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A randomized study of effects of obesity framing on weight stigma

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Abstract

Objective: Growing evidence suggests highly processed foods may trigger an addictive-like process, which is associated with obesity. Other research suggests an addictive-like process occurs in response to eating itself, rather than specific foods. Addiction-based obesity explanations raise concerns about double stigmatization of people with obesity and addiction. This study compared effects of obesity framings on external and internalized weight stigma.

Methods: The study was preregistered via Open Science Framework. Four hundred and forty-seven adults read an informational passage that described food addiction, eating addiction, or calorie balance explanations for obesity or a control passage about memory. Participants then completed external and internalized weight stigma measures.

Results: Participants in the food addiction condition reported higher internalized weight stigma compared with those in the control condition. Obesity framing did not significantly affect external weight stigma compared with the control.

Conclusions: These findings suggest that food addiction explanations for obesity may elicit greater internalized weight stigma than non-obesity-related messages. Addiction-based and traditional obesity explanations do not appear to influence external weight stigma. Illuminating the effects of obesity framing on stigma will help researchers communicate discoveries in ways that mitigate stigma.

INTRODUCTION

Between 1999 and 2016, adult obesity rates rose from 30.5% to 39.6% in the United States (1). The dominant explanation for the increased prevalence of obesity has been that individuals consume too many calories and/or do not burn enough calories through activity, resulting in an imbalance of energy in the body (2). Researchers have critiqued the calorie balance theory for being overly simplistic, which has led to additional theoretical frameworks (3).

Food addiction theory suggests highly processed (HP) foods may have the potential to trigger an addictive pattern in vulnerable individuals (4). Similar to addictive drugs, HP foods with elevated amounts of sugar and fat (e.g., chocolate, pizza) strongly activate neural reward circuitry and they can be challenging to consume in moderation (4). The Yale Food Addiction Scale (YFAS) assesses symptoms of food addiction (5) by applying substance use disorder (SUD) criteria from the *Diagnostic and Statistical Manual of Mental Disorders* to the HP food context (5,6). YFAS scores were positively associated with BMI, and individuals who met food addiction criteria had BMI in the obesity range on average, which suggests that food addiction may contribute to obesity (4).

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Another explanation for obesity comes from eating addiction theory, which suggests that an addictive-like process occurs in response to the act of eating itself (7). Eating addiction theory emphasizes the behavioral aspects of the disorder because evidence is currently insufficient to label any specific food or ingredient as addictive (7). Eating addiction, as measured by the Addiction-like Eating Behavior Scale, was positively associated with BMI, emotional eating, binge eating, and YFAS scores (8).

One key implication of novel theories on obesity is their impact on weight stigma, which is defined as the co-occurrence of negative labeling, stereotyping, separation, status loss, and discrimination of individuals based on their weight status (9). There are two main types of weight stigma: external, which refers to negative weight-related attitudes and beliefs directed toward others, and internalized, which refers to these negative attitudes and beliefs directed toward oneself (10). Attribution theory predicts that individuals generally attempt to explain obesity by linking people who experience it to characteristics that are devalued by society (e.g., "weak-willed," "lazy") (9). Presenting alternative theories about obesity to the public may therefore change these attributions (11).

Most obesity-related messaging has centered on personal choice and responsibility, which are associated with increased weight stigma (12), and biologically based explanations, which have shown mixed associations with weight stigma (13). With regard to food and eating addiction frameworks, stigma researchers have expressed concern that these messages may doubly stigmatize individuals, based on both SUD and obesity (14,15). However, some studies have found that using the food addiction framework to explain obesity decreases external weight stigma (16,17). This observed reduction in stigma may be due to a heightened focus on the addictive potential of HP foods themselves, reducing the blame and control attributed to individuals who overconsume them (16,17). The observed effects could also have been driven by language in the control vignettes describing obesity as the result of deliberate lifestyle choices. Although this reflects a dominant societal narrative, describing obesity as driven by choices increases blame attribution toward people with obesity (12).

