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Daily self-weighing compared with an active control causes greater negative affective lability in emerging adult women: A randomized trial

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Abstract

Age-related weight gain prevention may reduce population overweight/obesity. Emerging adulthood is a crucial time to act, as rate of gain accelerates and health habits develop. Evidence supports self-weighing (SW) for preventing weight gain; however, how SW impacts psychological states and behaviors in vulnerable groups is unclear. This study assessed daily SW effects on affective lability, stress, weight-related stress, body satisfaction, and weight-control behaviors. Sixty-nine university females (aged 18–22) were randomized to daily SW or temperature-taking (TT) control. Over 2 weeks, participants completed five daily ecological momentary assessments with their intervention behavior. A graph of their data with a trendline was emailed daily, with no other intervention components. Multilevel mixed models with random effect for day assessed variability in positive/negative affect. Generalized linear mixed models assessed outcomes pre- and post-SW or TT and generalized estimating equations assessed weight-control behaviors. Negative affective lability was significantly greater for SW versus TT. While general stress did not differ between groups, weight-related stress was significantly higher and body satisfaction was significantly lower post-behavior for SW but not TT. Groups did not significantly differ in the number or probability of weight-control behaviors. Caution is advised when recommending self-weighing to prevent weight gain for emerging adults.

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CONFLICT OF INTEREST STATEMENT

Dr. Crosby is a paid statistical consultant for Health Outcomes Solutions, Winter Park, Florida. The other authors have no conflicts of interests to disclose.

ETHICS STATEMENT

Approval was obtained from the ethics committee of the University of Delaware. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. All participants were consented (using an Institutional Review Board-approved consent form) prior to data collection.

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CLINICAL TRIAL REGISTRATION

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Keywords

affective lability; disordered eating; emerging adulthood; risk factor; self-weighing; women

INTRODUCTION

Two significant public health problems, obesity and eating disorders, are prevalent during emerging adulthood, a unique stage of life between ages 18 and 25 (Arnett, 2000; Flegal et al., 2012; Hudson et al., 2007; C. L. Ogden et al., 2012). Over half of emerging adults experience weight gain (Berg et al., 2009) and/or disordered eating (Cooley & Toray, 2001), for example, overly restrictive dieting and binge eating, both of which contribute to obesity. With continued concern about overweight and obesity, behavioral strategies that assist with weight management are of importance.

A promising approach for preventing weight gain during college is daily self-weighing (Bertz et al., 2015; Levitsky et al., 2006; Ogden & Whyman, 1997), an example of behavioral self-monitoring, an evidence-based strategy for weight control (Burke et al., 2011). Self-monitoring is fundamental to behavior change, and feedback allows the user to evaluate their goal-oriented progress and modify behavior. Advances in wireless technology enable users to track personal health information in real time. Given that 60% of US adults report tracking weight, diet, or exercise (Poushter, 2016), and 96% of adults aged 18–29 own a smartphone (Pew Research Center, 2021), electronic self-monitoring is a feasible strategy for young adults. Although evidence supports daily self-weighing for weight control (i.e. weight loss and prevention of weight gain) in adults (Pacanowski et al., 2014; VanWormer et al., 2008), for certain sub-populations such as young adults, this weight control strategy may have iatrogenic effects, including unintended psychological consequences (Benn et al., 2016; Ogden & Whyman, 1997; Pacanowski et al., 2015) such as the manifestation of negative mood states, which are shown to precipitate disordered eating (Polivy & Herman, 2002). A meta-analysis examined moderators of the relationship between self-weighing and psychological outcomes (affect, attitudes about one’s body, disordered eating) (Benn et al., 2016). In younger samples, self-weighing was more negatively correlated with disordered eating. Randomized controlled trials (RCTs) as compared with correlational studies typically observed a more positive association between self-weighing and affect or attitudes about one’s body. Weight status moderated the relationship between self-weighing and attitudes about one’s body (but not self-weighing and affect or disordered eating) in that self-weighing was positively correlated with attitudes about one’s body in samples at higher weights but not those at “normal” weights (Benn et al., 2016). Another factor that could be related to the psychological effects of self-weighing along with weight status is whether individuals are participating in a weight loss intervention. Several weight loss intervention studies in adults using self-weighing have found psychological improvements (e.g. Gokee-Larose et al., 2009; Steinberg et al., 2014) or no adverse effects (Linde, 2014, 2017; Wing et al., 2007). Yet, it is unclear whether these results are confounded by individuals losing weight, meaning that weight loss often improves psychological state.

Regarding age, one RCT found that daily self-weighing increased anxiety and depression in women aged 16–23 (Ogden & Whyman, 1997). This age range overlaps with emerging adulthood (Arnett, 2000), which focuses on the age range of 18 to 25, a transitory period of life in which many individuals attend college. This period of life has been the focus of study because individuals in this phase of life have been found to have unique characteristics and mood qualities as compared with individuals in adulthood (Arnett et al., 2014).

