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Implicit Bias about Weight and Weight Loss Treatment Outcomes

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Abstract

Objectives—The goal of the current study was to examine the impact of a weight loss intervention on implicit bias toward weight, as well as the relationship among implicit bias, weight loss behaviors, and weight loss outcomes. Additionally, of interest was the relationship among these variables when implicit weight bias was measured with a novel assessment that portrays individuals who are thin and obese engaged in both stereotypical and nonstereotypical health-related behaviors.

Methods—Implicit weight bias (stereotype consistent and stereotype inconsistent), binge eating, self-monitoring, and body weight were assessed among weight loss participants at baseline and post-treatment (*N*=44) participating in two weight loss programs.

Results—Stereotype consistent bias significantly decreased from baseline to post-treatment. Greater baseline stereotype consistent bias was associated with lower binge eating and greater self-monitoring. Greater post-treatment stereotype consistent bias was associated with greater percent weight loss. Stereotype inconsistent bias did not change from baseline to post-treatment and was generally unrelated to outcomes.

Conclusion—Weight loss treatment may reduce implicit bias toward overweight individuals among weight loss participants. Higher post-treatment stereotype consistent bias was associated with a higher percent weight loss, possibly suggesting that losing weight may serve to maintain implicit weight bias. Alternatively, great implicit weight bias may identify individuals motivated to make changes necessary for weight loss.

Keywords

Implicit weight bias; implicit associations test; obesity; weight loss treatment

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Introduction

Individuals with obesity are often characterized unfavorably (e.g., viewed as "lazy," "weak-willed," "ugly," etc.) and experience discrimination in nearly all domains of life, including employment, medical, and educational settings, and interpersonal relationships (Puhl & Heuer, 2009). Individuals who are overweight and obese show little in-group favoritism (Rudman, Feinburg, & Fairchild, 2002; Wang, Brownell, & Wadden, 2004) and often evidence explicit and implicit anti-fat bias (e.g., Carels et al., 2010; Schwartz, Vartanian, Nosek, & Brownell, 2006; Wang et al., 2004).

Explicit attitudes represent a person's conscious views toward people, objects, or concepts, whereas implicit attitudes represent thoughts and feelings toward objects, groups or concepts which one is either unaware of or cannot attribute to an identified previous experience (Greenwald & Banaji, 1995; Lane, Banaji, Nosek, & Greenwald, 2007). On explicit measures of weight bias individuals who are obese or overweight attribute negative characteristics (e.g. lazy; lacking in self-control) to individuals who are obese at a greater rate than they attribute those same characteristics to individuals who are thin (Carels et al., 2010; Wang et al., 2004). On implicit measures of weight bias, individuals who are overweight or obese express negative implicit bias more frequently toward obese individuals than to thin individuals (Carels et al., 2009b; Carels et al., 2010; Schwartz et al., 2006; Wang et al., 2004).

Generally, explicit attitudes more often predict deliberative responses, such as written evaluations of individuals, whereas implicit attitudes more often predict spontaneous and nonverbal behaviors, such as the amount of time spent looking at someone during a conversation (Bessenoff & Sherman, 2000; Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997). In weight bias research, implicit and explicit biases are often not significantly correlated and are differentially associated with psychological well-being and weight loss treatment outcomes (Carels et al., 2010). To date, analyses have not been conducted to examine whether implicit bias predicts various treatment outcomes above and beyond explicit bias. Typically, explicit and implicit weight bias among overweight individuals seeking weight loss treatment have been associated with poor psychosocial and weight loss treatment outcomes (Carels et al., 2009a; Carels et al., 2010; Carels et al., 2009b; Carels et al., 2013a; Puhl & Heuer, 2009; Wott & Carels, 2009). With few exceptions (Latner, Wilson, Jackson, & Stunkard, 2008), these findings are consistent with research showing an association between weight bias and unhealthy eating behaviors known to negatively influence weight loss, such as loss of control during eating, increased caloric intake, reduced desire to exercise, lower energy expenditure, and inconsistent self-monitoring (Ashmore, Friedman, Reichmann, & Musante, 2008; Carels et al., 2010; Carels et al., 2009b; Wott & Carels, 2009; Schvey, Puhl, & Brownell, 2011; Seacat & Mickelson, 2009; Vartanian & Novak, 2011).

