BODY MASS INDEX AND SOCIAL ANXIETY: EFFECTS OF IMPLICIT WEIGHT BIAS AND BODY SALIENCE IN UNDERGRADUATE WOMEN

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ABSTRACT

There is a well-established link between peer victimization and social anxiety disorder (SAD). Additionally, rates of bullying are significantly higher in obese compared to normal-weight individuals. However, social anxiety (SA) has not yet been examined in the context of weight, weight bias, and social rejection. This study examined the relationship between SA and weight in undergraduate women (*N* = 186). It aimed to determine whether implicit weight bias moderated the relationship between body mass index (BMI) and SA. In addition, it explored the interactive effects of SA, BMI, and body image salience on emotional response to exclusion in a social ostracism paradigm (Cyberball). Participants answered questions pertaining to SA and stigmatizing attitudes toward overweight/obesity and completed an implicit association test about weight. One week later, they played Cyberball, completing state measures of affect before and after the game. Although rates of clinically elevated SA did not differ significantly across normal-weight, overweight, and obese women, implicit weight bias did moderate the relationship between BMI and SA. The 3-way interaction of BMI, SA, and body image salience did not significantly predict post-exclusion state measures. However, body image salience moderated the relationship between SA and post-exclusion anxiety as well as between BMI and post-exclusion anxiety. Findings from this study shed light on the role of body weight in the experience of SA. Results suggest that higher BMI is associated with higher SA for those with high, but not low implicit weight bias. In addition, individuals with elevated SA are particularly reactive to exclusion if their bodies are visible to others.

DEDICATION

This dissertation is dedicated to

my parents, who taught me the value of

the intellectual pursuit.

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CHAPTER 1: INTRODUCTION

Social anxiety disorder (SAD) is characterized by fear and avoidance of social and performance situations and is associated with impaired functioning across multiple domains, such as school, work, and relationships (American Psychiatric Association [APA], 2013). SAD has a lifetime prevalence of 10.7% and is one of the most common mental disorders in the US (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). A nuanced understanding of the etiological processes and varying manifestations of social anxiety (SA) across diverse individuals (e.g., persons suffering from disabilities, stigma, marginalization, and/or discrimination) could lead to more targeted and, consequently, more effective prevention and treatment efforts.

Social Anxiety and Peer Victimization

One of the most commonly investigated risk factors for SAD is bullying. Prior research has revealed significant associations between SA/SAD and bullying/peer victimization (e.g., Ranta, Kaltiala-Heino, Fröjd, & Marttunen, 2012). In a clinical sample, a significantly higher percentage of individuals with SAD (92%) reported a history of bullying or severe teasing than did individuals with obsessive-compulsive disorder (50%) or panic disorder (35%) (McCabe, Antony, Summerfeldt, Liss, & Swinson, 2003). In addition, adults who reported more memories of childhood teasing also reported higher SA (Roth, Coles, & Heimberg, 2002). These findings indicate a clear association between report of being teased or bullied in childhood and having SAD/SA as an adult.

Other research has demonstrated that peer victimization predicts SA in adolescents (e.g., Erath, Flanagan, & Bierman, 2008). Storch, Masia-Warner, Crisp, and

Klein (2005) found that relational, but not overt, peer victimization predicted SA one year later in ninth-grade adolescents. This finding suggests that verbal teasing and social exclusion play a more important role in the development of SA than overt physical aggression. A two-month prospective study of adolescents also found a strong relationship between peer victimization and SA: peer victimization emerged both as a predictor and consequence of SA over time, with relational victimization again exhibiting a stronger relationship with SA than overt aggression (Siegel, La Greca, & Harrison, 2009). Furthermore, Levinson, Langer, and Rodebaugh (2013) found that reactivity to exclusion prospectively predicted SA in young adults, suggesting that there is a temporal and potentially causal relationship between reactivity to exclusion and SA.

Peer Victimization related to Weight

Given the relationship between bullying/exclusion and SA, it is important to examine populations that are particularly vulnerable to victimization; it seems plausible that exposure to targeted stigma in one's everyday life from both individuals and society at large (e.g., through the news and other forms of media) could pose a risk for the development of SA. One of the most stigmatized populations consists of overweight and obese persons (Puhl & King, 2013). On a daily basis, such individuals face weight bias (i.e., anti-fat bias), such as stereotyped views of obese individuals as lazy, incompetent, and lacking in willpower and self-discipline (e.g., Puhl & Heuer, 2009).

In a study of adolescents from two national weight-loss camps, 64% of participants reported experiencing weight-based victimization, and the risk of weight-based victimization increased as body mass index (BMI) increased (Puhl, Peterson, & Luedicke, 2013). An epidemiological study of Danish students between ages 11 and 15 found that overweight and obese children were bullied significantly more often than their normal-weight peers (Brixval, Rayce, Rasmussen, Holstein, & Due, 2011). There is also consistent documentation of weight bias in employment, schools, health care, media, and interpersonal relationships (Puhl & King, 2013). Puhl and King (2013) posit that the continued social acceptability of weight stigma (compared to stigma of other marginalized groups) might explain the vulnerability of overweight and obese individuals to difficulties in multiple life domains.

In Puhl and Brownell's (2001) systematic review of research on weight discrimination, laboratory studies suggested that people are less likely to hire and/or want to work with overweight individuals than thin individuals with identical qualifications. Health professionals, including physicians, nurses, and medical students, also reported negative beliefs about overweight people, and obese individuals faced teasing at school and discrimination in the college admissions process. In another systematic review, Puhl and Heuer (2009) concluded that obesity is associated with lower wages, lower workforce participation, and lower educational attainment after controlling for intelligence and socioeconomic status. Puhl and Heuer (2009) also documented weight bias in entertainment and advertising: movie, television, and book characters were more likely to be thin, and those who were overweight were more likely to be portrayed as unattractive and unpopular and to be made fun of by other characters. Weight bias was evident in weight-loss advertisements and in the news media as well.

Weight-based Victimization and Psychopathology

Weight stigma appears to be associated with a vast array of psychopathology and problems with living, including anxiety and depression (e.g., Ashmore, Friedman, Reichman, & Musante, 2008; O'Brien et al., 2016), lower self-esteem and self-worth (e.g., Fox & Farrow, 2009), lower life satisfaction (e.g., Annis, Cash, & Hrabosky, 2004), elevated stress levels (e.g., Tomiyama et al., 2014), lower positive affect and greater negative affect (e.g., Pearl & Puhl, 2016), and significant eating disorder pathology (e.g., Quick, McWilliams, & Byrd-Bredbenner, 2013). Among obese, treatment-seeking adults, experiences of weight stigma predicted overall psychological distress (Ashmore, Friedman, Reichman, & Musante, 2008). In a nationally representative sample of adults from the National Epidemiological Survey on Alcohol and Related Conditions, perceived weight discrimination was associated with a high prevalence of psychiatric disorders and comorbidity, such that 56% of those who endorsed weight discrimination met criteria for at least one DSM-IV (APA, 1994) Axis I disorder (Hatzenbuehler, Keyes, & Hasin, 2009). Rates of SAD, major depression, dysthymia, mania, hypomania, generalized anxiety disorder, panic disorder, posttraumatic stress disorder, and substance use disorders were all significantly higher in those who perceived weight discrimination. All results were significant when controlling for BMI, suggesting that weight stigma is more influential than actual weight in the development of psychopathology.

Weight-based Victimization, Obesity, and SAD/SA

Thus far, we have presented evidence that peer victimization is related to SAD/SA, that obese individuals are at greater risk of victimization, exclusion, and discrimination, and that weight stigma puts overweight and obese individuals at risk for experiencing a range of psychopathology. It would seem to follow that obese individuals would be at increased risk for developing SAD compared to non-marginalized persons or the general population. A comprehensive literature search yielded only a few studies that specifically examined the relationship between weight stigma and SA. One such study, reviewed above, found that rates of SAD were 10.8% in overweight and obese individuals who perceived weight discrimination, compared to 2.4% in those who did not (Hatzenbuehler et al., 2009), indicating that among overweight and obese individuals, those who experience weight stigma are more likely to be diagnosed with SAD.

In a questionnaire study, Yen, Liu, Ko, Wu, and Cheng (2014) examined bullying as a mediator between BMI and mental health in Taiwanese high-school students (N = 5,252). Higher BMI was associated with more severe bullying, and more severe bullying was associated with greater SA, depression, suicidality, and lower self-esteem. Notably, however, this study utilized a cross-sectional design; therefore, the ability to draw causal inferences is limited.

We found two studies that examined the prevalence of SAD in obese individuals versus those who are not obese. Mirijello et al. (2015) examined rates of SAD using the clinician-rated Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) in 46 Italian patients with morbid obesity, either waiting to receive or having completed bariatric surgery. The percentage of individuals who met criteria for a diagnosis of SAD was significantly higher in persons with morbid obesity compared to healthy controls (43% vs. 16%, respectively). Rosik (2005) examined prevalence of Axis I disorders in 294 pre-bariatric surgery candidates. Of all anxiety disorders, SAD had the highest prevalence (18%). These studies suggest that prevalence of SAD is higher in obese individuals than in the general population. It is possible, however, that SAD is higher in *treatment-seeking* obese individuals. It seems likely that persons who are especially concerned about being negatively evaluated for their weight might seek more invasive treatment options.

Individuals seeking treatment for bariatric surgery specifically are among the highest-weight individuals with obesity. It is thus important to examine the prevalence of SAD in obese individuals regardless of their treatment-seeking status. Furthermore, research is needed to examine more nuanced differences in prevalence, such as rates of SAD in normal-weight, overweight, and obese individuals. Our study seeks to examine the prevalence of SA in this way.

Weight-based Victimization and Social/Interpersonal Difficulties

Though little research has specifically examined SAD in obese populations, many studies have explored social and interpersonal difficulties among obese individuals, particularly as they relate to weight stigma. Degree of weight-related teasing in an overweight sample was positively correlated with loneliness and preference for sedentary/isolating activities and was negatively correlated with confidence in one's social abilities and liking of active/social activities (Hayden-Wade et al., 2005). In a clinical sample of overweight and at-risk for overweight children and adolescents, there was a positive relationship between peer victimization and social physique anxiety and loneliness (Storch et al., 2007). Overweight adolescents have reported significantly greater social isolation and weaker social connections than their non-overweight peers (Falkner & Neumark-Sztainer, 2001; Strauss & Pollack, 2003). Furthermore, overweight youth have attributed peer rejection to their weight; they reported believing that weight loss would increase their number of friendships (Pierce & Wardle, 1997).

