



## Relationships between depression, gender, and unhealthy weight loss practices among overweight or obese college students<sup>☆</sup>



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### ABSTRACT

**Introduction:** Unhealthy weight loss practices are common among female college students. It is unknown if these practices are also most common among women in the subset of overweight or obese college students or if these practices are related to depression. We examined the relationship between gender, depression, and unhealthy weight loss practices among overweight or obese college students.

**Methods:** Students (body mass index between 25.0 and 34.9 kg/m<sup>2</sup>) from three Southern California universities ( $M_{age} = 22$  years,  $SD = 4$ ; 70% women) were recruited from May 2011 to May 2012 for participation in a weight loss clinical trial ( $N = 404$ ). Logistic regressions were performed with baseline data to assess the cross-sectional relationship between self-reported unhealthy weight loss practices and gender and depression as measured by the Center for Epidemiologic Studies Depression short form.

**Results:** Twenty-nine percent of participants reported engaging in at least one unhealthy weight loss behavior (e.g., fasting, purging) over the last 30 days, with no differences by gender. Self-report of at least one unhealthy weight loss behavior was associated with report of symptoms of depression ( $e^B = 1.14$  [confidence interval, CI: 1.08–1.20]), adjusting for potential confounders. Interactions between gender and depression were not significant ( $e^B = 1.04$  [CI: 0.93–1.16]).

**Conclusion:** Among an overweight or obese sample of college students, unhealthy weight loss practices were equally common in both genders, and students with depressive symptomatology were at greatest risk. Obesity interventions targeting overweight or obese college students should educate both men and women about the dangers of unhealthy weight loss practices. In addition, screening for depression can help identify students who would benefit from additional supportive and coping strategies and resources.

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### 1. Introduction

Research suggests that unhealthy weight loss practices (e.g., fasting, vomiting, taking diet pills, laxatives, or diuretics, smoking cigarettes as food substitute) are common among college students, particularly college women (Bish et al., 2005; Harring, Montgomery, & Hardin, 2011; Striegel-Moore et al., 2009). In the 2008 National College Health

Assessment (NCHA) survey of 90,484 United States (U.S.) college students, women were more likely than men to report dieting to lose weight (42.1% vs. 24.1%), vomiting or using laxatives (3.3% vs. 0.6%), and taking diet pills (3.8% vs. 1.7%); these estimates included normal to obese students (Harring et al., 2011). Depression may be one possible reason why college students, particularly women, engage in unhealthy weight loss practices. Harring et al. (2011) found that among overweight college students with an accurate weight perception, women were more likely than males to be depressed (Harring et al., 2011). In a study of 2822 U.S. college students, a greater proportion of women than men screened positive for both an eating disorder and depression (Eisenberg, Nicklett, Roeder, & Kirz, 2011). In fact, eating disorders often are associated with depression among college women (Eisenberg et al., 2011; Gutzwiller, Oliver, & Katz, 2003; Meno, Hannum, Espelage, & Low,

*Abbreviations:* CESD-10, Center for Epidemiologic Studies Depression short form; SD, standard deviation.

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2008). This may be because college women are most vulnerable to social norms for thinness, with many of these women suffering from low self-esteem (Elgin & Pritchard, 2006; Harring et al., 2011; Klesges, Mizes, & Klesges, 1987). Because eating disorder symptoms also have been associated with depression among college men (Olivardia, Pope, Mangweth, & Hudson, 1995), their possible depression is associated with unhealthy weight loss practices regardless of gender. Nevertheless, because more college women than men have been found to diet to lose weight at lower BMIs (Bish et al., 2005; Harring et al., 2011), it is possible that among a sample of overweight and obese college students, gender differences in engagement in unhealthy weight loss practices will not be evident.

The purpose of this analysis was to assess the association between gender, depression, and unhealthy weight loss practices in a sample of overweight or obese college students from Southern California. We hypothesized that 1) men will be as likely as women to engage in at least one unhealthy weight loss practice, 2) engagement in at least one unhealthy weight loss practice will be associated with greater symptoms of depression, 3) the strength of association between depression and engagement in at least one unhealthy weight loss practice will be greater among women than men.