Research suggests that implicit attitudes are malleable and responsive to stimulus characteristics, such as the type of images employed (Dasgupta & Greenwald, 2001). Therefore, it is conceivable that participation in a weight loss program may challenge negative stereotypes about obesity, particularly when participants are exercising regularly and eating more healthfully. Yet, weight loss program participation does not appear to reduce implicit weight bias (Carels et al., 2009b). For example, in two studies, implicit weight bias remained unchanged following weight loss treatment (Carels et al., 2009b; Carels et al., 2010). Because it is automatic in nature, implicit bias may be more resistant to change. Nevertheless, given that implicit weight bias has been associated with poor weight loss treatment outcomes, high levels of weight bias following treatment could create a barrier for successful long-term weight loss.

An alternative explanation for the observed lack of change in implicit bias following weight loss treatment is that the past assessment of implicit bias was not sensitive enough to capture changes in bias. Past weight bias research using the implicit associations test (IAT; Carels et al., 2009b; Carels et al., 2010; Schwartz et al., 2006; Wang et al., 2004) has often relied on the non-specific concepts of '*fat' and 'thin*' rather than images. However, more recently, IATs were developed that contain realistic images of individuals with obesity engaging in behaviors *consistent* (being sedentary or eating junk food) and *inconsistent* (exercising or eating healthy) with obese stereotypes and weight loss (Hinman, Burmeister, Kiefner, Borushok, & Carels, 2014; Carels et al., 2014). We used these IATs to examine change in implicit weight bias in response to weight loss treatment.

Given that the images in the current study were designed to depict individuals who are thin and obese engaging in behaviors commonly associated with obesity (eating junk food and being sedentary) and weight loss (exercising and eating vegetables), implicit bias assessed in response to these images may be more responsive to change following participation in a weight loss program. For example, the automatic associations between being obese and eating junk food (stereotype consistent) might be weakened following participation in a weight loss program, particularly if the individual is engaging in regular exercise and healthy eating. The predictions are somewhat less clear regarding stereotype inconsistent weight bias. In prior research, stereotype inconsistent weight bias was significantly lower than stereotype consistent weight bias (Hinman et al., 2014; Carels et al., 2014). Nevertheless, participating in a weight loss program and becoming accustomed to engaging in positive behaviors commonly associated with weight loss, such as eating healthy and exercising, might serve to diminish implicit weight bias further (e.g., that '*fat'* is '*bad'*).

One aim of the current study was to examine the relationship between stereotype consistent and inconsistent implicit bias about weight and weight loss outcomes, as well as behaviors associated with weight loss outcomes, including self-monitoring frequency, daily caloric intake, daily minutes of exercise, and binge eating. It was hypothesized that during and following weight loss treatment, greater bias, including stereotype consistent or inconsistent implicit biases, would be associated with greater binge eating, less self-monitoring, lower levels of exercise, increased caloric intake, and lower percent weight loss.

In prior research, implicit weight bias was greater when participants viewed images of individuals with obesity engaging in stereotype consistent activities (e.g., watching TV; eating junk food), compared to when the same individuals were engaging in stereotype inconsistent activities (e.g., exercising; eating healthy; Carels et al., 2013b). It was expected that these findings would be replicated. However, another aim of the current study was to examine whether implicit bias assessed utilizing images of individuals who are obese and thin engaging in stereotype consistent and inconsistent activities would be reduced following participation in a weight loss program. That is, as participants find themselves engaging in healthy behaviors (exercise, healthy eating) it was hypothesized that both stereotype consistent and inconsistent bias would be diminished.