Latner and Stunkard (2003) examined the likability of children with obesity, various other disabilities, or no disabilities in 5^{th}- and 6^{th}-grade children attending lower- and upper-middle income US public schools. Children were given six pictures and instructed to circle the picture of the child they liked best until all six pictures were ranked. The "healthy" child received the highest mean rank, whereas the obese child was given the lowest. Research suggests that children as young as five-years-old demonstrate weight bias, such that they may be less likely to form friendships with obese children and even nonoverweight children associated with obese children (Penny & Haddock, 2007). Children (ages 5-10) were presented with drawings of children who were either male or female, overweight or nonoverweight, and asked to rate how much they would like to be friends with each child. Target children were presented in the middle of "background characters" who were either nonoverweight or overweight. Overweight female targets were less liked than nonoverweight female targets, but there was no effect of size for male targets. Additionally, nonoverweight female targets were evaluated more negatively when presented with overweight background characters, and overweight female targets were evaluated more negatively when presented with nonoverweight background characters, suggesting that from a young age, overweight children's social networks are intricately affected by weight bias.

These social difficulties, isolation, and loneliness appear to translate into fewer friendships and lower relationship quality. In one study, obese women reported fewer close friends (Sarlio-Lahteenkorva, 2001). Among individuals from a multistage probability sample of noninstitutionalized adults (Carr & Friedman, 2006; $N = 3,656$), those with obesity class II (BMI 35.0-39.9 kg/m^2) and class III (BMI $\geq$ 40 kg/m^2) reported significantly worse relationship quality with family members and friends than nonoverweight persons (but did not differ significantly in relationship quality with spouses or coworkers). Individuals classified as obese II/III reported significantly fewer positive interactions and significantly more negative interactions with family members than normal-weight individuals. The relationship between current weight and amount of positive family interactions was contingent upon weight in adolescence, such that those who were overweight before age 21 reported less supportive family relationships as their current BMI increased. Individuals who were not overweight earlier in life reported similar levels of emotional support within family relationships regardless of current weight. Thus, obesity may interfere with developing supportive family relationships for individuals who have been obese since adolescence.

Weight stigma extends to romantic and sexual relationships as well. In a study of 57 male-female couples with a range of BMIs (Boyes & Latner, 2009), women with higher BMIs were more likely to report lower relationship quality and expect that their partners would be more likely to end their relationships. Men perceived their female partners as having less of a “nice body” if the women were heavier, and male partners’ ratings of “nice body” were associated with relationship quality ratings. Men’s BMI was not associated with relationship quality. In a different study examining weight stigma in sexual relationships, undergraduate students ($N = 449$) ranked six drawings of potential sexual partners, including a partner with obesity, with various other disabilities, and a healthy partner. Obese partners were the least preferred category. Men ranked obese partners significantly lower than did women. There were no differences across BMI category in ranking of the obese partner (Chen & Brown, 2005). Weight stigma in the context of dating has been documented in high school students as well (Sobal, Nicolopoulos, & Lee, 1995; Pearce, Boegers, & Prinstein, 2002).

Social Anxiety and Interpersonal Difficulties

Research on interpersonal functioning in individuals with SAD suggests that the disorder is related to impaired interpersonal functioning and social difficulties. Individuals with SAD compared to those with other disorders are more likely to report not having any close friends (Whisman, Sheldon, & Goering, 2000) and less satisfaction with the frequency and quality of interaction with friends they do have (e.g., Cramer, Torgersen, & Kringlen, 2005). SAD is related to greater loneliness, lower rates of cohabitation and marriage (Falk Dahl & Dahl, 2010), and less satisfaction with partners if marriage does occur (Bech & Angst, 1996). Finally, Alden, Regambal, and Placencia (2014) suggest that people with SAD may be more likely to experience cautious rather than audacious trust, which lowers the closeness of relationships. Audacious trust (Holmes & Murray, 2007), characteristic of positive romantic relationships, allows individuals to believe that their partner loves and values them even when behavioral cues are more ambiguous. Cautious trust (Murray, Holmes, Griffin, Bellavia, & Rose, 2001) occurs when people assume that their partner views them the way they view themselves; they therefore underestimate the amount that their partner values them and feel less secure even in serious relationships with committed partners. Indeed, Sparrevohn and Rapee (2009) found that individuals with SAD reported less self-disclosure and emotional expression within their romantic relationships compared to those without SAD.

The Current Study

The research on interpersonal difficulties in SAD/SA parallels the research on social life impairments and interpersonal struggles in obese persons who experience weight bias. Thus, it seems important to determine whether SA comprises part of the picture of interpersonal concerns in obese individuals and whether the mental salience of one's body weight influences the experience of SA and reactivity to social stressors in overweight and obese persons. In the present study, we aimed to address this gap in the literature. First, we examined the relationship between weight, internalized stigma, and SA, aiming to determine the prevalence, precipitants, and correlates of SA in overweight and obese female-identified individuals.[1]

Prevalence of SAD across Weight Categories

In the current study, we examined rates of clinically severe SA among healthy-weight, overweight, and obese women. We hypothesized that significantly more obese individuals would report clinical levels of SA than overweight and normal-weight peers and that more overweight individuals would report clinically elevated SA than normal-weight persons. In addition, we examined the relationship between BMI and SA as dimensional constructs. We hypothesized that BMI and SA would be positively correlated.

[1]In the present study, we chose to examine these questions in women only due to a number of gender differences in the relevant areas of research. First, there are gender differences in implicit weight identity: both men and women explicitly reported accurate appraisals of their weight, whereas men (but not women) implicitly self-identified as light regardless of their actual weight (Grover, Keel, & Mitchel, 2003). In addition, some forms of weight stigma are more prominent in women compared to men: wage and employment discrimination and weight stigma in dating and sexual relationships were found more frequently in women compared to men (Puhl & Heuer, 2009). Additionally, studies suggest that girls and women (as compared to boys and men) are at greater risk of not being liked due to overweight/obesity, having fewer friends, and having more relationship difficulties (e.g., Boyes & Latner, 2009; Penny & Haddock, 2007; Sarlio-Lahteenkorva, 2001). Given the complexity of our proposed analyses, examining gender differences was beyond the scope of our study; if gender differences were to require examining or controlling for gender, we would have difficulty recruiting the number of participants needed for adequate statistical power. Thus, we chose to limit our investigation to women, who seem to be at greatest risk for stigma, exclusion, body image issues, and resulting psychopathology.

Internalized Weight Bias as a Moderator of BMI and SA

Notably, much of the research presented here suggests that weight stigmatization, rather than weight status alone, increases risk for psychological symptoms (e.g., Puhl & King, 2013). Thus, it is important to examine factors related to weight stigmatization that interact with BMI to predict emotional distress. In this study, we investigated whether internalizing society's stigma influences the relationship between BMI and SA. We conjectured that if individuals with higher BMIs had internalized society's weight stigma, such that they themselves have adopted stigmatizing beliefs about "fat" people, either consciously or unconsciously, then they would be at increased risk for elevated SA. Accordingly, in the current study, we examined whether implicit and explicit measures of weight bias moderate the relationship between BMI and SA. We looked at explicit weight bias to determine if individuals who display implicit bias also display explicit bias and to examine whether explicit bias can also be used as a measure of adopting societal stigma.

We measured internalized weight bias using the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). The IAT uses reaction time to measure implicit associations, which are assumed to reflect evaluations determined outside of one's conscious control. In this task, reaction time is used as an indirect index of the degree of association between a concept (e.g., 'fat people') and an attribute (e.g., 'lazy') in an individual's mind; the degree of association between the concept and the attribute is understood as a measure of one's implicit attitude toward the concept.

Individual's attitudes about weight are often assessed through the IAT (e.g., Teachman, Gapinski, Brownell, Rawlins, & Jeyaram, 2003). Wang, Brownell, and Wadden (2004) found that overweight individuals demonstrated a significant anti-fat bias across numerous attributes (e.g., smart-stupid; good-bad), suggesting that, in contrast to other minority group members who face frequent stigmatization, overweight individuals do not seem to hold 'in-group' preferences. Schwartz, Vartanian, Nosek, and Brownell (2006) also found that individuals—from underweight to extremely obese—displayed significant anti-fat bias; however, they found an inverse relationship between BMI and level of bias. Notably, Wang et al.'s (2004) study examined treatment-seeking obese individuals. It is possible that obese individuals actively seeking treatment exhibit higher levels of anti-fat bias than non treatment-seeking obese adults. Thus, it is important to examine levels of implicit weight bias in other samples of individuals who may or may not be seeking treatment and are therefore more representative of the general overweight/obese population.

In the current study, we used the weight IAT to examine the relationship between BMI, implicit weight bias, and SA. In this case, association of the concept 'fat people' with negative attributes is assumed to be an indicator of the extent to which an individual has internalized society's weight bias. We hypothesized that implicit weight bias would moderate the relationship between BMI and SA, such that high BMI would predict elevated SA only when internalized weight bias was also high. To further examine weight stigma, we also collected explicit (i.e., overt) measures of weight bias. Based on prior research, we hypothesized that implicit and explicit weight bias would not be significantly correlated and that explicit anti-fat attitudes would generally not be endorsed (Teachman et al., 2003; Wang et al., 2004). We therefore hypothesized that explicit weight bias would not moderate the relationship between BMI and SA.

Social Exclusion, Weight Salience, and Emotional Distress

Next, we investigated whether factors specific to self-consciousness about one's body contribute to emotional distress and SA. If BMI and internalized weight stigma do interact to predict SA, it is important to understand the unique emotional experiences of individuals with overweight/obesity and high SA. For instance, does salience of body image influence state levels of affect and anxiety in overweight individuals with SA? In a study examining appearance-based rejection sensitivity in young adults, participants were asked either to list aspects of their appearance they did not like (i.e., threat condition) or to list objects in a room (i.e., non-threat condition) (Park, 2007). Afterwards, they reported how unwanted, lonely, rejected, and isolated they felt. There was a significant interaction between condition and appearance-related rejection sensitivity, such that more appearance rejection-sensitive participants were, the more alone and rejected they tended to feel, but only if they were first reminded of the body parts about which they felt insecure. This finding suggests that for individuals sensitive to appearance-related rejection, salience of body image during a rejection situation may increase their negative emotions. Given obese persons' increased exposure to appearance-related discrimination, it is important to examine the factors that lead to emotional distress in stigmatizing situations.