## 2. Methods

### 2.1. Participants

The current analyses used baseline data from a randomized controlled trial to assess a theory-based weight loss program delivered via social and mobile technologies, project SMART (SMART: Social Mobile Approaches to Reduce weight) (Patrick et al., 2013). College students ( $N = 404$ ) between the ages of 18 and 35 years with a BMI between 25.0 and 34.9 kg/m were recruited from May 2011 to May 2012. Participants were students enrolled at San Diego State University, California State University San Marcos, or University of California San Diego. Institutional review boards from these universities approved study protocols. Individuals were excluded if they: 1) met American Diabetes Association criteria for diabetes; 2) screened positive for an eating disorder or a cardiovascular condition; 3) were taking weight-altering medications; 4) were pregnant or intending to get pregnant over the study period; and 5) were enrolled in or planned to enroll in another weight loss program. More information about project SMART can be found elsewhere (Patrick et al., 2013).

### 2.2. Measures

During the baseline visit, physiologic measurements were taken, and participants completed surveys with questions about demographics, unhealthy weight loss practices, and depression symptoms.

Body weight was measured to the nearest 0.1 kg using a calibrated digital scale. Subjects were asked to wear lightweight clothes (e.g., exercise clothes). Height (without shoes) was measured to the nearest 0.1 cm using a stadiometer. BMI was calculated from height and weight ( $\text{kg}/\text{m}^2$ ). Those with a BMI between 25.0 and 29.9  $\text{kg}/\text{m}^2$  were classified as overweight while those with  $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$  were classified as obese (Centers for Disease Control and Prevention, 2011). The Seca703, a combined digital scale and stadiometer, was used for body weight and height measurements.

Demographic characteristics included the following: age (continuous), race (1: White, 2: Black or African American, 3: Asian, 4: Pacific Islander, 5: American Indian, 6: Other), Hispanic ethnicity (1: Yes, 2: No), college graduate (1: Yes, 2: No), and relationship status (1: Single, 2: Engaged, married or in a committed relationship, 3: Separated, divorced, or widowed).

Engagement in unhealthy weight loss practices was based on the question: "Over the last 30 days, have you done any of the following things in order to lose weight or to keep from gaining weight?" The

list included: fasting, eating very little food, taking diet pills, self-vomiting, using laxatives, using diuretics, skipping meals, or smoking cigarettes. A score was created using the sum of the 'yes' responses. A dichotomous variable also was created and defined as the engagement in at least one unhealthy weight loss practice. These items and dichotomization have been used by others and show high test–retest agreement (Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011).

Depression symptomatology (e.g., depressed mood, feelings of guilt, worthlessness and helplessness, psychomotor retardation, loss of appetite, or sleep difficulties) was based on self-report and measured with the Center for Epidemiologic Studies Depression (CESD) short form (CESD-10) (Andresen, Malmgren, Carter, & Patrick, 1994). This short form is a 10-item subset of the 20-item CESD scale and has a 30-point categorical response scale (range 0–30). Higher scores represent greater depressive symptoms, and a score of  $\geq 10$  is indicative of depression; this threshold was used to create a dichotomous variable for depression. The widely used CESD has shown good reliability and validity, including among college students (Carleton et al., 2013; Radloff, 1991). The short form has shown good reliability and validity as well (Andresen et al., 1994), but its psychometric properties among college students are unknown.

### 2.3. Statistical analyses

Chi-square and t-tests were used to assess gender differences in demographics, BMI, CESD score, and engagement in unhealthy weight loss practices. The unadjusted association between gender and CESD score (continuous variable) and engagement in at least one unhealthy weight loss practice was assessed with a univariable logistic regression, with engagement in at least one unhealthy weight loss practice as the outcome variable. The unadjusted association between CESD score and gender was assessed using univariable linear regression and CESD score as the outcome variable. The CESD score  $\times$  gender interaction was tested. Associations and interactions with BMI were also tested given findings by others (Harring et al., 2011; Hoerr, Bokram, Lugo, Bivins, & Keast, 2002).

The multivariable hierarchical logistic regression model included, in addition to gender and CESD score, demographics and BMI, as these may be potential confounders (Hoerr et al., 2002; Madanat, Hawks, & Novilla, 2006). To increase statistical power of the regression analysis, race categories of Pacific Islander, American Indian, and others were collapsed; the relationship status categories of single and separated, divorced or widowed were collapsed; and the continuous variables for CESD score and BMI were used (instead of dichotomous variables). Variables were considered significant at  $p < 0.05$ . The Hosmer–Lemeshow Goodness-of-Fit statistic was used to assess model fit. An alpha level of 0.05 was used for all statistical tests.

