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Fed Up: Do Diet Violations Affect Implicit and Explicit
Wanting and Liking in Restrained Eaters?

A thesis submitted in partial fulfillment of the requirement
for the degree of Bachelor of Arts in the Psychology Department from
The College of William and Mary

by

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Abstract

Dietary restraint is defined as a tendency to consciously restrict or control food intake. When restrained eaters consume a “forbidden food,” or a preload, they experience a diet violation that often is followed by overeating. The goals of this study were to examine whether the perception of a diet violation influences restrained eaters’ implicit and explicit liking and wanting – and whether their liking and wanting of food stimuli is related to subsequent eating patterns. We recruited female participants ($n = 135$) who were asked to consume a high calorie milkshake (a preload). Half of the participants were told that the preload was a “high calorie milkshake,” whereas the remaining participants were told that the milkshake was a “low calorie smoothie.” Before and after consuming the milkshake, participants completed a series of tasks that measured their implicit liking (i.e., the Affective Simon Task) and wanting (a forced choice task) of a range of high and low calorie foods. They were also asked to explicitly rate how much they liked and wanted these foods. Finally, they were given a snack to consume to measure changes in consumption as a function of the information they were given about the milkshake. Results demonstrated that perceptions of caloric content of a preload do not affect implicit and explicit liking and wanting in restrained eaters, however it does affect explicit wanting in unrestrained eaters. Moreover, the degree to which unrestrained eaters, but not restrained eaters, consumed a subsequent snack was affected by explicit liking and wanting of high and low calorie food stimuli. These results suggest that restrained eaters’ liking and wanting of foods may be more sensitive to physiological cues than to external information, and the degree to which they like and want foods does not predict their subsequent consumption of a snack.

Introduction

The obesity epidemic is a growing problem in the United States. As of 2012, more than one-third of adults in the United States are obese (Ogden, Carroll, Kit, & Flegal 2014). To combat this problem, many turn to dieting, which has become a major industry in the United States valued at more than \$30 billion per year (Brownell & Rodin, 1994). There is, however, little support for the notion that diets lead to lasting weight loss or health benefits. Research indicates that one to two thirds of dieters regain more weight than they lose on their diets (Mann, Tomiyama, Westling, Lew, Samuels, & Chatman, 2007).

Dietary restraint is a psychological construct that originally was conceptualized as an intention to diet with the ultimate goal of achieving or maintaining a desired weight (Laessle, Tuschl, Kotthaus, & Prike, 1989). More recently, researchers have suggested that, in contrast to dieters whose caloric restriction appears to be motivated by the goal to lose weight, restrained eaters appear to be motivated by the fear of gaining weight (Lowe, Doshi, Katterman, & Feig, 2013). As a result, restrained eaters' thoughts tend to be dominated by food (Polivy, 1996). For example, when presented with information about a fictitious person, restrained eaters remember more food and weight-related information than unrestrained eaters (King, Polivy, & Herman, 1991). Their thoughts are also disrupted by food and/or weight related words, especially after the consumption of a high-energy food (Mahamedi & Heatherton, 1993; Ogden & Greville, 1993; Perpiña, Hemsley, Treasure, & De Silva, 1993). Moreover, their food consumption tends to be determined by the presence of external food cues in their environment rather than their internal hunger and satiety cues. In one early study, this was demonstrated by giving participants a "vitamin" prior to an ad-lib taste test. Participants were told that previous participants reported that the vitamin made them feel either hungry or full, or they were given no information about

the vitamin. Results demonstrated that restrained eaters ate more when told that the “vitamin” made others hungry than when it made them feel full (Heatherton, Polivy & Herman, 1989), supporting the contention that restrained eaters rely on external food cues rather than their internal cues of hunger and satiety when making food choices.

According to Herman and Polivy (2008), external cues can be divided into two categories: normative and sensory cues. They argue that normative cues, or environmental indicators of what or how much one should eat (i.e. portion size), affect all eaters indiscriminately. However, sensory cues, which refer to the properties of the food itself (i.e. palatability, texture, smell, sound), may have a much stronger effect on restrained eaters. As a result, when restrained eaters are pre-exposed to food cues, such as the odors and the visual characteristics of palatable foods, they are more likely to abandon their dieting goals and engage in disinhibited eating (Fedoroff, Polivy, & Herman, 1997; Fedoroff, Polivy, & Herman, 2003).

In addition to restrained eaters’ hedonic responses to sensory cues, there are other possible explanations for why they disinhibit their eating (Bublitz et al., 2010). One possible explanation is the rebound effect, which occurs after a restrained eater has successfully resisted a temptation. Studies have shown that actions that move one closer to their goal, such as exercising or avoiding tempting food items, can actually cause one to subsequently stray from their goal and indulge in high calorie foods (Fishbach & Dhar, 2005; Louro, Pieters, & Zeelenberg, 2007; Chandon & Wansink, 2007). Bublitz et al. (2010) argues that the rebound effect may be a possible explanation for why restrained eaters move between periods of restraint and periods of disinhibited eating.

Disinhibition often occurs after the consumption of a forbidden or high calorie food, hereafter referred to as a “preload.” This phenomenon was first demonstrated by Herman and

Mack (1975). In their study, participants were “preloaded” with high calorie milkshakes followed by free access to a test food. Although unrestrained eaters compensated for the calories they consumed in the preload by eating less of the test food, restrained eaters did not. In fact, they ate *more* of the test food if they had previously been exposed to the preload. In contrast, when they were not exposed to the preload, restrained eaters ate considerably *less* than the unrestrained eaters. Since Herman & Mack’s seminal paper, this paradigm has been repeatedly used to demonstrate counter-regulatory eating in restrained eaters (e.g., Herman & Polivy, 1975; Herman, Polivy, & Silver, 1979; Hibscher & Herman, 1977; Polivy, 1976).

Counter-regulation has been described as a pattern in which restrained eaters will eat little ad-lib food after no preload or a small preload, but engage in disinhibited eating practices after the consumption of a large, high-calorie preload (Herman & Polivy, 1975; Herman, Polivy, & Silver, 1979; Hibscher & Herman, 1977; Polivy, 1976). According to Herman and Polivy’s (1984) boundary model, restrained eaters have a set “diet boundary” that they impose upon themselves to maintain their desired weight. These boundaries may consist of various rules that limit caloric intake (Stroebe, 2008, p.120). Once their diet boundary has been breached by the consumption of a preload, all inhibitions on eating are removed. (Herman & Polivy, 1984).

Further studies have shown that counter-regulation occurs as a result of restrained eaters’ cognitive perceptions that they have overeaten rather than the physiological experience of overeating (Polivy, 1976; Spencer & Fremouw, 1979; Knight & Boland, 1989). Polivy’s (1976) study demonstrated that when provided with identical preloads, restrained eaters who were informed that the preload was high calorie subsequently consumed more of a test food compared to those who were informed that the preload was low calorie. Thus, it appears that it is the awareness of a caloric violation or the breach of the diet boundary that causes counter-regulation.

Not all research has supported this model however. For example, Jansen (1996) demonstrated that although restrained eaters ate more than unrestrained eaters, they actually underestimate their caloric intake, whereas unrestrained eaters estimated their caloric intake more accurately. These results suggest that rather than perceiving a breach in their diet, they appear to be unaware or in denial with respect to their caloric intake. Therefore, it is still unclear what factors are responsible for restrained eaters' counter-regulatory intake.