Method

Participants

Overweight and obese adults (BMI ≥ 27; *N* = 44) were recruited through mass email, advertisements, and flyers posted in public areas of a medium-sized metropolitan area in the Midwestern United States. Participants were primarily female (84%) and Caucasian (94%). Average age was 53.2 (*SD* = 13.6) and average BMI was 37.0 (*SD* = 7.6; Range 27.5 – 63.3). Sixty-four percent had at least a college degree and 87% reported an annual income greater than $30,000.

Behavioral Weight Loss Program

Participants were randomized into one of two behavioral weight loss programs: a) Diabetes Prevention Program (The Diabetes Prevention Program (DPP) Research Group, 2002) or b) Transform Your Life program (Carels et al., 2011). Both programs lasted 18 weeks and met weekly in small groups of 12 to 15 participants for 90 minutes. Both programs included a combination of didactic instruction, interactive exercises, and homework designed to facilitate weight loss goals through a greater understanding and use of nutrition principles, increased physical activity, and the use of behavioral principles (e.g., goal setting, habit formation). Neither program emphasized issues related to weight bias or other potential confounders, such as body image. Additional details on each program can be found at Diabetes Prevention Program (The Diabetes Prevention Program (DPP) Research Group, 2002) or Transform Your Life (Carels et al., 2011).

Measures

The measures described below for binge eating, implicit bias, and weight were administered before the start of each program and again after its conclusion at 18 weeks (post-treatment). Self-monitoring data were collected throughout the length of each program.

Self-Monitoring

Participants were instructed to record dietary intake. They were encouraged to use popular online calorie databases, such as CalorieKing.com and NutritionData.com and were provided with a calorie guide for common foods items. Participants provided daily calorie intake and self-reported minutes exercised (e.g., 20 minutes walking) electronically to a website or via paper and pencil.

Binge Eating

Participants completed the Binge Eating Scale (Gormally, Black, Dastin, & Rardin, 1982). This widely used 16 item scale measures the severity of an individuals' binge eating behavior across several behavioral and psychological areas. Research has shown that the BES is capable of discerning binge eating pathology severity (Gormally et al., 1982). In the current study sample the chronbach's αs were .87 at baseline and .82 at post-treatment.

Weight Loss

Weight was measured to the nearest 0.1 pounds at baseline and post-treatment using an electronic Tanita BF-350 scale (Tanita; Arlington Heights, Illinois). Height was measured in inches to the closest 0.5 inch using a height rod on a standard spring scale at baseline. Height was converted to meters and weight to kilograms. Body mass index (BMI) was calculated from those measurements as kg/m^2.

Implicit Associations Test

Two previously used computerized versions of the IAT were administered at baseline and post-treatment to measure stereotype consistent and stereotype inconsistent bias (Carels et al., 2013b). Participants classified stimulus exemplars, presented in a random order throughout trials, that were either photos (obese and thin people) or words (e.g., joy, hate) into their appropriate category ('*fat*' or '*thin*' and '*good*' or '*bad*') as quickly as possible based on provided instructions. Faster reaction times to categorize *'fat'* images when paired with concepts of *'bad'* (and *'thin'* images when paired with *'good'* concepts) relative to *'fat'* images paired with *'good'* (and *'thin'* images paired with *'bad'*) were indicative of implicit weight bias.

