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An Ecological Momentary Assessment of Self-improvement and Self-evaluation Body Comparisons: Associations with College Women's Body Dissatisfaction and Exercise

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Abstract

Upward body comparisons are prevalent among college women and associated with body dissatisfaction and disordered eating. However, less is known about distinguishing features of the comparisons themselves as they occur in daily life. The primary purpose of the present study was to examine whether two types of upward body comparisons previously studied experimentally (self-improvement and self-evaluation) are differentially associated with body- and exercise-related outcomes in real-life settings using ecological momentary assessment (EMA). Undergraduate women ($N = 74$) between 18–25 years (Mage = 20.4, $SD = 1.63$) completed five surveys on smartphones daily for seven days. EMA measures assessed body comparisons, body dissatisfaction, and exercise cognitions and behaviors. Baseline body dissatisfaction, comparison tendency, and exercise behavior were examined as moderators. Multilevel analyses revealed that both self-improvement and self-evaluation were associated with greater exercise thoughts (ps $< .05$), but not with changes in body dissatisfaction (ps$> .05$). Moderator analyses revealed differences between the two types and their associations with outcomes for select subgroups. For example, self-improvement comparisons were associated with fewer exercise thoughts among participants with high baseline exercise behaviors ($p < .01$). Further research is needed to understand the differences between self-improvement and self-evaluation and the potential protective mechanisms of self-improvement.

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CRediT authorship contribution statement

Rachel I. MacIntyre: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft. **Kristin E Heron:** Conceptualization, Writing - review & editing, Supervision, Funding acquisition, Resources. **Abby L. Braitman:** Methodology, Writing - review & editing. **Danielle Arigo:** Writing - review & editing.

Declaration of Competing Interest

None.

Keywords

Social comparisons; Disordered eating; Ecological Momentary Assessment (EMA); Exercise; Women

1. Introduction

Body comparisons, or comparing one's body weight or shape to the bodies of others, are common among college women, and are associated with negative health consequences (Arigo, Schumacher, & Martin, 2014; Corning, Krumm, & Smitham, 2006). During college, concerns about weight and shape become increasingly salient among women (Cash & Green, 1986) with as many as 80% endorsing maladaptive beliefs about their bodies (Fitzsimmons-Craft, 2011). Body comparisons are one way in which weight and shape ideals are transmitted across women and often contribute to body dissatisfaction (Fitzsimmons-Craft, 2011; Myers & Crowther, 2009). Research in this area has largely focused on upward body comparisons - or comparisons to those who are closer to one's body ideal - versus downward comparisons (i.e., comparisons to those who are further from one's body ideal); upward body comparisons appear to be more common (Fardouly, Pinkus, & Vartanian, 2017; Fuller-Tyszkiewicz et al., 2019; Leahey, Crowther, & Mickelson, 2007; Ridolfi, Myers, Crowther, & Ciesla, 2011) and are more closely linked to body dissatisfaction (Fardouly et al., 2017; Fuller-Tyszkiewicz et al., 2019; Myers, Ridolfi, Crowther, & Ciesla, 2012) and disordered eating (Arigo et al., 2014) than downward body comparisons. However, upward body comparisons have also been found to be associated with *positive* body ratings (Mills, Polivy, Herman, & Tiggemann, 2002; Myers & Biocca, 1992), suggesting some conflicting findings in the literature.

To better understand these comparisons and disentangle these conflicting findings, studies have examined qualities of the comparers (e.g., level of body dissatisfaction and eating pathology; Leahey, Crowther, & Ciesla, 2011) and their comparison targets (e.g., peers versus media images; Carey, Donaghue, & Broderick, 2014; Leahey & Crowther, 2008). Yet little attention has been given to distinguishing features among the comparisons themselves. Studies that have identified potential distinguishing features of comparisons have examined women's motivations to engage in comparisons (Halliwell & Dittmar, 2005; Knobloch-Westerwick, 2015; Tiggemann, Polivy, & Hargreaves, 2009). These studies have examined upward comparisons motivated by self-improvement and self-evaluation. Self-evaluation comparisons involve judgement about oneself, whereas self-improvement comparisons are sought to gain assistance or inspiration to improve an attribute (Halliwell & Dittmar, 2005). In the context of upward body comparisons, self-improvement and self-evaluation comparisons have only been examined experimentally (Halliwell & Dittmar, 2005; Knobloch-Westerwick, 2015), which limits our knowledge on whether women engage in comparisons in these different ways in real-life settings during naturally occurring comparisons. The present study aims to close this gap in the literature by examining the natural occurrence of these potentially important comparison distinguishing features, self-improvement and self-evaluation.