Another recent study compared the effects of descriptions of medically diagnosed and self-diagnosed food addiction with a control condition that described obesity with no explanation (18). In two samples, they found no significant differences in levels of external weight stigma between conditions. In an all-female sample of mostly lower-weight undergraduates, they found those exposed to food addiction explanations expressed greater stigma toward a fictional vignette target with obesity compared with the control condition. However, this effect did not replicate in a larger, more diverse sample (18). Thus, findings regarding the relative stigmatization of food addiction explanations for obesity continue to be mixed. Given that the mere use of the term "obesity" can elicit stigma, comparing the food addiction framework with a control condition that does not mention obesity is important for understanding how this framework impacts stigma (19).

Study Importance

What is already known?

- ► External and internalized weight stigma is detrimental to the health and well-being of people with obesity.
- ► Recent evidence supports addiction-based explanations for obesity.
- ► Evidence is mixed for whether addiction-based explanations reduce weight stigma.

What does this study add?

- ► Participants who read the food addiction explanation reported higher internalized weight stigma compared with those in the control condition, but there were no significant differences in comparison to the eating addiction explanation and calorie balance explanation.
- ► Calorie-based and addiction-based explanations of obesity did not significantly affect external weight stigma.

How might these results change the direction of research?

- ► Findings suggest that when obesity is explained using tightly controlled, nonaffective language, food addiction, eating addiction, and calorie balance explanations may all be used without increasing external weight stigma.
- ► Continued investigation is needed to understand the impact of addiction-based explanations of obesity on internalized weight stigma.

Additionally, no research has examined how the eating addiction framework affects stigma or how it compares with the food addiction or calorie balance frameworks. Advocates of the eating addiction framework assert that a food addiction framework may inappropriately strip away personal responsibility tied to problematic eating patterns, whereas the eating addiction framework would not (7). In SUD, however, blaming the individual increases stigma (20). Thus, the eating addiction framework's emphasis on individual behavior may inadvertently increase weight stigma (21).

The aim of the current, preregistered study was to investigate the effects of using either food addiction, eating addiction, or traditional calorie balance frameworks to explain obesity on external and internalized weight stigma. This study sought to address methodological concerns of previous studies of framing and weight stigma by developing and piloting informational vignettes that were matched on length and tone and by including a control condition without any mention of obesity, to compare stigma levels without any manipulation. We hypothesized that exposure to the food addiction explanation would be associated with lower reported levels of

external and internalized weight stigma as compared with the eating addiction and calorie balance frameworks.

We also examined how individual differences impacted responses to the various frameworks. Individuals who perceive themselves as having obesity tend to experience more internalized weight stigma than those who perceive themselves as "normal weight" (22). Moreover, personal relevance influences the persuasiveness of weight-related messaging. Individuals who perceive themselves as having excess weight or food addiction may feel the strongest sense of relevance to obesity and addiction-related messages (23). Therefore, we examined whether individuals who perceived themselves as having food addiction or excess weight differed in the degree to which the conditions elicited internalized weight stigma.

METHODS

Participants

Participants were recruited via Amazon Mechanical Turk (Mturk), an online platform that has been shown to produce higher quality data than college student, online panel, and community samples (24). Participants responded to an invitation to complete a "survey on lifestyle factors." After informed consent, participants followed a link to the experiment in Qualtrics. All procedures were reviewed and considered exempt by the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board. Participants were limited to United States residents and they could complete the survey from any convenient location. Participants received $1.25 for study completion. On average, participants completed the study in 15.09 minutes (SD = 16.0).

Participants were excluded from analyses if they responded incorrectly to any of three "catch questions," implemented to assess data quality ($n = 60$), if they completed the study in under 5 minutes ($n = 39$), or if their reported height and weight indicated an implausible BMI (below 12 or above 70) ($n = 6$) (25). Some participants reported height and weight consistent with the example given in the survey, which may have been entered for convenience and may not be accurate. Thus, participants who entered these parameters and took less than 10 minutes to complete the survey were excluded from analyses ($n = 3$).

Vignette development

Participants were randomly assigned to first read an informational vignette explaining obesity using food addiction, eating addiction, or calorie balance or a control vignette about human memory (see online Supporting Information). Vignettes were designed to use person-first language and be as similar as possible across conditions except for their explanations for obesity. Vignettes were designed to have an informational tone that did not use words associated with increased stigma like "choice," "willpower," or "self-control" (26,27). Food and eating addiction vignettes had one sentence presented in boldfaced type to draw attention to the key point.