The IATs were developed and scored using standard block trials and procedures (Greenwald, Nosek, & Banaji, 2003). Participants received several block practice trials (e.g., categories *'good'* and '*bad*' paired with words indicative of '*good*' and '*bad*'; categories *'fat'* and *'thin'* paired with images of *'fat'* and *'thin'* people; categories '*fat*' and '*bad*,' or '*thin*' and '*good*' paired with appropriate words and images; categories '*fat*' and '*good*,' or '*thin*' and '*bad*' paired with appropriate words and images) prior to test trials. Consistent with standard scoring procedures, practice trials were not included in the scoring. For each IAT test trial, participants viewed each of the 32 images multiple times for a total of 112 images, the order of which was randomly sampled. To ensure adherence to pairing instructions, participants received immediate feedback (i.e. "error" signal) only for errors on each trial. Additionally, trials with reaction times greater than 10,000 ms were identified (n = 0 for all IATs) and participant data for which greater than 10 percent of trials were shorter than 300 ms (n = 1 for both baseline stereotype consistent and inconsistent IATs). This participant's data was excluded from final analyses.

For each participant, two difference scores were calculated, one for the stereotype consistent IAT and one for the stereotype inconsistent IAT. Difference scores were created by subtracting selected trials with category pairings '*fat/bad'* and '*thin/good'* from trials pairing '*fat/good'* and '*thin/bad'* categories. Thus, greater difference scores suggested that response times were significantly shorter when the category '*fat'* was paired with the category '*bad'* versus the category '*good*' (again, all response times are relative to when the category '*thin*' was paired with the categories '*good*' and '*bad*', respectively). Higher difference scores for both IATs were indicative of increased implicit anti-fat attitudes when responding to images that were either stereotype consistent or inconsistent. For more detailed information about IAT scoring procedures used, please see Greenwald et al. (2003).

Photos of individuals with obesity in stereotype consistent and inconsistent poses were provided by the Yale Rudd Center for Food Policy and Obesity (http://www.yaleruddcenter.org/press/image_gallery.aspx). These images depicted individuals with obesity engaging in stereotype consistent '*unhealthy*' behaviors (e.g., watching TV/eating junk food) and stereotype inconsistent '*healthy*' behaviors (e.g., exercising/preparing fruits and vegetables). The photos of normal weight individuals were taken by our laboratory to match the Rudd Center photos on factors such as gender, ethnicity, age, style of dress, poses, situations, and props used. These images depicted normal weight individuals engaging in stereotype consistent '*healthy*' (e.g., exercising/preparing fruits and vegetables) and inconsistent '*unhealthy*' behaviors (e.g., watching TV/eating junk food).

Results

Stereotype Consistent and Inconsistent Bias at Baseline

Forty-four participants completed the baseline IAT and 39 participants completed the post-treatment IAT. As previously reported (Carels et al., 2013b), a one sample *t*-test, comparing difference scores to zero, indicated that significant implicit anti-fat attitudes were present at baseline, regardless of whether participants viewed stereotype consistent (M = 1.09, SD =0.53; $t(44) = 13.83$, $p < .01$) or inconsistent photos (M = 0.65, SD = 0.46; $t(44) = 9.39$, $p < .01$). There was greater weight bias (i.e., higher difference scores) when participants responded to stereotype consistent images compared to stereotype inconsistent images, $t(44) = 4.60$, $p < .01$.

Stereotype Consistent and Inconsistent Bias at Post-Treatment

At post-treatment, a one sample *t*-test, comparing difference scores to zero, indicated significantly high difference scores and thus the presence of implicit anti-fat bias. Significant implicit anti-fat bias continued to be present for both consistent (M = 0.54, SD = 0.53; *range* = 0.10 – 2.32; $t(39) = 10.86$, $p < .01$) and inconsistent (M = 0.68, SD = 0.59; *range* = −0.22 – 1.90; $t(39) = 7.18$, $p < .01$) photos. However, at post-treatment, the difference in weight bias between stereotype consistent and inconsistent images failed to meet conventional standards of statistical significance, $t(38) = 2.02$, $p = .054$.

Change in Implicit Bias Following Treatment

Paired-sample *t*-tests were used to analyze differences between baseline and post-treatment implicit bias when responding to stereotype consistent versus stereotype inconsistent photos. Stereotype consistent weight bias was significantly reduced from baseline (M = 1.18, SD =0.52) to post-treatment (M = 0.92, SD =0.55; *range* = −0.24 – 2.21; $t(36) = 2.32$, $p < .03$). Stereotype inconsistent bias was unchanged from baseline (M = 0.65, SD = 0.48) to post-treatment (M = 0.64, SD =0.59; *range* = −0.44 – 2.24; $t(36) = 0.14$, p = ns).