Research on the natural occurrence of self-improvement and self-evaluation has the potential to help explain conflicting findings in the literature on the association between these comparisons and body dissatisfaction. Although we define upward body comparisons as comparisons a person makes about their body to someone who they assess to be 'better off' than themselves, these comparisons are likely to be more nuanced than this simple definition and to vary between comparisons within person. For instance, there may be times that women engage in upward body comparisons and are focused on wanting their bodies to look as thin, lean, curvy, or muscular as their comparison target's and ways in which they may achieve these outcomes. There may be other times they engage in upward body comparisons and are focused on how much better their comparison target's body is compared to their own and on the negative judgments they make about their body as a result. The former pattern, which refers to self-improvement according to experimental research on motivations, may contribute to women feeling confident that they can achieve their ideal bodies and inspired to engage in behaviors to work towards their goals, such as exercise. Alternatively, the latter pattern which refers to self-evaluation, may increase women's negative feelings about their bodies and discourage them from making positive changes. If self-improvement and self-evaluation capture differences between comparisons within person, they may help explain the associations that have been found between these comparisons and positive body ratings at times (self-improvement comparisons) and these comparisons and negative body ratings and other times (self-evaluation comparisons).

During one of the experimental studies that examined comparisons for self-improvement and self-evaluation, Knobloch-Westerwick (2015) presented thin-ideal media images to women and measured the extent to which these comparisons were associated with thoughts of self-improvement and self-evaluation following the exposures using a longitudinal, experimental design. Across the 5-day exposure period, comparisons with higher self-improvement ratings were associated with an increase in body satisfaction while comparisons higher in self-evaluation were associated with a decrease in body satisfaction. Although this study provides experimental evidence that upward comparisons can be self-evaluative and self-improvement-focused and each may be differentially associated with body satisfaction, the experimental design does not provide evidence that these patterns exist when women engage in comparisons based on their own volition in natural settings.

In addition to assessing whether these patterns apply to naturally occurring comparisons, this study also has the potential to inform the development of better assessment techniques to more accurately measure and distinguish between one comparison and another. Upward body comparisons are considered to play an important role in shaping how women feel about their bodies during their everyday lives and we need to consider improvements in our assessment techniques in order to advance our understanding of these phenomena.

1.1. Ecological Momentary Assessment (EMA) of Body Comparisons

Ecological momentary assessment (EMA), a methodology used to capture events and experiences as they occur in their natural context, has been used to examine the generalizability of experimental findings to real-life settings (Smyth & Stone, 2003). EMA studies have demonstrated positive associations between upward body comparisons and

body dissatisfaction, exercise thoughts, and self-reported exercise behaviors in young adult women (Leahey et al., 2007; Leahey et al., 2011; Rancourt, Leahey, LaRosa, & Crowther, 2015). For example, Rancourt et al. (2015) found that upward weight-focused social comparisons increased thoughts of exercising and self-reports of exercise engagement in overweight young adult women. Leahey et al. (2011) found this association to be stronger in young adult women who reported high compared to low trait-level body dissatisfaction and eating pathology. Neither of these studies examined distinguishing features of upward body comparisons (i.e., self-improvement, self-evaluation) or intentions to exercise or exercise behavior with an objective measure. Although it is apparent that body comparisons are associated with greater exercise and body-related thoughts, further EMA research is needed to understand within-person distinguishing features (self-improvement and self-evaluation) and how these distinguishing features may explain differences in these associations.