Two possible factors involved in counter-regulation may be wanting and liking. Berridge (1996) argues that food reward is made up of two main components: liking (i.e. pleasure or hedonic value) and wanting (i.e. motivation, drive, or appetite). Liking, which is associated with the hedonic component of food reward, results from a central integrative process that incorporates aspects of taste, the physiological state of the individual, and the individual's associative history. Whereas "liking" reflects the pleasure immediately gained from consumption or contact with a stimulus, "wanting" is associated with the incentive salience of a stimulus; the degree to which the stimulus is a desirable and attractive goal that commands attention, and is sought out (Berridge, 1996). These constructs have been shown to be controlled by different neural substrates. Opioid and benzodiazepine/GABA neurotransmitter systems, and substantia innominata/ventral pallidal circuits appear to be mostly associated with liking. In contrast, wanting depends upon mesotelencephalic dopamine systems, which do not influence or mediate the hedonic value of foods (Berridge, 1996; Berridge & Robinson, 1998). Typically, these neural pathways work together so that when we consume a palatable food it produces hedonic pleasure, which in turn increases its incentive salience, thereby causing us to seek it out again, especially when we are hungry (Bindra, 1978; Toates, 1986).

However, research shows that “wanting” and “liking” processes can be triggered even without a person's conscious awareness (Berridge & Winkielman 2003) (i.e., on an implicit level). For example, implicit wanting may occur when stimuli acquire excessive incentive salience (as in the case of addictive substances) which may lead to irrational “wants” for outcomes that are not explicitly wanted, and are neither liked nor even expected to be liked (Wyvell & Berridge, 2000; Berridge & Aldridge, 2008). With respect to liking, researchers have proposed a Reflective-Impulsive System model which involves spontaneous and automatically activated attitudes and evaluations, as well as deliberately activated attitudes and evaluations. Automatically activated attitudes are fast and impulsive and operate on an unconscious level, whereas deliberate attitudes are slower and reflective and operate on a conscious level. Therefore, implicit “liking” and motivational “wanting” for food can influence intake without explicit awareness of the underlying cause (Berridge & Robinson, 2003; Finlayson, King, & Blundell, 2007).

This has been demonstrated by Winkielman, Berridge, and Wilbarger (2005) who conducted a study to investigate the influence of subliminally presented happy and angry faces on pouring and consumption of a beverage, perception of beverage value, and reports of conscious feelings. Their findings were divided into two studies. Study one found that subliminal smiles caused thirsty participants to pour and consume more of the beverage than angry faces. Study two found that when someone receives a beverage as an evaluative target, the expressions of the subliminal faces influenced the beverage's incentive value, or in the case of this study, the participants' willingness to pay for the beverage and the amount they were willing to drink. In both study one and two, the priming effects were restricted to immediate impressions. Furthermore, participants whose beverage ratings were influenced by the

subliminal facial expressions reported no conscious change in their subjective experience. This demonstrated an unconscious change in the participant's liking and wanting for the beverage that occurred without awareness.

Various studies also show that implicit and explicit liking and wanting can become dissociated when it comes to high fat and low fat foods. Finlayson, King, and Blundell (2007; 2008) assessed liking and wanting for foods that varied in fat (high or low) and taste (savory or sweet) with computer-based tasks. In Finlayson et al.'s 2007 study, participants were asked to complete two computer tasks before and after a savory test meal. Explicit wanting was measured with a forced choice methodology asking participants which of two foods they wanted to eat at that moment, and explicit liking was assessed by asking participants to rate the palatability of the food. They found that hunger and satiation influenced the dissociation between liking and wanting in participants. In a satiated state, after the consumption of a savory test meal, participants liked, but did not want, high-fat savory foods more than low-fat savory foods, and they wanted, but did not like, low-fat sweet foods more than high-fat sweet foods. Therefore, this study demonstrates that there is a dissociation between liking and wanting.

Finlayson et al. (2008) also demonstrated dissociations between implicit and explicit wanting. To do this they used the forced choice task described above, and analyzed the proportion of high and low fat foods chosen for explicit wanting and reaction times as a measure of implicit wanting. After completing the tasks while hungry, participants were then given a savory meal. Their study found that satiation caused explicit ratings of wanting to decrease for sweet and savory foods, whereas implicit wanting increased for sweet but not for savory foods. Thus, it appears that while explicit wanting for food decreases across a meal, implicit wanting increases for foods with unique taste characteristics. The question remains whether these

processes are similar for restrained and unrestrained eaters and if so, whether they are related to dietary violations. Although Finlayson et al. (2007; 2008) demonstrated that liking and wanting and implicit and explicit wanting are dissociable measures, their studies did not look at the effects of perceived calories on counter-regulation and disinhibited eating in restrained eaters.

According to Hoefling and Strack (2008), disinhibited eating may occur because of the strong pull that palatable foods have on restrained eaters. Studies show that the sight and smell of palatable foods evoke strong appetitive reactions in restrained eaters, which is indicated by high levels of salivation in response to palatable foods (Brunstrom, Yates, & Witcomb, 2004; LeGoff & Spiegelman, 1987; Tepper, 1992). Hoefling and Strack (2008), measured restrained and unrestrained eaters' implicit and explicit attitudes toward high calorie and low calorie foods when deprived and satiated. In this study, restrained eaters exhibited a dissociation between implicit and explicit liking in which their implicit evaluations were more positive while their explicit evaluations were more negative toward high calorie content than unrestrained eaters regardless of their deprivation state. Thus, it appears that restrained eaters are conflicted about the palatability of high calorie foods and are more attracted to foods on an impulsive level.

Hoefling and Strack (2008) argue that these findings can be understood through the lens of the previously mentioned Reflective-Impulsive System (Strack & Deutsch, 2004). At times, the reflective system and the impulsive system could potentially compete if incompatible schema are presented, which may lead to feelings of conflict. Hoefling and Strack (2008) argue that this is what may potentially be occurring in restrained eaters when they engage in disinhibited eating practices. Restrained eaters exhibit positive implicit associations, which are part of the impulsive system, and negative explicit evaluations which are part of the reflective system. Their positive implicit associations toward high calorie foods may trigger various positive

schemas with respect to enjoying and consuming palatable foods and encourage restrained eaters to approach them. Because the impulsive system is much faster and requires less cognitive resources, their impulsive system may overpower their reflective system and cause them to overeat.

Because of the results demonstrated by these studies, we would like to further investigate the role that implicit and explicit liking and wanting play in restrained eating and possibly further investigate the mechanisms behind counter-regulation. In the present study we manipulated participants' cognitive perceptions of how many calories they consumed. This was accomplished by providing them with a high calorie preload that was either described as a high calorie milkshake or a low calorie smoothie. We then investigated how this manipulation differentially affected restrained and unrestrained eaters' implicit and explicit measures of liking and wanting of pictures of high and low calorie stimuli, and whether liking and wanting predicted their subsequent intake of a snack. Therefore, we aimed to determine whether implicit liking and wanting may be possible mechanisms behind the counter-regulation of restrained eaters. Although Hoefling and Strack (2008) and Veenstra and de Jong (2010) attempted to measure implicit and explicit liking and wanting in restrained eaters, both studies did not evaluate all four of these together nor did they attempt to look at the influence of perceived calories consumed on implicit and explicit liking and wanting.

We hypothesized that after the consumption of a high calorie preload, restrained eaters' implicit liking and wanting for high calorie foods would increase while their explicit liking and wanting of high calorie foods would decrease relative to unrestrained eaters. We further predicted that the *perception* of calories they consumed would further decrease their explicit liking and wanting but not implicit liking and wanting of high calorie foods in the High Calorie

Milkshake Condition. We expect that this may be the case because restrained eaters have displayed a dissociative pattern with respect to their implicit and explicit ratings (Hoeftling & Strack, 2008), whereas unrestrained eaters did not. Because we are predicting that restrained eaters will exhibit a conflict between their implicit and explicit associations, if the Reflective-Impulsive System theory holds true, we further predict that they will counter-regulate when presented with a snack. In the Low Calorie Smoothie Condition, we expect restrained eaters to behave similarly to unrestrained eaters such that implicit and explicit liking and wanting for all foods should decrease due to proper regulation after the consumption of the preload. We expect that this may be the case because restrained eaters will not believe that they have committed a dietary violation after the consumption of a low calorie preload.