Implicit Bias and Treatment Outcomes

Preliminary analyses—There were no differences between treatment conditions at pre- and post-treatment for stereotype consistent and stereotype inconsistent bias. Nevertheless, as a precaution, treatment condition was controlled for in all analyses not examining baseline correlates. Preliminary analyses indicated that age was associated with stereotype inconsistent bias ($r = .44$, $p < .01$) and marginally associated with percent weight loss ($r = .32$, $p = .058$). Therefore, age was controlled for in subsequent regression analyses. No other demographic factors were associated with implicit bias or percent weight loss (i.e., income, education, ethnicity, gender, baseline BMI).

Treatment outcomes—There was no difference between weight loss conditions on any treatment outcomes. Participants lost, on average, 8.3% of their baseline body weight ($SD = 0.6$). Self-monitoring frequency was calculated for each participant based upon the number of days they reported monitoring. They completed, on average, 69.6 daily self-monitoring entries ($SD = 42.9$) over the last 18 weeks of the program (55.2% compliance; after a two week practice period). Participants reported consuming, on average, 1567 calories per day ($SD = 523$) and exercising for 49 minutes per day ($SD = 24.4$). Over the course of treatment, binge eating scores significantly decreased from 21.0 ($SD = 9.3$) to 12.5 ($SD = 6.5$), $t(39) = 7.10$, $p < .001$.

Baseline bias—Pearson correlations between baseline stereotype consistent and inconsistent bias and baseline binge eating indicated that as stereotype inconsistent weight bias increased, binge eating decreased ($r = -.31$; $p = .04$). Separate linear regressions for stereotype consistent and inconsistent bias, controlling for age and condition, revealed that higher stereotype consistent weight bias at baseline was associated with greater self-monitoring frequency, $t(36) = 2.84$, $p = .008$, and lower binge eating at post-treatment, $t(36) = 3.35$, $p = .002$. See Table 1.

Post-treatment implicit bias—Because there was no change in stereotype inconsistent bias from baseline to post-treatment, regressions on post-treatment stereotype inconsistent bias were not performed. Linear regressions, controlling for age, condition, and baseline stereotype consistent bias, were used to examine the relationship between post-treatment stereotype consistent IAT scores and binge eating, self-monitoring variables, and percent weight loss. Higher post-treatment stereotype consistent bias was associated with a higher percent weight loss, $t(36) = 2.58$, $p = .015$. Consistent with the baseline analyses, baseline stereotype consistent bias continued to predict greater self-monitoring frequency, $t(36) = 2.64$, $p = .014$, and lower binge eating, $t(36) = 2.72$, $p = .018$ at post-treatment. Finally, in a linear regression controlling for age and condition, but not controlling for baseline bias, higher post-treatment stereotype consistent bias continued to be associated with a higher percent weight loss, $\beta = .35$, $t(36) = 2.30$, $p = .028$, and lower binge eating, $\beta = -.30$, $t(36) = 2.00$, $p = .05$ at post-treatment. See Table 1.

Associations among treatment outcomes—Linear regressions controlling for age and condition were used to examine the associations between binge eating, self-monitoring variables, and percent weight loss. Greater weight loss was predicted by greater self-

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monitoring frequency, $\beta = .52$, $t(36) = 3.04$, $p = .005$, fewer daily calories consumed, $\beta = -.40$, $t(36) = 2.15$, $p = .041$, and lower binge eating at post-treatment, $\beta = -.448$, $t(36) = 3.02$, $p = .005$. Greater self-monitoring frequency was marginally associated with lower binge eating at post-treatment, $\beta = -.352$, $t(36) = 2.00$, $p = .056$.

