



Implicit and explicit anti-fat bias: The role of weight-related attitudes and beliefs



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ABSTRACT

Introduction: The increasing prevalence of anti-fat bias in American society comes at a great cost to the health and well-being of people who are overweight or obese. A better understanding of the correlates of anti-fat bias would inform development of interventions for reducing anti-fat bias. Based on three theoretical perspectives, this study tested the relation between attitudes and beliefs about weight and anti-fat bias (implicit and explicit): (1) The belief that one is like people who are fat (social identity theory). (2) The belief that one can control her/his weight (attribution theory). And (3) the beliefs that most people prefer thin people and that weight is important (socio-cultural theory).

Methods: Participants were 66,799 volunteers (47,265 women, mean age of 27.88 ± 11.9 years) who completed the Thin-Fat Implicit Association Test on the Project Implicit website (<https://implicit.harvard.edu/>) during 2016. Explicit anti-fat bias and weight-related attitudes and beliefs were assessed by self-report. Correlation and regression analyses were conducted to examine links between weight-related attitudes and beliefs and anti-fat bias.

Results: All tested weight-related attitudes and beliefs were significantly ($p < .001$) correlated with explicit and implicit anti-fat bias, but some of the correlations were very weak. An examination of the relative contribution of the tested weight-related attitudes and beliefs to a model explaining anti-fat bias suggested that the strongest correlates of explicit anti-fat bias were the beliefs that weight was important ($\beta = 0.194, p < .001$), that most people prefer thin people ($\beta = 0.177, p < .001$), and that the respondent was like people who are fat ($\beta = -0.180, p < .001$).

Discussion: The social-identity and socio-cultural theories may provide a stronger explanation for anti-fat bias relative to attribution theory. Future research could use longitudinal designs with more reliable measures in order to verify these cross-sectional findings.

1. Introduction

Anti-fat bias, defined as prejudice and discrimination against people who are fat, has increased in prevalence in American society over the past decades (Puhl and Heuer, 2009; Latner and Stukard, 2003; Andreyeva et al., 2008; Tomiyama et al., 2015). Individuals who are overweight or obese are being stigmatized and discriminated against in nearly all domains of life, including relationships, education, employment, and health care, at great cost to their well-being (Hilbert et al., 2008). Studies suggest that overweight and obese individuals who suffer from weight discrimination or apply negative stereotypes towards themselves (self-directed anti-fat bias) may suffer from adverse outcomes, including depression, anxiety, perceived stress, lack of social support, medication non-adherence, and health-care avoidance

(Papadopoulos and Brennan, 2015). In addition, evidence suggests that self-directed anti-fat bias can interfere with weight-loss efforts and might lead to additional weight gain (Puhl et al., 2008).

Despite the growing understanding that social constructs, such as anti-fat bias, have negative health consequences (Haslam et al., 2018; Clair et al., 2016) and that anti-fat bias is fairly prevalent among health care providers, including medical doctors (Sabin et al., 2012), there is currently no clear empirical understanding of the correlates of anti-fat bias (Crandall and Schiffhauer, 1998; Puhl and Brownell, 2003). Acquiring a better knowledge of what factors increase anti-fat bias would help to develop interventions for decreasing anti-fat bias and for improving the health and well-being of individuals who are overweight or obese.

Goffman (1963) defined stigma as “the situation of the individual

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who is disqualified from full social acceptance” (p. 9) and observed that people tend to be stigmatized for three different reasons: bearing physical abnormality, possessing a character flaw, or being a tribal out-group member (Goffman, 1963, p. 10). Although Goffman's work is certainly one of the most important contributions to the field of stigma (van Leeuwen et al., 2015), he has also been criticized for theorizing that stigmatized individuals tend to accept their inferior status (Puhl and Brownell, 2003).

Empirical research following Goffman's (1963) seminal work has improved the understanding of the correlates of stigma. Several theoretical models have been proposed to provide an explanation for the underlying mechanism behind stigma in general and anti-fat bias in particular. Among these models are social identity theory (Tajfel and Turner, 1986), attribution theory (Crocker et al., 1993), socio-cultural theory (Polivy and Herman, 2004), the psychological concept of essentialism (Howell et al., 2011; Bastian and Haslam, 2006), social consensus theory (Puhl and Brownell, 2003), and stigma-asymmetry model (Hoyt et al., 2017). As explained below, this study focused on the first three aforementioned theories, as these three theories received the most of the attention in the recent scientific literature but were not examined empirically using implicit measures (Puhl and Heuer, 2009). Furthermore, despite the growing number of studies investigating correlates of anti-fat bias (Puhl and Brownell, 2003), most previous studies have focused on only one theoretical explanation of anti-fat bias and measured explicit (and not implicit) anti-fat bias among a specific population (e.g., patients with obesity and binge eating disorders; Pearl et al., 2014). There is still a lack of research on the correlates of both implicit and explicit anti-fat bias among the general population.

Importantly, this study examined both implicit and explicit anti-fat bias because people often refrain from explicit endorsements of negative attitudes and stereotypes toward social groups (Crosby et al., 1980; Greenwald et al., 2009; Teachman and Brownell, 2001). A long-standing challenge in attitude research is that self-reported attitudes and behaviors often only weakly correlate with each other (Ajzen and Fishbein, 1977; Wicker, 1969). Implicit bias often improves explanatory power (Greenwald et al., 2009), sometimes even surpassing the predictive value of explicit attitudes, especially when they pertain to sensitive issues such as negative judgments of social groups (e.g., Dovidio and Gaertner, 2000).

1.1. Theoretical models

Social identity theory postulates that perceived membership in a social group is often linked with in-group favoritism and out-group derogation (Tajfel and Turner, 1986). This theory suggests that anti-fat bias may arise when people categorize themselves as belonging to specific social groups (e.g., people who are thin), and develop their social identity by comparing their group with other groups. Positive social identity is maintained by negatively stereotyping other groups (e.g., people who are fat; Puhl and Brownell, 2003). Several studies provided partial validation for social identity theory in the context of anti-fat bias based on the evidence that one's BMI (Body Mass Index, kg/m²) is negatively linked with his/her anti-fat bias and that overweight and obese individuals hold lower implicit and explicit anti-fat bias than underweight and normal weight individuals (Marini et al., 2013; Schwartz et al., 2006). Conflicting evidence, however, comes from studies that found that overweight individuals do not hold weaker anti-fat attitudes in comparison to normal weight individuals (Latner et al., 2005; Wang et al., 2004).

