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 JOURNAL OF  
 ADOLESCENT  
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Original article

## Prevalence of Adolescents' Self-Weighing Behaviors and Associations With Weight-Related Behaviors and Psychological Well-Being

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Article history: Received September 10, 2012; Accepted November 19, 2012

Keywords: Self-weighing; Weight monitoring; Weight control behaviors; Adolescents

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 A B S T R A C T

**Purpose:** To examine the relationships between self-weighing frequency, and weight-related behaviors and psychological well-being in a population-based sample of adolescents.

**Methods:** This study compared weight-related behaviors between infrequent and frequent self-weighers, stratified by weight status and gender. Data were from Project EAT 2010 (Eating and Activity in Teens), a population-based study of 2,778 adolescents.

**Results:** Approximately 14% of girls and boys weighed themselves frequently (weekly or more). In comparison to girls who were infrequent self-weighers, girls who were frequent self-weighers were more likely to diet, engage in unhealthy and extreme weight control behaviors, use unhealthy muscle-enhancing behaviors, and have lower self-esteem and greater body dissatisfaction. In comparison to boys who were infrequent self-weighers, boys who were frequent self-weighers were more likely to diet, engage in unhealthy and extreme weight control behaviors, use unhealthy muscle-enhancing behaviors, and report greater depressive symptoms. Among overweight adolescents, in addition to being associated with these harmful outcomes, frequent self-weighing was associated with the use of healthy weight control behaviors and with higher levels of moderate-to-vigorous activity.

**Conclusions:** Findings indicate that adolescents who frequently self-weigh themselves are at increased risk for a number of problematic health behaviors and poorer psychological outcomes. For overweight adolescents, frequent self-weighing was additionally associated with a number of positive outcomes. Based upon these findings, any recommendations for weight monitoring should be made cautiously; all adolescents, including overweight adolescents, should be advised not to engage in frequent self-weighing behaviors. Furthermore, any adolescents engaging in frequent self-weighing behaviors should be monitored for problematic outcomes.

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 IMPLICATIONS AND  
 CONTRIBUTION

Findings suggest that any recommendations for weight monitoring should be made cautiously; all adolescents, including overweight adolescents, should be advised not to engage in frequent self-weighing behaviors. Furthermore, any adolescents engaging in frequent self-weighing behaviors should be monitored for problematic outcomes.

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 Financial Disclosure: This study was supported by Grant Number R01HL084064 (PI: Dianne Neumark-Sztainer) and Grant Number R01HL093247 (PI: Dianne Neumark-Sztainer) from the National Heart, Lung, and Blood Institute. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Heart, Lung, and Blood Institute or the National Institutes of Health. Supported also by National Research Service Award (NRSA) in Primary Medical Care, grant no. T32HP22239 (PI: Borowsky), Bureau of Health Professions, Health

Resources and Services Administration, Department of Health and Human Services.

Conflict of Interest: The authors have no conflict of interest.

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The high prevalence of overweight and obesity is a public health concern. More than two-thirds of the U.S. population and a third of adolescents are either overweight or obese [1], and many of these individuals struggle with weight management [2]. Adults who experience success at losing, maintaining, or preventing weight gain (39%) report using self-weighing as a weight control strategy [3,4]. Healthcare providers and researchers also have encouraged self-monitoring one's weight as a weight control strategy to prompt behavior change in their overweight and obese patients [5,6]. However, it still remains unclear whether self-weighing is appropriate for all subgroups of the population, especially young people and those who are not overweight or previously overweight [4]. For instance, increased self-weighing has been associated with negative body image, greater depressive symptoms, and engagement in unhealthy weight-related behaviors (e.g., use of diet pills, laxatives) and unhealthy muscle-enhancing behaviors (e.g., steroid use) among young adults in the general population [7]. Additionally, in a 5 year longitudinal study, increased self-weighing predicted a higher frequency of binge eating and unhealthy weight control behaviors among female adolescents [8]. In contrast, in a clinical population of overweight adolescents seeking weight loss treatment, increased self-weighing was found to be associated with healthy weight control behaviors (e.g., increased fruit and vegetable intake and engagement in physical activity) [9].