1.2. Person-level Differences

Previous research indicates that several person-level differences may be important moderators of relations between body comparisons and body-related outcomes among college women. Individuals with high trait-level body dissatisfaction are more likely to engage in these comparisons (Leahey et al, 2011) and those who engage in them regularly may experience greater state body dissatisfaction following comparisons (Fitzsimmons-Craft et al., 2015). Additionally, individuals who exercise regularly are likely driven to exercise for alternative reasons (e.g., sports training; Gardner, de Bruijn, & Lally, 2011) and may experience weaker associations between upward body comparisons and exercise thoughts and behaviors. Thus, in the present study, trait-level body dissatisfaction, tendency to engage in appearance comparisons, and baseline exercise behaviors were examined as moderators, as they may strengthen or weaken the associations between upward comparisons and the outcomes of interest.

1.3. The Present Study

The primary aim of the present study was to use EMA to examine whether self-improvement and self-evaluation upward body comparisons observed in experimental research are differentially associated with body dissatisfaction and exercise-related cognitions and behaviors in real-life settings. We examined both moment-level and day-level associations for self-improvement and self-evaluation. Moment-level outcome variables included body dissatisfaction and thoughts of exercising. Day-level outcome variables included objectively measured exercise behavior and intentions to exercise the next day. Day-level exercise behavior was used to examine the associations between the comparisons and intentional exercise rather than moment-level changes that may be impacted by daily commutes or occupational tasks.

1.3.1. Self-improvement hypotheses—At times when participants reported higher levels of self-improvement, they would also have (a) lower body dissatisfaction, and (b) greater thoughts of exercising (Hypothesis la; moment-level). Further, on days when they reported higher self-improvement, they would show (a) greater engagement in daily exercise (based on an objective measure) and (b) greater intentions to exercise the next day (Hypothesis lb; day-level).

1.3.2. Self-evaluation hypotheses—In contrast to self-improvement, we predicted that at times when participants reported higher levels of self-evaluation, they would report (a) greater body dissatisfaction and (b) less intense thoughts of exercising (Hypothesis 1c; moment-level). Moreover, no associations between participants daily self-evaluation and their daily exercise behavior or exercise intentions the next day were expected (Hypothesis 1d; day-level).

1.3.3. Moment-level change hypotheses—A secondary aim of the current study was to examine whether self-improvement and self-evaluation predicted change in the momentary constructs, body dissatisfaction and thoughts of exercising. Consistent with the momentary hypotheses above, we predicted that positive changes in self-improvement would be associated with lower body dissatisfaction and greater thoughts of exercising (Hypothesis 2a; moment-level) and positive changes in self-evaluation would be associated with greater body dissatisfaction and less intense thoughts of exercising (Hypothesis 2b; moment-level).

1.3.4. Person-level difference hypotheses—The third aim of the current study was to explore the moderating effects of baseline measures of trait-level body dissatisfaction, tendency to engage in appearance comparisons, and exercise behaviors on the associations examined in Hypotheses 1a-d. We predicted that the associations described in Hypotheses 1a-d would be stronger for women with higher trait-level body dissatisfaction (Hypothesis 3a). We predicted the positive association between self-evaluation and body dissatisfaction and the negative association between self-evaluation and thoughts of exercising would be stronger for women with greater tendency to engage in comparisons (Hypothesis 3b). The final hypothesis predicted a curvilinear trend, such that only moderate exercisers at baseline would experience the positive day-level associations between self-improvement comparisons and exercise behaviors and next day exercise intentions with the idea that individuals who exercise rarely or often will not experience fluctuations related to upward body comparisons (Hypothesis 3c).

2. Method

2.1. Participants

Female undergraduate students at a large Southeastern university who were between the ages of 18 and 25 were eligible to participate in the present study. Seventy-seven women were recruited via the university cloud-based research participation system and all provided consent at the start of their scheduled lab visit. Two participants were dropped from analyses due to survey compliance rates lower than 20%. A third participant was removed from analyses because of missingness in her baseline exercise behavior scores, yielding a final sample of 74 participants.