While most studies investigating thin/fat group identity and anti-fat bias have used objective measures of adiposity (e.g., BMI) to determine participants' group identity (i.e., normal weight vs. overweight and obese), only a very few studies have used subjective measures of weight to determine group identity (Holub, 2008). It might be important to use subjective measures of group identity—such as weight-status perception and the feeling of being like people who are thin/fat—because

different people have different perceptions of overweight and obesity. In fact, subjective weight perceptions are often unrelated to the established BMI cutoffs (WHO, 2000) of overweight (BMI = 25) and obesity (BMI = 30; e.g., McCabe et al., 2006). It is important to note that because identity depends on self-perception, subjective weight identity may be more relevant to social identity theory than objective weight. In the present research, we used both a relatively objective measure (self-reported BMI) and subjective measures (perceived weight status and the feeling of being like people who are thin/fat) in order to examine the link between thin/fat identity and both implicit and explicit anti-fat bias among the general population.

Attribution theory is probably the theory most commonly used to explain anti-fat bias (Crandall et al., 2001; Puhl and Brownell, 2003); it focuses on the explanations and meanings that people find for outcomes and behaviors that cannot necessarily be explained rationally (Crocker et al., 1993). In the context of weight, people often attribute one's weight to the person's character by assuming that people can control their weight (Puhl and Brownell, 2003). This belief often leads to discriminative views against overweight and obese individuals because it may suggest that they are lazy, undisciplined, or less competent (Hilbert et al., 2008).

Several studies provide support for attribution theory in the context of anti-fat bias (for review see Puhl and Brownell, 2003). For example, studies show that people are more distant and rejecting toward people with health conditions that are perceived to be under their control (including obesity; Crandall and Moriarty, 1995); studies also show stronger explicit anti-fat bias the more an individual thinks that people are responsible for their own weight problems (Crandall et al., 2001; Hilbert et al., 2008; Durso and Latner, 2008). Although a few studies have already provided important insights on the link between the belief that weight is controllable and explicit anti-fat bias, little is known about the link between the belief that weight is controllable and implicit anti-fat bias. In the present research, we evaluated whether the belief that weight is controllable is positively related to both implicit and explicit anti-fat bias.

Another theory that provides further insights into the correlates of anti-fat bias is *socio-cultural theory* (Polivy and Herman, 2004; Neighbors et al., 2008). This theory emphasizes the dominant influence of society and culture on people's attitudes and beliefs. According to socio-cultural theory, societal ideals and cultural norms that stress the importance of appearance and body shape (e.g., the thin ideal standard of beauty; Low et al., 2003) are overwhelmingly portrayed through the media to shape people's evaluations and interpretations of themselves. Anti-fat bias may arise, according to this theory, because overweight and obese individuals do not fit the cultural norms that promote thinness and denigrate fatness (Crandall and Schiffhauer, 1998). Heinberg et al., (1995) differentiate between two components of sociocultural attitudes toward appearance: attitudes that reflect *awareness* of the societal norms about shape and weight and attitudes that reflect *internalization* of these societal norms. Compatible with that differentiation, these two constructs (awareness, internalization) were measured separately in the present study. In a previous study (Vartanian et al., 2005), a small sample of 56 female undergraduate students showed no relation between awareness of societal norms regarding thinness and anti-fat bias (implicit and explicit). In that sample (Vartanian et al., 2005), internalization of societal norms was positively related to explicit anti-fat bias, but not to implicit anti-fat bias. In the present study, these relations were examined in a larger sample that includes females and males across different age groups.

The goal of the present study was to shed more light on the correlates of anti-fat bias by examining the relations between implicit and explicit anti-fat bias and weight-related attitudes and beliefs. A large convenience sample of U.S. participants who chose to take the Weight Implicit Association Test (IAT) by accessing the Project Implicit website (<https://implicit.harvard.edu/>) was used. Earlier data collections on that website were used to report general statistics about implicit anti-fat

bias (Nosek et al., 2007); examine the relations between implicit anti-fat bias, self-reported BMI, and national average BMI (Marini et al., 2013); and study implicit anti-fat bias among medical doctors (Sabin et al., 2012). The relation between anti-fat implicit and explicit bias was examined with three factors derived (respectively) from social identity theory, attribution theory, and socio-cultural theory: (1) A thin/fat identity, operationalized as the self-reported belief that one is normal/overweight and the self-reported belief that one is like other people who are thin/fat. (2) Perceived controllability of weight, operationalized as the self-reported belief that people have control over their weight. And (3), awareness and internalization of societal norms, operationalized as the self-reported beliefs that people prefer thin people over fat people and that weight is important to the sense of who one is. Gender differences in implicit and explicit weight bias were also examined in order to use the large sample to verify previous findings that males tend to have higher implicit and explicit anti-fat bias in comparison to females (Sabin et al., 2012). In addition, the inter-correlations between the weight-related attitudes and beliefs were examined, as well as the relative contribution of each weight-related attitude and belief to a model explaining implicit and explicit anti-fat bias.

2. Methods

2.1. Participants

Participants were 66,799 volunteers (47,265 of whom were women) who completed the Thin-Fat IAT demonstration task on the Project Implicit website between March 2016 and October 2016. This task was designed by the researchers (including the second author) at Project Implicit as an educational demonstration of the IAT and as a way to increase empirical knowledge about implicit anti-fat bias. The original sample included 71,304 participants who completed the IAT and identified themselves as United States residents. Of those, 4505 participants (6.3%) were excluded from the sample due to missing information about their weight, height, gender, perception of how thin/fat they were, and self-reported liking of people who are thin/fat. Little's Missing Completely at Random (MCAR) test (Little and Rubin, 1987) was conducted for age and BMI, which was significant ($\chi^2 = 30.524$, $DF = 2$, $p < .001$), suggesting that the data were not missing at random. Data imputation techniques were not used for missing data because when data are not missing at random, the mechanisms by which data are missing can be complex and are not easily modeled (Van Buuren, 2012).