Method

Participants: One hundred thirty-five female participants who were between 18 and 37 years of age ($M = 19.67$, $SD = 2.43$) and free of food allergies were recruited. Participants were recruited from either an introductory psychology course at a small liberal arts college in the mid-Atlantic of the USA or through interest in participating in paid studies. Those who participated for monetary compensation were given \$10 for their participation. All procedures were approved by the school's Protection of Human Subjects Committee. Written informed consent was obtained from each participant.

Materials:

Picture Stimuli: Color pictures of various food and non-food items with a white background were presented on a black background on a 17in monitor using E-Prime 2 software (Psychology

Software Tools, Inc., Pittsburgh, PA, USA). Pictures consisted of 10 high calorie foods (cashews, potato chips, chocolate, croissant, donut, french fries, hamburger, hotdog, pepperoni pizza, and swiss cheese) and 10 low calorie foods (bran cereal, grilled chicken breast, hard-boiled egg, fish, grapes, orange, pretzels, rice cakes, salad, and tomatoes). Additionally, 10 non-food neutral images were used for practice trials. All pictures were collected from a food image database created by Blechert, Meule, Busch, and Ohla (2014), which contained high and low calorie food as well as neutral images (Appendix C).

Preload: Each participant was given an identical preload and told that it was either a high calorie “milkshake” or a low calorie “smoothie.” The preload was made with 275 grams of Strawberries and Cream Turkey Hill Ice Cream and 175 mL of Natrel 2% Reduced-Fat Milk. The experimenter prepared the preload five minutes before the participant’s arrival and stored it in the freezer until it was presented to the participant. The preload contained about 600 calories and was weighed before and after the session to determine consumption.

Snacks: Four snacks were chosen to act as an independent variable check towards the end of the procedure and to give insight into the types of foods participants chose to eat after the consumption of either a “milkshake” or a “smoothie.” The foods consisted of two high calorie and two low calories items: 51.6 grams of almonds (292.4 calories; healthy high calorie), 133.1 grams of green seedless grapes (230.9 calories; healthy low calorie), 41.9 grams of Ruffles potato chips (280.6 calories; unhealthy high calorie), and 51.6 grams of Hershey’s chocolate chips (240.8 calories; unhealthy low calorie).

Implicit & Explicit Measures: Three tasks were used to assess implicit and explicit liking and wanting.

Affective Simon Task (AST): The Affective Simon Task (AST) is an implicit measure of liking that was modified from a design used by Veenestra and de Jong (2010). E-prime was used to present 80 trials, each of which began with a 1500ms presentation of a fixation cross that was followed by a picture that appeared in the middle of the screen that was either in a horizontal or portrait orientation for 3000ms. Participants were asked to respond based on the orientation (i.e., landscape or portrait) of pictures presented on the screen using designated keys on a keyboard. Half of the participants were asked to indicate that landscape pictures were “yummy” and portrait pictures were “yucky” while the other half was asked to do the opposite. For each of these counterbalanced conditions, half of the participants were asked to press the “m” key for yucky and the “x” key for yummy, while the other half was asked to do the opposite. The appropriate keys were labelled with the words “YUM” or “YUCK” to minimize confusion. The keyboard used by the participant depended on the version they were assigned. Furthermore, before the start of the task, participants completed a practice session to ensure that they understood the instructions.

The AST task had 16 practice trials consisting of non-food objects and 80 experimental trials consisting of the 20 food stimuli. Each food image was edited into portrait and landscape versions with five different sizes of each orientation (Huijding & de Jong, 2005) to prevent participants from fixating on a part of the screen and to increase the probability that the the orientation of the image would be processed (Veenestra & de Jong, 2010). The long side of the picture was 360, 380, 400, 420, or 440 pixels, and the short side was 15% shorter than the long

side. Of the ten total images created for each food (i.e., five landscape, five portrait), four were randomly selected to be presented during the task. Therefore, each stimulus was presented at random in four different sizes, twice as portrait and twice as landscape.

Forced Choice: The forced choice task was adapted from Finlayson et al. (2008) to measure implicit wanting. E-Prime was used to present 100 trials, each of which consisted of the presentation of a pair of images, one of which depicted a high calorie food item and the other was a low calorie food item. For each participant, half of the trials presented the high calorie food image on the right side of the screen while the remaining trials presented the high calorie food items on the left. Additionally, two versions were created to counterbalance the side of the screen that the high and low calorie foods items were presented between participants. The presentation of these trials were randomized. Participants were instructed to “choose the food that they wanted to eat the most right now with ‘x’ indicating that they prefer the picture on the left and ‘m’ indicating that they prefer the picture on the right.” In addition to recording the frequency with which participants chose high calorie vs. low calorie foods, reaction time was also measured (in milliseconds). By measuring reaction time, participant’s implicit wanting of the high and low calorie foods were recorded.

Visual Analogue Scale (VAS) Task: Explicit liking and wanting was measured with a modified VAS task from Finlayson et al. (2008). Each food stimulus was presented and assessed using a VAS anchored at each end by the statements “not at all” and “extremely”. Participants were told to use the scale to respond to the following questions based on how they felt at that moment: “How much do you like this?” and “How much do you want to experience a mouthful of this?” Participants were also asked to indicate whether or not they have ever eaten the food before.

Before starting this task, participants were shown a preview of what they would view to make sure they understood the instructions.

Questionnaires: Demographic information (e.g. age, race, ethnicity, date of birth, etc.) for all participants, as well as information on their weight, height, and when and what they last ate, was collected. Several other questionnaires were administered and are described below.

Three-Factor Eating Questionnaire (TFEQ): All participants completed the 21-item subscale for cognitive dietary restraint (the degree to which individuals restrain their food intake in order to lose or maintain their weight) of the Three-Factor Questionnaire/Eating Inventory (Stunkard & Messick, 1985). A sample question from this scale was: “When I have eaten my quota of calories, I am usually good about not eating anymore” (Appendix A). Consistent with Stunkard and Messick (1985), cut-off scores were used to separate participants into dichotomous categories. Participants with restraint scores higher than 11 were classified as restrained eaters. Disinhibition, the characterization of the habitual tendency to respond to hedonic properties of food (Barkeling, King, Naslund, & Blundell, 2007) was also assessed (Appendix B).

Time Since Last Ate: We asked participants at what time they last consumed a food or beverage in order to control for the inherent variability in participants’ level of hunger. Participants were asked to not eat at least 1 hour before the session, and several participants indicated they had not eaten since the night before.

Hunger and Fullness. Participants' level of hunger was assessed on a VAS anchored at each end by the statements "not at all" and "extremely." Participants were told to respond to the following question with respect to their hunger level: "How hungry are you right now?" Additionally, participants were asked to indicate how many calories they believed were in the beverage.

Procedure: Participants were randomly assigned to either the High Calorie Milkshake Condition or the Low Calorie Smoothie Condition. Upon arrival, participants were seated in front of a computer and completed informed consent and a demographics questionnaire. They then completed each of the above mentioned tasks in partially randomized order, with the VAS task always at the end. At the beginning of each task, participants were reminded to keep their feet flat on the floor and to sit straight up in their chair. Then, the experimenter read the instructions for each task to the participants and ensured that they understood the instructions. Throughout the tasks, the experimenter remained in the room to ensure compliance.

