Weight suppression and weight elevation are associated with eating disorder symptomatology in women age 50 and older: Results of the gender and body image study

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Abstract

Objective: Weight suppression (WS), the difference between highest past non-pregnancy weight and current weight, predicts negative outcomes in eating disorders, but the impact of WS and related weight constructs are understudied in nonclinical, midlife populations. We examined WS (current weight < highest weight) and weight elevation (WE), the opposite of WS (current weight > lowest weight) and their associations with eating psychopathology in women aged 50+.

Method: Participants were a community-based sample (N = 1,776, M_{age} = 59) who completed demographic and eating psychopathology questions via online survey. WS, WE, and WS × WE were tested as predictors of outcome variables; BMI and medical conditions that affect weight were controlled for.

Results: Individuals that were higher on WS and WE were most likely to engage in current weight loss attempts, dieting in the past 5 years, and extreme lifetime restriction. Individuals with higher WS were more likely to experience binge eating, greater frequency of weight checking, overvaluation of shape and weight, and lifetime fasting. Individuals with higher WE were more likely to report negative life impacts of eating and dieting. Higher WS and WE each predicted higher levels of skipping meals over the lifetime.

Discussion: This novel study investigated WS in midlife women and introduced a new conceptualization of weight change (WE) that may be more relevant for aging populations given that women tend to gain weight with age. The findings implicate the utility of investigating both WS and WE as factors associated with eating psychopathology in midlife women.

KEYWORDS
eating disorder symptoms, mid-life, older adult, weight suppression, women

1 | INTRODUCTION

Eating disorders are stereotyped as a disease of adolescence and young adulthood, thus, midlife women have often been overlooked in eating disorder research. However, eating disorders can occur at any age. Clinical and community reports have established that eating disorders and related symptomatology are present at midlife (aged 40 years and older): the incidence for this age group is 1.9–5.8 per 100,000 for anorexia nervosa (AN; Lucas, Crowson, O'Fallon, & Melton, 1999) and 1.7 for bulimia nervosa (BN; Turnbull, Ward, Treasure, Jick, & Derby, 1996). Additionally, a large majority (73%) of midlife women experience weight dissatisfaction and report wanting to lose weight (Allaz, Bernstein, Rouget, Archinard, & Morabia, 1998; Jackson et al., 2014). More specifically, 62% of midlife women aged 50+ in a large community-based sample (the sample of interest of the current study) reported that eating, weight, and shape "occasionally" to "often" negatively affected their lives (Gagne et al., 2012). National studies in both the United States and Australia revealed that approximately 11%

of middle aged women self-report disordered eating practices, such as binge eating (Fairweather-Schmidt, Lee, & Wade, 2015). Despite the increased attention to midlife eating disorders and related symptomatology, little is known about their etiology and course.

Given that most women experience an increase in body mass index (BMI) over the lifespan (Clarke, O'Malley, Johnston, & Schulenberg, 2009), changing weight patterns at midlife may be particularly relevant in the etiology of midlife eating disorder symptoms and body dissatisfaction. Further, changes in weight have been implicated in the symptomatology of and treatment outcomes for AN, BN, and binge-eating disorder (BED) (Butryn, Juarascio, & Lowe, 2011; Wildes & Marcus, 2012), specifically weight suppression (WS), which is defined as the difference between highest past adult (nonpregnancy) weight and current weight. For example, WS predicts more frequent binge-eating and purging behaviors and the maintenance of these behaviors, longer time to remission, more severe associated psychopathology (e.g., depression), and worse treatment outcomes in individuals with eating disorders (Butryn et al., 2011; Clarke et al., 2009; Gagne et al., 2012; Marcus, Bromberger, Wei, Brown, & Kravitz, 2007; Mitchell et al., 2011; Wildes & Marcus, 2012). Similar associations are observed in nonclinical samples such that WS is associated with weight concerns, weight-loss practices, and low-fat eating behaviors in women younger than 40 (French & Jeffery, 1997) and with higher levels of restraint, drive for thinness, and dieting behaviors prospectively in women before and after the age of 18 (Mitchell et al., 2011). To date, WS and related eating pathology research in nonclinical samples has focused on young adult populations. Little is known about whether similar associations are observed between WS and eating disorder symptomatology in nonclinical midlife women.