2.2. Procedure and measures

Participants completed, in random order, the IAT, the attitudes and beliefs self-report questions, and the demographics questions.

Implicit Association Test. The categories were *Fat people*, *Thin people*, *Good words*, and *Bad words*. The items for the “people categories” were silhouettes of six fat women, six fat men, six thin men and six fat men. The items for the “word categories” were eight positive and eight negative words selected randomly for each participant out of a list of 32 positive words (e.g., *Love*, *Smiling*, and *Fabulous*) and 32 negative words (e.g., *Abuse*, *Scorn*, and *Horrific*). In the Weight IAT (first developed by Teachman and Brownell, 2001), the participants put the items (images and words) into one of four categories by pressing one of two computer keys. In the two other blocks, participants categorize images of people who are fat and positive words with one key and images of people who are thin and negative words with the other key. In two other blocks, participants categorize images of people who are thin and positive words with one key and images of people who are fat and negative words with the other key.

The IAT score was computed using the D600 algorithm, recommended by Greenwald et al. (2003). The overall IAT D score was an

average of two D scores computed for each pair of critical blocks (blocks 3 versus 6, and blocks 4 versus 7). The D score for each pair of blocks was the difference between the average latency of each of the two opposing blocks (e.g., block 3 versus block 6) divided by the standard deviation of the trials in both blocks together. A positive D score indicated faster responding on average when the category Thin people shared the same key with the category good words and Fat people shared the same key with bad words compared to the reverse; this was interpreted as an implicit anti-fat bias. D was calculated after removing response latencies under 400 ms or over 10,000 ms and included all other trials. Latencies of error responses were replaced with the block mean of correct latencies plus 600 ms.

Explicit anti-fat bias. Participants reported their explicit preference by answering the question: *Which statement best describes you?* Possible responses were, *I strongly [moderately/slightly] prefer Fat[Thin] people to Thin[Fat] people* coded from -3 (for strong preference for people who are fat) to 3 (strong preference for people who are thin) and the statement *I like Fat people and Thin people equally* in the middle (coded 0).

The attitudes and beliefs self-report questions. Of the various attitudes and beliefs reported by the participants, only those relevant to the present research were analyzed.

Self-perception of weight. Participants completed the statement *Currently, I am _* with one of the following responses (coded 1–7): *Very underweight*, *Moderately underweight*, *Slightly underweight*, *Neither underweight nor overweight*, *Slightly overweight*, *Moderately overweight*, *Very overweight*.

Thin/fat group identity. Participants answered two questions, *How much do you feel similar to people who are Thin [Fat]?* Possible responses were (coded 1–5): *Not at all similar*, *Somewhat similar*, *Moderately similar*, *Very similar*, *Extremely similar*.

Controllability of weight. Participants answered the question, *How much control do people have over their weight?* Possible responses were (coded 1 to 5): *Complete control*, *A lot of control*, *Some control*, *A little control*, and *No control*.

Awareness of societal standards. Participants answered the question, *Do most people prefer Fat people or Thin people?* Possible responses were (coded 1 to 7): *Most people [strongly/somewhat/slightly] prefer Fat people to Thin people*, *Most people like fat people and thin people equally*, *Most people [slightly/somewhat/strongly] prefer Thin people to Fat people*.

Internalization of societal standards. Participants answered the question, *How important is your weight to your sense of who you are?* Possible responses were (coded 1 to 5): *Not at all important*, *Slightly important*, *Moderately important*, *Very important*, and *Extremely important*.

Demographics. Among other demographic information, participants reported their age, race, education, and gender.

Self-reported BMI. Participants reported their height from a list of options indicating height by centimeter and inch, ranging from 91 cm to 213 cm in increments of one inch. Participants reported their weight from a list of options indicating weight by kilograms and pounds, ranging from 23 kg to 200 kg in increments of five pounds. Participants could also indicate that their weight and/or height was above or below the ends of those ranges (in which case, the measurement to the maximum measurement in that range was recorded). BMI was computed as kg/m^2 .

2.3. Data analyses

Data were analyzed using SPSS version 23.0 and R version 3.3.2. Means, standard deviations, and frequencies to characterize the sample based on gender, BMI, race, and education were reported (Table 1). To compare women and men on anti-fat bias and weight-related attitudes and beliefs, *t*-tests were used (Table 2). Bivariate Pearson's correlations were used to examine relations among anti-fat bias (implicit and explicit), BMI, and weight-related attitudes and beliefs. Multiple linear regressions were used to examine the contribution of all tested weight-

Table 1
Characteristics of participants.

Portion of sample	Women			Men		
	<i>n</i> (%)	Mean Age (<i>SD</i>)	Mean BMI (<i>SD</i>)	<i>n</i> (%)	Mean Age (<i>SD</i>)	Mean BMI (<i>SD</i>)
All test takers	47,265	27.726 (11.970)	25.468 (7.196)	19,534	28.299 (11.926)	25.731 (6.478)
BMI						
•Underweight (BMI < 18)	1,682 (3.6)	21.149 (8.023)	16.604 (1.827)	506 (2.6)	19.640 (6.146)	16.489 (1.840)
•Normal (18 ≤ BMI < 25)	27,427 (58.0)	25.712 (10.581)	21.652 (1.823)	9,645 (49.4)	25.382 (10.080)	22.193 (1.724)
•Overweight (25 ≤ BMI < 30)	9,124 (19.3)	29.777 (12.862)	27.085 (1.418)	6,330 (32.4)	31.184 (12.749)	26.923 (1.452)
•Obese (BMI ≥ 30)	9,032 (19.1)	32.994 (13.357)	37.185 (7.774)	3,053 (15.6)	32.971 (12.945)	36.006 (9.588)
Race						
•White	30,361 (70.4)	28.724 (12.488)	25.329 (6.949)	12,517 (71.0)	29.430 (12.469)	25.721 (6.215)
•African American	2,870 (6.7)	28.420 (11.638)	28.862 (8.556)	946 (5.4)	27.982 (11.007)	27.066 (6.302)
•Asian	2,182 (5.1)	23,696 (8.132)	22.410 (4.653)	1,180 (6.7)	24.722 (8.148)	23.886 (4.307)
•Hispanic	5,494 (12.7)	24.229 (8.623)	26.028 (6.980)	2,106 (11.9)	24.396 (8.636)	26.197 (6.751)
Education						
•0–12 years	11,097 (23.9)	18.787 (5.693)	23.582 (6.240)	4,596 (23.9)	19.184 (5.678)	23.921 (7.173)
•More than 12 years	35,344 (76.1)	30.674 (12.033)	26.124 (7.402)	14,631 (76.1)	31.264 (11.928)	26.316 (5.896)