Studies in young adults, aged 18–35, have found no problematic effects of frequent weighing (e.g. Gokee-Larose et al., 2009; Gorin et al., 2019). However, given that emerging adulthood (ages 18–25) represents a unique developmental stage (Arnett, 2000), it is possible that negative psychological effects occur in individuals who are emerging adults, but not young adults. In fact, in one study that found self-weighing to have positive psychological effects, most of the sample was older than 25 years (Gorin et al., 2019). In addition to age/developmental stage potentially moderating the relationship between self-weighing and adverse psychological outcomes, gender may also play a role. Notably, studies finding problematic outcomes included a high proportion of women; a review identified gender (i.e. identifying as female) as a potential factor in self-weighing being problematic (Pacanowski et al., 2015) and a prospective study with a sample of 86% women found that self-weighing at baseline predicted disordered eating and weight gain during college (Rohde et al., 2018). Importantly, this study included nonobese college-aged students with weight concerns. Another cross-sectional study found that self-weighing in college women was significantly correlated with body image concerns, including those associated with disordered eating (Klos et al., 2012).

Further, studies finding no ill effects of weighing tend to focus on a broader time (e.g. 2 years); thus, the momentary psychological effects of weighing are less understood. A cross-sectional study conducted by Mintz and colleagues (2013) found that 63% of college women aged 17 to 26 years reported that self-weighing impacted their mood. Affective lability is a more momentary and reactive construct than mood. Affective lability takes place when an individual reacts to an internal or external stimulus with an emotional response, which eventually changes to a lessened, more neutral version of the emotion or a different emotion (Renaud & Zacchia, 2012). Affective lability is not only a well-established risk factor for disordered eating (Anestis et al., 2010; Brownstone et al., 2013; Lavender et al., 2013; Zander & De Young, 2014), it also predicts behaviors related to disordered eating such as reassurance seeking and impulsivity (Anestis et al., 2009). If daily self-weighing leads to affective lability and affective lability is a risk factor for disordered eating behaviors and associated negative behaviors (e.g. impulsivity), which are known to contribute to weight gain, intervening with daily self-weighing could produce weight gain instead of preventing gain. Ecological momentary assessment (EMA) is a methodology that can address momentary changes in mood and variability throughout the day in response to behavioral interventions (Shiffman et al., 2008).

The present study addresses an important gap in the literature by answering the question: Does daily self-weighing cause affective lability among emerging adult women? We hypothesized that daily self-weighing would result in significantly greater affective lability compared with an affect-neutral, active control behavior, daily temperature-taking. A

secondary hypothesis was that there would be a greater increase in stress about weight and decrease in body satisfaction prebehavior and postbehavior with self-weighing compared with temperature-taking. Finally, it was hypothesized that the daily self-weighing group would report more weight-control behaviors at the end of the day as compared with the daily temperature-taking group.

METHODS

Participants and procedure

In the Summer and Fall of 2017, recruitment flyers were distributed around campus at a large, Mid-Atlantic, 4-year University (e.g. to clubs, placed in residence life buildings and on-campus housing, in advising centers, and given out or posted in large undergraduate classes) indicating that participants would be asked to engage in a behavior that would take less than 10 s per day, that the study would help us to understand how young adults could prevent weight gain, and that participants could earn up to $250 for the entirety of the three-month study. Research assistants also approached individuals on campus, asked questions about eligibility, and then scheduled an assessment or directed interested individuals to contact the research team. Potential participants emailed the research team or called the study phone number and were screened for eligibility twice. During the first screening, individuals were asked if they currently had an eating disorder or had one in the past (yes/no, if yes not eligible), identified as a woman, were between the ages of 18 and 26, were a student at the University conducting the study, resided in an area that used the University's secure Wi-Fi, and owned a smartphone. If any of the afore-mentioned criteria were not met, individuals were informed that they were not eligible to participate in the study. During the second screening email, the SCOFF questionnaire (Morgan et al., 1999) was administered and participants were excluded if they answered "yes" to three or more items they were not eligible. The SCOFF questionnaire has 99.1% sensitivity and 95.8% specificity for detecting eating disorders. Participants were randomized as they signed up for the initial meeting (after two interested individuals confirmed the meeting, the first was randomized using a coin flip, and the second was allocated to the other group). Participants were randomized to a daily self-weighing (SW) group or a daily temperature-taking (TT) group by trained graduate research assistants. Temperature taking was chosen as an active control because it is a behavior that can be done daily, takes a comparable amount of time as weighing, and produces a numerical result that is likely affect-neutral. During the initial meeting, consenting and collection of baseline data occurred. Participants in either group were provided with a Wi-Fi-enabled device (scale or thermometer: Nokia brand) for use throughout the study and trained to use their smartphone to answer Ecological Momentary Assessment prompts using the ReTAINE system (Sanford Health, 2021).