## 3. Results

Table 1 shows participant demographics and health status by sex. Many participants were women, single, White, undergraduates, overweight, and/or without depressive symptoms; 11% of women and 12% of men were overweight and met criteria for depression (i.e., CESD score  $\geq 10$ ). There were no statistically significant differences between men and women for demographics, BMI, obese status, CESD score, or depression classification. Men and women reported equal engagement (29%) in at least one unhealthy weight loss practice. Only 14% of the sample engaged in more than two unhealthy weight loss practices and less than 5% in more than three. The most common unhealthy weight loss practices were "eating very little" and "skipping meals." College students engaging in at least one unhealthy weight loss practice had a statistically greater CESD score ( $M = 7.88$ ,  $SD = 3.98$ ) than college students not engaging in any ( $M = 5.29$ ,  $SD = 4.84$ ),  $t(402) = 5.59$ ,  $p = < 0.001$ .

**Table 1**  
Participant characteristics.

Variables	Men n = 120	Women n = 284	Total N = 404
<i>Demographics</i>			
Age, years, M (SD) <sup>a</sup>	22.7 (4.2)	22.0 (3.6)	22.2 (3.8)
Race, n (%)			
White	47 (39.2)	122 (43.0)	169 (41.8)
Black or African-American	2 (1.7)	15 (5.3)	17 (4.2)
Asian	36 (30.0)	65 (22.9)	101 (25.0)
Pacific Islander	6 (5.0)	5 (1.8)	11 (2.7)
American Indian	1 (0.8)	5 (1.8)	6 (1.5)
Other	28 (23.3)	72 (25.4)	100 (24.8)
Hispanic, n (%)	34 (28.3)	91 (32.2)	125 (31.0)
College graduate, n (%)	29 (24.2)	53 (18.7)	82 (20.3)
Relationship status, n (%)			
Single	74 (61.7)	156 (55.1)	230 (57.1)
Engaged/ married/ committed	46 (38.3)	125 (44.2)	171 (42.4)
Separated, divorced, widowed	0	2 (0.7)	2 (0.5)
<i>Health status</i>			
Body mass index, kg/m <sup>2</sup> , M (SD)	29.4 (2.7)	28.8 (2.8)	28.9 (2.8)
Body weight classification, n (%)			
Overweight	74 (61.7)	195 (68.7)	269 (66.6)
Obese	45 (37.5)	88 (31.0)	133 (32.9)
CESD score <sup>b</sup> , M (SD)	5.9 (4.4)	6.2 (4.4)	6.0 (4.4)
CESD ≥ 10 <sup>c</sup> , n (%)			
No	98 (81.7)	234 (82.4)	332 (82.2)
Yes	22 (18.3)	50 (17.6)	72 (17.8)
<i>Unhealthy weight loss practices, n (%)</i>			
Ate very little food	23 (19.2)	53 (18.7)	76 (18.8)
Skipped meals	22 (18.3)	53 (18.7)	75 (18.6)
Fasted	9 (7.5)	18 (6.3)	27 (6.7)
Took diet pills	3 (2.5)	5 (1.8)	8 (2.0)
Smoked for weight management	2 (1.7)	4 (1.4)	6 (1.5)
Used laxatives	1 (0.8)	1 (.4)	2 (0.5)
Took diuretics	1 (0.8)	1 (.4)	2 (0.5)
Vomited/purged	0	0	0
Engaged in at least one unhealthy weight loss practice			
No	85 (70.8)	203 (71.5)	288 (71.3)
Yes	35 (29.2)	81 (28.5)	116 (28.7)

<sup>a</sup> Standard deviation.<sup>b</sup> Center for Epidemiologic Studies Depression short form.<sup>c</sup> CESD score ≥ 10 is considered meeting criteria for depression.

In the unadjusted logistic regressions, women did not have greater odds than men for engaging in at least one unhealthy weight loss practice ( $e^B = 0.97$ , confidence interval, CI = 0.61, 1.15), but students with greater CESD score did ( $e^B = 1.14$ , CI = 1.08, 1.20,  $p < 0.001$ ). The strength of association between CESD score and unhealthy weight loss practices did not differ by gender, and the depression × gender interaction term was not statistically significant ( $e^B = 1.04$ , CI = 0.93, 1.16). Neither demographics nor BMI were associated with engaging in at least one unhealthy weight loss practice.

Table 2 shows the results of the adjusted logistic regression. Engagement in at least one unhealthy weight loss practice was associated with greater symptoms of depression ( $p < 0.001$ ), adjusting for demographics and BMI. Model fit was acceptable,  $\chi^2(8, N = 440) = 14.02$ ,  $p = 0.08$ . The model explained between 8% (Cox & Snell R Square) and 11% (Nagelkerke R Square) of the variance in unhealthy weight practices and correctly classified 72% of cases.