The mean age of study participants was 20.4 years old (SD = 1.63, range 18–25).The majority of participants were Black (n = 44, 59.5%) or White (n = 31, 41.9%) with several other participants who self-identified as other races (n = 9, 12.2%); percentages across the race categories do not add to 100% because participants were allowed to select multiple races. Body Mass Index [BMI] was calculated for all participants based on their measured height and weight The mean BMI of study participants was 27.8 (SD = 7.61).[1]

2.2. Baseline Measures

2.2.1. Trait-level body dissatisfaction—The Body Shape Questionnaire (BSQ-16; Evans & Dolan, 1993) is a 16-item questionnaire that measures concerns about body shape. Participants were asked to rate the frequency with which they experience body dissatisfaction on a 7-point scale (0 = *never* to 6 = always). Higher summed scores indicate greater body weight and shape concerns. A sample item is "Have you been so worried about your shape that you have been feeling you ought to diet?" The scale has demonstrated adequate convergent validity with other measures of body dissatisfaction (r = .58−.81; Rosen, Jones, Ramirez, & Waxman, 1995). In the present study, it demonstrated high internal consistency (α = .93).

2.2.2. Tendency to engage in appearance comparisons—The Physical Appearance Comparison Scale-Revised (PACS-R; Schaefer & Thompson, 2014) is an 11-item measure that assesses this tendency in eight social contexts and with five different aspects of one's physical appearance. The scale asks participants to indicate how often they make each type of comparison in the different settings on a 5-point scale (0 = *never* and 4 = *always*). A sample item is "When I'm in public, I compare my physical appearance to the appearance of others," Participants' responses were summed to determine their baseline tendency to engage in social comparisons; higher scores indicate a stronger tendency. In the present study, the PACS-R demonstrated high internal consistency (α = .95).

2.2.3. Exercise behavior—The International Physical Activity Questionnaire (IPAQ; Booth, 2000) short form is a 7-item measure that gathers information on time spent in vigorous physical activity, moderate physical activity, walking, and sitting. The version of the measure we used assesses exercise behavior in a usual week. For example, one question asks, "During a usual week, on how many days do you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?" Craig et al. (2003) found the usual IPAQ short form to be a reliable measure of exercise behavior in a diverse adult sample (rho = 0.79 for test-retest reliability). Dinger, Han, and Behrens (2006) found the IPAQ short form to be a valid measure when compared to accelerometer-measured physical activity in a college sample. Participants' baseline exercise behavior was calculated by summing the amount of time they typically spend in vigorous physical activity and moderate physical activity a week.

2.3. EMA Measures

2.3.1. Body comparisons—The EMA survey assessed the occurrence, nature, and effects of body comparisons (Leahey & Crowther, 2008). Participants were asked if they had made a body comparison since the last questionnaire they answered. If they did, they were asked to consider their most recent comparison and indicate whether the comparison was upward or downward ("Compared to the other person, I looked: much worse, worse, same, better, or much better"). "Much worse" and "worse" selections were coded as upward comparisons.

[1]BMI was included in all models and did not significantly change the pattern of results. Therefore, it was removed in all analyses presented. Results are available upon request.

When participants indicated they had engaged in an upward body comparison, they were asked to assess the extent to which self-improvement and self-evaluation occurred during the comparison event. Two statements were used to assess self-evaluation ("I thought that person was thinner or more physically fit than me," "I negatively judged my own body compared to that person") and self-improvement ("I would like my body to be as thin or physically fit as that other person's." and "I thought about ways I could change my body to look like theirs"). Responses were gathered on 7-point scales (0 = *not at all* and 6 = *very much*) and averaged responses to the two questions were used as self-evaluation and self-improvement composite scores. The self-evaluation and self-improvement items were adapted from those used in experimental research (Knobloch-Westerwick, 2015).

