As such, certain brain regions are inhibited, allowing these resources to be re-allocated. The frontal lobe, in particular, is inhibited, and with it the functioning of regions responsible for visual attention and those responsible for reward processing and addiction are altered (van Rensburg, Taylor, Benattayallah, & Hodgson, 2012).

The transient hypofrontality hypothesis has been supported by brain imaging studies. Evero, Hackett, Clark, Phelan, and Hagobian (2012) found that a 60-minute bout of exercise, relative to a 60-minute period of rest, significantly decreased neuronal responses to high and low calorie foods relative to neutral cues in brain regions associated with desire to seek and consume food and involved in assessing the overall reward value of food. Specifically, changes in activation were observed in the insula, putamen, rolandic operculum, and right inferior orbitofrontal cortex, which are brain structures implicated in processes leading up to and involved in the desire to seek and consume food and in the overall reward value of food (i.e. liking and wanting of food) (Evero et al., 2012).

Despite evidence of the neurological effects of physical exercise, research has demonstrated that exposure to exercise advertisements – even without engagement in exercise – also affects consumption. After watching exercise commercials, participants reduced their caloric intake at a pasta lunch by about 20% relative to those who had watched non-exercise-related commercials (Van Kleef, Shimizu, & Wansink, 2011). It may be that exercise commercials

heighten awareness not only of the value of physical activity but of the closely related concepts of weight loss and eating.

Although studies have examined the effects of exercise on attentional bias to food and the relationship between attentional bias towards food and eating restraint, to the best of our knowledge there has been no research that has sought to determine whether exercise differentially reduces attentional biases towards food in restrained eaters. Moreover, to our knowledge, no study has examined the effect of exercise on attentional bias towards food in emotional eaters. Therefore, the goals of the present study were to determine whether exercise itself or exposure to reading material focused on exercise reduces attentional bias towards food in restrained and emotional eaters relative to unrestrained and non-emotional eaters, respectively.

We predicted that initially restrained eaters will exhibit a greater attentional bias towards high-calorie foods than unrestrained eaters but that, following exercise, attentional biases towards food cues would be reduced to the same level as those of unrestrained eaters. We also predicted that, because exercise has been found to induce positive mood states (Reed & Ones, 2000), emotional eaters would exhibit decreased attentional biases towards food cues following exercise. For those who read material focused on exercise, we predicted that attentional biases would be decreased, though to a lesser extent than for those who had engaged in exercise.

Method

Participants

Ninety-three female undergraduates (M_{age} = 19.16 years, SD = 1.296) at the College of William and Mary participated in this study. Students were recruited in one of two ways: through placement of advertisements at locations on campus and through an online system. Those who learned of the study via the ads received $10 in exchange for their participation. Those who

signed up to participate in the study via the online system received partial or extra credit in their psychology classes. This study was approved by the Institutional Review Board at the College of William and Mary prior to its inception, and each participant signed a written informed consent form before participating in the study.

Materials

Stimuli.

Target images. Target images included 120 color pictures. These pictures were presented in pairs in which one food item was paired with one neutral object of similar size, shape, color, brightness, and position. Pictures were taken of the selected items on a square white plate placed on a black sheet, and all pictures were taken from the same angle in the same lighting conditions. Of the food pictures, thirty were considered healthy foods and thirty were considered unhealthy foods. Prior to their use in the study, the pictures were pilot-tested by female undergraduates to ensure that each image was easily identified in content and as healthy or unhealthy.

Magazines. Two magazines were used in the study: *Runner's World* and *TIME*. The choice of these magazines was due to the fitness-related and neutral content respectively. Any food-related content or direct reference to weight-loss was removed from these magazines.

Measures

Dot probe task. Participants were presented with paired images (i.e. food item and neutral object appeared simultaneously) in a visual dot probe task. Participants were seated approximately 90 cm from the computer monitor and were instructed to keep both their feet flat on the floor and to place their index fingers on two keys ("x" and "m") on a standard computer keyboard. Solely natural light was used as not to disrupt the computer task, and the lighting in the room was controlled so as to remain constant.

As shown in Figure 1 each trial in the dot probe task began with a black fixation cross, presented on a white background in the center of the screen for 1,000 milliseconds (ms). A picture pair followed, wherein a neutral image and a food-related image appeared on either side (i.e. left and right) of a white background for 200 ms. Images of foods and neutral objects were equally as likely to be presented on either the left or right side of the screen across trials. Following the picture pair, participants saw a visual mask presented for 433 ms. A black dot then appeared on the screen where one of the pictures had been. The dot remained on the screen until the participant pressed a key denoting which side (left or right) the dot appeared. The intertrial interval varied between 1500 and 3000 ms to ensure that reaction times were not affected by expectation of stimulus presentation.

The time it took participants to respond to the location of the dot by pressing a button on the keyboard was a measure of attention to the image on one side of the screen relative to the image on the other side of the screen. Faster responses to the dot, therefore, indicated that the participant had been attending to the image on the side of the screen on which the dot appeared. A more positive score indicated that the participant had been attending more to the image of the food relative to the image of the neutral object.

Participants completed the dot probe task once before and once after the task in which they participated. The first dot probe task completion was to establish a baseline, and the second dot probe task completion was to establish change following the task that the participant's condition denoted.

Questionnaires.

Demographics. Participants provided general background information, including gender, age, year in school, height, weight, ethnicity, race, and family income. In addition, they

completed a series of questionnaires that assessed their exercise and eating habits. After completion of the study and questionnaires, experimenters measured height and weight using a standard tape measure and scale. These measurements were used to calculate participants' BMIs.

Exercise Motivations Inventory-2 (Markland, & Ingledew, 1997). The revised Exercise Motivation Inventory (EMI-2) has been validated as an assessment of motivation for exercise participation in men and women and in exercisers and non-exercisers. The questionnaire includes groupings of questions, each aimed to address specific factors: psychological motives (stress management, revitalization, enjoyment, challenge), interpersonal motives (social recognition, affiliation, competition), health motives (health pressures, ill-health avoidance, positive health), body related motives (weight management, appearance), and fitness motives (strength and endurance, nimbleness). For the purposes of this study, the subset of body-related questions were the only questions deemed relevant, and, therefore, were the only questions used in this study's final questionnaire (Markland, & Ingledew, 1997). (Appendix A1 and A2)

Dutch Eating Behavior Questionnaire (Van Strien, Frijters, Bergers, & Defares, 1986). The Dutch Eating Behavior Questionnaire (DEBQ) includes 33 items. Ten items focus on restrained eating (e.g. "If you have put on weight, do you eat less than you usually do?"). The next thirteen items focus on emotional eating (e.g. "Do you have a desire to eat when you are depressed or discouraged?"). The remaining ten items focus on external motivation for eating (e.g. "Do you eat more than usual when you see others eating?"). Questions were formatted on a Likert scale with values of never (1), seldom (2), sometimes (3), often (4), and very often (6). "Not applicable" was included as an option where appropriate (Van Strien et al., 1986). The inclusion of this questionnaire allowed us to identify restrained and emotional eaters, who we

defined as those whose scores on the respective subscales were above the median split of the total sample. (Appendix B)