#### 4. Discussion

In this sample of overweight or obese college students, almost 30% engaged in at least one unhealthy weight loss practice. As hypothesized, gender was not, but depressive symptoms were, associated with engagement in unhealthy weight loss practices. No interaction between gender and CESD score was observed. Our findings regarding gender

**Table 2**Adjusted<sup>a</sup> logistic regression model to assess the relationship between depression, gender, and engagement in at least one unhealthy weight loss practice (N = 404).

	B	SE B	$e^B$	95% CI <sup>b</sup>	p
CESD score <sup>c</sup>	0.13	0.03	1.14	1.08–1.20	<0.001
Gender					
Female	−0.05	0.26	0.95	0.58–1.58	0.85
Male (reference)					
Age (years)	−0.04	0.04	0.96	0.89–1.04	0.35
Race					
White	−0.36	0.34	0.70	0.36–1.35	0.28
Black or African-American	−0.41	0.67	0.67	0.18–2.45	0.54
Asian	−0.20	0.40	0.82	0.37–1.81	0.62
Other <sup>d</sup> (reference)					
Ethnicity					
Hispanic	−0.42	0.34	0.66	0.34–1.27	0.21
Non-Hispanic (reference)					
College graduate					
Yes	−0.20	0.36	0.82	0.41–1.66	0.58
No (reference)					
Relationship status					
Single/separated/divorced/widowed	−0.25	0.25	0.78	0.48–1.28	0.33
Engaged/married/committed (reference)					
Body mass index, kg/m <sup>2</sup>	0.21	0.04	1.02	0.94–1.11	0.61

<sup>a</sup> This model is adjusted for the variables listed in this table.<sup>b</sup> Confidence interval of  $e^B$ .<sup>c</sup> Center for Epidemiologic Studies Depression short form (10-item).<sup>d</sup> Other category includes Pacific Islander and American Indian in logistic regression analyses.

are incongruent with research suggesting unhealthy weight loss practices are more common among women (Bish et al., 2005; Striegel-Moore et al., 2009) but congruent with research suggesting equalization at greater BMIs (Harring et al., 2011). Although there is less research about the relationship between depression, gender, and disordered eating, including unhealthy weight loss practices, our findings are in agreement with a study of college men and women that found more women than men screening positive for both eating disorders and depression (Eisenberg et al., 2011).

The causes of disordered eating and unhealthy dieting practices are complex and not completely understood (Fairburn & Harrison, 2003). A possible explanation for our findings regarding depression is that depressed individuals use unhealthy weight loss practices as a way to cope with problems (Polivy & Herman, 2002), elevate mood, and regulate emotional distress or negative affect (Polivy & Herman, 1993). At higher BMIs (e.g., overweight or obese), depression may be the driving force prompting both college women and college men to engage in unhealthy weight loss practices to lose weight. At lower BMIs, the driving force could be social norms for thinness (Elgin & Pritchard, 2006; Harring et al., 2011), especially for college women. This would explain why other studies, which focused on students of all BMIs (not only overweight or obese students), found more college women than college men engaging in these practices.

Study limitations should be noted. Because this is a cross-sectional study, temporality cannot be discerned; thus, although we hypothesize that depression leads to engagement in unhealthy weight loss practices, the reverse could also be true (Lucka, 2006). Data on depression symptoms and unhealthy weight loss practices are based on self-report. There may be an underestimation of college students with unhealthy weight loss practices because we excluded individuals screening positive for an eating disorder (7%). We did not test the reliability and validity of the items used to assess unhealthy weight loss practices. Our findings may not be representative and generalizable to college students from other regions or academic institutions.

This study adds to the literature by suggesting that unhealthy weight loss practices are equally common among overweight and obese male

and female college students, but college students showing signs of depression are at greatest risk, irrespective of gender. Obesity interventions targeting college students should provide education on healthy weight loss practices and the dangers of unhealthy weight loss practices, screen for depression, and include supportive strategies (e.g., counseling referrals, coping techniques) for those screening high for depression symptoms. Research aimed at explaining the link between depression and unhealthy weight loss practices is recommended.

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#### Contributors

Author 1 conceptualized the research question for this manuscript, conducted literature review, performed statistical analyses, and wrote the manuscript. Author 2 assisted with the literature review, statistical analyses, and manuscript writing. Authors 3, 4, 5, 6, 7, 8, 9, and 11 designed the study and wrote the protocol. Author 10 was the study project coordinator. All authors contributed to and approved the final manuscript.

#### Conflict of interest

There are no conflicts of interest to disclose.

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