Thus, the few studies that have investigated self-weighing behaviors and associations with weight-related behaviors and psychological well-being among young people have been somewhat mixed, with one study suggesting that self-weighing is helpful [9] while others suggest that it is harmful [7,8]. Mixed findings from these previous studies may be due to variations in the racial/ethnic make-up and intent-to-treat (clinical vs. community) populations studied, or a result of differences in the measures used to assess self-weighing frequency. For example, in the 5 year longitudinal study from Project EAT 2010 (Eating and Activity in Teens), self-weighing was measured as an agreement with a cognitive perception variable statement ("I weigh myself often") and not a behavioral measure of self-weighing frequency [8]. Additionally, few studies have examined associations between self-weighing frequency and a number of healthy and unhealthy weight-related behaviors and psychological well-being outcomes by weight status and gender. In particular, there is limited research examining associations of self-weighing frequency and use of muscle-enhancing substances (e.g., steroids) among adolescents, a behavior that has increased in prevalence among young people over the last decade [10,11] and causes deleterious psychological and physical side effects with continued use [10].

A better understanding of how the frequency of self-weighing may influence weight-related behaviors and psychological well-being in different subgroups of adolescents is warranted. Thus, the purpose of this study is to build upon the growing body of research on self-weighing behaviors. Specifically, this study examines the prevalence of self-weighing in overweight and non-overweight adolescents across sociodemographic associations. This study further includes a comprehensive examination of associations between self-weighing frequency and healthy and unhealthy weight control behaviors, binge eating, muscle-enhancing behaviors, and various measures of psychological well-being, across gender and weight status. We hypothesized that adolescents who frequently weigh themselves would have an increased prevalence of all of these outcomes. It was determined

*a priori* to stratify findings by weight status and gender based on previous research showing differences in frequency of self-weighing [12] and prevalence of disordered eating [13] in non-overweight and overweight females and males.

## Methods

### Study design and population

Data are from EAT 2010, a cross-sectional research study that assessed dietary intake, physical activity, weight control behaviors, weight status, and factors associated with these outcomes in an ethnically and racially diverse sample of adolescents. Adolescents ( $n = 2,793$ ; 53.2% girls) with a mean age of 14.4 years ( $SD = 2$ ) from 20 public middle and high schools in the Minneapolis/St. Paul metropolitan area of Minnesota completed surveys and had their height and weight measured. Trained research staff administered surveys and measured adolescents' height and weight during selected health, physical education, and science classes. Measurements were completed in a private area and surveys were administered during two class periods that were typically 45–50 minutes. Participants received a \$10 gift card as an incentive. All study procedures were approved by the University of Minnesota Institutional Review Board Human Subjects Committee and by the research boards of the participating school districts. On the days of survey administration, among adolescents who were at school, 96.3% had parental consent and chose to participate.

### Survey development and measures

The 235-item EAT 2010 survey was developed through a series of pilot tests and expert reviews [14,15]. Test-retest reliability of survey items was examined over a 1-week period in a sample of 129 adolescents. Scale psychometrics (e.g., internal consistency of items) were based on the full sample of adolescents ( $N = 2,793$ ).

*Self-weighing frequency.* The outcome variable of interest, self-weighing frequency, was assessed by asking "How often do you weigh yourself?" Responses included: "less than 1 time per month," "every month," "a few times per month," "every week," "a few times per week," "every day," and "more than one time per day," (test-retest  $r = .67$ ). This question was adapted from a previous study to include additional response options based on pilot group feedback [6]. Self-weighing frequency was dichotomized into frequent self-weighing (self-weighing "every week," "a few times per week," "every day," or "more than once a day") and infrequent self-weighing (self-weighing "less than once a month," "every month," "a few times per month") as done in a previous study of adolescents [9].

*Weight status.* Trained research staff measured adolescent's height and weight using standardized equipment and procedures. Height was measured without shoes and was recorded to the nearest .1 cm. Weight was measured after having students remove their shoes and heavy outerwear; weight was measured using a previously calibrated portable digital scale and was recorded to the nearest .5 lb. Weight status categories were created using sex-specific Body Mass Index (BMI)-for-age percentiles derived from the 2000 Centers for Disease Control (CDC) Growth Charts [16]. Normal weight was defined as BMI

<85th percentile; overweight as BMI  $\geq$ 85th percentile and <95th percentile; and obese as BMI  $\geq$ 95th percentile. In this study BMI percentiles were dichotomized to BMI <85th percentile (non-overweight; includes underweight adolescents) and BMI  $\geq$ 85th percentile (overweight).