related attitudes and beliefs to explicit and implicit anti-fat bias, while controlling for BMI, age, race and education. Specifically, one multiple regression was conducted with the self-reported preference between Thin and Fat people as the outcome variable, and another was conducted with the IAT score as the outcome. The predictors in these analyses were the participant's response to each of the five attitudes and beliefs, BMI, age, and dummy variables that represented the categorical variables of race and education. Pairs of beta coefficients were compared by testing whether a regression model with the constraint that these coefficients must be equal had a significantly lower fit than a regression model without the constraint. For that test, R's package lavaan (version 0.5–20, Rosseel, 2012) was used. It should be noted that the large sample size, although a strength, likely makes most correlations statistically significant. Therefore, this study reports and discusses significant levels as well as effect sizes.

3. Results

A summary of participants' characteristics appears in Table 1: There were 47,265 women (71%) and 19,534 men (29%). The mean age among women was 27.9 (*SD* = 11.95) years and 28.3 (*SD* = 11.93) years among men. Based on the self-reported height and weight, the mean BMI among women was 25.5 (*SD* = 7.20) and 25.7 (*SD* = 6.48) among men. About 3% were underweight (BMI < 18), 56% were normal weight (18 ≤ BMI < 25), 23% were overweight (25 ≤ BMI < 30), and 18% were obese (30 ≥ BMI). About three quarters of the participants (74%) were white, 13% were Hispanic, 7% were African American, and 6% were Asian. About one quarter of the participants

(24%) had obtained 12 years of education, and the rest (76%) had obtained higher education.

Table 2 presents implicit and explicit attitudes by gender. Men had higher implicit ($t = 17.6$, $d = 0.15$, $p < .001$) and explicit ($t = 41.45$, $d = 0.36$, $p < .001$) anti-fat bias than women. Men had lower ($t = 26.48$, $d = 0.22$, $p < .001$) weight-status self-perception (i.e., men perceived themselves as less overweight relative to how women perceived themselves). Men also identified more with people who were thin ($t = 39.14$, $d = 0.33$, $p < .001$) and less with people who were fat ($t = 39.14$, $d = 0.333$, $p < .001$) in comparison to how women felt. The belief that weight is controllable was more common among men relative to women ($t = 21.20$, $d = 0.18$, $p < .001$), and the self-perceived importance of weight to one's identity was higher among women relative to men ($t = 25.91$, $d = 0.22$, $p < .001$). A very slight difference was found among women and men in their belief that people prefer thin people over fat people ($t = 8.14$, $d = 0.07$, $p < .001$). The correlation between explicit and implicit anti-fat bias (r overall = 0.221; women: $r = 0.214$; men: $r = 0.209$, $p < .001$) was of typical size for socially sensitive group attitudes (Hofmann et al., 2005; Greenwald et al., 2009).

Table 3 presents relations between anti-fat bias (implicit and explicit), BMI, and weight-related attitudes and beliefs. Most weight-related attitudes and beliefs were related to BMI. The belief that weight is important was not associated with BMI ($r = -0.014$, $p < .001$) and, the belief that weight is controllable was hardly associated with BMI ($r = 0.056$, $p < .001$). All weight-related attitudes and beliefs were related to with explicit anti-fat bias; most weight-related attitudes and beliefs were related to implicit anti-fat bias, but some of the correlations

Table 2
Implicit and explicit anti-fat bias and weight-related attitudes and beliefs among women and men.

Dimension	Women <i>n</i> = 47,265		Men <i>n</i> = 19,534		Test statistics	
	Mean	SD	Mean	SD	<i>t</i>	Cohen's <i>d</i>
Implicit anti-fat bias ^a	0.50	0.41	0.56	0.41	17.60	0.15
Explicit anti-fat bias ^b	4.72	1.03	5.11	1.14	41.45	0.36
Weight-related aptitudes and beliefs:						
1. Weight status self-perception ^b	4.57	1.05	4.34	1.02	26.48	0.22
2. I feel similar to people who are thin ^c	2.40	1.02	2.74	1.02	39.14	0.33
3. I feel similar to people who are fat ^c	2.35	1.03	2.12	0.98	27.90	0.23
4. People have control over their weight ^d	2.61	0.79	2.46	0.83	21.20	0.18
5. Weight is important to the sense of who I am ^c	3.14	1.09	2.91	1.08	25.91	0.22
6. Most people prefer thin people over fat people ^b	5.68	1.05	5.61	1.04	8.14	0.07

Notes. All *t* values are statistically significant, $p < .001$.

^a Ranges from -2 to $+2$.

^b Ranges from 1 to 7.

^c Ranges from 1 to 5.

Table 3
Correlations among anti-fat bias (explicit and implicit), BMI, and weight-related attitudes and beliefs.

Dimension	Anti-fat bias		Weight-related attitudes and beliefs					
	Implicit	Explicit	1	2	3	4	5	6
BMI	-.136	-.246	.702	-.312	-.371	.056	-.014	.122
Weight-related attitudes and beliefs:								
1. Weight status self-perception	-.124	-.226						
2. I feel similar to people who are thin	.095	.205	-.392					
3. I feel similar to people who are fat	-.146	-.287	-.390	-.177				
4. People have control over their weight	-.108	-.172	.063	-.096	.115			
5. Weight is important to the sense of who I am	.115	.219	.033	-.010 ^{ns}	.003 ^{ns}	-.117		
6. Most people prefer thin people over fat people	.016	.171	.162	-.062	.038	-.010	.142	

Note. All correlations are statistically significant ($p < .001$) except where noted.

Table 4
Regression models to predict implicit and explicit anti-fat bias based on BMI and weight-related attitudes and beliefs.