Previous research has examined the effects of social rejection on SA (e.g., Levinson et al., 2013) using the Cyberball social ostracism task (Williams, Yeager, Cheung, & Choi, 2012), a virtual ball-toss game played between the participant and two other "players" who are in actuality computer simulations. In the exclusion condition of this task, the participant is included for the first two ball-tosses and then is excluded for the remainder of the game. The current study utilized this rejection paradigm as a simulation of peer victimization to examine whether SA, BMI, and body salience predict reactivity to exclusion. We hypothesized that SA, BMI, and body salience would interact to predict higher post-rejection scores of negative affect (NA), anxiety, and self-esteem. More specifically, we hypothesized that individuals with higher SA and higher BMI would exhibit greater increases in NA and anxiety and greater decreases in self-esteem following a body-salient rejection compared with a non-body-salient rejection; in contrast, individuals with lower BMIs and higher SA would experience the same increase in NA and anxiety and decrease in self-esteem regardless of body image salience. In other words, we predicted that the more socially anxious the individual, the greater the increase in various negative emotions following rejection when body image is made salient and that this relationship would be moderated by BMI.

CHAPTER 2: METHOD

Participants

Participants were female undergraduates at Temple University who participated in the study for credit and were at least 18 years old. Participants were screened based on self-reported gender, BMI, and eating disorder symptomatology. Individuals were excluded from the study if they were male or met diagnostic criteria for anorexia nervosa or bulimia nervosa as determined by the Eating Disorder Diagnostic Scale (Stice, Rizvi, & Telch, 2000). Individuals with binge eating disorder were not excluded because the diagnosis does not include the criterion of undue influence of body weight or shape on self-evaluation. Self-reported BMI among women was obtained through screening survey data in order to recruit similar numbers of participants from each of three weight categories: normal-weight (BMI 18.5-24.9 kg/m^2), overweight (BMI 25.0 -29.9), and obese (BMI $\geq$ 30.0). This was done so that that the full range of BMI could be adequately represented.

Measures

Demographic Characteristics

The *Demographics Questionnaire* is a self-report measure designed to collect information regarding the participant's age, gender, primary race or ethnic origin, and self-reported weight.

Screening Measure

The *Eating Disorder Diagnostic Scale* (Stice et al., 2000) is a 22-item measure assessing all DSM-IV diagnostic criteria for anorexia nervosa, bulimia nervosa, and binge eating disorder. Items use a mixture of Likert, frequency, yes/no, and write-in response formats. Diagnoses have demonstrated good temporal reliability and criterion validity. The overall symptom composite possessed good test-retest reliability, internal consistency, and convergent validity (Stice et al., 2000). The version of this scale updated for DSM-5 eating disorder criteria was administered as a screening measure as described above, and participants who met DSM-5 criteria for anorexia nervosa or bulimia nervosa were excluded. The DSM-5 version can be found at this website: http://www.ori.org/sticemeasures. Internal consistency was calculated using the standardized scores of all items excluding height and weight, and it was good in our sample (α = .86).

Social Anxiety Measures

The *Straightforward Social Interaction Anxiety Scale* (SIAS-S; Rodebaugh, Woods, Heimberg, Liebowitz, & Schneier, 2006; Rodebaugh et al., 2011) is a 17-item measure of anxiety-related reactions to social interactions in dyads and groups that includes only the straightforwardly worded items from the original Social Interaction Anxiety Scale (Mattick & Clarke, 1998). Participants rate items on a 5-point Likert-type scale from 0 (*Not at all characteristic of me*) to 4 (*Extremely characteristic of me*). Example items include "When I mix socially, I am uncomfortable" and "When mixing in a group, I find myself worrying that I will be ignored." The SIAS has demonstrated good internal consistency (α = .88) and test-retest reliability ($r > .90$) (Mattick & Clarke, 1998). Rodebaugh, Woods, and Heimberg (2007) found that when the SIAS included only the 17 straightforwardly worded items, it predicted criterion measures more strongly than the full scale in both undergraduate and clinical samples. As suggested by Rodebaugh et al. (2007), we used only the straightforward items to calculate the total score, creating a 17-item straightforward SIAS (SIAS-S) score. The SIAS-S has exhibited excellent internal consistency (α = .93) and factorial validity, and strong construct validity (Rodebaugh et al., 2007). A score of 28 or above on this scale indicates a probable diagnosis of SAD (Rodebaugh et al., 2011). Internal consistency of the SIAS-S in our sample was excellent (α = .95).

The *Social Phobia Scale* (SPS; Mattick & Clarke, 1998) is a 20-item scale designed to assess fear of scrutiny by others. Items ask about fears of being scrutinized during routine activities such as eating or drinking and performance activities like public speaking. Example items include “I can feel conspicuous when standing in a line,” and “I feel self-conscious if I have to enter a room where others are already seated.” Mattick and Clarke (1998) found the SPS to demonstrate high levels of internal consistency (α = .93) and test-retest reliability and to discriminate between individuals with SAD and other anxiety and mood disorders. A score of 24 or above on the SPS indicates a probable diagnosis of SAD (Brown et al., 1997). Internal consistency of the SPS in our sample was excellent (α = .94).

A *Social Anxiety Composite* was formed to create a more robust and comprehensive measure of SA. We made the composite measure of the SIAS-S and SPS by standardizing the scores on each item of each measure and adding together the standardized scores to create a total SA score. We used this method because composite measures generally provide more reliable estimates of constructs (Zeller & Carmines, 1980). Additionally, a composite measure can reduce the number of analyses conducted; this method has been used in previous SA research (Clark et al., 2003; Clark et al., 2006; Levinson et al., 2013; Kaplan, Levinson, Rodebaugh, Menatti, & Weeks, 2015). This composite measure has been found to have very good internal consistency (e.g., Kaplan et al., 2015) and test-retest reliability (Levinson et al., 2013). Internal consistency for the SA composite was excellent in our sample (α = .97).

The Social Appearance Anxiety Scale (SAAS; Hart et al., 2008). The SAAS is a 16-item measure assessing anxiety about negative evaluation by others due to overall appearance and body shape. The scale has demonstrated high test-retest reliability, good internal consistency, and good divergent validity in undergraduate samples. In addition, it has demonstrated good factor validity and incremental validity, such that it was associated with SA uniquely over and above indicators of negative body image (Hart et al., 2008; Levinson & Rodebaugh, 2011). Example items are "I feel nervous when having my picture taken" and "I am frequently afraid I would not meet others' standards of how I should look." Internal consistency of the SAAS in our sample was excellent (α = .95).

A note about SA and the SA measures: The SIAS-S and SPS were used to examine prevalence rates of SAD in this sample. If an individual met the cutoff on either the SIAS-S or SPS, then that individual was classified as having a probable diagnosis of SAD. The SA composite measure was utilized for all remaining analyses examining SA as a continuous construct. The SAAS was included to determine whether BMI was related to SA broadly, as it aligns with a typical SAD diagnosis, or whether the relationship (if found) was specific to appearance-related SA.

Measures of Attitudes toward Weight

The *Implicit Association Test* (IAT; Greenwald et al., 1998) was used to assess implicit attitudes. Participants completed two computer-administered weight-related IATs. The concept discrimination in both IATs was between 'thin people' and 'fat people.' The attribute discrimination in the first IAT was between 'good' and 'bad;' the attribute discrimination in the second IAT was between 'lazy' and 'motivated.' Items from the 'thin' category were *thin*, *slim*, and *skinny*, and items from the 'fat' category were *fat*, *overweight*, and *large*. Attributes in the good category were *wonderful, joyful*, and *excellent*; attributes from the bad category were *terrible, nasty*, and *horrible*; attributes from the lazy category were *lazy, slow*, and *sluggish*; items from the 'motivated' category were *motivated, determined*, and *eager*. Items were taken from the IAT described in Schwartz et al. (2006).

We modeled the IAT procedure after Egloff and Schmukle's (2002) 'IAT-Anxiety' paradigm, which was adapted from Greenwald et al. (1998). Each IAT contained five blocks of trials. Blocks 1, 2, and 4 were practice blocks. The first block included 20 practice trials in which participants categorized the concept discrimination (i.e., thin people/fat people). More specifically, they categorized concept words (e.g., slim; overweight) into thin and fat categories. The second block consisted of 20 practice trials in which participants categorized the attribute stimuli (e.g., good/bad). Block 4 contained practice trials in which the response assignment for the attribute discrimination (good/bad) was switched. The third and fifth blocks (i.e., the critical blocks) each contained 40 trials, which combined the concept and attribute discriminations. In Block 3, participants categorized items into the two combined categories, each containing the concept and attribute that were assigned to the same key in the first two blocks (e.g., thin people + good for the left key, and fat people + bad for the right key). Block 4 included trials in which the key assignment corresponding to the attributes was reversed. Block 5 mirrored Block 3 but used the switched key assignment that participants practiced in Block 4 (e.g., thin people + bad for the left key and fat people + good for the right key).

Participants were told to make a series of categorization judgments. In each trial, category labels were shown in the upper left and right sides of the screen, and the stimulus word was shown in the center. Participants were instructed to keep their left index finger on the *Q* key and their right index finger on the *P* key throughout the task, to use the *Q* key to categorize words into the category on the left, and the *P* key for the category on the right, and to respond as quickly and accurately as possible. In addition, they were informed that if they made a mistake, a red *X* would appear and the task would then continue.

IAT Scoring. IAT response latencies were scored with the algorithm developed by Greenwald, Nosek, and Banaji (2003). First, outliers were deleted, such that trials with response latencies over 10,000 ms were not included in the analyses. Data were also not included in analyses if participants had response latencies of less than 300 ms in greater than 10% of the trials. Next, error latencies were replaced with error penalties, calculated by adding 600 ms to the mean latency of correct categorizations for that block. For the rest of analyses, these error penalty latencies were used. We then computed the "inclusive" (i.e., pooled within-subject) standard deviations for all critical block trials and the mean latency for responses in each critical block. *D* scores for each of the two IATs were calculated by subtracting the mean latencies for fat people-good and fat people-motivated associations from the mean latencies of fat people-bad and fat people-lazy associations, respectively, and then dividing the result by the corresponding inclusive standard deviation. This method of computing a *D* score helps to improve the psychometrics of the IAT and to account for overall response latency (Lane, Banaji, Nosek, & Greenwald, 2007). Positive IAT scores indicate greater fat people-bad and fat people-lazy associations (i.e., implicit weight bias), while negative IAT scores indicate greater fat people-good and fat people-motivated associations (i.e., implicit positive attitudes toward fat compared to thin people).