**Dieting behavior.** Dieting was assessed with the question “How often have you gone on a diet during the last year? By ‘diet’ we mean changing the way you eat so you can lose weight?” As in past analyses [17], responses were dichotomized to identify non-dieters “never” and dieters “1 to 4 times,” “5 to 10 times,” “I am always dieting” (test-retest agreement = 82%).

**Healthy weight control behaviors.** Healthy weight control behaviors were assessed by asking participants how frequently they had done any of the following behaviors in the past year in order to lose weight or keep from gaining weight: “exercised,” “ate more fruits and vegetables,” “ate less high-fat foods,” “ate less sweets,” “drank less soda pop,” “watched portion sizes.” Responses for each were “never,” “rarely,” “sometimes,” or “on a regular basis” (test-retest agreement = 91%). To approximate normal distributions for analysis, the cutoff points for healthy weight control behaviors were determined by distribution medians. That is, participants who reported using four or more healthy weight control behaviors sometimes or on a regular basis were categorized as using healthy weight control behaviors.

**Unhealthy and extreme weight control behaviors.** Unhealthy weight control behaviors were assessed by asking participants if they had done any of the following behaviors in order to lose weight or keep from gaining weight in the past year: “fasted,” “ate very little food,” “used food substitutes,” “skipped meals,” and “smoked cigarettes” with responses being “yes” or “no.” If participants responded “yes” to one or more of these behaviors they were categorized as engaging in unhealthy weight control behaviors (test-retest agreement for each behavior  $\geq$ 85%).

Extreme weight control behaviors were assessed by asking participants if they had done any of the following behaviors in order to lose weight or keep from gaining weight in the past year: “taking laxatives,” “taking diuretics,” “using diet pills” and “self-induced vomiting” with responses being “yes” or “no.” If participants responded “yes” to one or more of these behaviors they were categorized as using extreme weight control behaviors (test-retest agreement for each behavior  $\geq$ 98%). Both the unhealthy and extreme weight control measures have been used in previous studies and found to be associated with expected variables such as body dissatisfaction, weight concerns, and changes in weight over time [18–21].

**Muscle enhancing behaviors.** Muscle-enhancing behaviors were assessed with the question: “How often have you done each of the following things in order to increase your muscle size or tone during the past year? Five behaviors followed this question. Behaviors categorized as general muscle-enhancing behaviors included “changed my eating” and “exercised more.” Behaviors categorized as unhealthy included: “used protein powder or shakes,” “used steroids,” and “used any other muscle-building substance (such as creatine, amino acids, hydroxyl methylbutyrate, dehydroepiandrosterone (DHEA), or growth hormones).” Response options for each behavior were: “never,” “rarely,” “sometimes” and “often.” This question was adapted from previous instruments [22–24]. Participants who reported

using these behaviors “sometimes” or “often” were categorized as having used general (test-retest for each behavior  $r \geq .60$ ) and unhealthy muscle-enhancing (e.g., used protein powder or shakes test-retest  $r = .52$ ) behaviors, respectively.

**Binge eating.** Binge eating with loss of control was assessed with two questions: “In the past year, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge-eating)?” and “During the times when you ate this way, did you feel you couldn’t stop eating or control what or how much you were eating?” (yes/no) for each question; test-retest agreement = 90% [first question] and 75% [second question].

**Physical activity.** Moderate-to-vigorous physical activity was assessed using two items adapted from the modified Leisure Time Exercise Questionnaire [25]. Participants were asked to separately report how many hours they engaged in moderate activities (e.g., walking quickly; test-retest  $r = .54$ ) and strenuous activities (e.g., biking fast; test-retest  $r = .73$ ) in a usual week; total weekly hours were computed (score range: 0–16).