Vignettes were piloted with Mturk participants on November 15, 2019 ($n = 41$; same inclusion criteria as larger study), to determine whether they influenced participant attitudes. After reading a randomly assigned vignette, pilot participants rated their agreement on a 6-point scale from "strongly disagree" to "strongly agree" to the statement, "A person may experience addiction to the behavior of eating, regardless of the kinds of foods they eat." A one-way ANOVA revealed a significant effect of condition on participant rating ($F(3,37) = 7.56$, $p = < 0.001$, $\eta p^2 = 0.38$). The Tukey honest significant difference (HSD) test indicated significant pairwise differences between conditions in the expected order: those assigned to the eating addiction vignette agreed most strongly (mean [SD] = 4.75 [0.45]), followed by calorie balance (3.75 [1.39]), control (3.67 [0.89]), and food addiction (2.56 [1.42]). The results suggest that the vignettes influence beliefs about the ability of certain foods to trigger an addictive response in some individuals.

Procedure

After vignettes were piloted, they were presented to participants in the main study on November 24, 2019. Participants were first asked to read their randomly assigned vignette, then shown a photograph of a woman accompanied by a vignette describing "Paulina," adapted from a recent paper by Ruddock and colleagues (18). The vignette describes Paulina's age, education, hobbies, and family. Paulina is described as "very overweight," followed by "and has food addiction," "and has eating addition," or no additional explanation if participants were assigned to the calorie balance or control conditions. Explanations were consistent with the informational vignettes (i.e., participants who read the food addiction vignette were told Paulina had food addiction). Participants completed the Modified Fat Phobia Scale (M-FPS) in reference to Paulina. Participants then completed the Anti-Fat Attitudes Questionnaire (AFA) and Modified Weight Bias Internalization Scale (WBIS-M), in randomized order. Lastly, participants completed descriptive measures. All randomization followed a simple randomization procedure via Qualtrics.

Dependent measures

M-FPS

The Fat Phobia Scale (FPS) is a shortened version of the original 50-item FPS (28) that lists 14 antonym pairs (e.g., Lazy versus Industrious) with 5 points between them (26). Participants choose the point that indicates which antonym they feel best describes a target (26). The FPS assesses negative attitudes and stereotypes about people with obesity (26). In this study, the FPS was modified to assess weight stigma toward a vignette target, Paulina (18). Points between each antonym pair were scored from 1 to 5. Total scores

could range from 1 to 5, with higher scores indicating higher levels of stigma. The M-FPS demonstrated good internal consistency in this sample ($\alpha = 0.84$).

AFA

The AFA consists of 13 statements (e.g., "I really don't like fat people much."), for which participants rate their agreement (27). The AFA assesses participants' prejudice toward people with obesity (27). Although the original scale is scored on a 9-point Likert scale, because of author error, items were scored from 1, "strongly disagree," to 5, "strongly agree." Total scores could range from 1 to 5, with higher scores indicating more weight stigma. The AFA demonstrated good internal consistency in this sample ($\alpha = 0.89$).

WBIS-M

The WBIS-M consists of 11 statements (e.g., "I am less attractive than most other people because of my weight."), for which participants rate their agreement using a 7-point scale from "strongly disagree" to "strongly agree." (22). The WBIS-M is a version of the original Weight Bias Internalization Scale (29), which assesses internalized weight stigma in individuals who self-identify as "overweight," that has been modified to assess internalized weight stigma in individuals across body weight statuses (22). In this study, the WBIS-M assessed levels of internalized weight stigma. Although the original scale is scored on a 7-point Likert scale, because of author error, items were scored from 1, "strongly disagree," to 5, "strongly agree," in the current study. Total scores could range from 1 to 5, with higher scores indicating more internalized weight stigma. The WBIS-M demonstrated excellent internal consistency in this sample ($\alpha = 0.94$).