Dimension	Implicit anti-fat bias		Explicit anti-fat bias	
	Adjusted R^2	$\beta \pm SE$	Adjusted R^2	$\beta \pm SE$
BMI	.064	-.099 ± .006 ^{ab}	.22	-.145 ± .005 ^b
Weight-related attitudes and beliefs:				
1. Weight status self-perception		-.040 ± .006 ^c		-.034 ± .004 ^d
2. Feel similar to people who are thin		.031 ± .004 ^c		.095 ± .004 ^c
3. Feel similar to people who are fat		-.080 ± .004 ^b		-.180 ± .004 ^a
4. People have control over their weight		-.080 ± .004 ^b		-.103 ± .004 ^c
5. Weight is important to the sense of who I am		.107 ± .004 ^a		.194 ± .004 ^a
6. Most people prefer thin people over fat people		.025 ± .004 ^c		.177 ± .004 ^a

Note. Models adjust for sex, age, race, and education; all coefficient values are significant ($p < .001$). Within each of the two regression models, different superscripts indicate that the absolute coefficient values differ significantly ($p < .001$). Coefficients were compared by testing whether a regression model that constrained their equality had a significantly lower fit than a regression model without the constraint. For that test, R's package lavaan (version 0.5–20, Rosseel, 2012) was used.

were very weak. The belief that most people prefer thin people over fat people (acknowledgment of societal norms) was not related to implicit anti-fat bias ($r = 0.016$, $p < .001$). In general, the weight-related attitudes and beliefs were more strongly related to explicit anti-fat bias than to implicit anti-fat bias.

Table 4 presents linear regression models that predict implicit and explicit anti-fat bias based on all tested weight-related attitudes and beliefs. After controlling for BMI, age, race, and education, the regression models showed that believing that weight is important was the largest predictor of implicit anti-fat bias ($\beta = 0.107$, $p < .001$). Feeling like people who are fat ($\beta = -0.180$), believing that weight is important ($\beta = 0.194$, $p < .001$) and believing that most people prefer thin people ($\beta = 0.170$, $p < .001$) were the strongest predictors of explicit anti-fat bias.

4. Discussion

This study investigated three primary theoretical models that try to explain anti-fat bias: (1) Social identity theory, operationalized by endorsement of the belief that one is overweight and the belief that one is like people who are thin/fat; (2) attribution theory, operationalized by endorsement of the belief that weight is controllable, (3) socio-cultural theory, operationalized by endorsement of the belief that most people prefer thin people over fat people and the belief that weight is important. Several interesting results emerged from the analyses. First, participants showed implicit and explicit preferences for thin people over overweight people, with men reporting a slightly higher anti-fat bias than women. Second, evidence was found that the feeling of being like people who are fat might be an equal or even a stronger predictor of anti-fat bias than actual BMI. Third, all tested theoretical models of anti-fat bias received at least some support. Nevertheless, the social-identity and the socio-cultural theories provided a stronger predictor of

anti-fat bias relative to attribution theory.

Social identity theory suggests that people favor their own social group over other groups. Therefore, people are less likely to hold prejudices against the group with which they identify than against other groups (Tajfel and Turner, 1986). Both objective (BMI) and subjective (weight-status self-perception, feeling of being like people who are thin/fat) measures of group identity were used in order to examine whether group membership predicts anti-fat bias. Findings indicated that both objective and subjective measures of group identity predicted implicit and explicit anti-fat bias. Higher obesity, higher self-perception of obesity, stronger feeling of being like people who are fat, or weaker feeling of being like people who are thin predicted lower implicit and explicit anti-fat bias. This research is probably the first to test the relations between thin/fat group identity and both implicit and explicit anti-fat bias among an adult population. These findings generalize previous findings that, among preschool children, subjective group identity (by perceived body size) predicted explicit anti-fat bias (Holub, 2008). Further, although several studies have already suggested that higher BMI is associated with lower explicit and implicit anti-fat bias (e.g., Marini et al., 2013), this report may be the first to show that subjective measures of thin/fat group identity are also associated with implicit and explicit anti-fat bias.

This evidence suggests that the feeling of being like people who are fat (i.e., the ability to identify with people who are fat) might be more important for explicit anti-fat bias ($\beta = 0.180$) than actual BMI ($\beta = -0.145$) and weight status self-perception ($\beta = 0.034$). These findings highlight the importance of identity in understanding anti-fat bias, particularly when identity diverges from weight. In addition, the finding about the strong role of identification with people who are fat in anti-fat bias can inform the development of anti-fat bias reduction programs by highlighting the importance of enhancing participants' ability to identify with overweight people (e.g., by exposure to personal

stories of overweight individuals, Greener et al., 2010; Thomas et al., 2008, or by having positive contact with them, Alperin et al., 2014).

According to attribution theory, people who believe that weight is controllable may have a higher anti-fat bias (Crocker et al., 1993). This study found that the belief that weight is controllable was correlated with anti-fat bias, although the correlations between this belief and explicit anti-fat bias ($r = 0.172$) were not as strong as the correlations between explicit anti-fat bias and most of the other beliefs we tested (e.g., $r = 0.287$ for the belief that one is like people who are fat). The study's finding may contradict previous reviews (e.g., Puhl and Brownell, 2003) that concluded that attribution theory is one of the strongest explanatory models for anti-fat bias. As an example of the strength of attribution theory, Crandall et al. (2001) showed a strong relation ($r = 0.50$) between the attribution index and explicit anti-fat bias. Identifying the reason for the difference between these results and previous results could be informative.

One explanation for this difference may be that Crandall et al.'s (2001) measure of attribution included the belief that some people are fat because they have no willpower, whereas this study only measured the belief that weight is controllable. The belief that people who are fat lack willpower is a judgmental assessment of them. Therefore, perhaps Crandall et al.'s (2001) measure of attribution is more strongly related to anti-fat bias due to a construct overlap. Further, people who have more bias against a specific group are also less likely to attribute to that group positive attributes such as willpower. Another possible interpretation of the difference between these results and previous results (Crandall et al., 2001) is that even people who believe that weight is controllable might not be quick to develop an anti-fat bias if they do not see failure to control weight as evidence of weak willpower. Based on these findings, perhaps interventions for reduction of anti-fat bias would be more effective if they emphasized the need to refrain from criticizing people's (lack of) ability to control their weight. Instead, they might attribute weight control failure to external reasons other than willpower (e.g., biological and genetic factors).