Food Craving Inventory (White, Whisenhunt, Williamson, Greenway, Netemeyer, 2002). The Food Craving Inventory (FCI) was developed to measure general and specific food cravings. The questionnaire consists of 28 items in which individuals are asked to indicate the frequency with which they craved particular foods. The 28 items are divided into 4 subscales that correspond to commonly craved food groups: high fat foods (e.g. bacon), sweets (e.g. donut), carbohydrates (e.g. biscuits), and fast foods (e.g. pizza). (Appendix C)

Procedure

Participants were asked to come to the lab for a single time-point study that was expected to span a period of about one hour. They were instructed to refrain from eating for one hour prior to arrival at the lab and to wear comfortable clothes. Upon their arrival at the lab, informed consent was obtained, and the participant was seated in front of a computer monitor. Participants were instructed to keep their feet flat on the floor so as to ensure that each was equidistant from the computer monitor. The experimenter then left the room while the participants completed the dot probe task. They were given written instructions on how to complete the task and were given a block of 4 trials to familiarize themselves with the task. Participants then completed the task, which consisted of one experimental block of 60 trials.

Participants were randomly assigned to one of three experimental conditions. The Exercise condition involved a twenty-minute ride on an upright stationary bike (Precor UBK615). The bike was adjusted to accommodate participants' differing heights. Participants were instructed that they were permitted to stop if they felt light-headed or overly fatigued at any point. The first five minutes of the ride was a warm-up, during which the resistance was low at

resistance 1 on a 1-20 scale. Then, the resistance was raised to resistance 8 and the participant was instructed to continue pedaling at a speed between 58 and 68 RPM For the final two minutes of the ride, resistance was reduced to resistance 1 again for a cool-down period. Throughout the ride, heart rate (HR) was monitored and was recorded by the experimenter after 5, 10, 15, 18, and 20 minutes with a Finger pulse oximeter SM-110.

Participants in Exercise magazine (Ex-Mag) condition spent 20 minutes reading an exercise-themed magazine, and participants in the Neutral magazine (Ntl-Mag) condition spent 20 minutes reading a news magazine. All images pertaining to food, diet, or weight loss had been removed prior to their use in this study. In both magazine conditions, the experimenter informed them that they could read whatever article or articles were of interest to them. So as to reduce variability between conditions, the experimenter remained in the room, and HR was monitored as in the exercise condition. To gauge engagement in the task, the experimenter asked participants what article or articles they had read following the 20-minute reading period.

After completion of the twenty-minute activity, participants were again seated in front of the computer monitor to complete the post-test. The experimenter left the room while the participants completed the dot probe task as in the pretest. After completing the post-test, the participants completed a series of questionnaires. Scores on the EMI-2 and FCI subscales were used to assess whether significant differences existed across groups.

After participants completed the questionnaires, the experimenter measured and recorded the participants' heights and weights, from which the participants' BMIs were calculated. Finally, the experimenter recorded when and at what time the participants had last eaten to ensure that the participant had complied with the experimental protocol and had not eaten within

the hour prior to her arrival at the lab. At the end of the session, the participants were debriefed and thanked for their participation.

Results

Participant Characteristics

Of the 99 participants who participated in the experiment, data were excluded from 6 participants who did not complete the experiment ($n = 4$) or who did not comply with the experimental protocol ($n = 2$). The remaining 93 participants were approximately 19 years old ($M_{age} = 19.16$ years, $SE = 0.13$). The majority of participants were Caucasian ($n = 60$), and the remainder were Asian ($n = 19$), Black ($n = 5$), and mixed race or other ($n = 9$). Of these, 9.7% reported that they were Hispanic or Latino ($n = 9$).

Participants were randomly assigned to one of the three conditions (i.e. Ex, Ex-Mag, or Ntl-Mag). As shown in Table 1, there were no significant differences between groups in terms of age, BMI, frequency of exercise, motivations for exercise, or food cravings. Groups also did not differ in terms of whether or not participants were currently dieting or the amount of time since participants had last eaten.

Participants within each condition were further divided into groups as functions of eating style. In these cases, participants within each condition were grouped either by restraint (restrained or unrestrained eaters) or emotional eating (emotional or non-emotional eaters) according to whether their scores on subscales of the DEBQ fell above or below the median split of the sample. Between-group analyses revealed that, overall, restrained eaters were more likely to engage in exercise in order to manage or lose weight ($M = 18.45$, $SE = 0.73$) than unrestrained eaters ($M = 13.27$ $SE = 0.78$; $F(1, 87) = 23.63$, $p < 0.01$). Additionally, restrained eaters were more likely to engage in exercise in order to change or improve their appearances ($M = 15.92$, SE

= 0.64) than unrestrained eaters (M = 12.73 SE = 0.69, $F(1, 87) = 11.40$, $p < 0.01$). There were no between-group differences for emotional and non-emotional eaters in terms of motivations for exercise.

Restrained Eating

To determine whether attentional bias towards high or low calorie foods differed as a function of restrained eating and whether the exercise manipulation affected attentional bias in restrained participants, a mixed-model ANOVA was conducted. Caloric content of the depicted foods (i.e. high-calorie or low-calorie) and time (i.e. pre-test or post-test) were used as within-subject variables. Condition (i.e. Ex, Ex-Mag, or Ntl-Mag) and restraint (i.e. restrained or unrestrained eater) were used as between-subject variables. These analyses revealed an interaction between caloric content and restraint, $F(1, 87) = 10.65$, $p = .01$. As shown in Figure 3, simple main effects analyses revealed that restrained eaters exhibited an attentional bias away from images of high-calorie foods relative to unrestrained eaters, $F(1, 87) = 6.95$, $p < .01$. No between-group differences were found for stimuli depicting low-calorie foods relative to stimuli depicting neutral objects.

Our analysis also revealed an interaction between caloric content of the depicted foods and participant condition, $F(2, 87) = 3.24$, $p < .05$. Simple main effects analyses revealed a main effect of caloric content in the Ex-Mag condition, $F(1, 28) = 4.322$, $p < .05$, such that restrained eaters exhibited an attentional bias away from high-calorie foods relative to unrestrained eaters. No main effects or interactions reached significance for the Exercise or Ntl-Mag conditions.

Emotional Eating

Similar analyses to those described above were conducted to determine whether attentional bias differed as a function of emotional eating and whether the exercise manipulation

affected this bias in emotional eaters. Here, emotional eating (i.e. emotional or non-emotional eater) replaced eating restraint as a between-subjects variable, and the other between- and within-subjects variables remained the same. These analyses revealed a four-way interaction between caloric content, time, condition, and emotional eating, $F(2, 87) = 3.605$, $p < .05$. To understand this interaction, we first analyzed emotional and non-emotional eaters separately. These analyses revealed that a three-way interaction between caloric content, time, and condition for non-emotional eaters $F(2, 41) = 3.751$, $p < .05$. No main effects or interactions reached significance for emotional eaters.