Descriptive measures

Modified YFAS 2.0

The modified YFAS (mYFAS) 2.0 is a 13-item self-report measure to assess food addiction symptoms in adults (30). The questions are based on *Diagnostic and Statistical Manual of Mental Disorders-5* SUD criteria, adapted for HP food (30). Participants provided the frequency they experienced each symptom in the past year. Symptom scores were calculated by adding the number of symptoms each participant endorsed and could range from 0 to 11. The average symptom score was 1.58 (SD = 2.79). Participants received a diagnostic score (no = 0, yes = 1) based on whether they endorsed at least two symptoms and clinically significant impairment or distress. A total of 13.2% of participants met diagnostic criteria. The mYFAS 2.0 had excellent internal consistency in this sample ($\alpha = 0.95$).

Perceived food addiction status

Participants were asked to respond "yes" or "no" in response to the following statement: "I believe myself to be a food addict." A total of 27.3% of participants believed themselves to be "food addicts."

BMI

Participants reported their height in inches and weight in pounds. BMI was calculated using the formula weight (pounds)/(height [inches])^2 × 703 (31). The average BMI was 27.09, which falls in the "overweight" range (SD = 7.35) (31).

Perceived weight status

Participants' perceptions of their weight and objectively measured BMI are often inequivalent (32). Given concerns about the validity of self-reported height and weight, we used a measure of perceived weight status for moderation analyses (33). Participants were asked, "Compared with others, would you say you are very thin, thin, average, overweight, obese, or morbidly obese?" Perceived weight status was coded as follows: very thin = 0 ($n = 9$), thin = 1 ($n = 48$), average = 2 ($n = 205$), overweight = 3 ($n = 121$), obese = 4 ($n = 44$), and morbidly obese = 5 ($n = 20$). On average, participants perceived themselves as "overweight" (3.45 [1.03]).

Demographic information

Participants reported their gender, age, race/ethnicity, education level, annual household income, and political party.

Data analytic plan

The sample size was based on a power analysis conducted in G*Power version 3.1.9 (Heinrich Heine University) with the following parameters: one-way ANOVA, power = 0.95, $\alpha = 0.05$, and expected $\eta p^2 = 0.04$ (18). Power analysis yielded a sample size of 436, but we rounded up to 440 to further increase power. The study ended once an adequate sample size was reached.

Statistical analyses were performed using SPSS Statistics version 26 (IBM Corp.). Study methods and hypotheses were preregistered on the Open Science Framework at https://osf.io/hp9rb, with an amendment at https://osf.io/6394w. We note the following deviations between the current manuscript and the study pre-registration. Although we had hypotheses regarding support for obesity-related policies and attitudes toward the food industry, we chose to limit the scope of the current manuscript to hypotheses related to external and internalized weight stigma. We note that the analyses of main effects of condition on support for obesity-related policies and

TABLE 1 Participant characteristics by condition

Variable	Food addiction (n = 111)	Eating addiction (n = 102)	Calorie balance (n = 118)	Control (n = 116)	Between-group differences
Excluded from analyses due to data quality concerns (% excluded)	18.38	19.69	17.48	21.09	X^2 (3) = 0.688, p = 0.88
Age (y)	41.40 (±12.33)	38.81 (±11.46)	39.07 (±11.55)	40.42 (±12.23)	F(3,443) = 1.133, p = 0.34
BMI	27.76 (±6.06)	28.48 (±10.19)	26.34 (±6.85)	25.98 (±5.60)	F(3,443) = 2.849, p = 0.04[a]
Food addiction symptom count	1.59 (±2.76)	1.67 (±2.86)	1.68 (±3.08)	1.38 (±2.45)	F(3,443) = 0.281, p = 0.84
Gender (% female)	54.05	55.88	49.15	45.69	X^2 (9) = 8.900, p = 0.52
Ethnicity (%)					X^2 (9) = 3.65, p = 0.93
White	74.77	74.51	67.8	70.69	
Black	7.21	8.82	12.71	12.07	
Asian	9.0	6.86	9.32	6.90	
Other	9.0	9.80	10.17	10.34	
Annual household income (%)					X^2 (9) = 0.896, p = 0.68
Less than $10,000 to 29,999	19.82	19.61	18.64	15.52	
$30,000 to $59,999	41.44	37.25	38.14	34.48	
$60,000 to $89,999	17.12	27.45	22.03	25.0	
$90,000 to $150,000 or more	21.62	15.69	21.19	25.0	
Educational level (% with bachelor's degree or higher)	66.67	61.76	67.8	63.79	X^2 (3) = 1.084, p = 0.78
Political affiliation (% Democrat)	57.66	45.1	44.92	43.97	X^2 (12) = 9.850, p = 0.63
Food addiction diagnosis (% that met criteria for diagnosis)	10.81	16.67	16.95	8.62	X^2 (3) = 5.194, p = 0.16