Discussion

The goal of the current study was to further examine the relationship among implicit bias, weight loss behaviors, and weight loss outcomes as well as the impact of participation in a weight loss intervention on implicit bias toward weight. Additionally, of interest was the relationship among these variables when weight bias was assessed with a novel assessment of implicit attitudes that portrays individuals who are thin and obese engaged in both stereotypical and nonstereotypical health-related behaviors (Carels et al., 2013b).

Consistent with previous findings among individuals who are overweight (Wang et al., 2004; Latner, Stunkard, & Wilson, 2005), significantly high levels of negative implicit bias toward weight emerged for weight loss participants for stereotype consistent or inconsistent images at baseline and post-treatment. However, although the difference between implicit bias using stereotype consistent and inconsistent images was significantly different at baseline, by the end of treatment, the difference between implicit bias using stereotype consistent and inconsistent images failed to meet conventional standards of statistical significance. Therefore, while it is generally easier for individuals to evidence implicit bias when stereotypical images prime the responder to make associations with common stereotypes (Carels et al., 2013b), this may become increasingly difficult when an individual with obesity is engaging in healthy behaviors that are inconsistent with those stereotypes. Thus, during the course of participation in a weight loss intervention, participants may have begun to implicitly reject common stereotypes of obesity as they increasingly engaged in healthy behaviors.

Over the course of the weight loss intervention, stereotype consistent implicit bias significantly decreased, whereas stereotype inconsistent bias did not change. These findings of decreased implicit weight bias are consistent with similar research assessing stereotype consistent and inconsistent bias in two separate samples, one assessed prior to a weight loss intervention and another assessed following weight loss treatment (Carels et al., 2013b). In that investigation, stereotype consistent bias was lower in a post-treatment sample relative to a different pre-treatment sample. However, because the findings were based on a comparison between samples from two previous weight loss programs, it could not be definitively concluded that intervention effects, rather than sample characteristics, resulted in the observed differences in stereotype consistent weight bias. These previous findings, along with the current study's results, are in contrast to previous research which revealed no differences in implicit bias following weight loss treatment utilizing a more generic assessment (Carels et al., 2009b; Carels et al., 2010). Nevertheless, it is noteworthy that implicit weight bias was lower following a weight loss intervention when it was assessed with more specific IATs that paired images of individuals with obesity with unhealthy behaviors (eating junk food and watching TV). It remains unclear why stereotype inconsistent bias would remain virtually unchanged following treatment. We assumed that participation in a weight loss program would strengthen the association between the category '*good*' and images of obese individuals exercising and eating healthy. However, stereotype inconsistent bias was lower than stereotype consistent bias at baseline and post-treatment. Therefore, a potential "floor" effect may have reduced the likelihood of lower bias. Understanding why stereotype inconsistent bias was not reduced following treatment will be an important question for future research.

The incorporation of images of individuals with obesity engaging in unhealthy behaviors appeared to play an important role in the association between implicit bias toward weight and weight loss behaviors and outcomes. Contrary to expectations, higher baseline levels of implicit weight bias in response to stereotype consistent images were associated with greater self-monitoring rates and lower binge eating following treatment. Additionally, higher post-treatment stereotype consistent implicit bias was associated with higher percent weight loss, when controlling for baseline stereotype consistent bias. This is in contrast to Carels et al.'s (2009b) findings that greater implicit weight bias (measured via a non-specific IAT asking participants to categorize stimuli related to '*fat*'/'*thin*' and '*good*'/'*bad*') was significantly associated with lower energy expenditure, a smaller daily caloric deficit, and less weight loss during the course of a weight loss program. Moreover, previous research has found that greater implicit weight bias, or believing weight-based stereotypes to be true, is positively related to binge eating (Carels et al., 2010; Puhl, Moss-Racusin, & Schwartz, 2007).