2.3.2. Body dissatisfaction—Participants' body dissatisfaction at the time they filled out each survey was assessed with a modified version of the 6-item Body Image States Scale (BISS; Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002).[2] The BISS measures one's evaluative and affective experiences related to their physical appearance at the given moment. To adapt the scale to our survey software, we modified each item to be presented as a question rather than an open-ended statement. For example, one item is "Right now, how do you feel about your body size and shape?". Additionally, we modified the original measure's 9-point bipolar response scale to a 7-point unipolar response scale for consistency with other 7-point scale items in our survey. The 7-point scale ranges from 0 (*extremely dissatisfied/extremely unattractive/a great deal worse*) to 6 (extremely *satisfied/extremely attractive/a great deal better*). To obtain participants' momentary level of body dissatisfaction, responses were reverse scored and summed; higher sum scores suggest greater body dissatisfaction.

2.3.3. Thoughts of exercising—Participants were asked a question created by the author to assess their thoughts of exercising. This question ("Have you thought about being more physically active since the last notification?") was answered using a 7-point scale (0 = *not at all* and 6 = *very much*). Similar questions have been used with young women to measure thoughts of exercising in EMA studies previously (Rancourt et al., 2015).

2.3.4. Daily exercise behavior—Total daily minutes in moderate and vigorous physical activity were gathered from the Fitbit devices participants wore throughout the EMA data collection period. Minutes in moderate and vigorous physical activity were added together to obtain participants' total daily exercise behaviors; greater number of minutes indicate more exercise behaviors.

2.3.5. Intentions to exercise—At the end of each day, intentions to exercise the next day were assessed using one item, "Do you think you will exercise tomorrow?" Responses were collected on a 5-point scale (0 = *definitely will not* and 4 = *definitely will*). A similar question has been used to assess college students' intentions to exercise in daily diary research (Conroy, Elavsky, Doerksen, & Maher, 2013).

[2]Two items of the BISS ask how the respondent feels about their body compared to how they usually feel and compared to the average person. We ran analyses with and without these items due to concerns the two items may overlap with our assessments of body comparisons. Given we did not find any differences with and without these items, analyses with the full 6-item version are presented.

2.4. Equipment

2.4.1. Fitbit devices—The Fitbit Flex was used to measure participants' daily exercise behaviors. It was worn by participants throughout the EMA data collection period. The Fitbit Flex has been found to be a valid and reliable measure of minute-by-minute energy expenditure (Bai et al., 2016; Diaz et al., 2015).

2.4.2. EMA survey software—Commercial software called LifeData was used to develop the EMA surveys. The software allows users to configure survey access and alarm schedules. It requires users to download the mobile application, RealLife Exp, on their mobile device to access the surveys.

2.5. Procedure

All procedures were approved by the Old Dominion University Institutional Review Board. As part of a larger study, participants were recruited through a cloud-based research system and scheduled for a lab visit in groups. During the lab visit, participants provided informed consent, completed baseline measures, and received training on study procedures. Also during the visit, the researchers collected each participants' height and weight. Participants were provided a Fitbit Flex to wear during the EMA portion of the study, but they did not download the Fitbit app or have any access to their Fitbit data. They were also instructed to download the mobile application RealLife Exp where they accessed the EMA surveys created through LifeData. All participants were provided the option to borrow an Android smartphone that had all non-survey functions (e.g., phone, text messaging, etc.) disabled if they did not have a smartphone or did not want to use theirs for the study. Only one participant used a study-supplied Android smartphone for the EMA portion of the study, and she was later removed from analyses due to an EMA survey compliance rate lower than 20%. The remaining participants used their own smartphones.