Participant characteristics displayed by condition and tests of differences between conditions shown (ANOVA for continuous variables, χ^2 for categorical variables).

[a] BMI appeared to differ across conditions (p = 0.04), but post hoc pairwise comparisons with Tukey honest significant difference (HSD) test indicated no significant differences ($p > 0.05$).

attitudes toward the food industry yielded nonsignificant results. All measures were assessed for normality and outliers prior to analyses. None were found. Prior to testing hypotheses, a one-way ANOVA was run with condition as the independent variable and continuous demographic variables as dependent variables to assess whether participants significantly differed across conditions. Differences across conditions by categorical demographic variables were assessed using χ^2 tests. Between-group demographic comparisons are detailed in Table 1.

Hypothesis 1: external weight stigma

Two one-way ANOVAs were conducted with condition as the independent variable and total M-FPS and AFA scores as dependent variables. When a significant effect was detected, pairwise comparisons were run using the Tukey HSD test and inspected (34).

Hypothesis 2: internalized weight stigma

A one-way ANOVA was conducted with condition as the independent variable and total WBIS-M scores as the dependent variable. When a significant effect was detected, pairwise comparisons were run using the Tukey HSD test and inspected (34).

Exploratory analyses

Hierarchical multiple regression analyses were used to determine whether perceived weight status or self-identification as a "food addict" moderated the effect of condition on internalized weight stigma. Condition was dummy-coded into three variables with the control condition as the reference group. Self-identified "food addict" and perceived weight status variables were dummy-coded (no = 0, yes = 1; not overweight = 0, overweight = 1). We chose to split the perceived weight status variable at the "overweight" category to allow for an adequate number of participants in each cell for moderation analyses. Only 14.3% of participants in this sample perceived their weight status as "obese" or "morbidly obese." Interaction terms were computed by taking cross-products of the dummy-coded condition variables and the dummy-coded self-identification variables. Perceived food addiction/perceived weight status were included in step 1 of each model, the dummy-coded condition variables were added in step 2 of each model, and the interaction terms were added in step 3 of each model.

RESULTS

The final sample comprised 447 participants. Table 1 details participant characteristics by condition. Participants did not differ across conditions in terms of gender, age, race/ethnicity, education level, annual household income, political party, food addiction symptoms, or food addiction diagnosis. Participants appeared to differ in BMI across conditions, but Tukey HSD revealed no significant pairwise differences in BMI.

Hypothesis 1: external weight stigma

The average M-FPS score was 2.58 (SD = 0.62), indicating midrange fat phobia across conditions. The average AFA score was 2.63 (SD = 0.82), indicating midrange antifat attitudes across conditions. There was no effect of condition on total M-FPS scores [$F(3,443) = 2.36$, $p = 0.07$, $\eta^2 = 0.02$] or total AFA scores [$F(3,443) = 2.51$, $p = 0.06$, $\eta^2 = 0.02$]. Because of marginal significance of the effect, post hoc pairwise comparisons were conducted using the Tukey HSD test. There were no significant pairwise differences in M-FPS or AFA scores across conditions.