According to socio-cultural theory, a major force that contributes to the anti-fat bias in western society is societal norms that put an emphasis on body shape and weight (Polivy and Herman, 2004). In the present study, we followed the recommendation to separate between awareness and internalization of these societal norms (Cusumano and Thompson, 1997). Several interesting findings emerged. Internalization of societal norms (the belief that weight is important) was not related to BMI. This finding implies that individuals across the weight status spectrum have a similar tendency to internalize the emphasis that society puts on weight as an important attribute of one's self-concept (Low et al., 2003; Siegling and Delaney, 2013). Awareness ($r = 0.171$) and internalization ($r = 0.219$) of societal norms were both related to explicit anti-fat bias. In contrast, implicit anti-fat bias was weakly related to internalization of societal norms ($r = 0.115$) but not to awareness of societal norms ($r = 0.016$). Overall, we found stronger evidence for the relation of anti-fat bias with internalization than with awareness of the norms. One reason for that finding is that internalization reflects a stronger influence of societal norms than the mere awareness these norms. These present findings expand upon prior research (Vartanian et al., 2005) that found, among a small female sample, evidence for a positive relation of anti-fat bias with internalization of societal norms but not with awareness of these norms. An additional interesting result pertaining to socio-cultural theory is that both internalization ($\beta = 0.194$), and awareness ($\beta = 0.177$) were two of the three strongest predictors of explicit anti-fat bias (the third was the belief that one is similar to fat people, $\beta = -0.180$). These results suggest that it would be informative to continue focusing on socio-cultural theory and other constructs derived from this theory (e.g., exposure to media) in order to better understand the correlates of anti-fat bias.

This study focused on three theoretical models of anti-fat bias. However, other theoretical models can help interpret these findings, including Goffman's typology of stigma (1963), social consensus theory

(Puhl and Brownell, 2003), the psychological concept of essentialism (Howell et al., 2011), and stigma-asymmetry model (Hoyt et al., 2017). For example, one could construe the belief that "weight is important to the sense of who I am" as reflecting the psychological concept of essentialism (Howell et al., 2011) and argue that these results demonstrate the relation between essentialist beliefs and anti-fat bias. The belief that people have control over their weight may be interpreted through Goffman's typology of stigma (1963) that states that one of the three grossly different types of stigma is the perception of one's character as weak-willed. The stigma-asymmetry model (Hoyt et al., 2017) is another perspective that can explain the relation between anti-fat bias and the belief about the controllability of weight. Believing that weight is controllable can increase bias via blame but can reduce it via reduced essentialist thinking. The assumption that a human condition, such as obesity, is controllable, makes people less likely to consider this condition as immutable and discrete (Dar-Nimrod and Heine, 2011). Last, the belief that most people prefer fat/thin people can be interpreted through social consensus theory such that an individual's attitudes and beliefs are highly influenced by others (Puhl and Brownell, 2003).

The present study examined implicit and explicit anti-fat bias among a large convenience sample of U.S. participants. Two of the main strengths of this study were the large sample size and the use of both implicit and explicit anti-fat measures. Strong implicit and explicit anti-fat biases were found, suggesting that participants felt that it was socially acceptable to express their negative attitudes towards people who are fat and their preferences for people who are thin. Still, the weak correlation between the implicit and explicit bias might suggest that these biases have different origins and might have different implications. Those possible differences, however, were mostly not reflected in the relations between the implicit and explicit bias and the weight-related attitudes and beliefs examined in the present research. Excluding the belief that people prefer thin people, which was related to explicit-fat bias more than to implicit-fat bias, and the pattern of relations was almost identical for implicit and explicit bias. For instance, the belief that weight was important was the best predictor of implicit anti-fat bias and of the explicit anti-fat bias. Nevertheless, the relations were always stronger for the explicit than for the implicit. This finding might be explained in part by the IAT's moderate reliability ($\alpha = 0.68$ in the present research). Alternatively, implicit anti-fat bias might be related to other factors not measured in the present study. In this respect, the present results might suggest that there is still much to learn about implicit anti-fat bias, its correlates, and its implications.

These findings will be useful in informing future development of interventions for reducing anti-fat bias among the entire population and among health care providers. Based on the present results, interventions might do well to increase people's identification with overweight individuals and reduce the importance that people attribute to weight as a feature that determines a person's identity and personality. Such interventions to reduce the importance of weight could be based on socio-cultural theory that emphasizes one's tendency to internalize societal norms about weight (Vartanian et al., 2005). Similarly, such interventions can also challenge essentialist beliefs and the particular belief that obesity is a fixed, underlying, and identity-determining essence (Bastian and Haslam, 2006).

4.1. Limitations

It is important to emphasize the limitations of the present research. Although the current study sample was very large and heterogeneous, it was not a representative sample. Participants voluntarily selected to take the online Weight IAT. Nevertheless, data collected from Project Implicit have been studied intensively for several years, and the validity of results is comparable to that of similar data collected in experimental laboratory conditions (e.g., Nosek et al., 2001; Klein et al., 2014). The use of cross-sectional data for this particular study (in contrast to

longitudinal or experimental designs) does not inform causation between weight-related attitudes and beliefs and anti-fat bias. Relatedly, unidentified third variables (e.g., demographics) might be responsible for some of the observed relations between weight-related attitudes and beliefs and anti-fat bias. The value in having an implicit assessment has been criticized by some researchers. Most vehemently, Blanton et al. (2009) have raised major concerns regarding the psychometric properties of the IAT. Naturally, there are weight-related beliefs that have not been included in the present study. For example, this study did not include a belief about the appearance of obesity (e.g., “thin/fat people are ugly”), which may be derived from Goffman's (1963) first type of stigma about the abominations of the body. Height and weight were assessed by self-report, which is likely less accurate than objective measurement. However, previous studies show that web responders usually provide quite accurate information about themselves (e.g., Kraut et al., 2004).