Participants were instructed to either weigh themselves or take their temperature first in the morning, daily. Of note, to answer the research question—"does daily self-weighing cause affective lability among emerging adult women?"—the purpose of this study was to assess self-weighing as an *isolated* intervention. As such, no education or directives were provided about weight status or weight management. Self-weighing was recommended to be done unclothed and after voiding or under the same circumstances each day. In addition

to completing their daily behavior, over the course of the 14 days, participants were asked to complete five daily EMA prompts: One upon waking, one after completing their daily behavior, two that were signaled throughout the day (sent via text message at a random time during a 2-h time period), and one before going to bed. The schedule of prompts within a day is depicted in Figure 1 and was not believed to be overly burdensome as it was in accordance with other published studies (e.g. Smyth et al., 2009; Zunker et al., 2011).

After weighing or taking their temperature, data were automatically synched over Wi-Fi and a graph of either weights or temperatures across time was generated and emailed to participants daily (one data point per day: day one's graph included one data point, day two's graph included two data points, one for day one and one for day two). Participants were encouraged to view the trend of the values. Participants were compensated for completing EMAs and their daily behavior with amounts that encouraged the EMAs before and after the daily behavior and bonuses for completing a percentage of EMAs each week. Participants completed all EMAs and daily behaviors and were selected for each lottery (one for completing their daily behavior 6 out of 7 days in a week, another for completing at least 85% of EMAs and their daily behavior); they could earn a total of $106. All procedures were approved by the University's Institutional Review Board. This trial was registered with clinicaltrials.gov. As data collected would be used to power future trials, researchers aimed to recruit a sample size sufficient to have 25 participants in each group, after accounting for study withdrawals and loss to follow-up, in accordance with published recommendations (Whitehead et al., 2016).

Measures

Demographic information including age and race/ethnicity was collected using Redcap. Height and weight were measured using a research-grade stadiometer and scale by trained research assistants according to standard procedures. Two measurements were taken for each variable and if there was a discrepancy of >0.5 cm or >0.3 kg, a third measurement was taken. For height and weight, the two measurements with the smallest difference were averaged. The resulting values were used to calculate body mass index (BMI) kg/m^2.

At each EMA prompt, participants were asked about their mood, stress, and body satisfaction. At the end of each day, participants were additionally asked about engagement in weight-control behaviors.

Specific measures are described below

Mood—EMA prompts included the Positive and Negative Affect Schedule (PANAS) with 10 items describing positive (active, alert, attentive, enthusiastic, excited, inspired, interested, proud, strong, determined) and negative affect (afraid, scared, nervous, jittery, guilty, ashamed, irritable, hostile, upset, distressed), which participants rated on a scale of 1 (*very slightly or not at all*) to 5 (*extremely*) using "in the moment" instructions (i.e. *to what extent you feel this way right now, that is, at the present moment*) (Watson et al., 1988). The PANAS has been used in EMA assessment of affective instability (Solhan et al., 2009).

Stress—General stress and stress related to body weight were assessed at each EMA prompt. General stress was assessed by asking, “How stressed do you feel in this moment?” Stress about weight was assessed by asking, “How stressed do you feel about your weight in this moment?” Response options for both questions were visual analog scales with anchors from *no stress at all* or 0 to *extremely stressed* or 100.

Body satisfaction—Body satisfaction was assessed by asking participants how satisfied they were with different parts of their body: Weight, body shape, waist, hips, thighs, stomach, chest, and overall body fat. Response options for each body part ranged from 1 (*very dissatisfied*) to 5 (*very satisfied*). Each body part was rated separately and then a total score was summed. These items were modified from items used in the Project EAT surveys (Crow et al., 2008).

Weight-control behaviors—At the end of the day, during the final EMA prompt, participants were asked about their weight-control behaviors. Participants were first asked, “Did you do anything today to lose weight or keep from gaining weight?” with response option (*yes/no*). If the participant responded yes, they were then asked if they exercised (if yes, what type, for how long, and level of exertion), ate more fruits and vegetables, ate less high-fat foods, ate less sweets, drank less soda pop, watched portion sizes, fasted, ate very little food, took diet pills, made themselves vomit, used laxatives, used diuretics, used a food substitute (powder/special drink/meal replacement bar), skipped meals, or smoked cigarettes. This question was adapted from Project EAT surveys (Crow et al., 2008).

Analysis

Analyses used an intention to treat approach (McCoy, 2017). Models are described as follows:

Mood—Multilevel mixed models with a random effect for day were run using indices of variability for dependent variables PANAS-Positive and PANAS-Negative. Both individual standard deviation (SD) and mean square of successive difference (MSSD) were used. While SD provides ease of interpretability, MSSD is methodologically preferred for measuring EMA data affective temporal instability (Jahng et al., 2008). MSSD measures the within-subject variance taking into account the change of two consecutive observations as well as the time lapse between these two observations. A first-order autoregressive, or AR(1), model was used to model serial dependency. R (version 4.0.5) was used to calculate effect size using Nakagawa’s R^2 for mixed model (r2_nakagawa) package.