One possible explanation for our contrary findings regarding implicit weight bias and weight loss outcomes relates to participants' changing body weight over the course of the study. Previous research has found that one's body weight is associated with implicit weight bias, with thinner individuals evidencing more bias (Latner, Wilson, Jackson, & Stunkard, 2009; Schwartz et al., 2006). Indeed, there is not a protective "in-group" favoritism for individuals who are overweight/obese. In-group favoritism tends to be higher among groups with permanent stigmatized characteristics, low stereotype endorsement, and higher status (Shapiro, 2011; Schwartz et al., 2006; Rudman et al., 2002). Weight is generally viewed as controllable, individuals with obesity evidence considerable stereotype endorsement, and obesity is considered to be a low status and an undesirable condition. Conversely, weight is generally viewed as controllable, individuals with obesity evidence considerable stereotype endorsement, and obesity is considered to be a low status/undesirable condition, so individuals who are overweight or obese generally do not demonstrate in-group favoritism (Puhl & Heuer, 2009).

As such, individuals with obesity evidence high rates of negative bias (Wang et al., 2004), and continue to possess bias even after losing weight (Latner et al., 2009). As one way of coping with the denigration of fat, individuals may strive to lose weight to escape from a stigmatized group (Myers & Rosen, 1999; Wang et al., 2004). Perhaps as individuals lose weight, they protectively view individuals who are overweight and obese as part of an "out-group," as they themselves have removed themselves from the stigmatized group. Losing weight may also strengthen the belief that obesity is controllable, which is strongly associated with other negative stereotypes about obesity (e.g., eating and activity habits; Tiggemann & Anesbury, 2000). Thus, past research suggests that implicit weight biases remain, if not grow stronger, as an individual becomes thinner (e.g., Latner et al., 2009).

While bias generally diminished in the present study, perhaps participants who lost the most weight maintained their bias more so than those who were less successful at weight loss. It is unclear if participants responding to the IATs viewed the individuals depicted as similar or dissimilar to themselves, as well as if feelings of self-identification with the overweight and obese and/or thin individuals pictured in the IATs changed over time. Elucidating this may be beneficial in future research in this area.

Even if weight loss helped to maintain implicit bias, contrary to expectation, higher baseline levels of implicit weight bias in response to stereotype consistent images were associated with greater self-monitoring rates and lower binge eating following treatment. These behaviors are commonly associated with positive weight loss treatment outcomes and were also associated with positive weight loss treatment outcomes in this investigation. One possible explanation for our contrary findings relates to our relatively novel measure of implicit weight bias, as the measure is not only likely to assess anti-fat bias, but also incorporates common health behavior-related stereotypes about weight. Therefore, it is plausible that the stereotypes used in the images (e.g., eating junk food, sedentary behaviors), combined with images of individuals with obesity engaging in these behaviors (as was the case in the stereotype consistent IAT), revealed unique participant attitudes that would ultimately impact weight loss. Presumably, individuals enrolling in a weight loss program have intentions to target eating and exercise behaviors (e.g., (Teixeira, Going, Sardinha, & Lohman, 2005). A negative reaction to images of individuals with obesity engaging in unhealthy behaviors may suggest someone who is motivated to change. Perhaps, individuals who responded in a particularly negative fashion to the images used in the stereotype consistent IAT were especially primed to make subsequent behavior changes, such as decreasing binge eating and engaging in self-monitoring, which in turn led to greater weight loss over the course of treatment. In the same way, participants who maintained these attitudes from pre- to post-treatment may have remained most vigilant about weight loss behaviors, and subsequently lost the most weight. For example, research utilizing the same methodology for assessing implicit weight bias found that among individuals of all weight statuses, those possessing the highest stereotype consistent implicit weight bias also evidenced increased orientations and focus on the importance of weight and appearance (Hinman et al., 2014). Future research will need to determine whether the current IAT is assessing motivation to change as well as implicit weight bias.