**Depressive symptoms.** Depressive symptoms were assessed by asking participants over the past 12 months, how often they have been bothered or troubled by six different symptoms of depression (e.g., hopelessness, worry) with responses being “not at all,” “somewhat,” and “very much.” This scale was adapted from Kandel and Davies [26]. Higher scores indicate greater depression (score range: 10 to 30, Cronbach’s alpha = .83, test-retest  $r = .75$ ).

**Self-esteem.** Self-esteem was assessed by asking participants to indicate how strongly they agreed with six statements (e.g., “At times I think that I am no good at all.”) that were adapted from the Rosenberg Self-Esteem scale [27]. Responses for each statement ranged on a 4-point scale from “strongly agree” to “strongly disagree.” All items were summed for an overall score with higher scores indicating higher self-esteem (score range: 6 to 24, Cronbach’s alpha = .77, test-retest  $r = .69$ ).

**Body satisfaction.** Participants were asked to rate how satisfied they were with seven various body parts related to body weight and shape (i.e., weight, body shape, waist, hips, thighs, stomach, overall body fatness) [28]. Responses ranged from “very dissatisfied” to “very satisfied” on 5-point scale for each body feature. All items were summed for an overall score, with higher scores indicating higher overall body satisfaction (score range: 7 to 28; Cronbach’s alpha = .95; test-retest  $r = .73$ ).

**Socio-demographic variables.** Participant gender, age, ethnic/racial identity, and socioeconomic status were self-reported. Participants were asked to complete two questions that assessed their race/ethnicity. The first question asked, “Do you think of yourself as... (you may choose more than one).” Responses included “white,” “black or African-American,” “Hispanic or Latino,” “Asian-American,” “Native Hawaiian or Pacific Islander,” “American Indian or Native American,” and “Other.” The racial/ethnic background of participants was re-categorized into the following groups: 18.9% white, 28.9% black or African-American, 16.9% Hispanic or Latino, 19.9% Asian-American, and 23.8% mixed or other. Socioeconomic status was based on several variables, including the highest education level completed by either parent, eligibility for public assistance, eligibility for free or reduced-cost school meals, and parental employment status [29].

**Table 1**  
Frequency of self-weighing among non-overweight and overweight girls and boys

Characteristic	Girls		Boys	
	Non-overweight (N = 907) % (N)	Overweight (N = 573) % (N)	Non-overweight (N = 754) % (N)	Overweight (N = 544) % (N)
Self-weighing Frequency <sup>a</sup>				
Less than once a month	57.7 (523)	50.3 (288)	58.5 (441)	54.6 (297)
Every month	14.1 (128)	17.1 (98)	13.9 (105)	18.6 (101)
A few times per month	14.7 (133)	17.6 (101)	14.1 (106)	13.4 (73)
Every week	5.1 (46)	6.1 (35)	4.9 (37)	3.3 (18)
A few times per week	5.0 (45)	4.4 (25)	5.7 (43)	6.1 (33)
Every day	1.8 (16)	3.7 (21)	2.4 (18)	3.1 (17)
More than once a day	1.8 (16)	.9 (5)	.5 (4)	.9 (5)

<sup>a</sup> Infrequent self-weighers = a few times per month or less; Frequent self-weighers = weekly or a few times per week or more.

### Data analysis

All analyses were stratified by gender and weight status (overweight [BMI percentile  $\geq 85$ th] vs. non-overweight). Fifteen participants were excluded from analyses due to missing reports of self-weighing frequency leaving a total of 2,788 eligible participants. We examined differences in self-weighing frequency (infrequent vs. frequent self-weighers) by sociodemographic characteristics (i.e., race/ethnicity, socioeconomic status, age) using chi-square tests and *t*-tests. We estimated the ratio of weight-related behaviors among frequent weighers relative to infrequent weighers using Poisson regression with robust variance estimates [30]. Prevalence ratios (PRs) and 95% confidence intervals that were adjusted for sociodemographic characteristic differences (i.e., age, race/ethnicity, and socioeconomic status) were obtained from the Poisson regression. Differences in physical activity, depression, self-esteem, and body satisfaction were estimated using linear regression. All analyses were conducted using SAS version 9.2 (SAS Institute, Inc; Cary, NC).