We then conducted separate analyses for non-emotional eaters in each condition. In the exercise condition, there was a main effect of time $F(1, 12) = 4.80$, $p < .05$. As shown in Figure 4, after exercise, non-emotional eaters reduced their attentional bias towards both low-calorie and high-calorie foods. For non-emotional eaters in the neutral magazine condition, we found an interaction between time and caloric content, $F(1, 17) = 8.45$, $p < .01$. Simple main effects analyses revealed a main effect of time on attentional bias towards low-calorie foods, $F(1, 17) = 32.97$, $p < .001$. As shown in Figure 5, non-emotional eaters exhibited lower attentional biases away from low-calorie foods after reading the neutral magazine. However, there was no main effect of time on attentional bias towards high-calorie foods. As shown in Figure 6, no main effects or interactions reached significance in the Ex-Mag condition.

Discussion

The results of the present study indicate that both restrained and emotional eating styles are associated with biased attention to images of foods. Further, it suggests that, for some individuals, exercise may be an effective means of reducing attentional bias towards foods.

To our knowledge, our study is the first to examine attentional bias towards both high- and low-calorie foods in restrained eaters without first exposing them to food-related cues. Our results indicated that restrained eaters relative to unrestrained eaters exhibit attentional biases away from, rather than towards, images of high-calorie foods when they were paired with images of neutral non-food objects. These findings are consistent with previous research that has shown that restrained eaters exhibit attentional avoidance of stimuli depicting high-fat food cues relative to stimuli depicting neutral cues (Veenstra et al., 2010). This said, these findings also deviate from other findings in the literature, which have shown that restrained eaters exhibit greater attentional biases towards foods than unrestrained eaters (Hollit et al., 2010; Papies et al., 2008). It should be noted, however, that our study differed from previous studies in several ways.

Whereas our study used picture pairs in our dot probe task, some previous studies using the dot probe paradigm have paired food and body-shape words with neutral words (Boon, Voglezang, & Jansen, 2000). Other studies that have used the dot probe paradigm and found attentional biases to foods have done so in clinical populations, external eaters, and under conditions of hunger or fasting (Smeets, Roefs, van Furth, & Jansen, 2008; Johansson, Ghaderi, & Andersson, 2004; Placanica, Faunce, & Job, 2002; Mogg, Bradley, Hyare, & Lee, 1997). Our study, on the other hand examined restrained eaters within a non-clinical sample and without consideration of hunger and satiety. Further, these studies using the dot probe paradigm presented word or picture pairs for 500 ms; this duration allows participants to shift their attention between stimuli. In the current study, the picture pairs were presented for only 200 ms in order to capture initial orienting of attention (Field & Cox, 2008). These differences in method and measure may account for the differences between our results and those of previous studies.

Our results suggest that restrained eaters initially respond to high-calorie food-related stimuli through avoidance. Although attentional avoidance of high-calorie food cues may appear to be consistent with restrained eaters' dieting goals, persistent avoidance of food cues may enhance the deprivation experienced, which in turn may enhance the reward value of these high-calorie foods (Brown, Jackson, & Stephens, 1998). Given that the restrained eaters showed an attentional avoidance of high-calorie food cues, it is not surprising that we did not observe further reductions in their attentional biases to food cues following the exercise manipulation. If restrained eaters do, however, show sustained attention towards food cues, future research should measure whether of not this changes as a function of exercise.

With respect to emotional eaters, our findings showed that non-emotional eaters decreased their attentional biases to both high- and low-calorie foods following exercise. In the control condition in which participants did not engage in exercise nor read an exercise magazine, non-emotional eaters decreased their attentional biases to only low-calorie foods. It was surprising to find that, emotional eaters, on the other hand, did not show an attentional bias for foods or a change in attentional bias after exercise. It is possible that emotional eaters demonstrate attentional biases for foods only when they are experiencing increased emotional arousal. There are discrepancies in the literature concerning the effect of mood on eating behavior. Some researchers have suggested that positive mood enhances the tendency to overeat (Yeomans & Coughlan, 2008), while others have suggested that negative affect increases appetite and attentional bias towards food-related stimuli (Hepworth, Mogg, Brignell, & Bradley, 2010). Future research should continue to investigate the interplay between emotions, emotion regulation, attentional bias, and cravings or caloric intake.

In the current study, no effects were observed in attentional biases towards foods for participants who read an exercise magazine. This is surprising in light of previous research using techniques such as preloads or diet- or exercise-related cues to prime participants. We expected that reading the exercise magazine would prime participants with the idea of exercise and that this would affect restrained and emotional eaters' attentional bias towards foods. In a study where participants watched exercise commercials, they reduced their caloric intake during a pasta lunch (van Kleef et al., 2011). It may be that these commercials were more salient than the exercise magazine, as they offer more sensory stimulation.

This study was limited by its small sample size and relative lack of diversity within the sample, which limit the generality of the findings. Researchers that have identified significant main effects of exercise have typically done so in populations of inactive (e.g. Panek et al., 2014) or overweight and obese (Yokum et al., 2011; Werthmann et al., 2011) adults. On the other hand, the present study's sample was made up of relatively young, active, and healthy participants. As such, the exercise intervention may not have been vigorous enough for to their fitness level to elicit effects similar to those found in previous research.

In other studies with interventions consisting of 20-minute bouts of moderate intensity exercise as ours did, baseline attentional bias towards the cued food – chocolate – was already elevated, because the sample was made up of habitual chocolate cravers who had been fasting from chocolate (Oh & Taylor, 2013). This suggests that elevated baseline attentional bias is necessary for reductions to occur following the exercise intervention.

Furthermore, we identified restrained and emotional eaters as those whose scores on the respective subscales of the DEBQ were above the median split for the sample. It made sense to dichotomize these variables for the purposes of our study, because we aimed to compare

restrained and emotional eaters to their respective counterparts. Using the upper quartile to classify restrained and emotional eaters might have been more effective; however, using the median was beneficial given our small sample size. Conversely, though the dichotomization of these variables facilitated our analyses, it also reduced statistical power, and it may have been more effective to perform a regression analysis.