Most midlife women experience unique changes in weight that may play a role in the etiology of eating disorder symptoms. For example, in the atherosclerosis risk in communities (ARIC) study, white women gained an average of 1.01 lbs per year and black women 0.84 lbs per year over the course of 6 years (Stevens et al., 2001). Studies have shown that the weight gain women experience during midlife is often because of unique circumstances of this age, such as hormonal changes related to reproductive processes (e.g., menopause; Baker & Runfola, 2016), bereavement (Lapid et al., 2010), and divorce/relationship-challenges (Slevec & Tiggemann, 2011). Studies have shown assocations between weight gain during midlife and eating disorder symptoms (Slevec & Tiggemann, 2011), which may at least be partially explained by midlife women feeling distressed over midlife weight gain and making efforts to control weight and/or shape (Hofmeier et al., 2016). Midlife women who are distressed over their body weight and shape are at an increased risk of eating disorder behaviors, such as dieting and binge eating (Gagne et al., 2012), and it is well documented that these behaviors can contribute to weight gain (Savage, Hoffman, & Birch, 2009; Yanovski, 2003). Thus, midlife women are at risk of weight gain, dissatisfaction with such physical changes, and disordered eating practices aimed at losing weight that may paradoxically result in weight gain. In this manner, it may be particularly important to identify eating disorder psychopathology among midlife women who may be at particular risk for weight gain.

Thus, as women age and gain weight, current weight may end up being higher than their lowest lifetime adult weight ("weight elevation [WE]") and women's bodies may move further away from what the individual may consider as their typical or ideal weight and further away from the thin ideal promoted by Western society (McLaren & Kuh, 2004). In turn, higher WE could contribute to increased body dissatisfaction and eating disorder symptoms. WE may occur for numerous reasons, such as a result of past low weight (e.g., weight gain in recovery from an eating disorder or other medical/psychological condition), or as a result of current higher weight (e.g., emotional or overeating, phase of life transition). Thus, while WE is not necessarily pathological, as WE increases, it may characterize a distinct phenotype of women with heightened body image concerns and problematic eating behaviors at midlife.

The aims of the current study were to (a) investigate the association between WS and eating disorder symptoms of midlife women and to (b) investigate WE as a construct in order to see if it is a unique predictor of eating disorder symptoms of midlife women. We hypothesized that midlife women who experienced higher levels of WS would be more likely to report current and lifetime eating disorder symptomatology than those with lower WS. We hypothesized that individuals with higher WE would be more likely to report eating disorder symptomatology than those with lower WE. Given the exploratory nature of the WE construct, we did not have specific predictions of which eating disorder symptoms may be unique to WE compared to WS. We did predict that WS and WE would interact to show that individuals with high WE and high WS would be most likely to report high levels of eating disorder symptomatology.

2 | METHOD

2.1 | Participants and procedure

Participants were 1,776 women from the Gender and Body Image (GABI) study who resided in the United States and were 50+ years of age. GABI participants were recruited from September 2010 through January 2011. Emails inviting participation in the study were sent via multiple online methods (see Gagne et al., 2012) and included links to the online consent form and the online survey (www.surveymonkey.com), as well as a brief description of the study. SurveyMonkey protects against duplicate responders by only allowing one response to the survey per computer. Participants were encouraged to send the survey link to others. Participation was anonymous and no compensation was provided. Inclusion criteria were: (a) female sex, (b) age 50+ years, (c) Internet access, and (d) English literacy. Of 2,020 women that consented to participate in the study, 240 were excluded based on the following criteria: (a) missing or ineligible age values (<50; $n = 171$), (b) missing values on current weight and highest ever and/or lowest ever adult weight; $n = 65$), and (c) invalid values (self-reported highest ever adult weight < current weight or self-reported lowest ever adult weight > current weight) ($n = 8$). This study was approved by the Public Health-Nursing Institutional Review Board of the University of North Carolina at Chapel Hill.