Stress and body satisfaction—Stress, stress about weight, and body satisfaction before and after completion of the assigned daily behavior were analyzed by comparing the difference between pre- and post-EMA surrounding the daily behavior within each participant. A generalized linear mixed model was applied to skewed data using gamma distribution with log link.

Weight-control behaviors—Generalized estimating equations were used with number of weight-control behaviors reported being the dependent variable. This was analyzed in

two ways. First, a generalized estimating equation with negative binomial distribution was used to test group differences for the number of weight-control behaviors reported each day by each participant during the end-of-day EMA. Second, using a generalized estimating equation with a binary logistic response function, the likelihood of each participant reporting any weight-control behaviors each day was compared between groups. Unless otherwise specified, analyses were conducted using the Statistical Package for the Social Sciences version 25.

RESULTS

Baseline characteristics

Sixty-nine participants were included in analyses. The CONSORT diagram, which depicts participant flow, is included as Figure 2. A CONSORT checklist is also available per request. The majority (94.3%) of the sample self-identified as Caucasian/White. Eight (5.7%) participants self-identified as Hispanic/Latino. Almost half (48.6%) of the sample indicated that they were trying to lose weight while about half (47.2%) were trying to stay the same weight or not trying to do anything about their weight. Most (65.7%) of participants had dieted during the past year.

Participants reported a mean age of 20.5 ± 1.0. Average BMI was 23.2 ± 2.9, classifying the sample as “normal” weight according to the World Health Organization BMI categories (World Health Organization, 2010). Three participants (4.3%) had BMIs in the underweight category; 52 participants (75.4%) had BMIs in the normal weight category; 12 participants (17.4%) had BMIs in the overweight category; and two participants (2.9%) had BMIs in the obese category. Measured height and weight correlated highly with self-reported height (.975) and self-reported weight (.989, both $p < .01$) consistent with literature (Olfert et al., 2018) and indicating that participants were aware of their height and weight. Baseline characteristics for demographic variables and dependent variables by group are presented in Table 1. Table 2 displays the frequency of weight-control behaviors reported during the study. Overall EMA compliance was 82%; compliance was 91% on days the participants completed their assigned daily behavior. Compliance fell in the upper range of compliance rates reported by other EMA studies in college students—for example, 55% (Bai et al., 2020) and 85% (Heron et al., 2015).

Mood lability—Multilevel mixed models found that the self-weighing group had a significantly higher within-participant standard deviation for PANAS-Negative than the temperature-taking group ($M = 2.7$, $SE = 0.1$ vs. $M = 2.1$, $SE = 0.1$; $t = 3.41$, $p = .001$, Cohen’s $d = .84$; conditional $R^2 = .33$). Further, the self-weighing group had a significantly higher within-participant MSSD than the temperature-taking group ($M = 23.2$, $SE = 2.2$ vs. $M = 13.5$, $SE = 2.3$; t = 3.009, $p = .003$, Cohen’s $d = .73$; conditional $R^2 = .21$). No significant differences were found between groups for PANAS-Positive SD and MSSD (ps > .05).

Stress—While general stress before and after completion of the daily behavior was not significantly different between groups ($p > .05$), there was a significant interaction between group and stress about weight on days that participants completed their daily behaviors (β

= —2.01 ± 1.0, 95% CI [—3.98, —0.05]; t = —2.02; p = .044). Before weighing, the self-weighing group's average stress about their weight was 19.17 ± 2.48 (95% CI [14.30, 24.04]) and after weighing, the self-weighing group's average stress about their weight was 21.52 ± 2.48 (95% CI [16.65, 26.39]). Before taking their temperature, the temperature-taking group's average stress about their weight was 17.64 ± 2.57 (95% CI [12.60, 22.69]) and after taking their temperature, the temperature-taking group's average stress about their weight was 17.98 ± 2.57 (95% CI [12.93, 23.02]). The interaction indicates that individuals in the self-weighing group's stress about weight increased in the postweighing EMA compared with the preweighing EMA, while individuals in the temperature-taking group's stress about weight remained stable from pre-temperature-taking to post-temperature-taking EMA. This interaction is depicted in Figure 3 (effect size: conditional R^2 = .68).

Body satisfaction—There was a significant interaction between group and body satisfaction on days that participants completed their daily behaviors (β = 0.40 ± 0.20, 95% CI [0.01, 0.79]; t = 2.01; p = .045). Before weighing, the self-weighing group's average body satisfaction score was 22.15 ± 1.25 (95% CI [19.70, 24.60]) and after weighing, the self-weighing group's average body satisfaction score was 21.95 ± 1.25 (95% CI [19.50, 24.40]). Before taking their temperature, the temperature-taking group's average body satisfaction score was 24.00 ± 1.29 (95% CI [21.47, 26.52]) and after taking their temperature, the temperature-taking group's average body satisfaction score was 24.19 ± 1.29 (95% CI [21.67, 26.72]) The interaction indicates that individuals in the self-weighing group's body satisfaction decreased in the postweighing EMA compared with the preweighing EMA, while individuals in the temperature-taking group's body satisfaction remained stable from pre-temperature-taking to post-temperature taking EMA. The interaction between group and body satisfaction is illustrated in Figure 4 (effect size: conditional R^2 = .94).