Hypothesis 2: internalized weight stigma

The average WBIS-M score was 2.45 (SD = 1.07), indicating midrange internalized weight bias. There was an effect of condition on total WBIS-M scores [$F(3,443) = 3.23$, $p = 0.02$, $\eta^2 = 0.02$]. Post hoc pairwise comparisons using the Tukey HSD test indicated that, compared with the control condition (2.21 [0.98]), WBIS-M scores were higher for participants in the food addiction condition (2.64 [1.06]; $p = 0.01$, $d = 0.42$). Compared with the eating addiction condition (2.50 [1.10]), WBIS-M scores were not significantly different for participants in the food addiction condition ($p = 0.76$, $d = 0.13$). Compared with the calorie balance condition (2.45 [1.09]), WBIS-M scores were not significantly different for participants in the food addiction condition ($p = 0.53$, $d = 0.18$) (Figure 1).

Moderating effect of perceived food addiction status

Results from the hierarchical regression analysis are detailed in Table 2. In step 1, perceived food addiction status was significantly associated with weight bias internalization, accounting for 25.6% of the variance [$R^2 = 0.26$, $F(1,445) = 153.17$, $p < 0.001$]. In step 2, the overall regression model for condition was significantly associated with weight bias internalization, controlling for perceived weight status, accounting for an additional 2.3% of the variance [$\Delta R^2 = 0.02$, $F(3,442) = 42.83$, $p = 0.003$]. The dummy-codes comparing food addiction, eating addiction, and calorie balance conditions with the control condition were significantly associated with weight bias internalization. In step 3, the overall regression model testing the interaction between perceived food addiction status and condition was not significantly associated with weight bias internalization [$\Delta R^2 = 0.01$, $F(3,439) = 24.92$, $p = 0.38$]. In this model, the dummy-code comparing food addiction with the control condition was significantly associated with weight bias internalization.

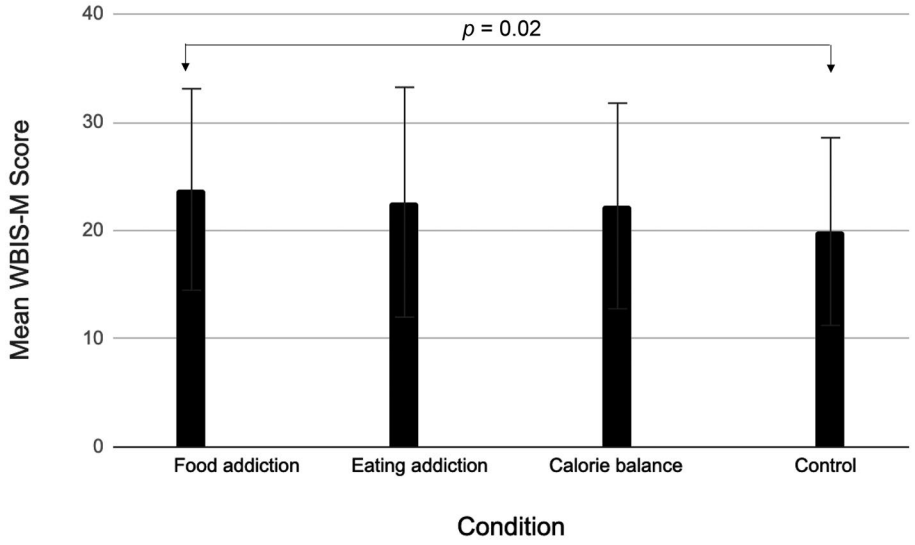

FIGURE 1 Internalized weight bias (mean WBIS-M) by condition. Higher scores indicate more internalized weight stigma. Error bars denote SD. WBIS-M, Modified Weight Bias Internalization Scale

TABLE 2 Regression output with mean WBIS-M score as the dependent variable

Model	B	SE	*t*	*p*
Step 1				
Perceived food addiction status	1.21	0.10	12.38	<0.001
Step 2				
Perceived food addiction status	1.21	0.10	12.58	<0.001
Food addiction	0.45	0.12	3.70	<0.001
Eating addiction	0.30	0.12	2.42	0.02
Calorie balance	0.27	0.12	2.24	0.03
Step 3				
Perceived food addiction status	1.01	0.19	5.38	<0.001
Food addiction	0.40	0.14	2.79	0.006
Eating addiction	0.24	0.15	1.68	0.09
Calorie balance	0.14	0.14	1.00	0.32
Perceived food addiction status × food addiction	0.18	0.27	0.65	0.51
Perceived food addiction status × eating addiction	0.19	0.28	0.70	0.49
Perceived food addiction status × calorie balance	0.47	0.27	1.75	0.08

Abbreviation: WBIS-M, Modified Weight Bias Internalization Scale.