## Results

### Frequency of self-weighing

Among overweight adolescents ( $n = 1,117$ ), 15% of girls and 13.4% of boys were categorized as frequent self-weighers, and

among non-overweight adolescents ( $n = 1,661$ ), 13.6% of girls and 13.5% of boys were categorized as frequent self-weighers (Table 1). Among both overweight and non-overweight adolescents, self-weighing frequency did not differ significantly by socioeconomic status (Table 2) and age (data not shown). However, there were significant differences in self-weighing by race/ethnicity among overweight girls and non-overweight boys (see Table 2).

### Girls: Associations between self-weighing frequency and weight-related behaviors and psychological well-being

Regression analyses controlling for age, socioeconomic status and race/ethnicity, indicate both non-overweight and overweight frequent self-weighers were significantly more likely to follow a diet, engage in unhealthy and extreme weight control behaviors, use unhealthy muscle-enhancing behaviors, and have lower self-esteem and greater dissatisfaction with their bodies compared to infrequent self-weighers (Table 3). For example, non-overweight frequent self-weighers were 3.3 times and overweight frequent self-weighers were 2.5 times more likely to use extreme weight control behaviors compared to infrequent self-weighers. Among non-overweight girls, frequent self-weighers were also significantly more likely to binge eat (PR = 1.75, CI = 1.04 to 2.95) compared to infrequent self-weighers. Additionally, among overweight girls, frequent self-weighers were significantly more likely to engage in healthy weight control behaviors and general muscle-

**Table 2**  
Frequent self-weighing (%) by socio-demographics, among non-overweight and overweight girls and boys

Characteristic	Girls		Boys	
	Non-overweight FW (N = 123)	Overweight FW (N = 87)	Non-overweight FW (N = 102)	Overweight FW (N = 73)
Socioeconomic Status				
Low	11.2	12.7	11.6	12.5
Low-middle	16.9	19.5	11.1	14.9
Middle	15.7	15.1	17.5	12.9
Middle-high	12.6	19.6	13.6	6.6
High	11.1	9.5	15.1	17.2
<i>p</i> <sup>a</sup>	.35	.35	.46	.53
Race/ethnicity				
White	16.1	23 <sup>a</sup>	14.5 <sup>a</sup>	9.6
Black or African-American	11.1	11.5 <sup>b</sup>	13.9 <sup>a</sup>	15.8
Hispanic or Latino	10.3	6.4 <sup>b</sup>	4.6 <sup>b</sup>	8.5
Asian-American	15.4	21.3 <sup>a</sup>	18.1 <sup>a</sup>	14.5
Mixed or other	15.7	19.7 <sup>a</sup>	14.8 <sup>a</sup>	15.9
<i>p</i> <sup>a</sup>	.33	<.01	.04	.34

Frequent self-weighers (FW) = weekly or a few times per week or more.

Lowercase superscript letters followed by differing letters in a column indicate significant differences in self-weighing frequency by race/ethnicity as determined by post-hoc contrast tests only when there was an overall statistical significance.

<sup>a</sup> Chi-square (df = 4); *p*-values represent within weight classification differences by socio-demographic characteristic.

**Table 3**

Prevalence of weight-related behaviors and psychological well-being by self-weighing behaviors among non-overweight and overweight adolescent girls