Though this study had limitations, it was unique in that it was the first to examine the role of exercise in restrained and emotional eaters' attentional biases towards high- and low-calorie foods relative to neutral objects. Dieting can have negative physical health consequences and frequently has poor long-term results; for these reasons, researchers typically recommend non-dieting approaches to losing weight (Wadden et al., 2002; Polivy & Herman, 1992). The role of physical activity for weight-loss energy expenditure is well researched (Wadden et al., 2002), but the degree to which exercise contributes to weight loss by reducing individuals' attentional biases towards foods (beyond increasing caloric expenditure) remains unclear. Blundell and King (2000) found evidence that exercise suppresses appetite and reduces energy intake. Other studies have supported this by showing reductions in the reward value of food after exercise relative to being sedentary (Hanlon, Larson, Bailey, & Lecheminant, 2012; Evero et al., 2012; Cornier, Melanson, Salzberg, Bechtell, & Tregellas, 2011). Though some researchers believe that exercise leads to these effects by reducing attentional biases towards foods (e.g. Oh & Taylor), there are likely more variables at play.

Our findings have important implications not only for future research but also for clinicians, public health officials, and individuals looking to live healthier lifestyles. We observed that restrained eaters exhibited an attentional bias away from high-calorie foods during initial processing, whereas unrestrained eaters did not. We also observed that non-emotional

eaters, but not emotional eaters, experienced reduced attentional bias towards food following exercise and reduced attentional bias towards high- and low-calorie foods after reading a neutral magazine. Between-group differences like these emphasize that interventions that might help non-emotional eaters change their eating behavior will not necessarily help emotional eaters. It is therefore important to tailor treatment approaches to individuals and to consider an individual's unique traits and tendencies before suggesting interventions.

References

Ahern, A. L., Field, M., Yokum, S., Bohon, C., & Stice, E. (2010). Relation of dietary restraint scores to cognitive biases and reward sensitivity. *Appetite*, *55*(1), 61-68.

Berridge, K. C. (1996). Food reward: brain substrates of wanting and liking. *Neuroscience & Biobehavioral Reviews*, *20*(1), 1-25.

Blundell, J. E., & King, N. A. (2000). Exercise, appetite control, and energy balance. *Nutrition*, *16*(7), 519-522.

Boon, B., Vogelzang, L., & Jansen, A. (2000). Do restrained eaters show attention toward or away from food, shape and weight stimuli?. *European Eating Disorders Review*, *8*(1), 51-58.

Brignell, C., Griffiths, T., Bradley, B. P., & Mogg, K. (2009). Attentional and approach biases for pictorial food cues. Influence of external eating. *Appetite*, *52*(2), 299-306.

Brown, G., Jackson, A., & Stephens, D. N. (1998). Effects of repeated withdrawal from chronic ethanol on oral self-administration of ethanol on a progressive ratio schedule. *Behavioural pharmacology*.

Burger, K. S., & Stice, E. (2011). Relation of dietary restraint scores to activation of reward-related brain regions in response to food intake, anticipated intake, and food pictures. *Neuroimage*, *55*(1), 233-239.

Center for Disease Control and Prevention. (2013). *Health, United States, 2013.*

Cogan, J. C., & Ernsberger, P. (1999). Dieting, weight, and health: Reconceptualizing research and policy. *Journal of Social Issues*, *55*(2), 187-205.

Cools, J., Schotte, D. E., & McNally, R. J. (1992). Emotional arousal and overeating in restrained eaters. *Journal of Abnormal Psychology*, *101*(2), 348.

Cornier, M. A., Melanson, E. L., Salzberg, A. K., Bechtell, J. L., & Tregellas, J. R. (2012). The effects of exercise on the neuronal response to food cues. *Physiology & Behavior*, *105*(4), 1028-1034.

Ehringer, M. A., Hoft, N. R., & Zunhammer, M. (2009). Reduced alcohol consumption in mice with access to a running wheel. *Alcohol*, *43*(6), 443-452.

Evero, N., Hackett, L. C., Clark, R. D., Phelan, S., & Hagobian, T. A. (2012). Aerobic exercise reduces neuronal responses in food reward brain regions. *Journal of Applied Physiology*, *112*(9), 1612-1619.

Federoff, I. D., Polivy, J., & Herman, C. P. (1997). The effect of pre-exposure to food cues on the eating behavior of restrained and unrestrained eaters. *Appetite*, *28*(1), 33-47.

Field, M., & Cox, W. M. (2008). Attentional bias in addictive behaviors: a review of its development, causes, and consequences. *Drug and Alcohol Dependence*,*97*(1), 1-20.

Hanlon, B., Larson, M. J., Bailey, B. W., & Lecheminant, J. D. (2012). Neural response to pictures of food after exercise in normal-weight and obese women. *Medicine and Science in Sports and Exercise*, *44*(10), 1864-1870.

Harris, J. L., Bargh, J. A., & Brownell, K. D. (2009). Priming effects of television food advertising on eating behavior. *Health Psychology*, *28*(4), 404.

Hepworth, R., Mogg, K., Brignell, C., & Bradley, B. P. (2010). Negative mood increases selective attention to food cues and subjective appetite. *Appetite*, *54*(1), 134-142.

Herman, C. P., & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality*, *43*(4), 647-660.

Hill, A. J., Weaver, C. F., & Blundell, J. E. (1991). Food craving, dietary restraint and mood. *Appetite*, *17*(3), 187-197.

Jansen, A., & Van den Hout, M. (1991). On being led into temptation: "Counterregulation" of dieters after smelling a "preload". *Addictive Behaviors*, *16*(5), 247-253.

Johansson, L., Ghaderi, A., & Andersson, G. (2004). The role of sensitivity to external food cues in attentional allocation to food words on dot probe and Stroop tasks. *Eating Behaviors*, *5*(3), 261-271.

Kemps, E., & Tiggemann, M. (2009). Attentional bias for craving-related (chocolate) food cues. *Experimental and Clinical Psychopharmacology*, *17*(6), 425.

Markland, D., & Ingledew, D. K. (1997). The measurement of exercise motives: Factorial validity and invariance across gender of a revised Exercise Motivations Inventory. *British Journal of Health Psychology*, *2*(4), 361-376.

McNeil, J., Cadieux, S., Finlayson, G., Blundell, J. E., & Doucet, É. (2015). The effects of a single bout of aerobic or resistance exercise on food reward. *Appetite*, *84*, 264-270.

Mogg, K., Bradley, B. P., Hyare, H., & Lee, S. (1998). Selective attention to food-related stimuli in hunger: Are attentional biases specific to emotional and psychopathological states, or are they also found in normal drive states? *Behaviour Research and Therapy*, *36*(2), 227-237.

O'Connor, D. B., Jones, F., Conner, M., McMillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology*, *27*(1S), S20.

Oh, H., & Taylor, A. H. (2013). A brisk walk, compared with being sedentary, reduces attentional bias and chocolate cravings among regular chocolate eaters with different body mass. *Appetite*, *71*, 144-149.

Oh, H., & Taylor, A. H. (2014). Self-regulating smoking and snacking through physical activity. *Health Psychology*, *33*(4), 349.

Panek, L. M., Jones, K. R., & Temple, J. L. (2014). Short term aerobic exercise alters the reinforcing value of food in inactive adults. *Appetite*, *81*, 320-329.