A limitation of the present study was that the small, mostly female, self-selected sample may limit generalizability, particularly to non-treatment seeking adults. Further study with a larger, more diverse sample is warranted. Additionally, it remains unclear which components of the weight loss intervention may have contributed to the observed reduction in weight biased attitudes when responding to stereotype consistent images. It is possible that simply the act of engaging in any weight loss effort and subsequent behaviors and weight loss, independent of participating in an intervention, has an impact on biased attitudes. Future research on the factors that contribute to the increase and/or decrease in bias, particularly as they pertain to health behaviors and weight, is needed. Additionally, future research involving the depiction of other types of weight-based stereotypes, aside from overeating and sedentary behavior (e.g., unattractiveness), is of interest. Findings may lend support to the potential unique contribution of a health-behavior related measure of weight bias predicting participants' behaviors and weight loss. As these findings are preliminary and utilize a relatively novel way to assess weight bias, as it incorporates reactions to viewing portrayals of health behaviors and weight, replication to rule out the potential for spurious findings is important. Future research examining correlations among various versions of the IAT as well as the differential and unique predictability of these IATs on outcomes will be important. Finally, in this investigation, the self-monitoring data was often incomplete (55.2% completed) and the observed changes in dietary intake in this study are based on self-report data, which are susceptible to considerable underreporting (Trabulsi & Schoeller, 2001).

Similar to previous research (Latner et al., 2009), the clinical implications of the present findings are complex. Not surprisingly, we found high levels of weight bias, regardless of whether participants responded to images that were consistent or inconsistent with common weight-based stereotypes. However, there is seemingly something unique about responding more quickly to images that are congruent with stereotypes, as this presentation appeared responsive to a weight loss intervention, and importantly, is associated with weight loss behaviors and weight loss. Indeed, this assessment may serve as an indicator for poorer treatment outcomes. Particularly, the way individuals respond to stereotypical portrayals of weight, sedentary activity, and eating behaviors may reflect a sense of vigilance and commitment to engaging in weight loss behaviors.

In the present study, individuals responded in biased ways to images that are consistent with weight-based stereotypes, and these portrayals commonly occur in media depictions (e.g., individuals who are overweight eating unhealthy foods or being sedentary). Thus, an important avenue of research continues to be revealing the nature of weight biased attitudes and implicating ways to actively reduce weight bias and its harmful consequences.

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Highlights

- Stereotype consistent bias significantly decreased from baseline to post-treatment.
- Greater baseline stereotype consistent bias was associated with lower binge eating and greater self-monitoring.
- Greater post-treatment stereotype consistent bias was associated with greater percent weight loss.
- Stereotype inconsistent bias did not change from baseline to post-treatment and was generally unrelated to outcomes.

Table 1

Summary of Linear Regressions Predicting Weight Loss Outcomes for Stereotype Consistent and Inconsistent Implicit Bias

(Baseline)	**Stereotype Consistent[a] (Baseline)**				**Stereotype Inconsistent[a]**				**Stereotype Consistent[a,b] (Post-treatment)**			
	B	**SE B**	β	R^2	**B**	**SE B**	β	R^2	**B**	**SE B**	β	R^2
Weight Loss %	.03	.02	.25	.21	.00	.02	.03	.16	.04	.02	.38*	.42
Self-monitoring	35.3	12.4	.42**	.43	23.6	15.7	.26	.33	7.4	11.8	.10	.44
Entries												
Caloric Intake	−101	175	−.10	.26	−357	195	−.32	.32	36	177	.04	.26
Exercise Minutes	−2.4	9.4	−.05	.07	−3.9	11.4	−.07	.07	7.4	8.5	.18	.17
Binge Eating (post)	−5.8	1.9	−.45**	.39	−1.6	2.4	−.12	.22	−2.1	2.0	.17	.48

[a] Controlling for age and condition.

** $p < .01$;

* $p < .05$.

[b] Controlling for baseline bias.