Behaviors <sup>b</sup>	Non-overweight girls (N = 907)			Overweight girls (N = 573)		
	IFW <sup>a</sup> (N = 784)	FW (N = 123)	PR (95% CI) <sup>c</sup>	IFW (N = 487)	FW (N = 86)	PR (95% CI) <sup>c</sup>
Follows a diet (%)	29	53.4	<b>1.83 (1.50, 2.23)</b>	63.1	91.7	<b>1.43 (1.29, 1.59)</b>
Healthy WCBs (%) (e.g., ate less sweets)	49.7	56.8	1.11 (.94, 1.32)	72.8	88.1	<b>1.18 (1.07, 1.30)</b>
Unhealthy WCBs (%) (e.g., fasting)	36.1	53.8	<b>1.49 (1.24, 1.80)</b>	63.8	83.3	<b>1.28 (1.13, 1.45)</b>
Extreme WCBs (%) (e.g., used laxatives)	2.9	9.4	<b>3.25 (1.59, 6.64)</b>	9.1	21.4	<b>2.52 (1.53, 4.13)</b>
Binge eating (%)	7.3	12.9	<b>1.75 (1.04, 2.95)</b>	10.9	18.1	1.58 (.92, 2.71)
General muscle-enhancing behaviors (%)	62.2	71.2	1.12 (.99, 1.27)	76.9	86.9	<b>1.13 (1.03, 1.25)</b>
Unhealthy muscle-enhancing behaviors (%)	6.3	12.7	<b>1.89 (1.11, 3.24)</b>	8.5	17.9	<b>2.56 (1.46, 4.48)</b>
	<b>Mean (SE)</b>	<b>Mean (SE)</b>	<b>Mean Diff (95% CI)<sup>d,e</sup></b>	<b>Mean (SE)</b>	<b>Mean (SE)</b>	<b>Mean Diff (95% CI)<sup>d,e</sup></b>
Moderate-to-vigorous activity (hour/wk)	4.3 (.2)	5.8 (.4)	-.50 (-1.36, .35)	5.1 (.3)	6.6 (.5)	<b>-1.44 (-2.46, -.42)</b>
Depressive symptoms	10.5 (.1)	10.9 (.3)	-.39 (-.95, .17)	10.8 (.2)	11.7 (.4)	<b>-.89 (-1.62, -.17)</b>
Self-esteem	18 (.2)	17.3 (.3)	<b>.71 (.00, 1.42)</b>	17.6 (.2)	15.8 (.4)	<b>1.77 (.94, 2.60)</b>
Body satisfaction	24.6 (.3)	22.5 (.7)	<b>2.06 (.61, 3.52)</b>	17.5 (.5)	15.1 (.9)	<b>2.43 (.64, 4.21)</b>

PR = prevalence ratio; SE = standard error; WCBs = weight control behaviors.

<sup>a</sup> Infrequent self-weighers (IFW) = a few times per month or less; Frequent self-weighers (FW) = weekly or a few times per week or more.<sup>b</sup> N's may differ because of missing data among self-reported behaviors.<sup>c</sup> Poisson regression analyses controlling for age, socioeconomic status, and race/ethnicity with infrequent self-weighing as reference group. Bolded odds ratio (95% CI) and *p*-values indicates significance (*p* < .05).<sup>d</sup> Mean difference is the beta coefficient from the linear regression analysis.<sup>e</sup> Linear regression analyses controlling for age, socioeconomic status, and race/ethnicity.

enhancing behaviors, increased moderate-to-vigorous activity, and reported more depressive symptoms compared to infrequent self-weighers.

#### Boys: Associations between self-weighing frequency and weight-related behaviors and psychological well-being

Among boys, non-overweight and overweight frequent self-weighers were significantly more likely to follow a diet, engage in unhealthy and extreme weight control behaviors, use unhealthy muscle-enhancing behaviors, and report greater depressive symptoms compared to infrequent self-weighers (Table 4). For example, non-overweight frequent self-weighers were 4.4 times and overweight frequent self-weighers were 3.5 times more likely to engage in extreme weight control behaviors compared to infrequent self-

weighers. Among non-overweight boys, frequent self-weighers were also significantly more likely to binge eat, engage in general muscle-enhancing behaviors, and have lower self-esteem compared to infrequent self-weighers. Additionally, among overweight boys, frequent self-weighers were significantly more likely to engage in healthy weight control behaviors and increased moderate-to-vigorous activity compared to infrequent self-weighers.

## Discussion

This study examined the relationship between self-weighing frequency and weight-related behaviors and psychological well-being among a racially and ethnically diverse population-based sample of non-overweight and overweight adolescents. Frequent self-weighing was associated with a number of

**Table 4**

Prevalence of weight-related behaviors and psychological well-being by self-weighing behaviors among non-overweight and overweight boys