Papies, E. K., Stroebe, W., & Aarts, H. (2008). The allure of forbidden food: On the role of attention in self-regulation. *Journal of Experimental Social Psychology*, *44*(5), 1283-1292.

Placanica, J. L., Faunce, G. J., & Soames Job, R. F. (2002). The effect of fasting on attentional biases for food and body shape/weight words in high and low eating disorder inventory scorers. *International Journal of Eating Disorders*,*32*(1), 79-90.

Polivy, J. (1976). Perception of calories and regulation of intake in restrained and unrestrained subjects. *Addictive Behaviors*, *1*(3), 237-243.

Polivy, J., & Herman, C. P. (2002). If at first you don't succeed: False hopes of self-change. *American Psychologist*, *57*(9), 677.

Rogers, P. J., & Hill, A. J. (1989). Breakdown of dietary restraint following mere exposure to food stimuli: interrelationships between restraint, hunger, salivation, and food intake. *Addictive Behaviors*, *14*(4), 387-397.

Smeets, E., Roefs, A., van Furth, E., & Jansen, A. (2008). Attentional bias for body and food in eating disorders: Increased distraction, speeded detection, or both? *Behaviour Research and Therapy*, *46*(2), 229-238.

Soetens, B., Braet, C., Van Vlierberghe, L., & Roets, A. (2008). Resisting temptation: effects of exposure to a forbidden food on eating behaviour. *Appetite*, *51*(1), 202-205.

Spoor, S. T., Bekker, M. H., Van Strien, T., & van Heck, G. L. (2007). Relations between negative affect, coping, and emotional eating. *Appetite*, *48*(3), 368-376.

Stice, E., Presnell, K., Shaw, H., & Rohde, P. (2005). Psychological and behavioral risk factors for obesity onset in adolescent girls: a prospective study. *Journal of Consulting and Clinical Psychology*, *73*(2), 195.

Stroebe, W., Papies, E. K., & Aarts, H. (2008). From homeostatic to hedonic theories of eating: Self-regulatory failure in food-rich Environments. *Applied Psychology*, *57*(1), 172-193.

Taylor, A. H., & Oliver, A. J. (2009). Acute effects of brisk walking on urges to eat chocolate, affect, and responses to a stressor and chocolate cue. An experimental study. *Appetite*, *52*(1), 155-160.

Van Kleef, E., Shimizu, M., & Wansink, B. (2011). Food compensation: do exercise ads change food intake?. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(6), 661-4.

Van Rensburg, K. J., Taylor, A., Benattayallah, A., & Hodgson, T. (2012). The effects of exercise on cigarette cravings and brain activation in response to smoking-related images. *Psychopharmacology*, *221*(4), 659-666.

Van Strien, T., Frijters, J. E., Bergers, G., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders*, *5*(2), 295-315.

Veenstra, E. M., & de Jong, P. J. (2010). Restrained eaters show enhanced automatic approach tendencies towards food. *Appetite*, *55*(1), 30-36.

Wadden, T. A., Brownell, K. D., & Foster, G. D. (2002). Obesity: Responding to the global epidemic. *Journal of Consulting and Clinical Psychology*, *70*(3), 510.

Werthmann, J., Field, M., Roefs, A., Nederkoorn, C., & Jansen, A. (2014). Attention bias for chocolate increases chocolate consumption–An attention bias modification study. *Journal of Behavior Therapy and Experimental Psychiatry*,*45*(1), 136-143.

Werthmann, J., Roefs, A., Nederkoorn, C., & Jansen, A. (2013). Desire lies in the eyes: attention bias for chocolate is related to craving and self-endorsed eating permission. *Appetite*, *70*, 81-89.

White, M. A., Whisenhunt, B. L., Williamson, D. A., Greenway, F. L., & Netemeyer, R. G. (2002). Development and validation of the food-craving inventory. *Obesity Research*, *10*(2), 107-114.

Yeomans, M. R., & Coughlan, E. (2009). Mood-induced eating. Interactive effects of restraint and tendency to overeat. *Appetite*, *52*(2), 290-298.

Yokum, S., Ng, J., & Stice, E. (2011). Attentional bias to food images associated with elevated weight and future weight gain: an fMRI study. *Obesity*, *19*(9), 1775-1783.

Table 1
Demographics

	Exercise Condition (n = 32)	Ex-Mag Condition (n = 30)	Ntl-Mag Condition (n = 31)
Age (in years)	19.28 ± 1.44	18.93 ± .980	19.16 ± 1.296
BMI	22.87 ± 3.06	23.57 ± 3.36	24.90 ± 4.26
underweight (%)	6.3%	3.4%	3.2%
normal weight (%)	75.0%	79.3%	67.7%
overweight (%)	15.6%	13.8%	19.4%
obese (%)	3.1%	3.4%	9.7%
Currently dieting (% yes)	31.30%	30.00%	22.60%
Time since last ate (in hours)	4.59 ± 5.35	3.73 ± 3.02	3.70 ± 3.66
Restrained eaters (%)	65.60	53.30	41.90
Emotional eaters (%)	59.40	56.70	41.90
Exercise			
Frequency (days/wk)	2.19 ± .90	2.43 ± 1.07	32.32 ± 1.01
Athletes (%)	31.30	40.00	32.30
Exercise Motivations Inventory			
Weight management	17.28 ± 5.13	15.13 ± 6.36	15.74 ± 5.24
Appearance	15.47 ± 4.88	13.67 ± 4.83	14.19 ± 4.33
Food Craving Inventory			
High Fat	1.80 ± .52	1.62 ± .49	1.57 ± .49
Carbohydrates	2.21 ± .63	2.35 ± .72	2.06 ± .59
Sweets	2.56 ± .67	2.58 ± .59	2.48 ± .78
Fast Food	2.55 ± .63	2.38 ± .79	2.65 ± .75

Note: BMI omitted from 1 participant who declined to have height and weight recorded