For the first four days, participants completed EMA surveys without social comparison questions as part of a larger study. These data were not used for the current study. For the following seven days, participants completed surveys that included questions assessing their body comparisons. Participants received notifications for the survey from the RealLife Exp app at four semi-random times throughout these days. Notifications for the four surveys were scheduled to deliver between 9am and 9pm and not occur within two hours of each other. If a survey went unanswered, it was replaced by the next prompted survey to prevent batched responding. The surveys included measures of body comparisons, body dissatisfaction, and thoughts of exercising. The fifth survey that participants were instructed to complete before they went to bed each night included a question that assessed their intentions to exercise the next day. Exercise behavior was gathered via Fitbits continuously throughout the data collection, with total minutes in moderate and vigorous exercise aggregated for each day and used in day-level analyses. Participants received research credits towards a psychology course for attending the initial laboratory session and returning their Fitbit Flexes after data collection. They were also compensated 15 U.S. dollars (USD) for answering EMA surveys and an additional 5 USD (a total of 20 USD) for answering at least 85% of the surveys.

2.6. Data Analysis

Preliminary descriptive statistics and survey compliance were calculated in SPSS 24. Given the nested, multilevel nature of the dataset (i.e., moments [level 1] within day [level 2] and day within person [level 3]) multilevel modeling using HLM version 7.0 (Raudenbush, Bryk, & Congdon, 2011) was used to test study hypotheses. Expectation Maximization (EM) imputation was used to address missing data for continuous baseline, day-level, and moment-level variables (< 15%), but not the missingness at the moment level that was expected due to survey branching. Assumptions were checked at each level; all outliers found were winsorized. Predictors at Levels 1 and 2 were group mean centered to separate between and within group variance. Predictors at Level 3 were grand mean centered. Each analysis was conducted with random slopes at the first two levels, and within (sigma) and between (tau) cluster variances were assessed to determine final models. When between cluster variances were significant, random slopes remained in the final models. When they were not significant, the random effects were removed. For variance p values that were just above .05 (between .05−.20), we conducted chi-square difference tests to determine final models. Maximum likelihood estimation with robust standard errors were used.

Hypotheses 1a and 1c examined self-improvement or self-evaluation as a predictor of each momentary dependent variable (i.e., body dissatisfaction, thoughts of exercising). Hypotheses 1b and 1d examined daily aggregated values of self-improvement or self-evaluation across momentary surveys each day as a predictor of each daily dependent variable (i.e., exercise minutes, exercise intentions). These models were simplified versions than the model below without the interactions (Hypotheses 1a and 1c) or the third level (Hypotheses 1b and 1d).

Hypotheses 2a and 2b examined the associations between self-improvement and self-evaluation and change in body dissatisfaction and thoughts of exercising. For each of the momentary analyses in Aim 1, the outcome at prior timepoints was added to the model as a control.

To examine person-level moderators, baseline composite scores were added to each model as a main effect as well as interaction with self-improvement or self-evaluation. Baseline total scores were used to examine possible linear associations, whereas squared values were used to assess the presence of curvilinear associations (as expected for Hypothesis 3c). Separate models were conducted for each moderator type, and linear and curvilinear associations were examined separately. When both the total and squared total baseline scores were significant in separate models, they were entered into the model together to determine which best described the association, a linear or curvilinear trend. For example, to assess if trait-level body dissatisfaction (via the BSQ) moderated the momentary association between self-improvement and moment-level body dissatisfaction, the following model was used:

$$\text{Level} - 1:$$
$$DISSATISFACTION_{tij} = \pi_{0ij} + \pi_{1ij} * \left(SELF\text{-}IMP_{tij}\right) + e_{tij}$$

Level– 2:
$$\pi_{0ij} = \beta_{00j} + r_{0ij}$$
$$\pi_{1ij} = \beta_{10j} + r_{1ij}$$

Level–3:
$$\beta_{00j} = \gamma_{000} + \gamma_{001} * \left(BSQ_j\right) + \gamma_{002} * \left(BSQ_j{}^2\right) + u_{00j}$$
$$\beta_{10j} = \gamma_{010} + \gamma_{011} * \left(BSQ_j\right) + \gamma_{012} * \left(BSQ_j{}^2\right) + u_{00j}$$

In the model both linear (γ_{001}) and curvilinear (γ_{002}) main effects for trait-level body dissatisfaction are explored, as well as both linear (γ_{011}) and curvilinear (γ_{012}) interaction effects that would impact the association between momentary self-improvement and body dissatisfaction (π_{1ij}).