Split-half reliability of each IAT in our sample was calculated by correlating the IAT *D* scores for the first block of 20 trials from each of the two critical blocks and the second block of 20 trials from each critical block. Split-half reliability for the good/bad IAT and the motivated/lazy IAT was $r = .49$ ($p < .001$) and $r = .40$ ($p < .001$), respectively. These scores are lower than previous split-half reliability correlations for weight IATs; for instance, weight IATs in Teachman et al. (2003) ranged from .52-.83. However, our correlates still demonstrate good psychometric properties relative to other latency-based measures (Nosek, Greenwald, & Banaji, 2007).

The *Explicit Weight Bias Measure* (EWBM) was developed for this study and asked participants to rate their beliefs about the attributes given in the IAT on a Likert-type scale. For example, participants were asked to rate "I think fat people are good" on a scale from 1 (strongly agree) to 5 (strongly disagree). Internal consistency for the EWBM was excellent in our sample ($\alpha = .96$).

Obese Persons Trait Survey (OPTS; Puhl, Schwartz, & Brownell, 2005). Puhl et al. (2005) adapted the format of the Racial Trait Survey (Stangor, Sechrist, & Jost, 2001) to construct the OPTS. Participants are instructed to estimate the percentage of obese individuals who possess 20 stereotypical traits, including 10 negative traits (lazy, undisciplined, gluttonous, self-indulgent, unclean, lack of willpower, unattractive, unhealthy, insecure, sluggish) and 10 positive traits (honest, generous, sociable, productive, organized, friendly, outgoing, intelligent, warm). The measure demonstrated adequate internal reliability for both the positive (α = .83) and negative traits subscales (α = .73). The traits 'good,' 'bad,' and 'motivated' were added to the lists to mirror IAT traits. Internal consistency of the OPTS was excellent in the present sample (α = .92).

Ideal-Body Stereotype Scale-Revised (IBSS-R; Stice, Ziembra, Margolis, & Flick, 1996). The IBSS-R is a 6-item 5-point Likert-type scale that assesses internalization of the thin-ideal (e.g., "Thin women are more attractive") from '1 – strongly disagree' to '5 – strongly agree.' The IBSS-R has been shown to have acceptable test-retest reliability (Stice, 2001), internal consistency, and convergent, discriminant, and predictive validity (DeBoer et al., 2013; Stice & Agras, 1998). Internal consistency for the IBSS-R was good in the current sample (α = .85).

Rejection Manipulation

Cyberball (Version 4.0; Williams et al., 2012) is a computer-based ball-toss game between the participant and two "peers." The photographs of the "peers" were taken of volunteer first-year graduate students, two of whom identified as white/Caucasian, and one of whom identified as black/African-American. The task simulates a game of catch and allows the experimenter to manipulate the degree of exclusion experienced by the participant. The players are represented by gender-neutral animated figures, and pictures of the participant and the confederates are uploaded to the game so that each figure corresponds to a photograph of a player. The exclusion condition is used to induce feelings of rejection. The current study utilized the exclusion condition, in which the participant received the ball from the other players twice and then was excluded for the remainder of the game. Prior research has employed Cyberball to simulate social ostracism and has demonstrated excellent construct validity, whether or not the participant is told that she is playing with real people or a computer (Eisenberger, Lieberman, & Williams, 2003; van Beest & Williams, 2006; Zadro, Boland, & Richardson, 2006).

In the current study, a manipulation was added to the exclusion paradigm. The players in the virtual ball-toss game were randomly assigned to one of two photo conditions: body image salient or body image not salient. In the body image salient condition, a full-body photo of the participant (and the two confederates) was uploaded to the game; in the body image not salient condition, as in prior research using Cyberball (e.g., Williams & Jarvis, 2006; Levinson et al., 2013), the photo included just the participant's face.

A *Manipulation Check* question from *The Cyberball Social Exclusion Questionnaire* (Hulme, Hirsh, & Stopa, 2012) was utilized in the current study (i.e., "What percent of the throws were thrown to you?").

State Measures

The Brief State Anxiety Measure (BSAM; Berg, Shapiro, Chambless, & Ahrens, 1998). The BSAM is a 6-item version of the State-Trait Anxiety Inventory (STAI; Spielberger, 1983) and was used to measure state anxiety pre- and post-Cyberball manipulation. It contains 6 of the original 20 items (e.g., tense) rated on a 1 (not at all) to 4 (very much so) Likert-type scale. This measure demonstrated good internal consistency and was highly correlated with the full state version of the STAI (r = .93) (Berg et al., 1998). Internal consistency of the BSAM in our sample was good (α = .82).

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item measure of positive (e.g., enthusiastic) and negative (e.g., upset) activated affect. It has demonstrated good internal consistency and convergent and discriminant validity (Watson et al., 1988). The state instructions (i.e., to what extent you feel this way right now) were given, and the measure was used to assess state activated affect pre- and post-Cyberball manipulation. For the purposes of the present study, we used only the 10 items assessing negative affect (NA). Internal consistency of the NA subscale of the PANAS in our sample was good (α = .86).

The State Self-Esteem Scale (SSES; Heatherton & Polivy, 1991). The SSES is 20-item measure of state self-esteem, which consists of three subscales: performance, social, and appearance self-esteem. Only the 13 items included in the social and appearance subscales were used in this study. Participants were instructed to answer according to how they feel "right now." Example items are "I am worried about whether I am regarded as a success or failure" (social self-esteem) and "I feel dissatisfied with the way my body looks right now" (appearance self-esteem). Items are rated on a 5-point Likert-type scale, from 1 (not at all) to 5 (extremely). The scale has demonstrated good internal consistency, good discriminant and construct validity, and robust factor structure (Heatherton & Polivy, 1991). Internal consistency of the SSES in our sample was excellent (α = .93).

Physical Measures

An *Omron HBF-400 Body Fat Monitor and Scale* was used to collect participants' weight. The scale measures 12.2 x 11.8 x 2.1 inches. *Measuring tape* was attached to a wall in a research room and used to collect participants' height. The rationale for measuring height and weight in the lab was based on a review of the literature examining the relationship between self-reported and measured height and weight which found that women consistently underreport weight and over-report height. This finding was more pronounced in heavier women (Engstrom, Paterson, Doherty, Trabulsi, & Speer, 2010).

Procedure

The study took place on two separate days, one week apart. See Figure 1 for a visual depiction of the procedure.

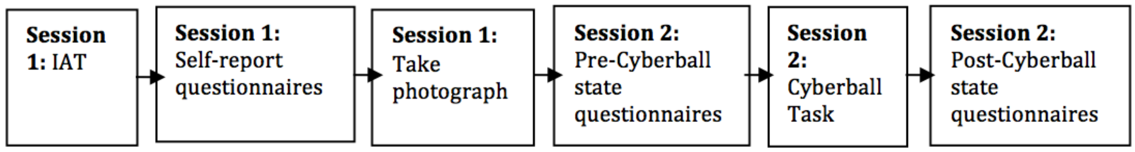

Figure 1. Procedure. (IAT = Implicit Association Test).

Session 1: On the first day, participants arrived at the lab and provided informed consent. Next, the IAT was administered. Order of IATs (good/bad and motivated/lazy) was counterbalanced across participants. Following the IAT, participants completed a series of online questionnaires including the SIAS-S, SPS, SAAS, EWBM, OPTS, and the IBSS-R. The experimenter then took a photograph of the participant (either full-body or face-only depending on condition) and informed her that the photograph would be used during a game in Session 2, would be kept confidential, and would be destroyed immediately after use. The experimenter showed the participant the pictures of the other two "participants" who would participate in the game (the pictures were actually of first-year Temple graduate students) and ensured that the participant did not know the other two players. If the participant did recognize either of the other players, the experimenter replied, "I'm glad I checked. We'll see if we can rearrange the schedule to get someone different to come in for your second session." There were three potential "other players" with whom the participant could play. Two of the three players were randomly assigned to each participant. If the participant knew one of the "other players," that player would be swapped out with the third potential "other player." No participants were lost as a result.

Session 2: Participants returned to the lab after one week and were told that the two other participants were already in place in other research rooms. The experimenter then left the room, and the participants completed the BSAM, PANAS, and SSES on the computer. After a few minutes, the experimenter returned and provided instructions for the Cyberball task, informing the participant that the study examines social participation. After completing the Cyberball game, the participant completed the BSAM, PANAS, SSES, and the manipulation check question. Then the research assistant measured the height and weight of the participant. Lastly, participants were debriefed on the true nature of the experiment.

Data Analytic Plan

The Relationship between BMI and SA

We performed a chi-square test (χ^2) to determine whether rates of clinically elevated SA were significantly different in normal weight (BMI 18.5 kg/m^2 - 24.99 kg/m^2; World Health Organization [WHO]), overweight (BMI 25.00 kg/m^2 – 29.99 kg/m^2), and obese (BMI ≥ 30.00 kg/m^2) groups. We conducted follow-up chi square tests to examine pairwise differences between groups.

The relationship between the dimensional constructs of SA and BMI were examined using a Pearson's Product Moment Correlation (*r*) coefficient between BMI and the SA composite and then BMI and social appearance anxiety. We determined *a priori* that if the correlation between self-reported BMI and BMI measured in the lab exceeded .85, self-reported BMI from participants who did not return for Session 2 would be used in place of measured BMI in order to optimize number of participants in these analyses. The correlation between BMI measured in the lab and self-reported BMI was $r = .90$ ($p < .001$), so we created a new variable that used self-reported BMI instead of measured BMI for those who did not return for Session 2 ($n = 13$).

IAT Results

To test whether there was an interaction between internalized weight bias and BMI predicting SA symptoms, we performed a hierarchical linear regression including implicit weight bias, BMI, and the interaction between the two variables as the predictors and SA as the outcome measure. BMI and implicit weight bias were mean-centered, and their mean-centered scores were used to calculate the BMI by implicit weight bias interaction variable. We used a chi-square test to determine whether there was a significant relationship between ethnicity (recoded into Black/African-American, White/Caucasian, and Other) and weight class. This relationship was significant, so all regression analyses moving forward controlled for ethnicity. Thus, two of the three dummy coded ethnicity variables were entered into the first step of the regression, BMI and implicit weight bias were entered into the second step, and the interaction between BMI and implicit weight bias was entered into the third step of the regression model. This analysis was performed for both the good/bad and motivated/lazy IATs.