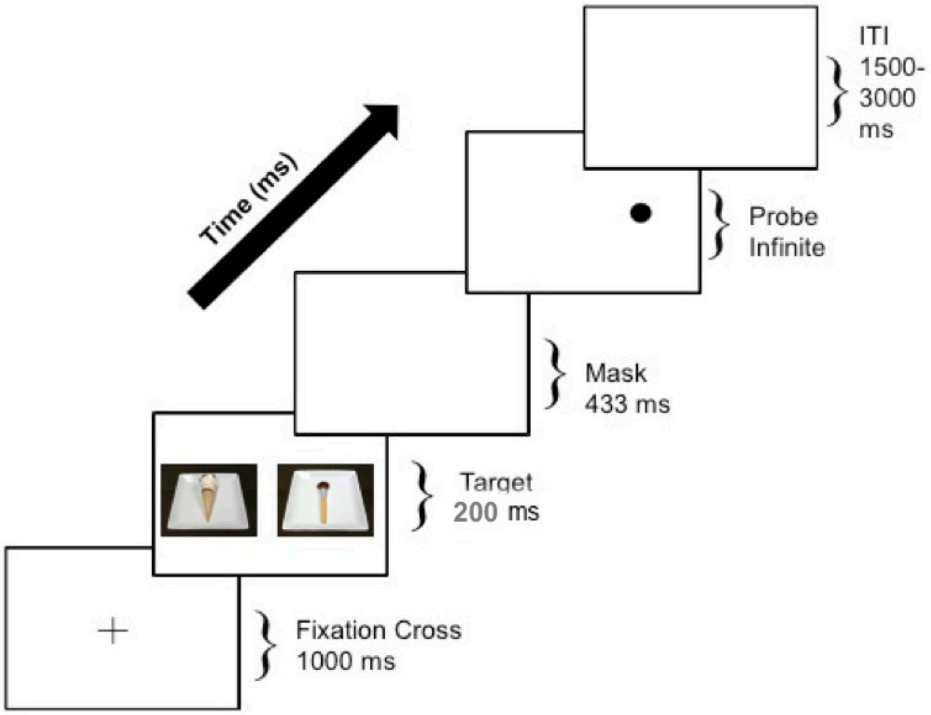

Figure 1. Schematic of the dot probe task. The boxes represent screenshots ordered chronologically from left to right. Duration is listed to the right of each screen.

Figure 2. High-calorie (top) and low-calorie (bottom) picture pairs used in the dot probe task. Pictures were developed in the lab.

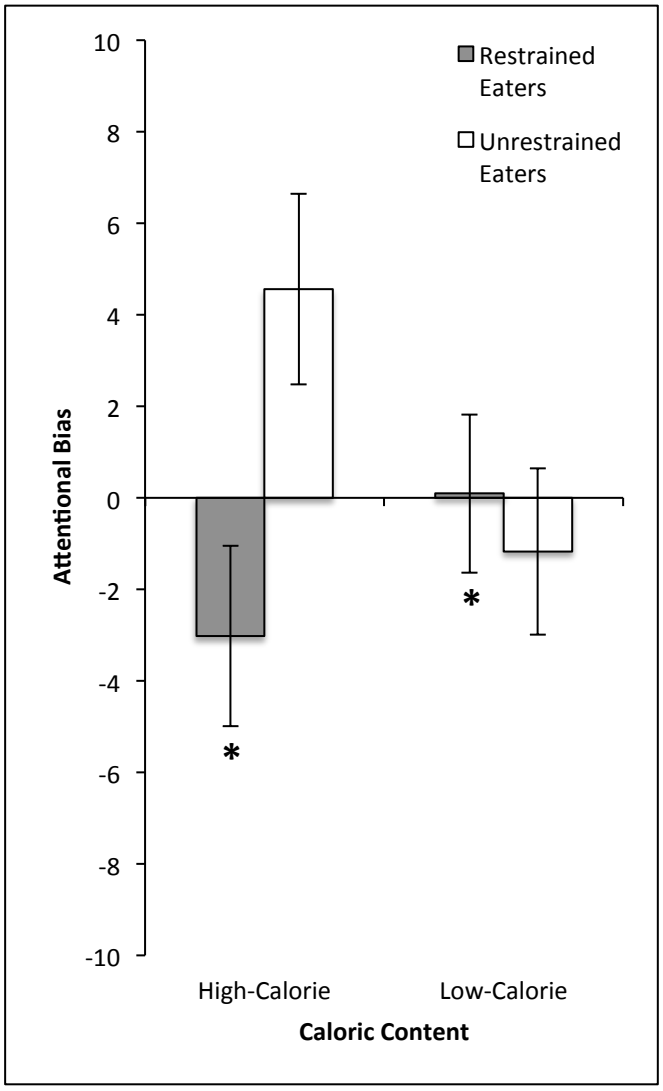

Figure 3. Attentional bias for high- and low-calorie foods in restrained and unrestrained eaters. Error bars indicate SEM. * indicates $p < .01$