Weight-control behaviors—Out of a total of 1530 end-of-day EMA responses, 33.8% (N = 517) responded *yes* that they did something that day to lose weight or prevent weight gain. The most frequent behavior was exercise (65.6% of yes responses, N = 340) followed by eating more fruits and vegetables (38%, N = 197) and watching portion size (34.2%, N = 177). Ten participants in the self-weighing did not report any weight-control behaviors and seven participants in the temperature-taking group did not report any weight-control behaviors. Results from generalized estimating equation negative binomial regression analyses indicated that the self-weighing group reported an average of 1.86 ± 0.13 weight-control behaviors daily, while the temperature-taking group reported an average of 2.14 ± 0.20 weight-control behaviors daily (p > .05). For the entire sample, the mean number of weight-control behaviors reported per day was 2.00 ± 1.24 with a range of 1–8. The probability of reporting any weight-control behaviors was 0.30 ± 0.05 in the self-weighing group, while the probability of reporting any weight-control behaviors in the temperature-taking group was 0.38 ± 0.06 (p = .352).

DISCUSSION

The primary purpose of this study was to test whether daily self-weighing as an isolated intervention impacted affective lability in women at risk for disordered eating. Results

showed that negative but not positive affective lability was significantly greater when emerging adult women self-weighed daily compared with an active control condition, taking temperature daily. This study also assessed how daily self-weighing impacted stress, stress about weight, body satisfaction, and weight-control behaviors. Consistent with hypotheses, while general stress was not impacted by daily self-weighing, daily self-weighing caused an increase in stress about weight and a decrease in body satisfaction compared with daily temperature-taking. Effect sizes (Cohen's d and conditional R^2) ranged from .68 to .94. These represent large effect sizes (i.e. greater than .26; Cohen, 1988). Contrary to hypotheses, there were no significant differences in number of or probability of reporting weight-control behaviors on days that participants completed either weighing or temperature taking.

Overall, results are consistent with general findings of Ogden and Whyman (1997) in that daily self-weighing as an isolated intervention negatively impacts emerging adult females' psychological state. The present study extends these findings by using assessing the momentary psychological impact of self-weighing (as opposed to over 2 weeks). While not significantly different between groups, the weight-control strategies reported by participants in this study were most frequently ones that fall under the category of healthy weight-control behaviors (as presented in Quick et al., 2013), suggesting that although the participants randomized to daily weighing may have experienced some stress about weight during their study participation, they were not engaging in unhealthy behaviors during the study period.

Several studies have reported positive psychological outcomes from frequent self-weighing (e.g. Fahey et al., 2018; Frie et al., 2020; Gorin et al., 2019; Zheng et al., 2018) and the findings from the present study must be interpreted with the extant literature in mind. At the same time, several differences are present between studies as discussed below.

In contrast to the findings from the present study, a comparable (age range, weight range) 2019 study concluded that frequent self-weighing was safe for normal weight young adults (Gorin et al., 2019). Several differences between Gorin et al. and the present study should be noted. First, the dependent variables and timeframe of measurement differed. Gorin et al. (2019) measured health-related quality of life, restraint, binge eating, and depression over a timeframe of 2 years. The present study assessed affective lability, stress, stress about weight, body satisfaction, and weight-control behaviors in the moment over a period of 2 weeks. Sec- ond, as the authors noted, self-weighing in their study was enveloped in a small changes or large changes interventions, which included other factors such as step counting and creating caloric deficits, in addition to in-person meetings. It is possible that greater interaction with and attention from study staff protected from any adverse effects. The present study assessed self-weighing in isolation. Gorin and colleagues did find increases in restraint—both flexible and rigid control—and improvements in general health with increases in weighing. Whether restraint is helpful (i.e. sensitizing individuals to environmental food cues, preventing weight gain) or harmful (i.e. is measured as an aspect of eating disorder symptomatology; Fairburn et al., 2008) is a topic of debate within the obesity and eating disorder fields. Finally, as dis- cussed previously, there may be developmental differences between emerging adults and young adults. Gorin et al.'s sample was between the ages of 18 and 35, while the present study, Arnett's theory of emerging

adulthood, and empirical data supporting the theory all apply to a younger age range and a more unstable time of life.