After the completion of the three tasks, participants were given the preload. Experimenters then read the participants a script according to what condition they were in. The script emphasized either the high calorie or low calorie nature of the preload and asked the participants to drink the entire beverage. Participants were given seven minutes to complete the preload. If the participant was unable to finish the preload by the end of the time or gave up in the middle of the seven-minute period, the experimenter encouraged them to drink as much as they could. Participants were given more time, if necessary, to finish their beverage. The maximum amount of time given to participants was fourteen minutes.

After the completion of the preload portion, participants were asked to repeat the three computer tasks in the same order as in the pre-test. After the three computer tasks, participants

answered the TFEQ questionnaire. Upon completion of the TFEQ, the experimenter brought the four snacks to the participant. They were told to eat as much or as little as they wanted of the ad-lib snacks. Participants were given 15 minutes to consume the snacks and were asked to stay in the room until the experimenter returned after the allotted time. After 15 minutes, the experimenter returned and recorded the participant's height and weight. Participants were then debriefed. Participation in the study took approximately 45-60 minutes.

Results

Participant Characteristics: Of the 135 participants recruited for the study, 11 participants were excluded from all analyses due to food allergies or other diet restrictions. In addition, participants who were unable to complete the tasks ($n = 9$) or did not comply ($n = 1$) were excluded, thus providing 114 participants (High Calorie $n = 56$, Low Calorie $n = 58$) for analyses. Further task-specific exclusion criterion was used for the individual tasks and are described below.

To ensure that the two groups did not differ on any pre-existing variables, we conducted a series of 2 x 2 mixed Analyses of Variance (ANOVAs) with Preload Condition (High Calorie Milkshake vs. Low Calorie Smoothie) as the within-subjects variable and Restraint Status (restrained vs. unrestrained) as the between-subjects variable. As shown in Table 1, participants did not differ in age, BMI, time since they last ate, or snack calories consumed. However, the restrained eaters scored higher than the unrestrained eaters overall on restraint, $F(1, 113) = 366.32, p < .001$, and disinhibition, $F(1, 113) = 8.52, p < .005$, as expected. There was also a marginal Preload Condition x Restraint Status interaction, $F(1, 113) = 3.90, p < .06$. Simple main effects analyses revealed a main effect of Restraint Status, $F(1, 55) = 4.82, p < .04$, in the

High Calorie Milkshake Condition, where restrained eaters consumed significantly less of the preload than unrestrained eaters ($M = 500.10$, $SE = 18.27$ vs $M = 552.33$, $SE = 15.25$), whereas there was no difference in the Low Calorie Smoothie Condition. This suggests that the restrained eaters modified their intake as a function of the information that was provided about the preload (cf. Cavanagh & Forestell, 2013). As a result of this between-group difference in consumption of the preload, subsequent analyses included this factor as a covariate. For perceived calories, there was a marginal main effect of Restraint Status, $F(1, 113) = 3.25$, $p < .08$, where restrained eaters estimated the number of calories in the preload to be higher than that of the unrestrained eaters ($M = 425.76$, $SE = 27.43$ vs $M = 361.77$, $SE = 22.57$). There was also a significant main effect of Preload Condition, $F(1, 113)$, $p < .001$, where participants estimated the calories to be higher in the High Calorie Milkshake Condition than in the Low Calorie Smoothie Condition ($M = 477.00$, $SE = 25.26$ vs $M = 310.53$, $SE = 24.96$).

Table 1

Descriptive characteristics of the sample in each experimental condition (Mean \pm SEM).

	High Calorie Milkshake		Low Calorie Smoothie	
	Restrained (<i>n</i> = 23)	Unrestrained (<i>n</i> = 33)	Restrained (<i>n</i> = 23)	Unrestrained (<i>n</i> = 35)
Age (years)	19.91 \pm .41	19.39 \pm .35	19.30 \pm .41	19.49 \pm .34
BMI (kg/m ²)	22.36 \pm .88	23.37 \pm .72	22.79 \pm .87	22.41 \pm .71
TFEQ*				
Dietary Restraint (range) ^a	14.61 \pm .53	5.49 \pm .46	15.52 \pm .53	6.06 \pm .43
Disinhibition (range) ^a	9.09 \pm .78	6.30 \pm .65	7.83 \pm .78	6.43 \pm .63
Time Since Late Ate (hours)	6.00 \pm .91	5.98 \pm .76	4.77 \pm .91	5.04 \pm .74
Preload Consumption (Cal)	500.10 \pm 16.45 ^b	552.33 \pm 13.73	561.36 \pm 16.45	554.08 \pm 13.34
Perceived preload calories ^{c,d}	511.09 \pm 38.78	442.91 \pm 32.38	340.44 \pm 38.78	280.63 \pm 31.44
Snack Consumption (Cal)	303.15 \pm 37.95	307.07 \pm 33.19	348.17 \pm 38.71	321.73 \pm 32.71

*A score less than greater than 11 indicates dietary restraint; ^a denotes a significant main effect of restraint group; ^b denotes a difference between restraint groups within a condition; ^c denotes a significant main effect of Preload Condition; ^d denotes a marginally significant effect of restraint group

Effect of Preload Consumption and Caloric Perceptions on Implicit and Explicit Responses

Implicit Liking – Affective Simon Task (AST): Trials with response times below 200ms and above 2000ms in the Affective Simon Task (AST) were excluded from analyses. Only trials where the participant answered correctly were used to calculate overall reaction times (RT) for each participant. Those with overall error rates (ER) above 25% were excluded from the analyses. The remaining data were used to calculate overall RT's for high calorie and low calorie foods before and after the preload.

These means were then used to calculate single Extrinsic Affective Simon Task (EAST) scores. EAST scores were calculated for both high calorie and low calorie foods before and after the preload. The EAST score allowed us to interpret the participants' implicit associations with high and low calorie foods. We calculated the EAST scores by subtracting RT's of "yum" responses from RT's of "yuck" responses for each stimulus type. Specifically, a positive EAST score reflected a positive implicit association whereas a negative score reflected a negative implicit association.

A 2 x 2 x 2 x 2 repeated measures ANCOVA was conducted with Stimulus (high calorie vs. low calorie) and Time (pre vs. post-test) as within-subjects variables, and Restraint Status (Restrained vs. Unrestrained) and Preload Condition (High Calorie Milkshake vs. Low Calorie Milkshake) as between-subjects variables. Preload calories consumed was entered as a covariate, and EAST scores were entered as the dependent variable. Analyses revealed a marginal effect of Restraint Status $F(1, 103) = 3.75, p < 0.06$, such that restrained eaters had a more negative implicit association ($M = -6.57, SE = 13.75$) with the food stimuli than unrestrained eaters ($M =$

29.15, $SE = 12.05$), overall. As shown in Figure 1, there was also a Stimulus x Time x Restraint Status interaction, $F(1, 102) = 4.74, p < .04$.

To further understand this interaction, separate analyses were conducted for high calorie and low calorie stimuli. For the high calorie stimuli, there was Time x Restraint Status interaction $F(1, 105) = 6.10, p < .02$. Simple main effects analyses revealed a main effect of Time for restrained eaters such that there was a more positive implicit association for the high calorie food before the preload ($M = 17.78, SE = 15.52$) than after the preload ($M = -18.33, SE = 13.37$), $F(1, 46) = 6.42, p < .02$. For the unrestrained eaters, simple main effect analyses revealed that there was not a significant effect of Time with high calorie stimuli, ($M = 17.05, SE = 14.48$ vs. $M = 34.28, SE = 15.46$), $F(1, 59) = 1.203, p > .25$. For the low calorie stimuli, there was not a Time x Restraint Status interaction, $F(1, 105) = .151, p > .65$.