Next, we performed three hierarchical linear regressions using the explicit weight bias measures [OPTS, IBSS-R, and the explicit weight bias measure (EWBM) derived from the IAT stimulus words] instead of the IATs, keeping the other variables the same, to test whether explicit weight bias or explicitly-reported internalization of the thin ideal moderated the relationship between BMI and SA.

We computed Pearson's Correlation (*r*) between explicit and implicit weight bias measures.

Cyberball Results

Finally, we conducted three hierarchical linear regressions to test a three-way interaction between SA, BMI, and photo condition (i.e., body salience) predicting three different state measures. We computed interaction variables comprised of these three variables after mean-centering SA and BMI. The dichotomous body image salience variable was coded as -.5 for the face condition and .5 for the body condition. The first regression examined NA as the outcome variable. After controlling for ethnicity, we entered baseline NA into the second step of the hierarchical regression model to control for individual differences in state NA. In the third step, we entered the main effects of SA, BMI, and photo condition, and two-way interactions between SA and BMI, SA and photo condition, and BMI and photo condition. We entered the three-way interaction into the fourth step. This hierarchical regression was performed again holding all variables constant but substituting pre- and post-Cyberball NA first with pre- and post-Cyberball state anxiety, and then with pre- and post-Cyberball self-esteem. We examined the unique effects of each step and used tests of simple slopes to probe significant interactions.

Data were missing for participants who did not return for the second session. We did not need to conduct data imputation, which would be called for if the retention rate were below 90%. Out of the 186 participants whose Session 1 data were used, 13 did not return for Session 2, placing retention at 93.01%. There were no systematic differences in retention across weight categories. Analyses that required presence at Session 2 included only participants who attended both study days.

CHAPTER 3: RESULTS

Participants

Missing Data

Of the 191 participants who signed up for the study, three did not appear for Session 1 and were deleted from the dataset. Of the 188 participants who attended Session 1, two had BMIs less than 18.5 kg/m^2 as measured in the lab and were subsequently excluded from the analyses. Thus, 186 participants were included in the final analyses. Of the 13 participants who did not attend Session 2, five were normal weight, five were overweight, and three were obese.

On the SPS, 12 participants had one question missing. On the SIAS-S, nine participants had one question missing. For each of these measures, the missing answer was replaced with the average of the participant's responses on all other items on that questionnaire.

Participant Characteristics

Our sample was comprised of 100% female-identified persons (women), with a mean age of 20.04±3.83 years (range = 18-50).

Of the 186 participants, 54.8% (n = 102) identified as white/Caucasian; 18.8% (n = 35) identified as black/African-American; 15.1% (n = 28) identified as Asian/Asian-American; 4.8% (n = 9) identified as Hispanic/Latino; 4.3% (n = 8) identified as mixed ethnic background; 0.5% (n = 1) identified as Native American; and 1.6% (n = 3) identified as other.

Regarding weight category, 40.9% (*n* = 76) of the sample was normal weight; 34.9% (*n* = 65) was overweight; 24.2% (*n* = 45) was obese. Mean BMI was 25.97±5.62 kg/m^2 (range = 18.74-46.19).

The Effects of Ethnicity

We conducted a 2x3 chi-square test and a 3x3 chi-square test to examine whether ethnicity varied based on photo condition or weight category, respectively. The relationship between ethnicity and photo condition was not significant, $\chi^2(2, N = 188) = 3.07$, $p = .22$, Cramer's $V = .13$. The relationship between ethnicity and weight class was significant, $\chi^2(4, N = 186) = 10.47$, $p = .033$, Cramer's $V = .17$.

Further chi-square tests were used to determine which specific relationships were significant. The follow-up analyses were largely not significant, with the exception of the 2x3 chi-square examining differences between "white/Caucasian" and "other" across the three weight categories. When examining "white" and "other," the relationship between ethnicity and weight category was significant $\chi^2(2, N = 151) = 6.17$, $p = .046$, Cramer's $V = .20$.

We conducted follow-up chi-square tests examining "white" and "other" in normal weight vs. overweight, overweight vs. obese, and normal weight vs. obese individuals. When examining individuals in the white/Caucasian and other groups only, the percentage of participants who were normal weight and overweight differed by ethnicity, $\chi^2(1, N = 119) = 6.11$, $p = .013$, Cramer's $V = .23$. The percentages of individuals in the "other" category who were normal weight and overweight were 38.5% and 61.5%, respectively, while the percentages of persons in the "white/Caucasian" category were 54.6% and 45.4%, respectively. No other follow-up tests yielded significant results.

The Relationship between BMI and SA

In our sample, 38.16% of healthy weight, 40.00% of overweight, and 46.67% of obese women met criteria for clinically significant SA as measured by the SIAS-S (clinical cutoff score = 28). However, the relationship between weight class and SAD diagnosis was not significant, $\chi^2(2, N = 186) = .88$, $p = .65$, Cramer's $V = .07$.

When using the SPS (clinical cutoff score = 24), 32.89% of healthy weight, 36.92% of overweight, and 44.44% of obese women met criteria for clinically significant SA as measured by the SPS. However, the relationship between weight class and SAD diagnosis was not significant, $\chi^2(2, N = 186) = 1.62$, $p = .45$, Cramer's $V = .09$. The correlation between the SA composite and BMI was not significant ($r = .09$, $p = .23$). The correlation between the SAAS and BMI was not significant ($r = .06$, $p = .45$).[2]

See Table 1 for the correlations between BMI, SA, and SAA, as well as the correlations among all other main study variables.

[2] We conducted these correlations using only BMI measured in the clinic, without replacing missing data with self-reported BMI, to determine whether the analyses yielded divergent results. The correlation between SA as assessed by the SA composite and BMI (just measured in clinic) was not significant ($r = .09$, $p = .22$). The correlation between SAAS and BMI was not significant ($r = .06$, $p = .40$). Due to the close similarity of these results to those which replaced missing data, we dispensed with the variable with missing data in all analyses moving forward.

Table 1. *Bivariate correlations among primary study variables*

	SPS	SIAS-S	SA	SAAS	BMI	Good IAT	Motiv-ated IAT	EWBM	OPTS	IBSS-R
SPS	1									
SIAS-S	.83***	1								
SA	.96***	.96***	1							
SAAS	.44***	.48***	.48***	1						
BMI	.08	.09	.09	.05	1					
Good IAT	.02	-.04	-.01	-.06	-.07	1				
Motivated IAT	.08	.01	.05	-.03	-.23	.35***	1			
EWBM	.15*	.16*	.16*	.14	-.15**	.01	-.02	1		
OPTS	.11	.12	.12	.13	-.14	.03	.06	.62***	1	
IBSS-R	.09	.13	.11	.03	-.20**	.15*	.19**	.13	.19*	1
M (SD)	21.23 (16.09)	24.51 (15.06)	0 (1.91)	41.52 (17.28)	26.87 (5.67)	.73 (.44)	.63 (.42)	96.38 (20.02)	1596.79 (394.97)	21.31 (4.04)

The Effects of Implicit and Explicit Weight Bias

Implicit Weight Bias

Descriptive IAT Results

In the present study, a positive mean reaction time difference score (*D* score) corresponds to stronger associations of negative attributes with fat people than with thin people; a *D* score of 0 represents no difference in associations of fat people and thin people; a negative *D* score indicates stronger associations of positive attributes with fat people than with thin people. The mean good/bad IAT *D* score was 0.73 (SD = 0.44), Cohen's *d* = 1.66. The mean *D* score for the motivated/lazy IAT was 0.63 (SD = 0.42), Cohen's *d* = 1.50. Thus, participants demonstrated large implicit anti-fat attitudes in both IATs. See Table 2 for a breakdown of anti-fat attitudes by weight category.

Table 2. *Implicit weight bias as a function of weight category*

	BMI Category		
	Normal Weight (*n* = 75)	**Overweight (*n* = 65)**	**Obese (*n* = 45)**
Fat+bad/Thin+good			
IAT *D* Score (SD)	0.78 (0.45)	0.74 (0.38)	0.66 (0.47)
Cohen's *d*	1.73	1.95	1.40
Fat+lazy/Thin+motivated			
IAT *D* Score (SD)	0.70 (0.42)	0.67 (0.39)	0.42 (0.43)
Cohen's *d*	1.67	1.72	0.98

Note. IAT = Implicit Association Test. For each IAT, positive *D* scores indicate a stronger association between bad or lazy and fat people (compared to thin people). Cohen’s *d* = IAT *D* Score/SD

The average error rate for the good/bad IAT was 5.19%, and the average error rate for the motivated/lazy IAT was 6.08%. No one had latencies of less than 300 ms on 10% or more of their trials, so no data were excluded on that basis.

The good/bad and lazy/motivated IATs were significantly related to one another ($r = .35$, $p < .001$). This result is similar to the calculated correlation between the good/bad and motivated/lazy weight IATs from a previous study (Wang et al., 2004; $r = .38$, $p < .001$).

Moderation

We conducted a hierarchical linear regression to determine whether implicit weight bias moderates the relationship between BMI and SA. The interaction between implicit weight bias as measured by the good/bad IAT and BMI significantly predicted SA ($\beta = .15$, $t = 1.98$, $p = .0498$). None of the main effects or covariates were significant. See Table 3 for full regression results. See Figure 2 for a visual depiction of the interaction. As predicted, simple slope analyses revealed that greater BMI was associated with greater SA for individuals with high implicit weight bias ($\beta = .23$, $t = 2.23$, $p = .027$). There was no relationship between BMI and SA for individuals with low implicit weight bias ($\beta = -.01$, $t = -.06$, $p = .949$).

Table 3. *Multiple linear regression: BMI predicting SA, moderated by good/bad implicit weight bias*

	B	**SE**	***t***	***β***
Dummy-coded black/AA	0.09	0.38	0.25	0.02
Dummy-coded other	0.33	0.34	0.98	0.08
Good/bad IAT	0.07	0.33	0.22	0.02
BMI	0.04	0.03	1.52	0.11
Good/bad IAT x BMI	0.10	0.05	1.98	0.15*
Overall Model F (5, 181) = 1.24, p = .292				
R^2 = .03				

Note. This table depicts the third and final step of the hierarchical linear regression. *p < .05, AA = African American; *B* = unstandardized coefficient; SE = standard error; β = standardized coefficient.