Several qualitative studies have assessed individuals' lived experiences with daily self-weighing. Zheng et al. (2018) conducted focus groups with a predominantly female sample (mean age about 53 years, mean BMI about 34 kg/m^2; Zheng et al., 2018). These individuals participated in a year-long weight loss study that encouraged daily weighing. On average, participants lost over 11% of their starting weight and the vast majority (29/30) of focus group participants strongly endorsed daily weighing. During periods of weight loss, participants reported being motivated to weigh. Weighing relieved beliefs about gaining weight and influenced and allowed them to feel in control but gain or lack of loss when attempting loss was met with frustration. While these qualitative findings provide support for daily self-weighing, they are specific to this middle-aged sample, who participated in a multicomponent treatment trial for which weighing was one part. Additionally, while there were no significant demographic differences between focus group participants and those who did not participate, about 42% of those invited to focus groups participated. It is possible that those with negative reactions to weighing were less likely to participate in the focus group. Further, participants experienced a notable average reduction in weight, which could be associated with positive views of self-weighing since they enrolled in a weight-loss trial. In another study, individuals who were active duty military participated in a year-long weight loss study (Fahey et al., 2018). Approximately half were female, 27% were less than 30 years old, and 98% had BMIs classified as overweight or obese. Weighing was also part of a multicomponent treatment intervention including individual energy intake and expenditure goals, a Wi-Fi scale and weights graphed visually over time, and manualized behavioral weight loss. While compared with baseline, after completing the year-long program, participants found self-weighing to be significantly more positive, helpful, and less frustrating, the belief that weighing promoted anxiety and self-consciousness did not differ. During the weight loss phase of the study, there was a significant difference in perceptions of weighing between those who lost (weighing is helpful, positive, makes them less self-conscious) compared with those whose weight did not change or increased (Fahey et al., 2018). In a third study, individuals over the age of 18 who had BMIs classifying them as overweight or obese participated in an 8-week daily weighing study and used the "think aloud" process to record momentary thoughts during weighing (Frie et al., 2020). Participant's mean age was 36.6, about 60% were female, and average BMI was 29.6 kg/m^2. Participants lost a small amount of weight on average (about 2 lbs.) over the study. Self-weighing elicited emotional reactions, which were stronger in women, some of whom described the reaction as overly intense. While self-weighing led to motivation, and comparison of weight data with a goal, action rarely followed.

While the above studies present support for self-weighing in adults, they included self-weighing as part of a multicomponent intervention. These comprehensive interventions may provide more social support and interaction, which could buffer the negative impact of weighing or promote shifts in perception of weighing. Further, the ability to see weight differently (i.e. in the context of trends instead of a number) may occur over time; these intervention trials occurred over a much longer timeframe than the present study. Many participants lost weight, which may have influenced positive feelings about self-weighing.

In contrast, the present study is concerned with emerging adults' (ages 18–26) *momentary* reactions to weighing, the sample was 100% female and is not a weight loss trial, and the majority of participants had lower BMIs than comparison studies (less than 20% had BMIs ≥25.0 kg/m^2.

Despite the support for daily weighing in samples with ages spanning midlife, there is reason to believe that emerging adult females are especially vulnerable to the negative effects of self-weighing. The scale is the instrument used to measure effectiveness of a diet. In one study, current desire to lose weight, a precipitator of dieting, was the most potent predictor of disordered eating (Barrack et al., 2019). Females are already focused on weight and appearance in adolescence, and data show that this preoccupation along with disordered eating increases throughout emerging adulthood (up to age 25) (Slane et al., 2014). Disordered eating is not only associated with negative psychological states (e.g. Davis-Becker et al., 2014) and poorer quality of life (Wade et al., 2012), it may also lead to a clinical eating disorder. Individuals with eating disorders have a two to over five times greater risk of mortality compared with the general population *after they have treatment* (van Hoeken & Hoek, 2020). Thus, promoting a behavior that focuses on weight in a population that already ascribes their weight and shape with their self-worth seems particularly unnecessary.

Limitations of the present study must be addressed. Typical challenges with EMA (e.g. Burke et al., 2017) were also a barrier in this study: Compliance was not perfect and participants needed to be incentivized to fill out assessments. Given that the sample was homogenous in terms of gender, race, and ethnicity and consisted of college students, generalizability to other groups is not possible. Further limiting external validity, sampling bias may have been present as recruitment reached those attending classes, checking campus email, and/or attending highly populated campus areas. While these limitations exist, this study was novel in that it is the first to use EMA to assess daily weighing and psychological outcomes in a sample that may be particularly vulnerable to weight-control messaging. The randomized design allows for causal inference, specifically about the momentary effects of daily self-weighing.

In conclusion, in contrast to the assertion that daily self-weighing is safe for young adults, this study found that daily self-weighing caused momentary negative psychological effects in emerging adult women. At the same time, self-weighing was not found to cause increases in problematic weight-control behaviors. In the context of the published literature, it is possible that self-weighing as part of an intervention with additional components (behavioral weight management, social support) would operate differently. Future research has yet to determine whether self-weighing as part of a multicomponent educational intervention focusing on the relationship between self and weight could help emerging adult women's reaction to the scale and promote healthful psychological attitudes around weight and weighing. Based on the findings from this study, caution is advised when considering daily or frequent weighing as an isolated weight-control prevention strategy across broad populations that may include emerging adult women as impact may differ depending on subpopulation.