For significant moderation findings, additional follow-up analyses were conducted to examine the significance and direction of the association where baseline scores were centered at one standard deviation above the mean and one standard deviation below the mean to examine the associations for individuals high or low, respectively, on that construct.

3. Results

3.1. Survey Compliance, Descriptive Statistics, and Reactivity

Participants completed an average of 22.9 (81.8%) of all momentary surveys, including those with and without reported upward body comparisons during the study and 5.1 (72.9%) of all end of day surveys during the study. In order to reduce the likelihood of recall bias, only surveys that were completed within an hour of when the participant was notified were included in the analyses; this maintained 80% of completed surveys. In total, 1,372 momentary surveys and 391 end of day surveys provided data for analyses. Descriptive statistics are presented in Table 1. Of the total momentary surveys included in analyses, 107 included reports of upward body comparisons and were used to examine self-improvement and self-evaluation. A shorter range was found for self-improvement than self-evaluation (self-improvement, *Range* = 4.81, *M* = 4.36, *SD* = 1.02; self-evaluation, *Range* = 6.00, *M* = 4.51, *SD* = 1.04). The correlation between the two ratings was high, *r* = .59. Intraclass correlation coefficients (ICCs) show momentary variability within both types of comparisons, body dissatisfaction, and thoughts of exercising (see Table 1 for ICCs).

Reactivity was indirectly tested by comparing day of study effects of the variables used in this study. Multilevel models revealed that participants engaged in less body comparisons and exercise behaviors across days of the EMA protocol (body comparisons, $B = -0.01$, $t(1372) = -3.51$, $p = .001$, pseudo $R^2 = 0.01$; exercise minutes, $B = -1.57$, $t(605) = -4.94$, $p < .001$, pseudo $R^2 = 0.03$; pseudo R^2 values were calculated using the formula in Raudenbush and Biyk [2002]). But there were no significant day effects on state body dissatisfaction ($B = 0.06$, $t(1386) = 0.12$, $p = .599$), exercise thoughts ($B = -0.04$, $t(1386) = -1.36$, $p = .175$), or exercise intentions ($B = -0.02$, $t(605) = -1.27$, $p = .206$). Although these findings indicate that the EMA protocol may have increased participants' awareness of their

behaviors, which then led to differences in reporting across days, the R^2 values indicate only small day effects and only for a subset of measures, not all constructs of interest.

3.2. Self-improvement Comparisons

As shown in Table 2, there was not a significant association between self-improvement ratings and momentary body dissatisfaction. However, there was a significant positive association between self-improvement ratings and thoughts of exercising. The pseudo R^2 calculation indicates that 65% of variability in momentary thoughts of exercising were explained by self-improvement ratings. There were no significant associations between self-improvement and daily exercise intentions or exercise minutes.

3.3. Self-evaluation Comparisons

Similar to the results for self-improvement, no significant association was found between momentary self-evaluation ratings and body dissatisfaction. But a significant positive association was found between momentary self-evaluation ratings and thoughts of exercising (see Table 2). These results indicate that 63% of variability in momentary thoughts of exercising were explained by self-evaluation ratings. Again, consistent with results for self-improvement, no significant associations were found between self-evaluation ratings and daily exercise minutes or intentions (see Table 2).

3.4. Moment-level Change Analyses

No significant associations were found between self-improvement or self-evaluation and changes in body dissatisfaction and thoughts of exercising (see Lagged Moment-level results in Table 2).