Although the present research linked anti-fat bias to a number of weight-related beliefs and attitudes, some of the relations this study found—especially the relations with implicit bias—were rather weak. A probable reason for the weak relations is that in the present dataset only one question reflected each construct of interest, thus reducing measurement reliability. Therefore, the results likely underestimate the strength of the relations. Replicating the present tests with more reliable measures might be a valuable future research direction to take, in order to examine the possibility that these relations are actually much stronger. Another valuable modification in future studies would be to utilize longitudinal designs, as causal inference is essential for the complete understanding of anti-fat bias.

5. Conclusions

The present study examined several theoretical models that explain the correlates of implicit and explicit anti-fat bias. The relations that were found provided at least some support that all tested theoretical models can provide some explanation for anti-fat bias. Both social identity theory and socio-cultural theory provided relatively strong explanations of anti-fat bias, whereas attribution theory's was relatively weak. Future studies are warranted to confirm these cross-sectional findings using prospective designs, as causal inference is essential for the complete understanding of anti-fat bias.

References

- Andreyeva, T., Puhl, R.M., Brownell, K.D., 2008. Changes in perceived weight discrimination among Americans, 1995–1996 through 2004–2006. *Obesity* 16 (5), 1129–1134.
- Ajzen, I., Fishbein, M., 1977. Attitude-behavior relations: a theoretical analysis and review of empirical research. *Psychol. Bull.* 84, 888–918.
- Alperin, A., Hornsey, M.J., Hayward, L.E., Diedrichs, P.C., Barlow, F.K., 2014. Applying the contact hypothesis to anti-fat attitudes: contact with overweight people is related to how we interact with our bodies and those of others. *Soc. Sci. Med.* 123, 37–44.
- Bastian, B., Haslam, N., 2006. Psychological essentialism and stereotype endorsement. *J. Exp. Soc. Psychol.* 42 (2), 228–235.
- Blanton, H., Jaccard, J., Klick, J., Mellers, B., Mitchell, G., Tetlock, P.E., 2009. Strong claims and weak evidence: reassessing the predictive validity of the IAT. *J. Appl. Psychol.* 94 (3), 567.
- Clair, M., Daniel, C., Lamont, M., 2016. Destigmatization and health: cultural constructions and the long-term reduction of stigma. *Soc. Sci. Med.* 165, 223–232.
- Crandall, C.S., D'Anello, S., Sakalli, N., Lazarus, E., Nejtard, G.W., Feather, N.T., 2001. An attribution-value model of prejudice: anti-fat attitudes in six nations. *Pers. Soc. Psychol. Bull.* 27 (1), 30–37.
- Crandall, C.S., Moriarty, D., 1995. Physical illness stigma and social rejection. *Br. J. Soc. Psychol.* 34 (1), 67–83.
- Crandall, C.S., Schiffhauer, K.L., 1998. Anti-fat prejudice: beliefs, values, and American culture. *Obesity* 6 (6), 458–460.
- Cusumano, D.L., Thompson, J.K., 1997. Body image and body shape ideals in magazines: exposure, awareness, and internalization. *Sex. Roles* 37 (9–10), 701–721.
- Crocker, J., Cornwell, B., Major, B., 1993. The stigma of overweight: affective consequences of attributional ambiguity. *J. Pers. Soc. Psychol.* 64 (1), 60.
- Crosby, F., Bromley, S., Saxe, L., 1980. Recent unobtrusive studies of Black and White discrimination and prejudice: a literature review. *Psychol. Bull.* 87, 546–563.
- Dar-Nimrod, I., Heine, S.J., 2011. Genetic essentialism: on the deceptive determinism of DNA. *Psychol. Bull.* 137 (5), 800.
- Dovidio, J., Gaertner, S.L., 2000. Aversive racism and selection decisions: 1989 and 1999. *Psychol. Sci.* 11, 315–319.
- Durso, L.E., Latner, J.D., 2008. Understanding self-directed stigma: development of the weight bias internalization scale. *Obesity* 16 (S2), S80–S86.
- Greener, J., Douglas, F., van Teijlingen, E., 2010. More of the same? Conflicting perspectives of obesity causation and intervention amongst overweight people, health professionals and policy makers. *Soc. Sci. Med.* 70 (7), 1042–1049.
- Greenwald, A.G., Nosek, B.A., Banaji, M.R., 2003. Understanding and using the implicit association test: I. An improved scoring algorithm. *J. Pers. Soc. Psychol.* 85 (2), 197.
- Greenwald, A.G., Poehlman, A.T., Uhlman, E., Banaji, M.R., 2009. Understanding and using the implicit association test: III. Meta-analysis of predictive validity. *J. Pers. Soc. Psychol.* 97, 17–41.
- Goffman, E., 1963. *Stigma: Notes on the Management of Spoiled Identity*. Prentice Hall, Englewood Cliffs, NJ.
- Haslam, S.A., McMahon, C., Cruwys, T., Haslam, C., Jetten, J., Steffens, N.K., 2018. Social cure, what social cure? The propensity to underestimate the importance of social factors for health. *Soc. Sci. Med.* 198, 14–21.
- Heinberg, L.J., Thompson, J.K., Stormer, S., 1995. Development and validation of the sociocultural attitudes towards appearance questionnaire. *Int. J. Eat. Disord.* 17 (1), 81–89.
- Hilbert, A., Rief, W., Braehler, E., 2008. Stigmatizing attitudes toward obesity in a representative population-based sample. *Obesity* 16 (7), 1529–1534.
- Holub, S.C., 2008. Individual differences in the anti-fat attitudes of preschool-children: the importance of perceived body size. *Body Image* 5 (3), 317–321.
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., Schmitt, M., 2005. A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures. *Pers. Soc. Psychol. Bull.* 31 (10), 1369–1385.
- Howell, A.J., Weikum, B.A., Dyck, H.L., 2011. Psychological essentialism and its association with stigmatization. *Pers. Individ. Differ.* 50 (1), 95–100.
- Hoyt, C.L., Burnette, J.L., Auster-Gussman, L., Blodorn, A., Major, B., 2017. The obesity stigma asymmetry model: the indirect and divergent effects of blame and changeability beliefs on antifat prejudice. *Stigma and Health* 2 (1), 53.
- Klein, R.A., Ratliff, K.A., Vianello, et al., 2014. Investigating variation in replicability: a “many labs” replication project. *Soc. Psychol.* 45 (3), 142–152. <http://dx.doi.org/10.1027/1864-9335/a000178>.
- Kraut, R., Olson, J., Banaji, M., Bruckman, A., Cohen, J., et al., 2004. Psychological research online: report of board of scientific affairs' advisory group on the conduct of research on the Internet. *Am. Psychol.* 59, 105–117.
- Latner, J.D., Stunkard, A.J., 2003. Getting worse: the stigmatization of obese children. *Obes. Res.* 11 (3), 452–456.
- Latner, J.D., Stunkard, A.J., Wilson, G.T., 2005. Stigmatized students: age, sex, and ethnicity effects in the stigmatization of obesity. *Obesity* 13 (7), 1226–1231.
- Little, R.J.A., Rubin, D.B., 1987. *Statistical Analysis with Missing Data*. Wiley, New York.
- Low, K.G., Charanasomboon, S., Brown, C., Hiltunen, G., Long, K., Reinhalter, K., Jones, H., 2003. Internalization of the thin ideal, weight and body image concerns. *SBP (Soc. Behav. Pers.): Int. J.* 31 (1), 81–89.
- Marini, M., Sriram, N., Schnabel, K., Maliszewski, N., Devos, T., Ekehammar, B., ... Schnell, S., 2013. Overweight people have low levels of implicit weight bias, but overweight nations have high levels of implicit weight bias. *PLoS One* 8 (12), e83543.
- McCabe, M.P., Ricciardelli, L.A., Sitaram, G., Mikhail, K., 2006. Accuracy of body size estimation: role of biopsychosocial variables. *Body Image* 3, 163–171.
- Neighbors, L., Sobal, J., Liff, C., Amiraian, D., 2008. Weighing weight: trends in body weight evaluation among young adults, 1990 and 2005. *Sex. Roles* 59 (1–2), 68–80.
- Nosek, B.A., Banaji, M.R., Greenwald, A.G., 2001. Harvesting implicit group attitudes and beliefs from a demonstration web site. *Group Dynam.: Theory Res. Pract.* 6, 101–115.
- Nosek, B.A., Smyth, F.L., Hansen, J.J., Devos, T., Lindner, N.M., Ranganath, K.A., Banaji, M.R., 2007. Pervasiveness and correlates of implicit attitudes and stereotypes. *Eur. Rev. Soc. Psychol.* 18 (1), 36–88.
- Papadopoulos, S., Brennan, L., 2015. Correlates of weight stigma in adults with overweight and obesity: a systematic literature review. *Obesity* 23 (9), 1743–1760.
- Pearl, R.L., White, M.A., Grilo, C.M., 2014. Overvaluation of shape and weight as a mediator between self-esteem and weight bias internalization among patients with binge eating disorder. *Eat. Behav.* 15 (2), 259–261.
- Polivy, J., Herman, C.P., 2004. Sociocultural idealization of thin female body shapes: an introduction to the special issue on body image and eating disorders. *J. Soc. Clin. Psychol.* 23 (1), 1–6.
- Puhl, R.M., Heuer, C.A., 2009. The stigma of obesity: a review and update. *Obesity* 17 (5), 941–964.
- Puhl, R.M., Brownell, K.D., 2003. Psychosocial origins of obesity stigma: toward changing a powerful and pervasive bias. *Obes. Rev.* 4 (4), 213–227.
- Puhl, R.M., Moss-Racusin, C.A., Schwartz, M.B., Brownell, K.D., 2008. Weight stigmatization and bias reduction: perspectives of overweight and obese adults. *Health Educ. Res.* 23 (2), 347–358.
- Rosseel, Y., 2012. lavaan: an R package for structural equation modeling. *J. Stat. Software* 48 (2), 1–36.
- Sabin, J.A., Marini, M., Nosek, B.A., 2012. Implicit and explicit anti-fat bias among a large sample of medical doctors by BMI, race/ethnicity and gender. *PLoS One* 7 (11), e48448.
- Schwartz, M.B., Vartanian, L.R., Nosek, B.A., Brownell, K.D., 2006. The influence of one's own body weight on implicit and explicit anti-fat bias. *Obesity* 14 (3), 440–447.
- Siegling, A.B., Delaney, M.E., 2013. Toward understanding body image importance: individual differences in a Canadian sample of undergraduate students. *Eat. Disord.* 21 (2), 117–129.
- Tajfel, H., Turner, J.C., 1986. The social identity theory of intergroup behavior. In: Worchel, S., Austin, W. (Eds.), *Psychology of Intergroup Relations*, pp. 7–24