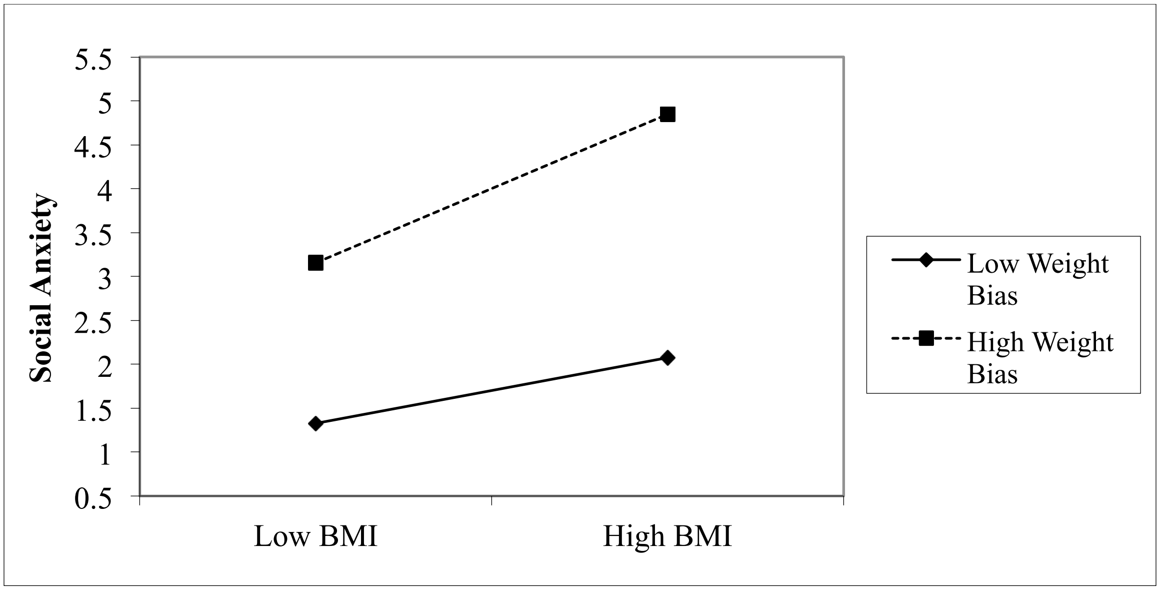

Figure 2. Interaction between BMI and Good/Bad Implicit Weight Bias. (BMI = Body Mass Index).

Next, we conducted a hierarchical linear regression to assess the same interaction, examining the motivated/lazy IAT rather than the good/bad IAT. The interaction between implicit weight bias as measured by the motivated/lazy IAT and BMI was not statistically significant. However, it predicted SA at the trend level ($\beta = .12$, $t = 1.89$, $p = .060$). See Figure 3 for a visual depiction of the interaction and Table 4 for the full regression results. None of the main effects or covariates were significant. Simple slope analyses revealed the same pattern as reported above, that greater BMI was associated with greater SA for individuals with high motivated/lazy implicit weight bias ($\beta = .32$, $t = 2.36$, $p = .020$) but not low implicit weight bias ($\beta = -.04$, $t = -0.34$, $p = .733$).

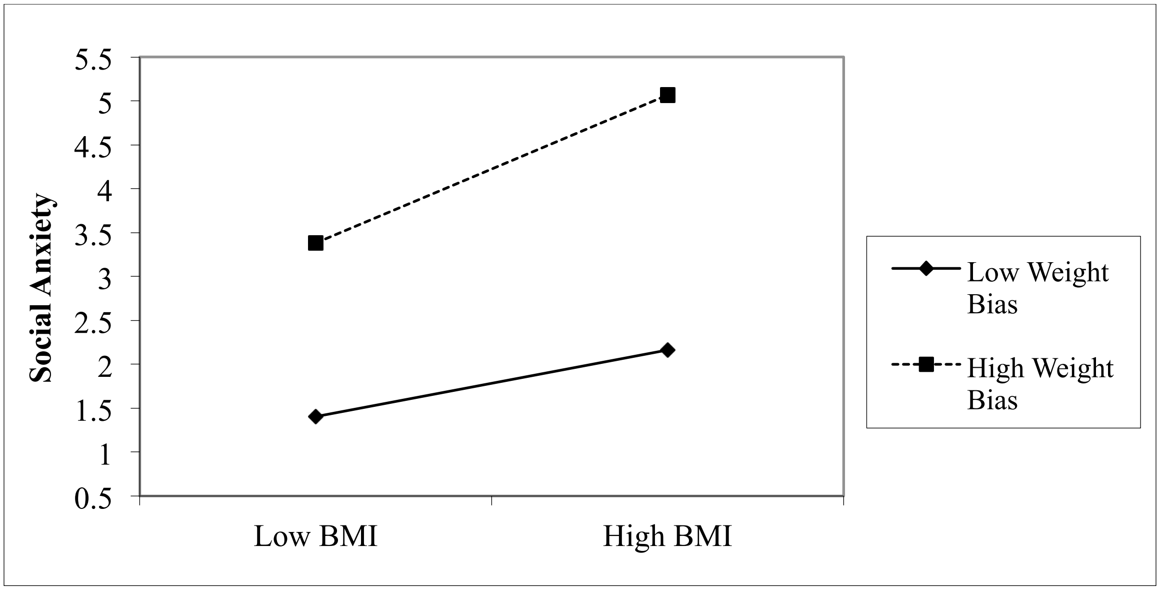

Figure 3. Interaction between BMI and Motivated/Lazy Implicit Weight Bias. (BMI = Body Mass Index).

Table 4. *Multiple linear regression: BMI predicting SA, moderated by motivated/lazy implicit weight bias*

	B	**SE**	***t***	***β***
Dummy-coded black/AA	0.16	0.38	0.42	0.01
Dummy-coded other	0.39	0.34	1.14	0.06
Good/bad IAT	0.30	0.35	0.86	0.05
BMI	0.05	0.03	1.82	0.09
Good/bad IAT x BMI	0.10	0.05	1.89	0.12

Overall Model F (5, 181) = 1.45, p = .209

R^2 = .04

Note. This table depicts the third and final step of the hierarchical linear regression. *p < .05, AA = African American; BMI = body mass index; SA = social anxiety; BSAM = Brief State Anxiety Measure; Photo = photo condition; *B* = unstandardized coefficient; SE = standard error; β = standardized coefficient.

Explicit Weight Bias

In similar multiple linear regression analyses, neither the OPTS or the IBSS-R significantly predicted SA. In the analyses using the Explicit Weight Bias Measure modeled off the IAT (EWBM), the main effect of explicit weight bias significantly predicted SA ($\beta = .18$, $t = 2.48$, $p = .014$). However, none of the other predictors were significant.

Motivated/lazy implicit weight bias was significantly correlated with the IBSS-R ($r = .19$, $p = .008$), but not the EWBM ($p = .821$) or OPTS ($p = .448$) (See Table 1). The same pattern emerged for good/bad implicit weight bias: it was related to the IBSS-R ($r = .15$, $p = .048$), but not the EWBM ($p = .945$) or the OPTS ($p = .684$).

Cyberball Results

Manipulation Check

The mean estimate for the percentage of throws that were directed at the participant was 7.29% (range: 0-30%), suggesting that participants accurately perceived that they were largely excluded from the ball-toss game.

Post-Rejection State Anxiety

A hierarchical linear regression predicting post-Cyberball state anxiety (BSAM scores), controlling for ethnicity and pre-Cyberball BSAM scores, found that the 3-way interaction between SA, BMI, and photo condition was not significant and did not significantly improve the model, *R* Square Change = .003, *F* change = 1.277, $p = .260$. Of the main effects, higher SA predicted higher post-Cyberball state anxiety, ($\beta = .23$, $t = 4.07$, $p < .001$). Two of the 2-way interactions were also significant. There was a significant interaction between SA and photo condition predicting post-rejection BSAM scores (β = .16, t = 2.97, p = .003) (See Figure 4). There was also a significant interaction between BMI and photo condition predicting post-rejection BSAM scores (β = -.15, t = -2.85, p = .005) (See Figure 5). See Table 5 for the full regression results.

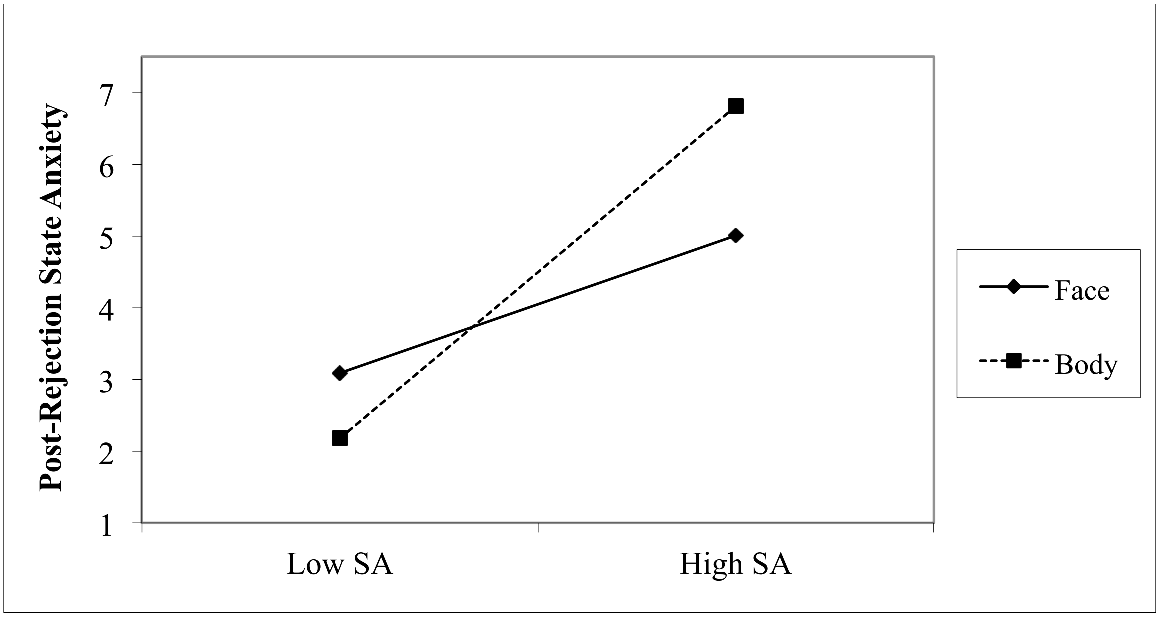

Figure 4. Interaction between SA and Photo Condition Predicting Post-Cyberball State Anxiety. (SA = social anxiety).