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DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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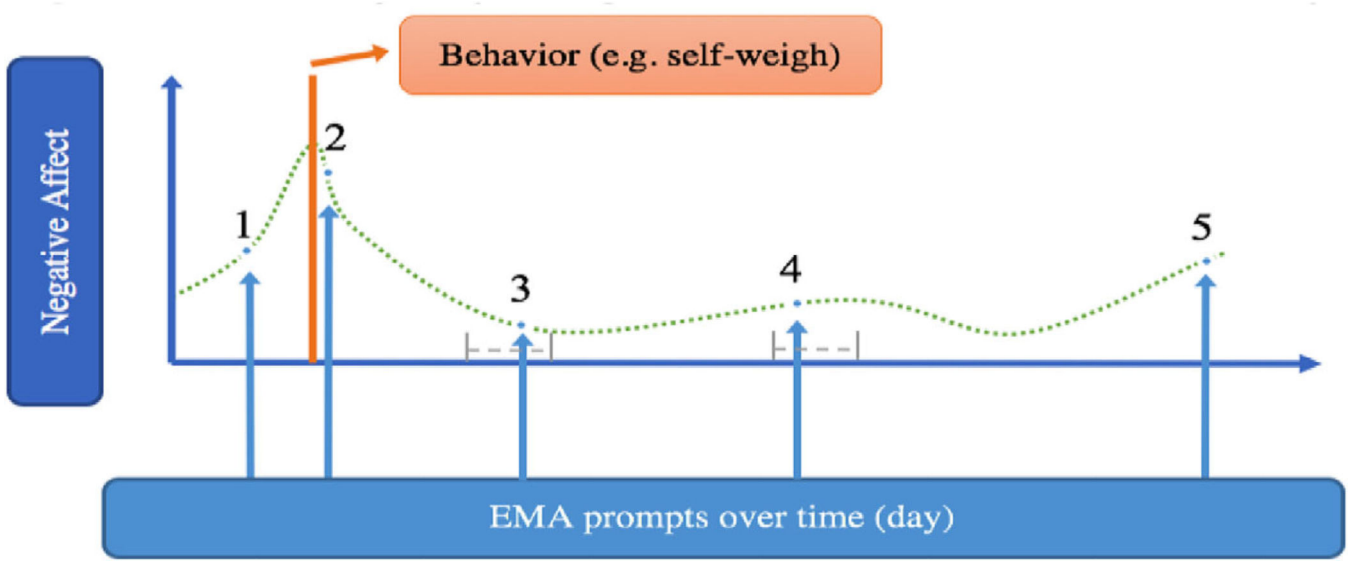

FIGURE 1.
Schedule of EMA prompts over the course of 1 day.