2.2 | Measures

2.2.1 | Sociodemographics

Participants self-reported age, race, ethnicity, current height and weight without shoes, highest adult non-pregnancy weight without shoes, lowest adult weight without shoes, if height had changed with age, and, if so, what their tallest adult height was without shoes. We used National Institutes of Health criteria for race (NIH, 2001): (a) White, (b) Black or African American, (c) Asian, (d) American Indian or Alaska Native, (e) Native Hawaiian or other Pacific Islander, and (f) other. Two or more responses were classified as "multiracial." Ethnicity was coded as Hispanic/Latino (Spanish, Hispanic, or Latina) or not.

2.2.2 | BMI, WS, and WE

Body mass index (BMI; kg/m^2) was calculated from height and weight and weight status coded ($<$18.5: underweight; 18.5–24.9: normal; 25–29.9: overweight; $\geq$ 30: obese) based on Centers for Disease Control and Prevention criteria. WS was calculated by subtracting each participants' current weight from their highest nonpregnancy adult weight. WE was calculated by subtracting each participants' lowest adult weight from their current weight. Participants also responded "yes" or "no" to the question, "Do you have any physical or medical conditions that affect your weight and/or appetite?"

2.2.3 | Binge eating and purging

Previously published questionnaires from the Virginia Twin Registry were used to assess core eating disorder symptoms based on the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (Bulik, Sullivan, & Kendler, 2000; First, Spitzer, Gibbon, & Williams, 2002; Neale, Mazzeo, & Bulik, 2003; Slof, Mazzeo, & Bulik, 2003). Core eating disorder symptoms were assessed, rather than eating disorder diagnoses, as a less stringent method given the community-based nature of the study. Binge eating (eating a large amount of food in a short period of time and feeling out of control during eating) was assessed and coded as present if there was a minimum binge-eating frequency of once per week (lifetime). Purging (self-induced vomiting, laxative/diuretic use, diet pill use, excessive exercise) was assessed and coded as present if there was a minimum frequency of at least once in the last five years (Gagne et al., 2012). Participants answered questions about whether or not they had ever tried to (lifetime) control weight by skipping meals, engaging in extreme restricting ($<$1,200 calories per day or very small portions), and fasting (consuming nothing but water for 24 hours).

2.2.4 | Weight control, checking behaviors, and weight and shape overvaluation

Weight control behaviors currently and in the past five years were measured with dichotomous variables: "Currently trying to lose weight" versus"Not trying to lose weight" and dieting in the past five years "About half the time or more" versus "About less than half the time." Current body shape checking frequency was assessed using the following scale: (a) "Practically hourly or more," "Several times a day," or "Daily," (b) "A few times a week" or "A few times a month," and (c) "Never." Frequency of weight checking was measured with the following scale: (a) "Two or more times a day," "Daily" or "A couple times a week," (b) "About once a week", "About once a month," or "A couple times a year," and (c) "Never." Weight and shape overvaluation was measured with a question about how important current body shape and weight are to the way one feels about oneself, with the following scale: (a) "Not at all" or "A small part;" (b) "A moderate part;" (c) "A significant part" or "Most important thing." The negative life impact of eating, weight, and shape concerns was measured with the following scale: (a) "Not at all; I don't have concerns about eating, weight, or shape" or "Very little; I have concerns about eating, weight, or shape but these concerns rarely or never negatively impact my life," (b) "Somewhat; I have concerns about eating, weight, or shape and these concerns occasionally negatively impact my life," and (c) "A lot; I have concerns about eating, weight or shape and these concerns often negatively impact my life."

2.3 | Data analysis

The associations between WS and WE and binary eating disorder outcomes (i.e., purging presence, binge eating presence, trying to lose weight, dieting in the past five years, skipping meals, extreme restriction, fasting) were examined with binary logistic regression. Firth's penalized regression method was used when sparse data and separation led to convergence difficulties. Associations between WS and WE and ordinal eating disorder outcomes (i.e., body checking, weight checking, overvaluation) were investigated with ordinal logistic regression. WS and WE were centered prior to creating the interaction term; current BMI was centered and was controlled for and physical/medical conditions affecting weight/appetite was also controlled for. Significant interactions were probed by plotting the conditional effect of WS on the dependent variable at varied levels of WE. To correct for multiple testing, *p*-values were adjusted using the false discovery rate (FDR) procedure (Benjamini & Hochberg, 1995).