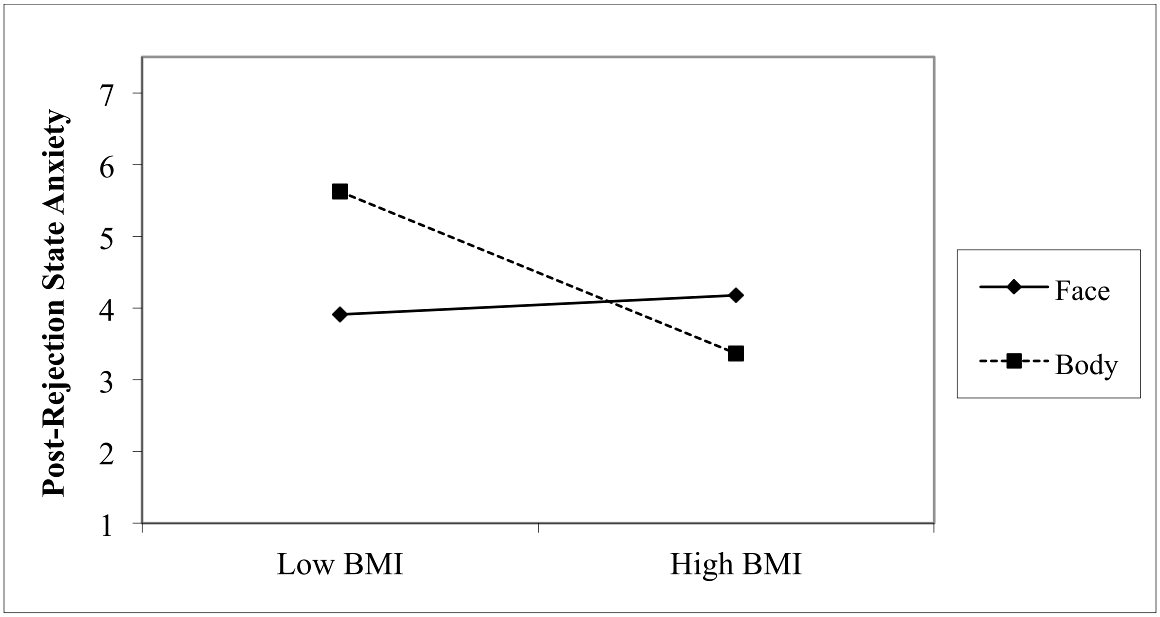

Figure 5. Interaction between BMI and Photo Condition Predicting Post-Cyberball State Anxiety. (BMI = Body Mass Index).

Table 5. *Multiple linear regression: BMI, SA, photo condition, and interactions predicting post-Cyberball BSAM*

	B	**SE**	***t***	***β***
Dummy-coded black/AA	0.18	0.57	0.32	0.02
Dummy-coded other	0.79	0.51	1.53	0.09
BSAM_Pre	0.71	0.06	11.50	0.63***
Photo Condition	0.45	0.44	1.02	0.06
BMI	0.02	0.04	0.60	0.03
SA	0.50	0.12	4.07	0.23***
SAxBMI	0.02	0.02	0.94	0.06
SAxPhoto	0.71	0.24	2.97	0.16**
BMIxPhoto	-0.22	0.08	-2.85	-0.15**
BMIxSAxPhoto	-0.04	0.04	-1.13	-0.07
Overall Model F (10, 148) = 22.77, $p < .001$				
$R^2 = .61$				

Note. This table depicts the fourth and final step of the hierarchical linear regression. *$p < .05$, **$p < .01$, ***$p < .001$; AA = African American; BMI = body mass index; SA = social anxiety; BSAM = Brief State Anxiety Measure; Photo = photo condition; *B* = unstandardized coefficient; SE = standard error; β = standardized coefficient.

To better understand the nature of the two-way interactions, we conducted simple slope analyses examining the relationship between SA and post-rejection state anxiety in each photo condition, controlling for ethnicity and pre-Cyberball BSAM scores. SA did not predict post-Cyberball BSAM scores in the face-only condition ($\beta = .07$, $t = 0.85$, $p = .398$). In contrast, SA significantly predicted post-Cyberball BSAM scores in the full-body condition, such that higher SA predicted higher post-rejection state anxiety, ($\beta = .36$, $t = 4.82$, $p < .001$).

Next, we examined the relationship between BMI and post-rejection state anxiety in each photo condition, controlling for ethnicity and pre-Cyberball BSAM. In the face-only condition, BMI significantly predicted post-Cyberball BSAM scores, ($\beta = .17$, $t = 2.21$, $p = .030$). BMI was not significantly related to post-Cyberball BSAM scores in the full-body condition, ($\beta = -.10$, $t = -1.27$, $p = .207$).

Post-Rejection Negative Affect

We conducted the same hierarchical linear regression as delineated above, with baseline NA in the 2nd step of the regression and post-Cyberball NA as the outcome variable. Of the main effects, higher SA predicted higher post-Cyberball NA, $\beta = .15$, $t = 3.71$, $p < .001$. No other predictors were significantly related to post-Cyberball NA.

Post-Rejection Self-Esteem

Again, we conducted the same hierarchical linear regression as described above, with baseline state self-esteem in the 2nd step and post-Cyberball self-esteem as the outcome variable. SA did not predict lower post-Cyberball self-esteem ($p = .165$). There was a trend-level interaction between SA and photo condition predicting post-rejection state self-esteem ($\beta = .05$, $t = 1.92$, $p = .056$) (See Figure 6). None of the other predictors were significant.

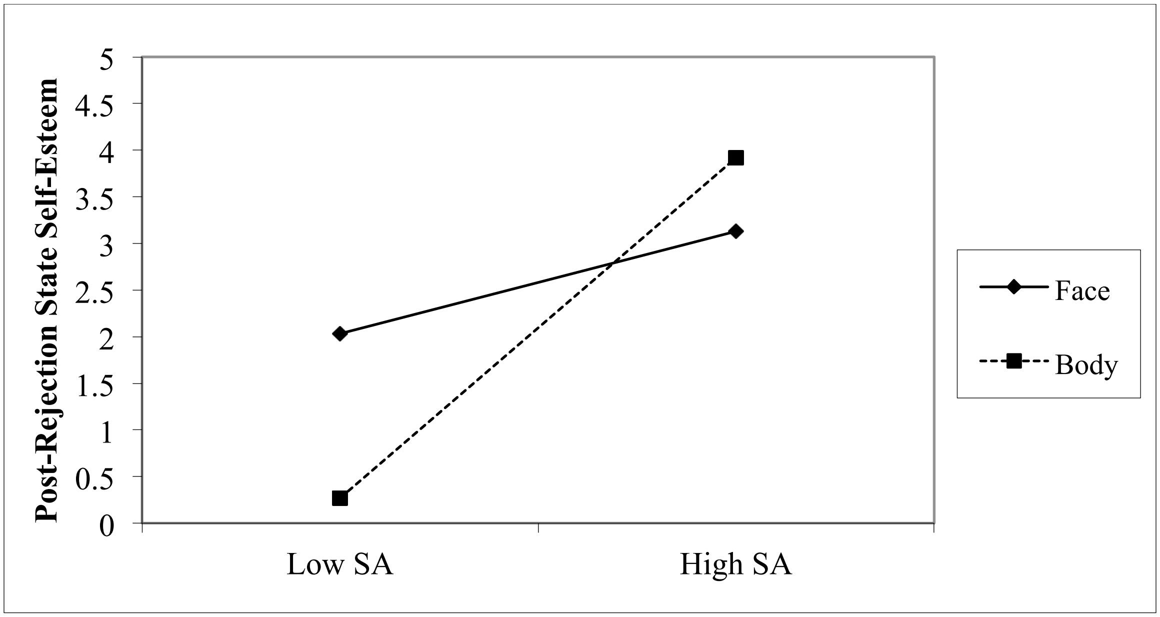

Figure 6. Interaction between SA and Photo Condition Predicting Post-Cyberball State Self-Esteem. (Note: Higher self-esteem score = worse self-esteem. SA = social anxiety).

We conducted simple slope analyses to examine the relationship between SA and post-Cyberball state self-esteem in each photo condition. SA was not significantly related to post-Cyberball SSES scores in the face-only condition ($\beta = .01$, $t = .23$, $p = .815$). In contrast, SA significantly predicted post-Cyberball SSES scores in the full-body condition, ($\beta = .11$, $t = 2.95$, $p = .004$). Greater SA predicted lower post-rejection state self-esteem in the full-body condition, but not in the face-only condition.

CHAPTER 4: DISCUSSION

The Relationship between BMI and SA

Contrary to hypotheses, rates of clinically elevated SA did not differ by weight category. Though rates of SAD as determined by clinical cutoff scores increased from normal weight, to overweight, to obese persons, these differences were not significant. Furthermore, the relationship between the continuous variables of BMI and SA, as well as BMI and social appearance anxiety, were not significant. Our results suggest that BMI alone does not constitute a risk factor for SAD/SA. This finding diverges from previous research that found a higher prevalence of SAD in bariatric surgery candidates with class III obesity compared to healthy controls (Mirijello et al., 2015).

Though it is possible that there is no relationship between BMI and SA, there are additional explanations for our nonsignificant finding. Recruitment of individuals in the obese category was substantially more difficult than recruitment of individuals who were classified as normal weight or overweight. We believe this is because there are fewer obese than overweight and normal weight adult women in the US: according to data aggregated from 2007-2012, about 30% of women were overweight and 37% of women were obese (Yang & Colditz, 2015), and the prevalence of obesity among college-educated women is even lower (Ogden, Lamb, Carroll, & Flegal, 2010). Due to time constraints, we stopped recruitment with 45 participants in the obese category. Furthermore, only 11 participants in our study met criteria for class II obesity, and seven participants met criteria for class III obesity. As BMI increases, so does stigma; for instance, in a population-based study of adults 50 and older in England, weight discrimination was less than 1% in normal weight and overweight participants and rose to

6.7%, 24.2%, and 35.1% in individuals who met criteria for class I, class II, and class III obesity (Jackson, Steptoe, Beeken, Croker, & Wardle, 2015). It is possible that if we had been able to recruit more individuals with class II, and especially class III obesity, rates of SAD would differ among these categories compared to lower-weight categories, in line with Mirijello et al. (2015). Indeed, the general pattern that emerged in our sample was an increase in SAD prevalence with each progressively heavier weight category.