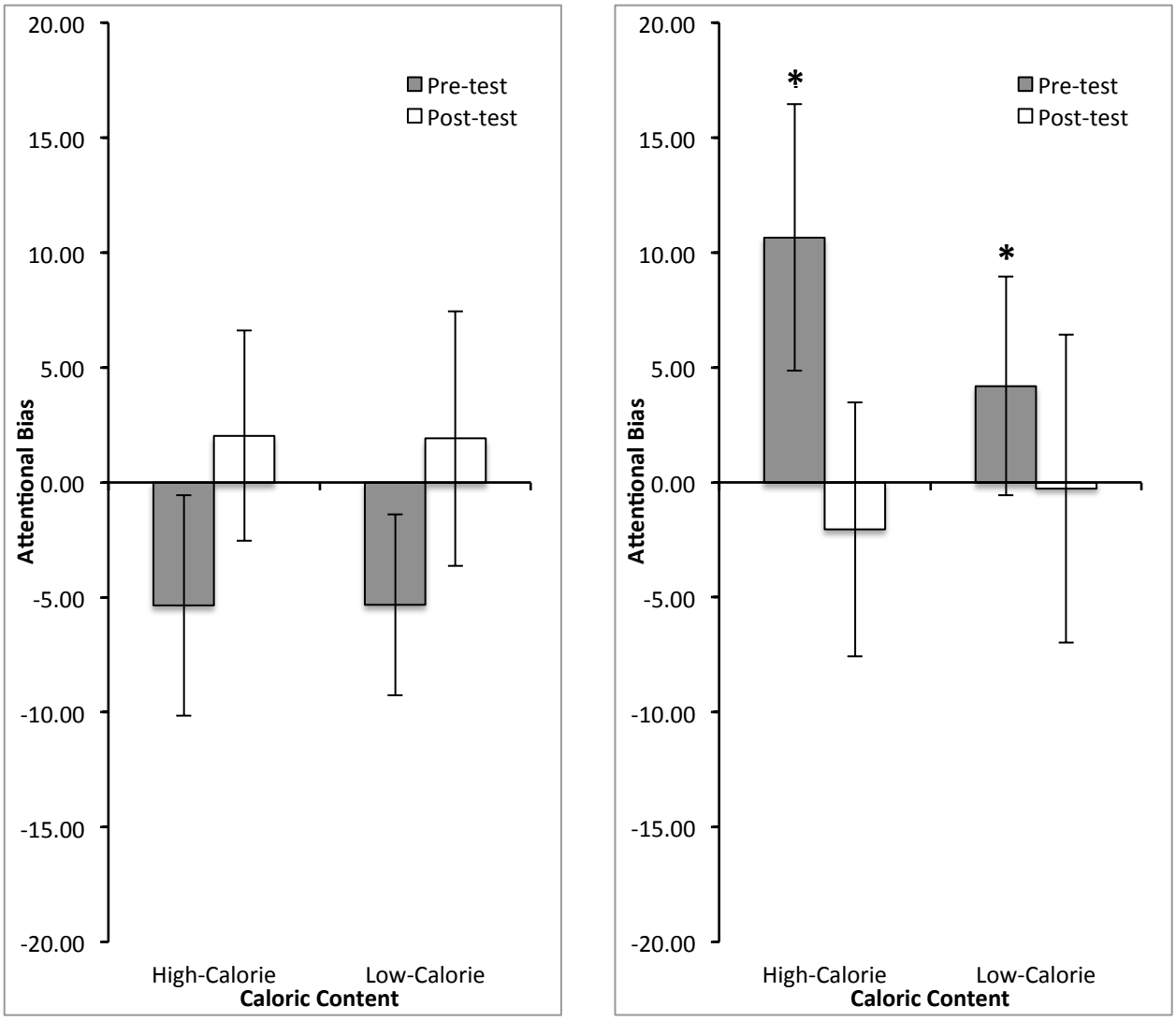

Figure 4. Attentional bias for high- and low-calorie foods before and after the intervention in emotional (left) and non-emotional eaters (right) in the Ex condition.

Error bars indicate SEM. * indicates $p < .05$.

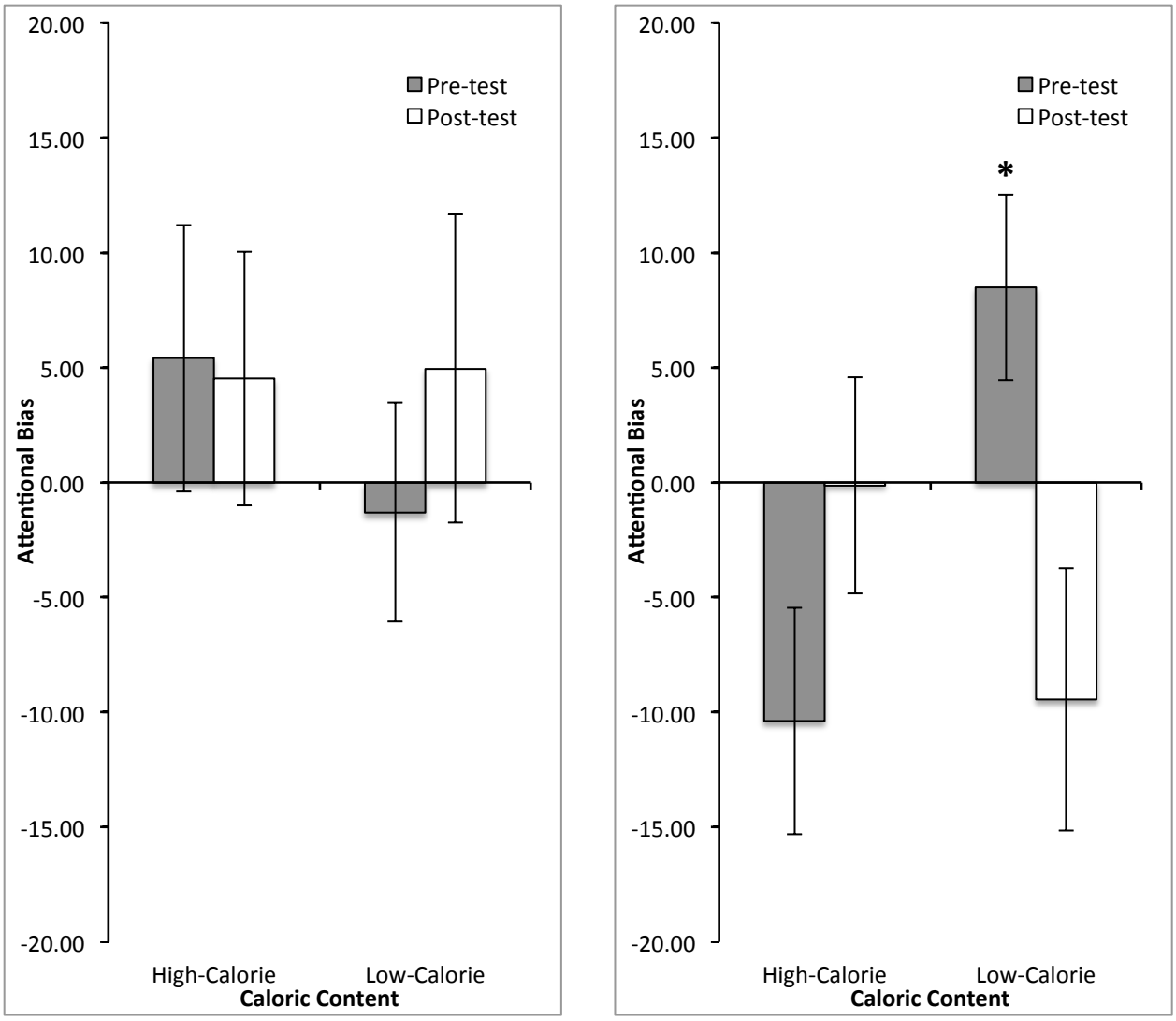

Figure 5. Attentional bias for high- and low-calorie foods before and after the intervention in emotional (left) and non-emotional eaters (right) in the Ntl-Mag condition.

Error bars indicate SEM. * indicates $p < .05$.