3 | RESULTS

3.1 | Descriptive statistics

Descriptive information for the sample is presented in Table 1. The women (N = 1,776) were aged 59 years on average (SD = 6 years, range = 50–89 years). The mean of weight suppression was 16 lbs (7 kg) with a *SD* of 21 lbs (10 kg) and a range from 0 to 260 lbs lost (0–118 kg). Eighty-five percent of the sample reported a history of weight suppression (i.e., computed WS score $>$0). The mean of weight elevation was 39 lbs (18 kg) with a *SD* of 31 lbs (14 kg) and a range of 0 to 195 lbs gained (0 to 88 kg). Ninety-nine percent of women reported a history of weight elevation (i.e., computed WE score $>$ 0).

3.2 | Dimensional weight suppression and weight elevation as predictors of eating disorder symptoms

WS and WE were associated with many eating disorder outcomes. Statistically significant WS $\times$ WE interaction effects will be discussed first. There was a significant WS $\times$ WE interaction on currently trying to lose weight (B = 0.004, FDR p = .01), dieting in the past 5 years

TABLE 1 Study sample descriptive statistics

	Total sample (N = 1,787)
Age (yrs) *M* (*SD*)	59.03 (6.73)
Age bands (yrs; %)	
50–54	30
55–64	51
65–74	16
75–84	3
85+	1
Race (%)	
White	93
Black	5
Asian	1
Other	1
Multiracial	1
Hispanic/Latino (%)	3
Physical/medical condition affecting weight (%)	28
BMI (kg/m^2) *M* (*SD*)	27.59 (6.56)
BMI category (%)	
Underweight (<18.5)	4
Normal (18.5–24.9)	40
Overweight (25–29.9)	29
Obese (≥30)	27
Weight suppression (lbs) *M* (*SD*)	15.97 (21.37)
Weight elevation (lbs) *M* (*SD*)	39.11 (30.97)

Note. BMI = body mass index.

($B = 0.002$, FDR $p = .02$), and lifetime extreme restriction ($B = -0.0002$, FDR $p = .01$; Table 2). Broadly, post hoc probing showed that women with higher WS and higher WE were most frequently trying to lose weight, dieting, and endorsing extreme restriction in their lifetime than women with other levels of WS and WE. Specifically, post hoc probing of these significant interactions yielded the following results: (a) Higher WE increased the probability of trying to lose weight at higher ($B = 0.02$, $p = .004$) but not at lower levels of WS ($B = -0.004$, $p = .37$). (b) Those with higher WS were more likely to diet in the past 5 years, but only at average and higher levels of WE (lower: $B = 0.01$, $p = .02$; average: $B = 0.02$, $p < .001$; higher: $B = 0.02$, $p < .001$). (c) Lastly, those with higher WS and higher WE had the highest probability of extreme restriction during their lifetime. WS was conditionally associated with extreme restriction at all levels probed, but the highest probability of restriction was observed in those with both higher WS and higher WE (lower: $B = 0.01$, $p = .03$; average: $B = 0.01$, $p < .001$; higher: $B = 0.02$, $p < .001$). No further statistically significant interactions were observed.

There were statistically significant main effects of both WS and WE on skipping meals over the lifetime (Table 2); individuals higher on WS and WE, respectively reported higher levels of skipping meals in their life. There was a main effect of higher WS on binge eating, frequency of weight checking, overvaluation of shape and weight, and lifetime fasting. There was a main effect of higher WE predicting higher levels of negative life impact of eating, weight, and shape concerns.