Moderating effect of perceived weight status

Results from the hierarchical regression analysis are detailed in Table 3. In step 1, perceived weight status was significantly associated with weight bias internalization, accounting for 21.2% of the variance [R^2 = 0.21, F(1,445) = 119.93, p < 0.001]. In step 2, the overall regression model for condition was not significantly associated with weight bias internalization, controlling for perceived weight status [ΔR^2 = 0.01, F(3,442) = 31.32, p = 0.19]. However, the dummy-code comparing food addiction with the control condition was significantly associated with weight bias internalization. In step 3, the overall regression model testing the interaction between perceived weight status and condition was not significantly associated with weight bias internalization [ΔR^2 = 0.00, F(3,439) = 17.86, p = 0.93].

DISCUSSION

The current study was the first to compare the effects of food addiction, eating addiction, and calorie balance frameworks on external and internalized weight stigma. We hypothesized that the food addiction framework would be associated with lower external and

TABLE 3 Regression output with mean WBIS-M score as the dependent variable

Model	B	SE	*t*	*p*
Step 1				
Perceived weight status	1.00	0.09	10.95	<0.001
Step 2				
Perceived weight status	0.97	0.09	10.64	<0.001
Food addiction	0.27	0.13	2.10	0.04
Eating addiction	0.21	0.13	1.59	0.11
Calorie balance	0.15	0.12	1.18	0.24
Step 3				
Perceived weight status	0.93	0.19	4.93	<0.001
Food addiction	0.26	0.17	1.58	0.12
Eating addiction	0.14	0.16	0.87	0.38
Calorie balance	0.14	0.16	0.91	0.36
Perceived weight status × food addiction	0.02	0.26	0.09	0.93
Perceived weight status × eating addiction	0.16	0.27	0.61	0.55
Perceived weight status × calorie balance	0.02	0.26	0.07	0.94

Abbreviation: WBIS-M, Modified Weight Bias Internalization Scale.

internalized weight stigma compared with eating addiction, calorie balance, and control conditions. The data did not support the hypotheses, as external stigma scores did not significantly differ across conditions. In contrast to our hypotheses, participants in the food addiction condition expressed greater internalized weight stigma than participants in the control condition. However, internalized weight stigma did not differ between food addiction and the alternative frameworks for obesity.

When accounting for self-identification as having food addiction or perceived overweight, the effect of the food addiction versus the control condition on internalized weight stigma remained significant. We also did not find any evidence that endorsement of internalized weight stigma in response to the food addiction condition was greater for individuals who self-identified as having food addiction or perceived themselves to be overweight. It therefore appears that one or more components of the food addiction framework increased internalized weight bias across individuals, but it is unclear which component and why. Because the WBIS-M was designed to address several content areas of internalized weight bias (35), we additionally conducted post hoc exploratory analyses to investigate which items on the WBIS-M the food addiction framework was increasing (Supporting Information Tables S1 and S2). The food addiction condition was associated with higher scores on the items that assess weight-related feelings of anxiety and depression and a desire to change one's weight. The items about weight determining worth, value, competence, and attractiveness did not differ across conditions. It is plausible that reading a strong case for the role of addictive foods and "not other foods" in the current study's vignette may have increased participants' self-blame for choosing foods identified as addictive or induced hopelessness about whether they could stop eating HP foods; this may have heightened participants' weight-related feelings of anxiety and depression and a desire to change one's weight. However, future research is needed to understand these effects and this research should consider debriefing participants to identify the components of food addiction messages that may contribute to internalized weight bias.