When examining the relationship between BMI and SA as moderated by implicit weight bias, a significant finding emerged. Implicit weight bias moderated the relationship between BMI and SA, such that BMI was significantly positively associated with SA for individuals with high, but not low, implicit weight bias. These results suggest that the state of being obese in a society that stigmatizes obesity does not alone place individuals at risk for elevated SA. Rather, this risk seems to occur only when individuals have internalized weight stigmatizing negative attitudes, such that they unconsciously endorse them. That there were no significant interactions between *explicit* weight bias and BMI supports this conclusion.

Internalized weight bias has been defined as the belief that negative attributions about obese individuals are true for oneself (Durso & Latner, 2008). Durso and Latner (2008) argue that to capture internalized weight bias, one must assess both the adoption of societal weight-stigmatizing views and the incorporation of such views into one's self-assessment. Nevertheless, some researchers (e.g., Davison, Schmalz, Young, & Birch, 2008) infer that the endorsement of anti-fat stereotypes by overweight persons represents the internalization of such stereotypes. In line with this view, Wang et al. (2004) have utilized the IAT as an index of internalized weight bias. We share the belief that the unconscious endorsement of negative attitudes toward fat people by individuals who are themselves overweight/obese indicates the presence of self-stigma. This seems especially true given that such implicit weight bias represents a lack of the usual preference for the "in-group" evident in IATs conducted among other marginalized groups (Wang et al., 2004). Our findings suggest that for overweight/obese clients with SAD, weight bias and the individual's own endorsement of this bias (i.e., stigma directed at the self) may be an important treatment target.

Of note, the significance level of the interaction between BMI and the good/bad IAT was just under .05, and the significance level of the interaction between BMI and the motivated/lazy IAT was .06. However, the same pattern (a significant positive association between BMI and SA for high, but not low implicit weight bias) emerged for both IATs, demonstrating consistency for the finding. The size of the BMI by good/bad implicit weight bias interaction effect was relatively small (β = .15), as was the size of the BMI by motivated/lazy interaction (β = .12). Simple slopes revealed a small to moderate relationship between BMI and SA when good/bad implicit weight bias was high, and a moderate relationship between BMI and SA when motivated/lazy implicit weight bias was high. Future research should continue to examine this interaction in samples of individuals in the general population in addition to college populations, and in samples that include more individuals with class II and III obesity. It is possible that the effect would be stronger and more easily detectable in a sample with a wider and more evenly distributed BMI range.

The Relationship between Implicit and Explicit Weight Bias

Implicit weight bias (as assessed by both IATs) was not associated with the OPTS or the EWBM, which used all of the attributes from the IATs to make a direct comparison about what individuals endorse implicitly versus explicitly. These results support prior research that demonstrated a lack of association between implicit and explicit measures of weight bias (Teachman & Brownell, 2001; Wang et al., 2004), providing further evidence that individuals monitor and censor their reported attitudes on explicit measures of anti-fat attitudes.

Implicit weight bias (as assessed by both the good/bad and motivated/lazy IATs) was significantly positively related to the IBSS-R, indicating that implicit endorsement of anti-fat attitudes and stereotypes is related to the explicit endorsement of the attitude that ideal women's bodies are thin. This finding suggests that individuals may be more comfortable explicitly endorsing pro-thin than anti-fat attitudes toward women. Given its correlation with implicit measures, the IBSS-R may be a more accurate index of weight bias than other explicit measures.

The Relationship between Body Salience and Reactivity to Rejection

We had predicted a significant three-way interaction between BMI, SA, and body salience predicting reactivity to exclusion; we thought that the more socially anxious the individual, the greater would be the increase in various negative emotions following rejection when body image was made salient and that this relationship would be moderated by BMI. This turned out not to be the case. The three-way interaction did not contribute significant variance to post-rejection reactivity above and beyond the two-way interactions. However, photo condition (i.e., body salience) did interact significantly with

SA to predict post-rejection state anxiety, and there was a trend-level interaction predicting post-rejection state self-esteem. Higher SA significantly predicted higher post-rejection state anxiety and worse post-rejection self-esteem in the full-body condition, but not the face-only condition.

Taken together, these findings suggest that regardless of BMI, body salience plays a role in the way that women experience peer exclusion. Given that individuals endorsing high SA were more anxious post-rejection only when their full bodies were ostensibly visible to other participants, it is possible that such individuals attribute even non-appearance related rejection to weight status or overall appearance. In our everyday lives, we operate in a world in which our whole physical selves are visible to others. Exclusion, rejection, and victimization (with the exception of parts of the online community) do not operate outside of this context. Our interpretations of our experiences, consciously or unconsciously, seem to be influenced by the knowledge that our bodies are visible to others and subject to evaluation. The finding that the visibility of one's body is associated with increased reactivity to exclusion among socially anxious individuals may have useful treatment implications; how one anticipates to be visually perceived by others may be an important part of the therapeutic conversation.

The procedural convention in Cyberball is to utilize pictures of faces (both the participant's, and the "other players'") (Levinson et al., 2013; Williams & Jarvis, 2006), likely because the Cyberball software (Williams et al., 2012) includes photographs of faces. Ours was the first Cyberball study to add a photograph manipulation to the paradigm, and the results suggest that full-body photographs may be more effective in simulating real-life rejections than face-only photographs, providing more external validity. This may not be the case for men however, as they were not included in this study.

One curious finding concerned the moderating effect of photo condition on the relationship between BMI and reactivity to exclusion. Though we expected that BMI would have a stronger positive association with reactivity to exclusion in the full-body condition, the opposite was true: greater BMI predicted greater reactivity in the face-only condition, but the two variables were not associated in the full-body condition. One possible explanation for this finding is that the photo manipulation does not have an effect on heavier individuals because they already expect to be judged based on their appearance. Perhaps for heavier individuals, awareness of one's body is ever-present. Individuals with lower BMIs were more reactive to rejection when their full bodies were visible. Perhaps for these individuals, body image is not automatically salient, and so the full-body photo manipulation served to increase body salience to a level similar to that which individuals with higher BMIs already experience on an ongoing basis. Future research should attempt to replicate these results in order to clarify the relationship between BMI and reactivity to exclusion.

Limitations

Our study is not without its limitations. First, rather than examine the influence of race/ethnicity in conjunction with our variables of interest, we chose to statistically control for race/ethnicity. Prior research has shown differences in obesity stigma among African-American vs. Caucasian women (Hebl & Heatherton, 1998). Additionally, the relationships between awareness and internalization of the thin ideal, and internalization of the thin ideal and body dissatisfaction, were significantly stronger in European-

American women than Mexican-American or Spanish women (Warren, Gleaves, Cepeda-Benito, del Carmen Fernandez, & Rodriguez-Ruiz, 2005). Thus, it is possible that our pattern of results would differ by race/ethnicity, and future research should investigate whether our effects hold across diverse races and ethnicities. In addition, future research should attempt to replicate our study among male-identified persons to determine if the pattern of results differs by gender. It should be emphasized that, at present, our findings apply only to women's experience of SA and exclusion.

In addition, our study used a nonclinical, undergraduate sample. Young adulthood is a critical time to examine due to the pervasiveness of weight stigma in schools and the workplace and because of frequent opportunities at college for peer interactions and exclusion. However, it would be interesting to see if our results differ across the spectra of age, socioeconomic status, and educational attainment. Prior research suggests that this might be the case. For instance, older individuals exhibit less implicit weight bias with good/bad and lazy/motivated attributes than younger individuals (Carels et al., 2010).

Finally, in our study we excluded participants who met criteria for anorexia and bulimia nervosa to avoid the confounding effects of eating disorder symptomatology and/or being underweight on anti-fat bias, SA, and attentiveness to body image. Future research should examine the effects that eating disorder symptoms have on these variables and their relation to SA.

Conclusions

Our study sets the stage for future research to examine whether implicit weight bias contributes to the development of SA among heavier people. Our study builds on prior research that revealed a relationship between perceived weight stigma and SA/SAD in obese individuals (e.g., Hatzenbuehler et al., 2009; Yen et al., 2014). Ours was the first study to examine the relationship between implicit/internalized weight bias and BMI predicting SA.

Perhaps the most important take-away is that, beyond the experience of weight-related victimization and the fear of future negative judgment, the unconscious adoption of the very stigma one fears is associated with SA. If you have negative attitudes about yourself, or a group to which you belong, it may be even more difficult to consider that others might think differently—that they view you more positively than you view yourself. Thus, the therapeutic conversation with a heavy client with SAD may benefit not only from challenging the client's beliefs about how others view her, but also challenging her beliefs—which may not yet be conscious—about the self. The importance of spending time in therapy exploring and challenging yet unconscious "core beliefs" aligns with both contemporary psychodynamic psychotherapy for anxiety disorders (Cohen & Kaplan, in press) and a gold-standard cognitive behavioral therapy for SAD (Hope, Heimberg, & Turk, 2010), which describes core beliefs as beliefs about oneself that are usually outside of awareness at the outset of treatment. An exploration of implicit beliefs about one's weight or implicit attitudes about "fat people" may be especially important for persons with Class II or III obesity, who in actuality do frequently face weight-based judgment, discrimination, and victimization. For such individuals, challenging negative thoughts and assumptions about how others view them may be experienced as invalidating given the external reality of weight bias; in contrast, exploring the individual's own beliefs about "fat people" and oneself may be more productive.

Furthermore, our study highlights the importance of examining how clients react to and process social stressors, taking into account the visual context in which people experience social interactions. We are so accustomed to living in a visual environment—to traversing the world being seen—that often we fail to consider the impact of this context. It is especially easy to overlook this context if one has the privilege of not having to confront weight-related (or other appearance-related) stigma. The results of our social ostracism photograph manipulation suggest that physical exposure—the state of being seen fully—influences reactivity even to relatively subtle exclusionary behavior that may not indicate rejection or victimization per se. Physical exposure seems to be an important component of one's social experience for socially anxious individuals of any weight.

Future research should continue to investigate the ways in which weight, implicit attitudes toward weight, and the larger contexts of societal weight bias and visual social perception influence the experience of social anxiety. The ultimate goal, however, must be to find a way to counter implicit weight biases, both on an individual and a societal level.

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