4 | DISCUSSION

Despite growing awareness and interest in eating disorder symptomatology in midlife women (Gagne et al., 2012; Marcus et al., 2007; Midlarsky & Nitzburg, 2008) and the weight changes that happen during this time, the association between weight change (i.e., WS and WE) and eating disorder symptoms have not been well characterized. Since WS is a robust predictor of eating disorder-related outcomes in clinical and nonclinical samples of younger women (Berner, Shaw, Witt, & Lowe, 2013; Butryn, Lowe, Safer, & Agras, 2006; Butryn et al., 2011; French & Jeffery, 1997; Keel & Heatherton, 2010), this study considered whether WS and the related construct, WE, were associated with eating outcomes in midlife women. Our hypothesis that women who were high on WS and WE would experience more eating disorder symptoms than those low on one or both measures was supported. Individuals higher on WE and WS had the highest level of current weight loss attempts, dieting in the past 5 years, and lifetime restriction. This indicates that WS and WE may both be important to consider when investigating the course of eating disorder behaviors in midlife women, and for characterizing a phenotypic group at increased risk of eating disorder onset at midlife age.

Main effects indicated that higher levels of WS and WE, respectively put one at risk for skipping meals over the lifetime. Higher WS was uniquely associated with higher frequency of weight checking, overvaluation of weight and shape, binge eating, and lifetime fasting; higher WE was associated with negative life impact of eating, weight, and shape concerns. Thus, our findings indicate that WE is an indicator of eating pathology and warrants further investigation, especially in midlife women. As women tend to gain weight with age (Clarke et al., 2009; Stevens et al., 2001), especially due to age-specific bodily and social changes (Baker & Runfola, 2016; Lapid et al., 2010), *and* these women express high levels of body concern (Gagne et al., 2012), our findings imply that experiencing a higher adult weight than one did previously may put one at risk for increased eating pathology.

Proposing a new construct such as WE must be justifiable. WS has gained acceptance as a relevant construct for eating disorder research independent of an overarching construct of weight fluctuation (WF; the difference between one's highest adult nonpregnancy weight and lowest adult weight). However, weight fluctuation is an imprecise term as fluctuation can be bidirectional, and WS only captures one direction of change. By introducing the concept of WE, our goal was to dismantle WF by clarifying directionality of weight change over time. By addressing WS, WE, and the WS × WE interaction, we functionally capture all potential directions of weight change over time. In addition, the construct of WF does not account for current weight status, as it only measures a total difference instead of one's current weight compared to other set points of adult weight (highest or lowest). That being said, the construct of WE needs further investigation in order to determine its utility. WE could emerge either due to current high weight or to low prior weight, which may carry different implications. Future designs should carefully explore the nature of WE in order to confirm its utility.

TABLE 2 Logistic regression estimates of the association between weight suppression, weight elevation, and eating disorder symptoms among midlife women: dimensional tests

	WS × WE interaction		WS main effect			WE main effect		
Outcome	***B***	**FDR *p***	***B***	**OR**	**FDR *p***	***B***	**OR**	**FDR *p***
Purging presence	−0.00002	.91	0.004	1.05	.62	0.03	1.30	.06
Binge eating presence	−0.00005	.64	0.01	1.16	<.001***	0.0005	1.05	.38
Trying to lose weight	0.0004	.01*	0.009	1.10	.02	0.004	1.04	.38
Dieting, past 5 yrs.	0.0002	.02*	0.01	1.16	<.001***	−0.004	0.96	.37
Body checking freq.	−0.00009	.15	0.002	1.02	.37	0.0001	1.00	.97
Weight checking freq.	0.00003	.64	0.008	1.00	.006**	−0.006	0.92	.12
Shape and weight overvaluation	0.00003	.64	0.006	1.06	.02*	0.004	1.04	.23
Negative life impact	−0.00003	.60	0.004	1.04	.18	0.0007	1.08	.02*
Skipping meals, lifetime	−0.00007	.28	0.007	1.07	.02*	0.008	1.09	.02*
Extreme restriction, lifetime	−0.0002	.01*	0.02	1.20	<.001***	0.008	1.09	.02*
Fasting, lifetime	−0.00007	.35	0.01	1.16	<.001***	0.01	1.09	.15