Future studies may also explicitly use blame attribution toward the food industry to reduce the impact of food addiction explanations for obesity on internalized weight stigma. Typical calorie balance explanations explicitly or implicitly blame individuals for eating too many calories and burning too few, which increases weight stigma (10). If individuals hold strong prior beliefs that people are personally responsible for excess caloric intake and obesity, stating that certain foods are addictive may not sufficiently challenge these beliefs. Industry responsibility for engineering and marketing addictive foods is a major implication of the food addiction framework (36). Comparably, when the addictive potential of tobacco was publicly acknowledged, it highlighted the tobacco industry's role in creating and marketing harmful products (37). However, the connection between foods' addictive potential and industry culpability was not explicitly highlighted in the current study's vignette. Future studies may test vignettes that explicitly blame the industry for engineering addictive foods and targeting vulnerable individuals, in addition to describing the clinical presentation of food addiction. Explicitly blaming the food industry may also help distinguish the food addiction framework from the eating addiction framework, which does not implicate industry practices (7).

Findings from this study add to a growing body of evidence that addiction-based explanations for obesity do not increase external weight stigma. However, the current findings contrast with prior findings that the food addiction framework reduced external weight stigma compared with a calorie balance explanation (16,17). The findings are consistent with research that found no differences in external weight stigma between the food addiction framework

and a control condition that only mentioned obesity (18). Vignette design and content is a key difference between this study and prior research comparing the effects of obesity frameworks on external weight stigma. Latner and colleagues' vignettes had equivalent sentence structure and length but used more negatively affective language in the control condition, which may have influenced stigma (16). Ruddock and colleagues (18) kept vignettes simple and consistent except for source of diagnosis. The current study's vignettes were more similar to the vignettes used by Ruddock and colleagues, in that they were structurally consistent across conditions except for information about each framework and had an informational, neutral tone. Designing the vignettes in such a controlled manner may have improved the internal validity of this study at the expense of external validity. Health-related messages that elicit stronger affect are more persuasive than affectively neutral messages (38). Thus, this study's vignettes may not have elicited the affective response needed to sway weight-related attitudes. Future studies might balance methodological rigor and ecological validity by developing vignettes that are as equivalent as possible in all domains except for the target language and including language that elicits greater affective response.

This study was subject to limitations. Although the sample size was adequately powered for primary analyses, the sample size may have been underpowered to detect moderation effects in exploratory analyses. Thus, nonsignificant interactions in exploratory analyses should be interpreted with caution. Less than half the sample identified as "overweight," which may have limited our ability to test for meaningful differences in internalized weight stigma. Although results did not appear to differ by weight status, prior research shows that internalized weight stigma is most relevant for those with higher weights (22). Thus, future research should examine the effects of addiction-based explanations for obesity on internalized weight stigma in samples comprised of participants who identify as "overweight."

The sample reflected a higher proportion of White participants and participants with at least a bachelor's degree than the US population (39). Replication with representative samples is needed to determine generalizability of results. Furthermore, the vignettes were written at a tenth-grade reading level, which may have limited comprehension for participants with fewer years of education. This study allowed participants to complete surveys via Mturk at convenient times and locations, which raises questions about data quality. Future studies may benefit from increased participant surveillance. Additionally, participants commonly misestimate their weight (40). To address this, we used perceived weight status, which may be more consistent with individuals' body sizes (40). Future research should replicate this study using direct BMI measurement. This study focused on weight stigma as the outcome variable of interest. However, in order to better understand the potential for double stigmatization of obesity and addiction, future research should examine the effects of addiction-based obesity explanations on addiction-specific stereotypes (e.g., emotional instability, self-pitying) (41).

CONCLUSION

Language powerfully influences how individuals stigmatize groups (42). We aim to ensure the language we use to explain obesity does not stigmatize people with higher body weights. The current study suggests that—when obesity is explained using tightly controlled, non-affective language—the food addiction, eating addiction, and calorie balance frameworks do not significantly differ from each other in their tendency to increase external or internalized weight stigma. Compared with a control condition, food addiction narratives may result in an increase in internalized (but not external) weight stigma. Future research is needed to understand the mechanism underlying this effect. Individual differences in perceived food addiction or weight status were not related to the direction or magnitude of these associations. Finally, future research is needed to identify the optimal obesity framing that promotes health while mitigating weight stigma.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

AUTHOR CONTRIBUTIONS

LP, RJJ, JRC, and ANG contributed to the design and implementation of the research. LP and RJJ contributed equally to the statistical analyses and drafting the manuscript. All authors have approved the final manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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