Behaviors <sup>b</sup>	Non-overweight boys (N = 754)			Overweight boys (N = 544)		
	IFW <sup>a</sup> (N = 652)	FW (N = 102)	PR (95% CI) <sup>c</sup>	IFW (N = 471)	FW (N = 73)	PR (95% CI) <sup>c</sup>
Follows a diet (%)	13.3	26.8	<b>2.21 (1.50, 3.24)</b>	50.2	71.4	<b>1.41 (1.17, 1.68)</b>
Healthy WCBs (%) (e.g., ate less sweets)	42.7	47.4	1.12 (.89, 1.41)	66.4	85.7	<b>1.28 (1.13, 1.44)</b>
Unhealthy WCBs (%) (e.g., fasting)	21.9	34.4	<b>1.60 (1.60, 2.20)</b>	54	74.2	<b>1.37 (1.14, 1.63)</b>
Extreme WCBs (%) (e.g., used laxatives)	1.8	8.3	<b>4.35 (1.81, 10.45)<sup>d</sup></b>	4.0	14.5	<b>3.46 (1.59, 7.54)<sup>d</sup></b>
Binge eating (%)	2.9	11.5	<b>3.84 (1.87, 7.86)</b>	9.1	12.7	1.39 (.66, 2.89) <sup>d</sup>
General muscle-enhancing behaviors (%)	75.4	86.6	<b>1.12 (1.03, 1.22)</b>	88.3	93.7	1.06 (.98, 1.14)
Unhealthy muscle-enhancing behaviors (%)	16.6	31.2	<b>1.79 (1.26, 2.55)</b>	17.5	39.7	<b>2.27 (1.59, 3.25)</b>
	<b>Mean (SE)</b>	<b>Mean (SE)</b>	<b>Mean Diff (95% CI)<sup>e,f</sup></b>	<b>Mean (SE)</b>	<b>Mean (SE)</b>	<b>Mean Diff (95% CI)<sup>e,f</sup></b>
Moderate-to-vigorous activity (hour/wk)	6.9 (.2)	7.6 (.5)	-.67 (-1.74, .40)	6.4 (.3)	8 (.6)	<b>-1.63 (-2.83, -.42)</b>
Depressive symptoms	9.2 (.2)	10 (.3)	<b>-.78 (-1.36, -.21)</b>	9.5 (.2)	10.6 (.4)	<b>-1.04 (-1.80, -.28)</b>
Self-esteem	18.8 (.2)	17.7 (.4)	<b>1.14 (.42, 1.87)</b>	18.0 (.2)	17.5 (.4)	.49 (-.36, 1.35)
Body satisfaction	26.0 (.3)	24.7 (.3)	1.22 (-.32, 2.75)	20.2 (.4)	21.2 (1)	-1.05 (-3.01, .91)

PR = prevalence ratio; SE = standard error; WCBs = weight control behaviors.

<sup>a</sup> Infrequent self-weighers (IFW) = a few times per month or less; Frequent self-weighers (FW) = weekly or a few times per week or more.<sup>b</sup> N's may differ because of missing data among self-reported behaviors.<sup>c</sup> Poisson regression analyses controlling for age, socioeconomic status, and race/ethnicity with infrequent self-weighing as reference group. Bolded odds ratio (95% CI) and *p*-values indicates significance (*p* < .05).<sup>d</sup> Socioeconomic status not controlled for in Poisson regression analysis.<sup>e</sup> Mean difference is the beta coefficient from the linear regression analysis.<sup>f</sup> Linear regression analyses controlling for age, socioeconomic status and race/ethnicity.

unhealthy behaviors and poorer psychological well-being. Specifically, adolescent girls who weigh themselves frequently were significantly more likely to follow a diet, engage in unhealthy and extreme weight control behaviors, use unhealthy muscle-enhancing behaviors, and have lower self-esteem and greater body dissatisfaction than adolescent girls who weighed less often. Adolescent boys who weighed themselves at least weekly were significantly more likely to follow a diet, engage in unhealthy and extreme weight control behaviors, use unhealthy muscle-enhancing behaviors, and report greater depressive symptoms. Only overweight adolescent girls and boys who weighed themselves frequently were found to also report engaging in significantly more healthy weight control behaviors and higher levels of moderate-to-vigorous physical activity than infrequent self-weighers. Our findings suggest that any recommendations for weight monitoring should be made cautiously; all adolescents, including overweight adolescents, should be advised not to engage in frequent self-weighing behaviors.