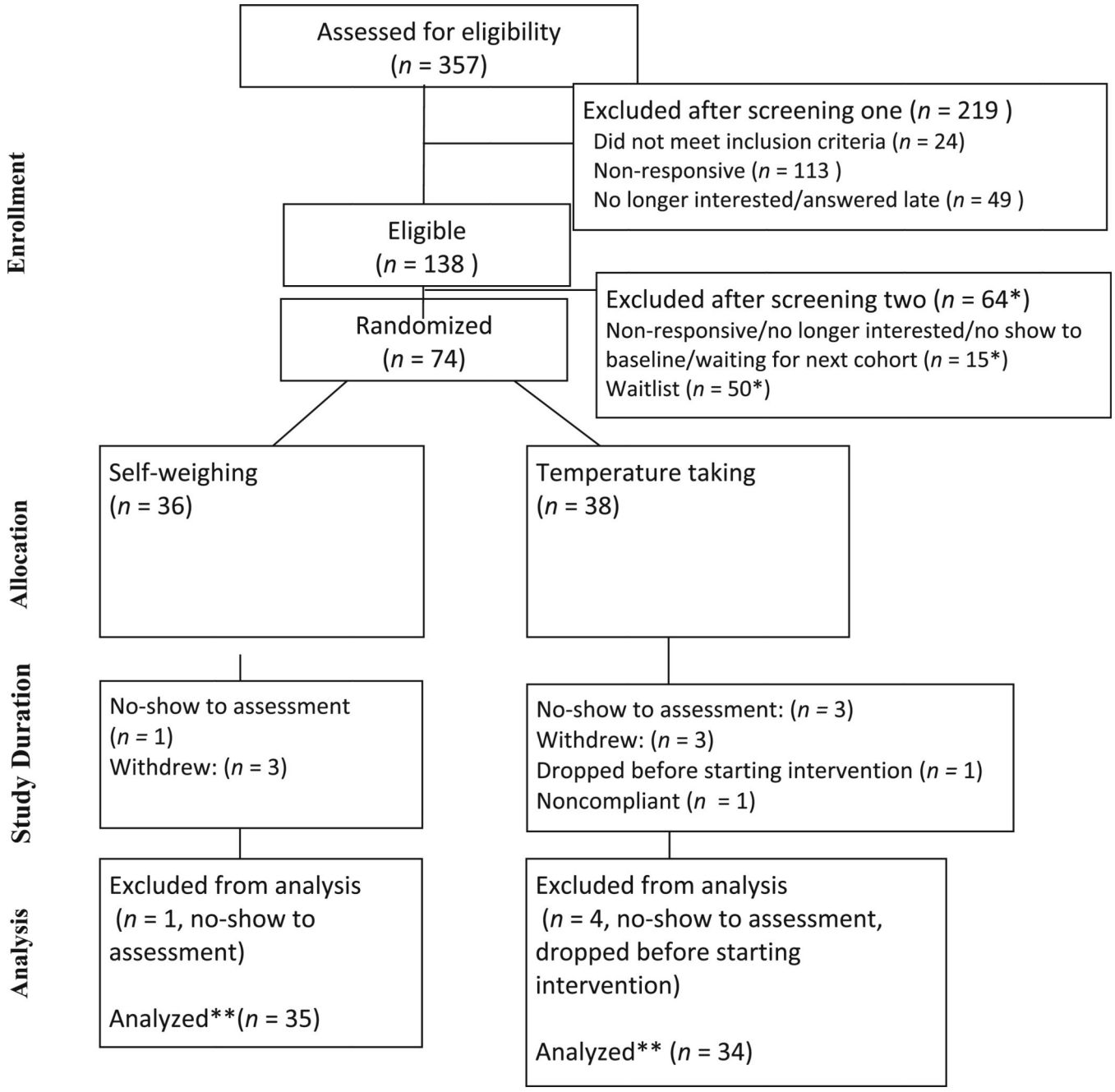

FIGURE 2.

CONSORT Flow Diagram. *Numbers do not sum exactly because *n* = 3 participants waited to participate from the first cohort to the second; *n* = 1 may have become non-responsive or not interested, resulting in being counted twice.

FIGURE 3.
Mean EMA stress about weight pre- and post-daily intervention behavior (self-weighing or temperature-taking). Note. Shaded bands represent standard errors for the corresponding color's results.

FIGURE 4.

Mean EMA body satisfaction pre- and post-daily intervention behavior (self-weighing or temperature-taking). Note. Shaded bands represent standard errors for the corresponding color's results.

TABLE 1

Baseline characteristics and dependent variables by randomization group.

	Self-weighing		Temperature-taking		
Baseline characteristic	***n***	**%**	***n***	**%**	***p* for difference**
Race					
American Indian/Alaska native (yes)	0	0	0	0	
Asian (yes)	3	8.57	2	5.88	.667
Black/African American (yes)	0	0	1	2.94	.307
Native Hawaiian/other Pacific Islander (yes)	0	0	0	0	
White (yes)	32	91.43	33	97.06	.317
Ethnicity					
Hispanic (yes)	6	17.14	2	5.88	.144
Are you currently trying to:					
Lose weight	13	37.14	21	61.76	.227
Stay the same weight	12	34.28	8	23.53	
Gain weight	2	5.71	1	2.94	
Not trying to do anything about my weight	8	22.86	4	11.76	
Dieted to lose weight in past year (yes)	22	62.86	24	70.59	.432
Baseline characteristic	**Self-weighing**		**Temperature-taking**		***p* for difference**
	n	**M (SD)**	***n***	**M (SD)**	
Age (years)	34	20.45 (0.86)	32	20.48 (1.05)	.898
Body mass index (kg/m^2)	35	22.80 (2.69)	34	23.66 (3.14)	.223
Positive affect[a]	26	22.57(9.73)	25	24.96(7.08)	.033
Negative affect[a]	26	15.92(6.98)	25	14.88(4.81)	.030
Stress[a]	26	28.43(21.37)	25	31.49(21.57)	.458
Stress about weight[a]	26	21.47(20.05)	25	24.92(24.73)	.320
Body satisfaction[a]	24	23.71(4.48)	25	22.48(6.42)	.076

[a]Baseline value was taken from the first EMA recording, the morning of the first day of the study prior to the intervention behavior.

TABLE 2

Frequency of weight-control behaviors by randomization group.

	Self-weighing		Temperature-taking	
Weight-control behavior[a]	***n***	**%**	***n***	**%**
Exercise	134	5.6	107	5.1
Ate more fruits & vegetables	69	2.9	88	4.2
Ate less high-fat foods	18	0.7	48	2.3
Ate less sweets	35	1.5	52	2.5
Drank less soda pop	10	0.4	33	1.6
Watched my portion sizes	57	2.4	72	3.5
Fasted	0	0	4	0.2
Ate very little food	25	1.0	17	0.8
Took diet pills	0	0	0	0
Made myself vomit	0	0	0	0
Used laxatives	0	0	0	0
Used diuretics	0	0	0	0
Used food substitute	4	0.2	5	0.2
Skipped meals	32	1.3	5	0.2
Smoked cigarettes	2	0.1	0	0

[a]Participants could select any weight-control behaviors they used each day after answering “yes” to “Did you do anything today to lose weight or keep from gaining weight?”