Note. FDR = false discovery rate; WE = weight elevation; WS = weight suppression. The odds ratio (OR) estimates for WS and WE reflect the odds of a 10-pound increase in these variables. Covariates of BMI and physical/medical conditions affecting weight or appetite were included in the models.
*FDR-adjusted $p < .05$. ** FDR-adjusted $p < .01$. *** FDR-adjusted $p < .001$

Two outcome variables were not predicted by any of the three regression analyses: purging and body checking frequency. Purging was of low frequency in this study, which may have contributed to the non-significant pattern of results. In non-clinical samples of eating disorder symptomatology, purging is often less frequently endorsed than other behaviors, such as binge eating (Keel, Baxter, Heatherton, & Joiner, 2007; Piran & Robinson, 2011). Body checking has been reported to be a fairly common practice in nonclinical mid-life women (41.2%; Gagne et al., 2012), but was not predicted by WS, WE, or WS × WE in our sample. A previous examination of eating disorder behaviors in non-clinical mid-life women (Gagne et al., 2012) found that body checking frequency only differed significantly between those with a current eating disorder and those without any history of an eating disorder. Other comparisons (e.g., past eating disorder versus current eating disorder; past eating disorder versus no eating disorder history) did not reveal any significant group differences on body checking frequency. Thus, perhaps although body checking is salient among non-clinical samples of women in midlife, it may only be salient in the context of those with more severe eating pathology, such as a current eating disorder, and not solely based on current weight status.

The findings of the current study also build on previous research regarding WS and related eating pathology across age groups, especially in previously understudied populations. For example, in a large, non-clinical study among females with a mean age of 40 years, WS was positively correlated with restraint scores and dieting (Mitchell et al., 2011). Thus, WS in middle-aged women appears to be related to eating pathology, much as it is in nonclinical populations of younger women (French & Jeffery, 1997; Mitchell et al., 2011). This suggests that weight and shape concerns and behaviors related to these concerns, such as dieting, are not just prevalent in younger women, but that they are similarly salient across the lifespan (Stunkard, Sørensen, & Schulsinger, 1983).

This study should be considered within the context of its limitations. First, GABI recruitment relied on convenience samples and internet-based data collection, which gives way to selection bias implications. The generalizability of our findings may also be limited due to the underrepresentation of racial and ethnic minority groups and due to the fact that socioeconomic and geographical information were not collected to maintain anonymity. Additionally, weights were self-reported in our study which may introduce bias, as previous research has shown that self-reported weight is often underreported in women (Gorber, Tremblay, Moher, & Gorber, 2007; Merrill & Richardson, 2009). Future studies should utilize medical records or in-person weighing to decrease bias and increase reliability of the construct. In an effort to reduce the potential effect of BMI in confounding the effects of WE and WS on outcome variables, we adjusted for current BMI as a covariate in all analyses with the goal of distinguishing the relative importance of higher BMI versus WE and WS. There are cons to this approach though, specifically statistical problems caused by overadjustment (i.e., suppression effects, adjustment of a mediator in a causal chain; Keevil & Khaw, 2014; Schisterman, Cole, & Platt, 2009). Similarly, the cross-sectional nature of this study comes with limitations as we are unable to make predictive conclusions. Longitudinal studies are needed to help elucidate the extent to which lifetime eating disorder behaviors influence current weight and vice versa. This study had a small number of participants who had not experienced WE or WS, which limits generalizability, as research on weight change has demonstrated the importance of having a large number of participants in each group (no weight change, weight gain, weight loss). Thus, future studies should aim to have sufficiently large samples in each weight change classification.

Despite these limitations, this study does contribute to the growing pool of weight-related literature in that the findings suggest that midlife women who experience high levels of WS and WE tend to experience higher levels of disordered eating pathology than those who experience less extreme, or more typical levels of WS and WE in adulthood. Thus, this study highlights the importance of assessing and screening for WS, WE, and eating-related symptomatology in women across the lifespan.

CONFLICT OF INTEREST

Dr. Bulik is a grant recipient from Shire Pharmaceuticals and has served on their Advisory Board. Dr. Peat is a consultant for Sunovion Pharmaceuticals.

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