Figure 1

A. High Calorie Stimuli



B. Low Calorie Stimuli

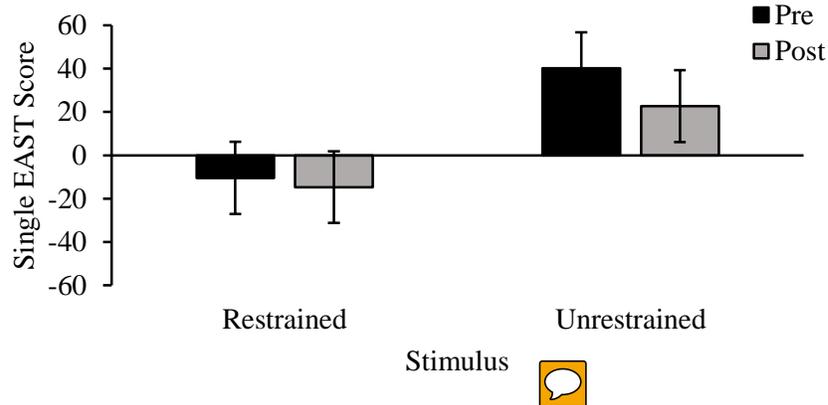


Figure 1 – Marginal estimated mean EAST scores for restrained and unrestrained eaters in response to high calorie food stimuli (A) and low calorie food stimuli before (black bars) and after (grey bars) the preload. Positive scores reflect positive implicit affect, whereas negative scores reflect negative implicit affect. An * indicates a significant difference at $p < 0.05$.

Explicit Liking – VAS Task: Analyses similar to that described above were conducted on the explicit liking ratings on the VAS task. These analyses revealed a significant main effect of Time, $F(1, 102) = 5.99, p < .02$, where participants reported greater explicit liking during the pretest ($M = 67.42, SE = 0.86$) than they did for the posttest ($M = 66.53, SE = 1.05$). As shown in Figure 2, a significant Time x Restraint Status interaction was found, $F(1, 102) = 7.95, p < .01$. Simple main effect analyses revealed that unrestrained eaters reported higher explicit liking ratings ($M = 69.25, SE = 1.14$) than restrained eaters before the consumption of the preload ($M = 65.58, SE = 1.30$) whereas restrained and unrestrained eaters did not differ in their ratings after the preload ($M = 66.21, SE = 1.57$ vs. $M = 66.82, SE = 1.37$).

Figure 2

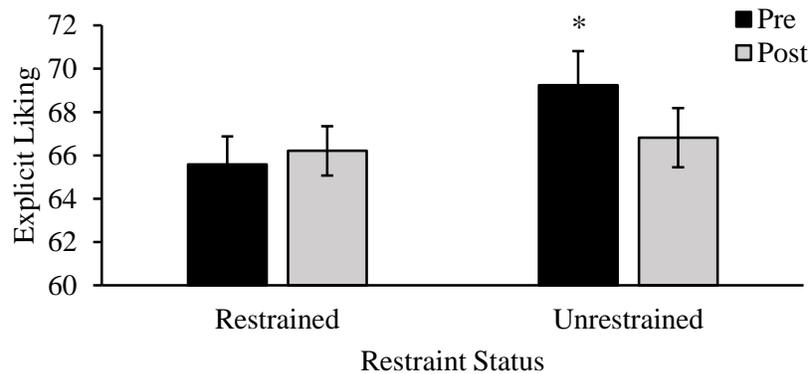


Figure 2 – Explicit liking ratings for restrained and unrestrained eaters before (black bars) and after (grey bars) the preload. An * indicates a significant difference at $p < 0.05$.

Implicit Wanting – Forced Choice: Using similar analyses to those described above, implicit wanting was assessed using the reaction times in the forced choice task as a dependent variable. These analyses revealed a significant main effect of Time, $F(1, 103) = 11.40, p < .001$, where participants responded more quickly after the consumption of the preload ($M = 980.11, SE = 31.17$) than before ($M = 1144.57, SE = 34.67$).

Explicit Wanting – VAS and Forced Choice Tasks: Explicit wanting was analyzed as described above for the wanting ratings on the VAS task. As shown in Figure 3, these analyses revealed a marginally significant Stimulus x Time x Restriction Status interaction $F(1, 114) = 3.62, p = .06$. To further understand this interaction, separate analyses were conducted for high calorie and low calorie stimuli. For high calorie stimuli, there was a main effect of Time, $F(1, 117) = 77.81, p < .001$, where participants reported greater explicit wanting for high calorie stimuli before the preload than after ($M = 55.44, SE = 1.60$ vs $M = 41.74, SE = 2.00$). There was also a significant

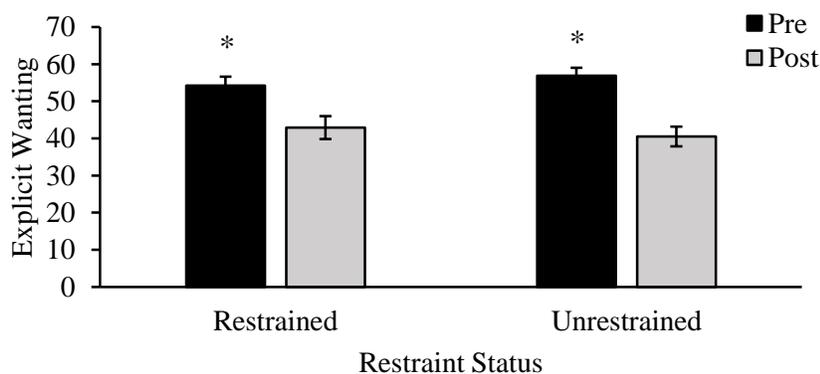
Time x Restraint Status interaction, $F(1, 117) = 4.33, p < .05$. Simple main effect analyses revealed a main effect of Time for restrained eaters, $F(1, 50) = 16.88, p < .001$, where restrained eaters reported greater explicit wanting ratings for high calorie stimuli before consumption of the preload ($M = 53.52, SE = 43.05$) than after the preload ($M = 43.05, SE = 3.11$). For unrestrained eaters, there was also a main effect of Time, $F(1, 67) = 79.95, p < .001$, where unrestrained eaters reported significantly greater explicit wanting ratings for high calorie stimuli before the preload than after ($M = 57.35, SE = 1.91$ vs $M = 40.43, SE = 2.54$).

For low calorie stimuli, there was a significant main effect of Time, $F(1, 117) = 79.96, p < .001$, where participants reported greater explicit wanting ratings for low calorie stimuli before the consumption of the preload than after ($M = 52.26, SE = 1.25$ vs $M = 40.76, SE = 37.48$).

Thus, it appears that although explicit wanting is reduced for both high and low calorie foods after the preload in restrained and unrestrained eaters, pre-post differences for unrestrained eaters are stronger than those of restrained eaters.

Figure 3

A. High Calorie Stimuli



B. Low Calorie Stimuli

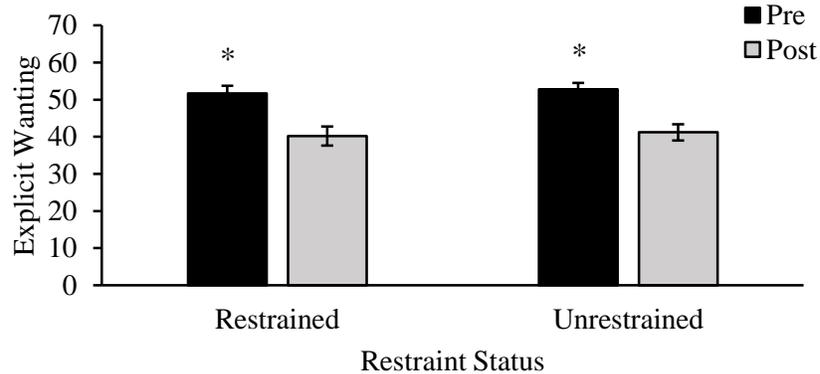


Figure 3 – Explicit wanting ratings for restrained and unrestrained eaters before (black bars) and after (grey bars) the preload. An * indicates a significant difference at $p < 0.05$.