These findings support previous research indicating positive associations between self-weighing frequency and poor psychological well-being (i.e., depression, low self-esteem, negative body image) in young adults and adults [7,12,31,32]. Interestingly, among boys, increased self-weighing frequency was not associated with body dissatisfaction compared to girls. Recent research in college students has found similar findings [12]. For instance, among men more frequent self-weighing was not related to lower body and appearance satisfaction; instead, more frequent self-weighing was related with health and fitness orientation [12]. Whereas among women, more frequent self-weighing was related to greater overweight preoccupation and appearance orientation [12]. These previous study findings suggest that the meaning of weight and self-weighing may differ by gender and may be further supported by our study findings among adolescents. A limited body of research has examined associations between self-weighing and psychological outcomes among adolescents [33], and to date, no experimental studies among adolescents have examined the long-term psychological effects of self-weighing. Findings from the current study suggest that adolescents who are frequent self-weighers are more likely to experience greater depression, lower self-esteem, and negative body image. Although it remains uncertain whether self-weighing preceded psychological outcomes, it would appear, based on previous experimental work among young adult females, that increased self-weighing predicts decreased psychological well-being [32]. Additional research is needed to clarify the long-term psychological effect of self-weighing by gender and weight status.

As supported by previous research with adolescents [8,33] and young adults [7], positive associations were found in our study between self-weighing frequency and unhealthy weight control behaviors (e.g., fasting) and muscle-enhancing behaviors (e.g., steroid use). For example, our 5 year longitudinal Project EAT study that assessed self-weighing and weight control practices and behaviors among adolescents in the general population found that frequent self-weighing predicted unhealthy weight control practices and behaviors and was not predictive of better weight management [8]. Additionally, as found in previous studies of overweight adults [5,34], in this study only the overweight adolescents who reported weighing themselves frequently were also significantly more likely to engage in healthy weight control behaviors and moderate-to-vigorous physical activity as compared to overweight adolescents who weighed themselves less frequently. In line with previous

findings, it may be that overweight adolescents who monitor their weight more frequently as a weight control strategy are more likely to actively monitor other healthy weight-related behaviors, such as increasing their physical activity and eating more fruits and vegetables compared to infrequent self-weighers [9] and/or are more successful at weight management [35]. The co-occurrence of healthy and unhealthy weight control behaviors in overweight adolescents who weigh themselves weekly or more suggests that these adolescents are using multiple behavior change strategies to lose, maintain, or gain weight.

Self-weighing frequency differed by race/ethnicity among non-overweight boys and overweight girls. Our findings suggest that black and Hispanic overweight adolescent girls and Hispanic non-overweight adolescent boys weighed themselves less frequently compared to other race/ethnic groups. Differences by race/ethnicity could have emerged due to differences in socio-cultural body ideals. Research suggests that body satisfaction varies across race/ethnicity [15,36,37] with greater acceptance of moderate levels of adiposity among black youth as compared to white youth [21,38]; thus, black adolescents may feel less need to monitor their weight. Further examination of self-weighing frequency behaviors among race/ethnic groups are needed to elucidate these unique findings.

To our knowledge, this is the first study to examine multiple measures of body change behaviors (healthy and unhealthy) and psychological well-being in a population-based sample of adolescents by weight status. The diverse nature of the sample in terms of race/ethnicity and socioeconomic status is an important strength of this study, and enhances the applicability of the findings to the general population of young people. However, because this is a cross-sectional study, temporal ordering between self-weighing frequency and weight-related behaviors and psychological well-being cannot be determined. Despite these limitations, findings from this study build upon our previous Project EAT work, along with other studies, showing that a number of weight-related behaviors and psychological well-being measures are associated with self-weighing frequency. Longitudinal and experimental research studies examining the long-term behavioral and psychological effects of self-weighing among adolescents and various subgroups (e.g., gender, weight status, or race/ethnicity) are warranted. These types of future research studies may help to determine the implications of promoting self-weighing and determine whether there is a recommended level of self-weighing that is helpful in fostering healthy behaviors and positive psychological well-being or if self-weighing should never be recommended.

Frequent self-weight monitoring as a weight control strategy may pose a health risk for some adolescents. Rather than focusing on weight, encouragement of behaviors such as eating fruits and vegetables, paying attention to internal signs of hunger and satiety, and engaging in regular physical activity, with the aim of promoting overall health and well-being is more appropriate for adolescents, especially at a time where they are still growing physically and mentally.

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