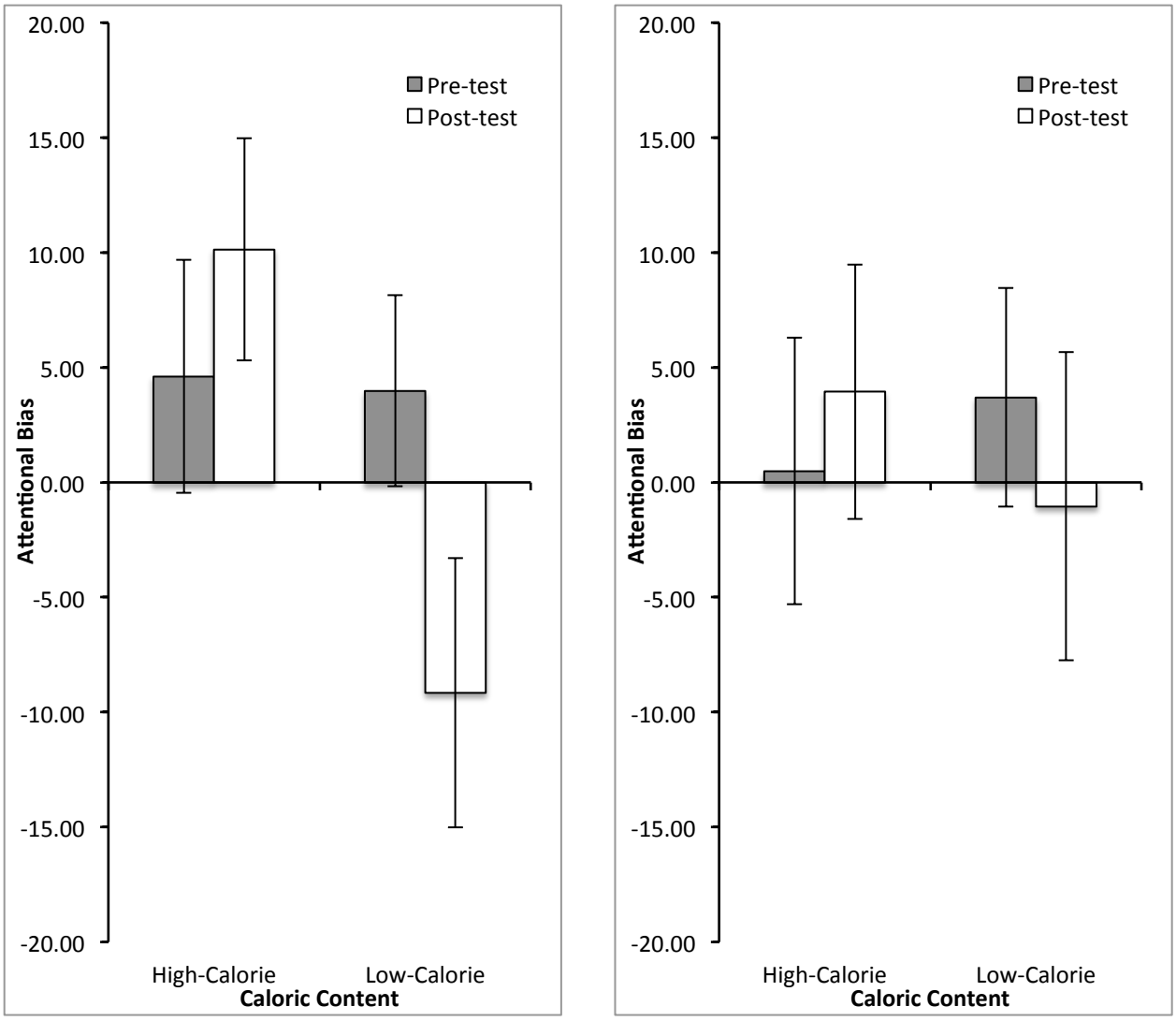

Figure 6. Attentional bias for high- and low-calorie foods before and after the intervention in emotional (left) and non-emotional eaters (right) in the Ex-Mag condition.

Error bars indicate SEM. * indicates $p < .05$.

Appendix A1

Exercise Motivations Inventory 2: Weight Management Subscale

Directions: Whether you currently exercise regularly or not, please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement is true for you personally, or would be true for you personally if you did exercise.

Personally, I exercise (or might exercise)…

	Not at all true for me					**Very true for me**
To stay slim	0	1	2	3	4	5
To lose weight	0	1	2	3	4	5
To help control my weight	0	1	2	3	4	5
Because exercise helps me to burn calories	0	1	2	3	4	5

Appendix A2

Exercise Motivations Inventory 2: Appearance Subscale

Directions: Whether you currently exercise regularly or not, please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement is true for you personally, or would be true for you personally if you did exercise.

Personally, I exercise (or might exercise)…

	Not at all true for me					**Very true for me**
To help me look younger	0	1	2	3	4	5
To have a good body	0	1	2	3	4	5
To improve my appearance	0	1	2	3	4	5
To look more attractive	0	1	2	3	4	5

Appendix B

Dutch Eating Behavior Questionnaire

If you have put on weight, do you eat less than you usually do? Never Seldom Sometimes Often Very often Non-relevant
Do you try to eat less at mealtimes than you would like to eat? Never Seldom Sometimes Often Very often
How often do you refuse food or drink offered because you are concerned about your weight? Never Seldom Sometimes Often Very often
Do you watch exactly what you eat? Never Seldom Sometimes Often Very often
Do you deliberately eat foods that are slimming? Never Seldom Sometimes Often Very often
When you have eaten too much, do you eat less than usual the following days? Never Seldom Sometimes Often Very often Non-relevant
Do you deliberately eat less in order not to become heavier? Never Seldom Sometimes Often Very often
How often do you try not to eat between meals because you are watching your weight? Never Seldom Sometimes Often Very often
How often in the evening do you try not to eat because you are watching your weight? Never Seldom Sometimes Often Very often

Do you take into account your weight with what you eat? Never Seldom Sometimes Often Very often
Do you have a desire to eat when you are irritated? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you have nothing to do? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are depressed or discouraged? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are feeling lonely? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when somebody lets you down? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are cross? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are approaching something unpleasant to happen? Never Seldom Sometimes Often Very often
Do you get the desire to eat when you are anxious, worried, or tense? Never Seldom Sometimes Often Very often
Do you have a desire to eat when things are going against you or when things have gone wrong? Never Seldom Sometimes Often Very often

Do you have a desire to eat when you are frightened? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are disappointed? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are emotionally upset? Never Seldom Sometimes Often Very often Non-relevant
Do you have a desire to eat when you are bored or restless? Never Seldom Sometimes Often Very often Non-relevant
If food tastes good to you, do you eat more than usual? Never Seldom Sometimes Often Very often
If food smells and looks good, do you eat more than usual? Never Seldom Sometimes Often Very often
If you see or smell something delicious, do you have a desire to eat it? Never Seldom Sometimes Often Very often
If you have something delicious to eat, do you eat it straight away? Never Seldom Sometimes Often Very often
If you walk past the baker, do you have the desire to buy something delicious? Never Seldom Sometimes Often Very often
If you walk past a snack bar or a café, do you have the desire to buy something delicious? Never Seldom Sometimes Often Very often

If you see others eating, do you also have the desire to eat?				
Never	Seldom	Sometimes	Often	Very often
Can you resist eating delicious foods?				
Never	Seldom	Sometimes	Often	Very often
Do you eat more than usual when you see others eating?				
Never	Seldom	Sometimes	Often	Very often
When preparing a meal, are you inclined to eat something?				
Never	Seldom	Sometimes	Often	Very often

Appendix C

Food Craving Inventory

Directions: over the past month, how often have you experienced a craving for the food?

1 = never
2 = rarely (once or twice)
3 = sometimes
4 = often
5 = always/ almost every day

Cake	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Pizza	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Fried chicken	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Gravy	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Sandwich bread	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Sausage	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
French fries	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Cinnamon rolls	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Rice	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Hot dog	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Hamburger	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day

Biscuits	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Ice cream	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Pasta	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Fried fish	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Cookies	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Chocolate	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Pancakes and waffles	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Corn bread	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Chips	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Rolls	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Cereal	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Donuts	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Candy	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Brownies	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day

Bacon	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Steak	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day
Baked potato	1 never	2 rarely	3 sometimes	4 often	5 always/ almost every day