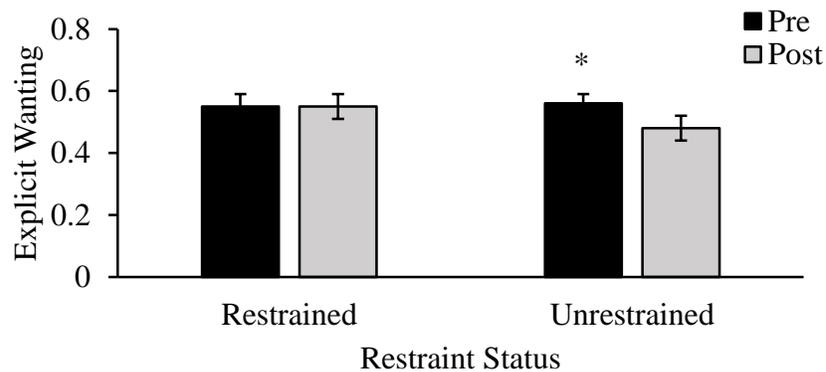
Additionally, we conducted a similar repeated measures ANCOVA to analyze the proportion of high calorie foods versus low calories foods chosen by participants in the forced choice task. As shown in Figure 4, a Time x Restraint Status x Preload Condition interaction was found, $F(1, 115) = 6.54, p < .02$. To further understand this interaction, separate analyses were conducted by Preload Condition for the High Calorie Milkshake Condition and the Low Calorie Smoothie Condition. In the High Calorie Milkshake Condition, there was a significant main effect of Time, $F(1, 58) = 4.74, p < .04$, where participants chose a higher proportion of high calorie stimuli before they consumed the preload than after ($M = .55, SE = .03$ vs $M = .51, SE = .03$). There was also a significant Time x Restraint Status interaction for the High Calorie Milkshake Condition, $F(1, 58) = 7.09, p < .02$. Simple main effect analyses revealed a main effect of Time for unrestrained eaters, $F(1, 33) = 11.41, p < .01$, where unrestrained eaters chose a higher proportion of high calorie stimuli before consuming the preload than after ($M = .57, SE = .03$ vs $M = .48, SE = .03$). For restrained eaters in the High Calorie Milkshake Condition, the

proportion of high calorie stimuli chosen did not differ before ($M = .53, SE = .04$) and after ($M = .54, SE = .04$) consuming the preload $F(1, 25) = .14, p > .7$.

In the Low Calorie Smoothie Condition, there was only a main effect of Time, $F(1, 58) = 4.66, p < .04$, where participants chose high calorie foods more than low calorie foods before the consumption of the preload than after ($M = .55, SE = .03$ vs $M = .51, SE = .03$).

Figure 4

A. High Calorie Milkshake Condition



B. Low Calorie Smoothie Condition

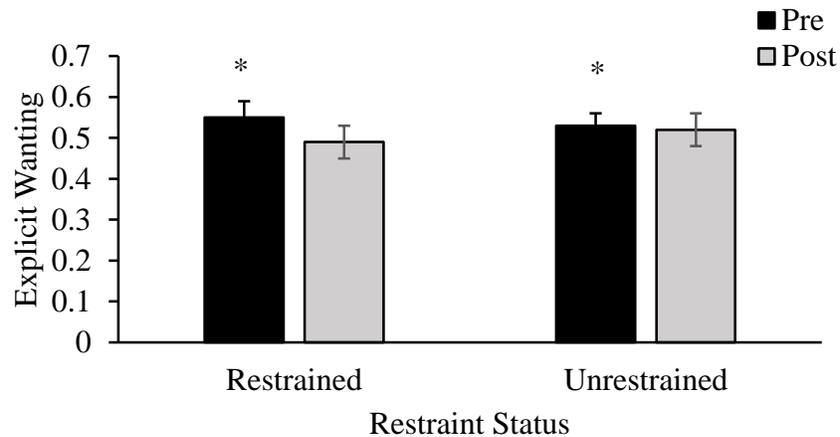


Figure 4 – Explicit wanting proportions for high calorie foods for the High Calorie Milkshake and Low Calorie Smoothie Conditions before (black bars) and after (grey bars) the preload.

An * indicates a significant difference at $p < 0.05$.

Relationship between Implicit and Explicit Liking and Wanting and Snack Consumption

Partial correlations controlling for calories consumed for the preload were used to analyze the relationship between post implicit and explicit liking and wanting scores and reaction times with the consumption of the snack foods. No significant correlations were found for implicit liking and wanting and snack consumption, however several correlations were found for explicit liking and wanting and snack consumption. These are reported below.

Explicit liking scores for high calorie stimuli were correlated with the consumption of high calorie foods, $r(119) = .19, p < .04$, such that the higher explicit liking was for high calorie stimuli after the preload, the more they consumed the high calorie foods. This was also the case for the consumption of low calorie foods with explicit liking scores marginally correlating with the consumption of low calorie foods, $r(119) = .16, p < 0.9$.

Explicit wanting scores for high calorie stimuli were significantly correlated with the consumption of high calorie foods, $r(119) = .26, p < .005$, and low calorie foods, $r(119) = .26, p < .005$. Specifically, the higher explicit wanting was for high calorie stimuli after the preload, the more participants consumed of the high calorie and low calorie foods. Explicit wanting ratings for low calorie foods were marginally correlated with the consumption of high calorie foods, $r(119) = .17, p < .07$, and significantly correlated with the consumption of low calorie foods, $r(119) = .27, p < .004$. Specifically, the higher the participants' explicit wanting score was for low calorie foods, the more they consumed of the high and low calorie foods.

Separate analyses were also done to determine whether there were differences between restrained and unrestrained eaters with respect to implicit liking and wanting and their consumption of the high and low calorie snack foods. Implicit and explicit liking and wanting were not predictive of the consumption of snack foods for restrained eaters. For unrestrained eaters, however, implicit wanting for high calorie stimuli were marginally correlated with the consumption of high calorie foods, $r(66) = .20, p < .1$, such that the higher their implicit wanting was for high calorie foods, the more they would consume of the high calorie snacks. Reported explicit wanting ratings for high calorie stimuli in unrestrained eaters were also significantly correlated with the consumption of high calorie foods, $r(66) = .32, p < .008$, and the consumption of low calorie foods, $r(66) = .30, p < .02$. Specifically, the higher unrestrained eaters' reported explicit wanting scores for high calories foods, the more they would consume of both the high and low calorie foods. Reported explicit wanting ratings for low calorie stimuli in unrestrained eaters was significantly correlated with the consumption of low calorie foods only, $r(66) = .34, p < .006$, where the higher their reported explicit wanting scores for low calorie foods were, the more low calorie snacks they would consume.

Bivariate correlations were also conducted to investigate the relationship between preload calories consumed and snack calories consumed. Preload calories consumed and snack calories consumed were marginally positively correlated, $r(122) = .15, p = .1$, where the more calories participants consumed of the preload, the more snacks they consumed.