- (Chicago: Nelson-Hall).
- Teachman, B.A., Brownell, K.D., 2001. Implicit anti-fat bias among health professionals: is anyone immune? *Int. J. Obes. Relat. Metab. Disord.* 25, 1525–1531.
- Thomas, S.L., Hyde, J., Karunaratne, A., Herbert, D., Komesaroff, P.A., 2008. Being 'fat' in today's world: a qualitative study of the lived experiences of people with obesity in Australia. *Health Expect.* 11 (4), 321–330.
- Tomiyaama, A.J., Finch, L.E., Belsky, A.C.I., Buss, J., Finley, C., Schwartz, M.B., Daubenmier, J., 2015. Weight bias in 2001 versus 2013: contradictory attitudes among obesity researchers and health professionals. *Obesity* 23 (1), 46–53.
- Van Buuren, S., 2012. *Flexible Imputation of Missing Data*. CRC press.
- Vartanian, L.R., Herman, C.P., Polivy, J., 2005. Implicit and explicit attitudes toward fatness and thinness: the role of the internalization of societal standards. *Body Image* 2 (4), 373–381.
- van Leeuwen, F., Hunt, D.F., Park, J.H., 2015. Is obesity stigma based on perceptions of appearance or character? Theory, evidence, and directions for further study. *Evol. Psychol.* 13 (3) doi: 1474704915600565.
- Wang, S.S., Brownell, K.D., Wadden, T.A., 2004. The influence of the stigma of obesity on overweight individuals. *International Journal of Obesity* 28 (10), 1333.
- Wicker, A.W., 1969. Attitudes versus actions: the relationship of verbal and overt behavioral responses to attitude objects. *J. Soc. Issues* 25, 41–78.
- World Health Organization, 2000. *Obesity: Preventing and Managing the Global Epidemic*. No. 894. World Health Organization.