Discussion

This study was the first to investigate changes in implicit and explicit liking and wanting as a function of the manipulation of a perceived caloric consumption in restrained and unrestrained eaters. Although both groups received a high calorie milkshake as a preload, some were accurately told that the milkshake was a high calorie milkshake, whereas others were told that it was a low calorie smoothie. Through manipulating perceptions of the caloric content of the preload while controlling for its caloric content, we were able to determine whether differential perceptions of a diet violation affected restrained and unrestrained eaters' implicit and explicit liking and wanting of high and low calorie foods and whether these factors predicted their subsequent consumption of snack foods.

First, our results indicate that our manipulation was effective. That is, those who were told that the preload was a high calorie milkshake perceived it to be more caloric than those who were told that the preload was a low calorie smoothie. In fact, it appears that restrained eaters in the High Calorie Milkshake Condition modified their intake of the preload according to the information provided (i.e., external stimuli) because they consumed significantly less of the milkshake than unrestrained eaters, while there was no difference in the condition in which they were told that the preload was a Low Calorie Smoothie. This is consistent with the tenants of restraint theory proposed by Herman & Polivy (1984), which posits that restrained eaters' consumption is more affected by external rather than internal cues. This finding is also consistent with previous research in our lab (Cavanagh & Forestell, 2013) showing that restrained eaters change their intake depending on the healthfulness of the brand information provided to them about a food.

Contrary to our hypotheses, differential cognitive perceptions of the caloric content of the preload did not affect participants' implicit or explicit liking, or implicit wanting of high and low calorie foods. However, the information provided to participants affected their explicit wanting, as was demonstrated by the change in proportion of high calorie foods chosen in the forced choice procedure. Unrestrained eaters in the High Calorie Milkshake Condition chose a higher proportion of high calorie stimuli relative to low calorie stimuli before compared to after the preload, whereas restrained eaters' choices did not differ. This may suggest that after restrained eaters consume a preload that is perceived to be high calorie, they may abandon their self-imposed diet boundaries. This, in turn, may cause restrained eaters to continue to want high calorie foods despite the fact that they think they have already consumed a high calorie preload. Although it is tempting to assume that restrained eaters' enhanced post preload explicit wanting relative to that of unrestrained eaters may predict their counter-regulatory behaviors, our findings indicate there was no relationship between restrained eaters' explicit wanting of food stimuli and their intake. It is possible that after the preload, which was high in calories, restrained eaters' consumption was affected more by the physiological experience of satiety than the external information provided.

Indeed, although perceived calories did not appear to affect liking and implicit wanting, the physiological effects that resulted from consuming a high calorie preload appeared to affect these cognitive responses. With respect to implicit liking, our findings demonstrated that restrained eaters' positive implicit evaluation of high calorie foods was significantly higher before than after the preload, whereas unrestrained eaters did not differ. This finding suggests that although the preload did not appear to change unrestrained eaters' implicit evaluations of high calorie foods, they did reduce restrained eaters' positive evaluations of these foods. These

findings do not replicate those of Hoefling and Strack (2008). In their study, they used the Extrinsic Affective Simon Task to measure the implicit evaluations of high and low calorie content while participants were either in a deprived (i.e., deprived of food for 15 hours) or satiated state. They found that deprived participants had more positive associations toward food than satiated participants regardless of their restraint status. In contrast, we found that while restrained eaters evaluated the high calorie stimuli more negatively after consuming the satiating preload, unrestrained eaters did not change. It is possible that differences in the levels of deprivation and satiety between the participants in these two experiments explain these disparate results. While participants who were deprived in Hoefling and Strack's (2008) study did not eat for 15 hours, our participants were on average only 5-6 hours deprived when they came into the lab. Moreover, those in the satiated group in Hoefling and Strack's (2008) study were asked to have lunch immediately before the session. This differs from our preload manipulation in that all participants in our study were asked to consume a high calorie milkshake whereas in Hoefling and Strack's (2008) study, they did not control or measure consumption of the lunch. Furthermore, we employed a within-subjects design whereas Hoefling and Strack (2008) used a less powerful between-subjects design, which may explain why we were able to detect an interaction between Time and Restraint Status.

We also found that restrained eaters' implicit evaluation of high and low calorie foods was more negative than that of unrestrained eaters. This is in contrast to Hoefling and Strack (2008) who found that restrained eaters implicitly evaluated high calorie stimuli more positively than unrestrained eaters. Although Hoefling and Strack (2008) argue that it is an intuitive assumption for restrained eaters to have more positive attitudes towards high calorie foods (Stroebe, 2000; Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008), they also claim that it is an

assumption that has not received much empirical support. Our finding also differs from Veenstra and de Jong (2010) who found that both restrained and unrestrained eaters demonstrated strong automatic liking associations with high-fat food over low-fat food. In our study, restrained eaters had more negative evaluations of the high calorie foods than unrestrained eaters before the preload. Given that restrained eaters are constantly attempting to control their intake of high calorie foods, it is possible that they begin to negatively evaluate the “forbidden” foods relative to unrestrained eaters.

Reported explicit liking ratings showed that participants, overall, displayed greater explicit liking for both high and low calorie foods before the preload than after the preload. These findings possibly demonstrate the influence of satiety on explicit liking reports for foods. This finding also replicates Finlayson et al.’s (2008) study that found that changes in hunger were associated with decreases in explicit liking of different types of foods after the consumption of a test meal. Finlayson et al. (2008) argues that this would suggest that foods become less pleasurable because of alliesthesia-like effects (Cabanac, 1989) and sensory-specific satiety (Rolls, 1999). In addition, we found a Time x Restraint Status interaction which revealed that although unrestrained eaters had higher explicit liking ratings than restrained eaters before the preload, there was no difference between the groups after the preload. The results suggest that unrestrained eaters change their ratings of both high and low calorie foods based on their consumption and internal cues of satiety whereas restrained eaters do not. In contrast, Hoefling and Strack (2008) found that restrained eaters evaluated high calorie content more negatively than unrestrained eaters regardless of whether they were deprived or satiated. There are a number of methodological differences between our study and that of Hoefling and Strack (2008) that may explain these disparate results. They presented food words and asked their participants

to rate how much they liked eating the foods in general. In contrast, we asked participants to rate pictures of foods, and our question was more specific (i.e. How much do you like this food right now?). It is also possible that our more powerful within-group design, as opposed to their between-subjects design, facilitated our ability to detect the Time x Restraint Status interaction, relative to Hoefling and Strack (2008).

In the forced choice task we found that participants generally responded more quickly when choosing high or low calorie foods after the consumption of the preload compared to before. This finding may suggest that participants demonstrated higher implicit wanting for both high and low calorie foods after the consumption of the preload, or it may reflect a practice effect, where participants were more familiar with the task the second time they completed it. This is a common problem with reaction times tasks, which can be remedied by conducting a control session where participants do not consume a preload (Finlayson et al., 2008).

With respect to explicit wanting, we measured participants rating of the foods using the VAS Task and the proportion of high calorie relative to low calorie foods they choose during the forced choice task. With respect to the VAS Task, we found that participants reported greater explicit wanting for high and low calorie stimuli before the preload than after. These findings replicate Finlayson et al.'s (2008) finding that explicit wanting decreased after consuming food. Additionally, for high calorie foods we found that this effect was larger for unrestrained than restrained eaters. Specifically, these findings suggest that satiation has an influence on participants' explicit wanting for all foods, especially that of unrestrained eaters for high calorie foods. However, this finding was not revealed in forced choice task. As described above, the proportion of high calorie relative to low calorie foods chosen differed as a function of participants' perceptions of the calories consumed in the preload. These disparate findings are

interesting in that they demonstrate that findings can vary widely depending on the type of task employed.

Although we did not find a relationship between implicit measures of wanting and liking measured after the preload and subsequent snack consumption, we did find relationships between explicit liking and wanting and subsequent snack consumption. Explicit liking scores for high and low calorie stimuli were correlated with the consumption of high and low calorie snacks, respectively; that is, the higher explicit liking was for the food stimuli, the more they consumed. Moreover, the higher reported explicit wanting scores were for high and low calorie food stimuli, the more high and low calorie foods participants consumed. These findings suggest that explicit liking and wanting, which likely reflect conscious awareness of one's previous consumption of a preload, is more predictive of snack consumption than implicit liking and wanting. These findings may be due to response bias, which would affect conscious ratings of the foods as well as snack consumption. It is also possible that participants' explicit liking and wanting may merely reflect their conscious feelings of satiation at the time (Bindra, 1978; Cabanac, 1971, 1979; Schallert & Whishaw, 1978). These findings do not support theories regarding the Reflective-Impulsive System because this theory would predict a correlation between implicit rather than explicit liking and wanting (Hoefling & Strack, 2008).

Closer analyses of the data revealed that although liking and wanting were not correlated with snack consumption for restrained eaters, implicit and explicit wanting were correlated with snack consumption for unrestrained eaters. The fact that implicit and explicit wanting correlate with snack consumption suggests that appetite and incentive motivational properties of foods cues affect consumption in unrestrained, but not restrained eaters. Specifically, unrestrained eaters' subsequent consumption can be predicted by their motivation to obtain the reward, or in

the case of our study, the snacks. Implicit wanting is described as incentive salience that is motivational. Incentive salience transforms sensory information about the reward (i.e. food) into attractive and desired incentives (Berridge and Robinson, 2003). Therefore, when unrestrained eaters viewed the food images in the forced choice task (implicit wanting) and VAS Task (explicit wanting), their motivation to acquire high and low calorie foods predicted how much they subsequently consumed the snacks after the preload. The fact that this occurred in unrestrained but not restrained eaters reinforces the idea that unrestrained eaters' consumption is more likely to be influenced by internal cues than external cues (Herman & Polivy, 1984).

We found only a marginal positive correlation between preload calories consumed and snack calories consumed such that the more of the preload participants consumed, the more snack foods they consume. However, this is not surprising because there was very little variability in preload consumption; most participants drank all of the preload and those who drank less than half of the preload were excluded from analyses. Therefore, the restricted range of consumption of the preload likely precluded our ability to find a significant correlation.

There were various limitations with our design. One possible limitation was that we used a high calorie preload. This could have overshadowed cognitive perceptions of the calories consumed because participants felt satiated in both conditions. Second, our study focused on a university female sample. This limits the generalizability of these findings to society at-large. Replication of this study with a community sample of men and women would provide more insight into the mechanisms involved in restrained eating and counter-regulation. More research in this area needs to focus on males because they are also concerned about weight.

The findings from this study demonstrate that restrained eaters' implicit liking and explicit liking and explicit wanting of food stimuli differs from unrestrained eaters as a function

of their level of satiety or external cues. Second, our study demonstrated that restrained eaters' implicit liking and explicit wanting can be influenced by satiation if a preload is calorically dense, whereas unrestrained eaters' explicit liking and explicit wanting is influenced by satiation. In contrast, for the most part, participants' perception of the calories consumed did not differentially affect their levels of wanting and liking (with the exception of explicit wanting in the forced choice task). Thus it appears that, generally, satiety has a greater influence over wanting and liking than cognitive perceptions – at least when a high calorie preload is used. More research is necessary to better understand the implicit and explicit mechanisms behind restrained eaters' food choices so that we can tailor programs to improve regulation of food intake. Overall, researchers and policy makers need to work together to create scientifically-based intervention programs that will help those who continue to struggle with their weight.

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Appendix A

Three-Factor Eating Questionnaire (TFEQ; Restraint)

- | | | |
|---|---|---|
| 1. When I have eaten my quota of calories, I am usually good about not eating anymore. | T | F |
| 2. I deliberately take small helpings as a means of controlling my weight. | T | F |
| 3. Life is too short to worry about dieting. | T | F |
| 4. I have a pretty good idea about the number of calories in common food. | T | F |
| 5. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it. | T | F |
| 6. I enjoy eating too much to spoil it by counting calories or watching my weight. | T | F |
| 7. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. | T | F |
| 8. I consciously hold back at meals in order to not gain weight. | T | F |
| 9. I eat anything I want, any time I want. | T | F |
| 10. I count calories as a conscious means of controlling my weight. | T | F |
| 11. I do not eat some foods because they make me fat. | T | F |
| 12. I pay a great deal of attention to changes in my figure. | T | F |
| 13. How often are you dieting in a conscious effort to control your weight? | | |
| Rarely Sometimes Usually Always | | |
| 14. Would a weight fluctuation of 5lbs. affect the way you live your life? | | |
| Rarely Sometimes Usually Always | | |
| 15. Do your feelings of guilt about overeating help you to control your food intake? | | |
| Never Rarely Often Always | | |
| 16. How conscious are you what you are eating? | | |
| Not at all Slightly Moderately Extremely | | |
| 17. How frequently do you avoid 'stocking up' on tempting foods? | | |
| Almost Never Seldom Usually Almost Always | | |
| 18. How likely are you to shop for low calorie foods? | | |
| Unlikely Slightly Unlikely Moderately Likely Very likely | | |
| 19. How likely are you to consciously eat slowly in order to cut down on how much you eat? | | |
| Unlikely Slightly Unlikely Moderately Likely Very likely | | |

20. How likely are you to consciously eat less than you want?

Unlikely

Slightly Unlikely

Moderately Likely

Very likely

21. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself? Please circle the choice that applies to you.

0 = eat whatever you want, whenever you want it

1 = usually eat whatever you want, whenever you want it

2 = often eat whatever you want, whenever you want it

3 = often limit food intake, but often 'give in'

4 = usually limit food intake, rarely 'give in'

5 = constantly limiting food intake, never 'giving in'

Appendix B

Three-Factor Eating Questionnaire (TFEQ; Disinhibition)

- | | | | |
|---|----------------|-------------------------------|------------------------|
| 1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal. | T | F | |
| 2. I usually eat too much at social occasions, like parties and picnics. | T | F | |
| 3. Sometimes things just taste so good that I keep on eating even when I am no longer hungry. | T | F | |
| 4. When I feel anxious, I find myself eating. | T | F | |
| 5. Since my weight goes up and down, I have gone on reducing diets more than once. | T | F | |
| 6. When I am with someone who is overeating, I usually overeat too. | T | F | |
| 7. Sometimes when I start eating, I just can't seem to stop. | T | F | |
| 8. It is not difficult for me to leave something on my plate. | T | F | |
| 9. When I feel blue, I often overeat. | T | F | |
| 10. My weight has hardly changed at all in the last ten years. | T | F | |
| 11. When I feel lonely, I console myself by eating. | T | F | |
| 12. Without even thinking about it, I take a long time to eat. | T | F | |
| 13. While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods. | T | F | |
| 14. Do you eat sensibly in front of others and splurge alone? | | | |
| Never | Rarely | Often | Always |
| 15. Do you go on eating binges though you are not hungry? | | | |
| Never | Rarely | Often | Always |
| 16. To what extent does this statement describe your eating behaviour? "I start dieting in the morning but because of any number of things that happen during the day, but the evening I have given up and eat what I want, promising myself to start dieting again tomorrow. | | | |
| Not like me | Little like me | Pretty good description of me | Describes me perfectly |

Appendix C

Figure C1. High Calorie Stimuli.



Figure C2. Low Calorie Stimuli.