3.5. Person-level Moderators

3.5.1. Trait-level body dissatisfaction—The association between self-improvement ratings and thoughts of exercising was significantly moderated by baseline body dissatisfaction using the BSQ.−16 total score and squared total score (see Table 3 and Fig. 1). When both the total score and squared score were entered into the same model, the total score interaction was significant, $B = 0.47$, $t(30) = 2.22$, $p = .027$, pseudo $R^2 = -0.02$, and the squared score was not significant, $B = -0.00$, $t(30) = -1.86$, $p = .093$, suggesting this moderating association is linear. As shown in Fig. 1, there was a stronger positive relationship between self-improvement and thoughts of exercising at higher levels of baseline body dissatisfaction (High BSQ Total line) compared to lower levels of body dissatisfaction (Low BSQ Total line). Follow-up analyses with values centered 1 *SD* above and below the sample mean confirmed that the association between self-improvement ratings and thoughts of exercising is significantly stronger for participants with higher levels of baseline body dissatisfaction. The 1 *SD* above and below values fell within the “no concern with shape” and “moderate concern with shape” BSQ-16 categories provided by Evans (2003). As is shown in Table 4, at lower levels of baseline body dissatisfaction, the association was not significant. The association between self-improvement ratings and thoughts of exercising was the only association described in Aim 1 that was significantly moderated by baseline body dissatisfaction (see Table 3 for non-significant findings).

3.5.2. Tendency to engage in appearance comparisons—Tendency to engage in appearance comparisons significantly moderated the associations between each type of comparison and momentary body dissatisfaction as well as the association between self-evaluation and thoughts of exercising (see Table 5 and Fig. 2). The association between self-improvement comparisons and momentary body dissatisfaction was significantly moderated by both PACS-R total scores and PACS-R total squared scores. When PACS-R total scores and PACS-R squared total scores were entered in the same model, both the total score interaction and total squared interaction were significant, PACS-R total: $B = 0.33$, $t(30) = 5.31$, $p < .001$, pseudo $R^2 = -0.12$; PACS-R total squared: $B = 0.01$, $t(30) = 2.75$, $p = .010$, pseudo $R^2 = -0.14$, suggesting that both a linear and curvilinear trend significantly fit this model (see Fig. 2a). Follow-up analyses were conducted using 1 *SD* above and below the PACS-R total and total squared sample means that corresponded to the bottom and top third possible scale values. The analyses revealed a stronger positive association between self-improvement and body dissatisfaction for participants with a higher compared to lower tendency to engage in comparisons (see Table 4). As seen in Fig. 2a, the curvilinear trajectory shows that this association is strongest for lower levels of self-improvement with a very steep increase in body dissatisfaction, then plateaus for higher levels of self-improvement with very high body dissatisfaction scores. Although only the PACS-R total scores moderated the self-evaluation and body dissatisfaction association suggesting a linear trend (see Table 5 for PACS-R total and PACS-R sq. total findings), follow-ups revealed a similar pattern to the self-improvement and body dissatisfaction association. A positive association between self-evaluation and body dissatisfaction was found for participants with a higher appearance comparison tendency; the association became non-significant at lower levels of appearance comparison tendency (see Table 4 and Fig. 2b).

In addition to its moderating effect on the associations between both self-improvement and self-evaluation and body dissatisfaction, baseline tendency to engage in comparisons also moderated the self-evaluation and thoughts of exercising association (see Table 5 and Fig. 2c). Although both the PACS-R total and the PACS-R squared total interactions were significant on their own, only the PACS-R squared total was significant when they were both entered into the model, $B = -0.81$, $t(31) = -1.98$, $p < .001$. This suggests that a curvilinear trend best describes the association. As shown in Fig. 2c, for participants with a greater appearance comparison tendency, when they engaged in comparisons high in self-evaluation, they experienced less intense thoughts of exercising. When they engaged in comparisons low in self-evaluation, they experienced more intense thoughts of exercising.

Baseline tendency to engage in appearance comparisons significantly moderated all momentary analyses in Aim 1, except for the self-improvement and thoughts of exercising association. It also did not moderate any of the day-level analyses in Aim 1 (see Table 5 for non-significant findings).

3.5.3. Baseline exercise behaviors—Baseline exercise behaviors significantly moderated the associations between self-improvement comparisons and exercise thoughts and exercise minutes (see Table 6 and Fig. 3). IPAQ total and IPAQ, squared total scores significantly moderated the association between self-improvement comparisons and thoughts of exercising. However, when both the IPAQ total and IPAQ squared scores were

entered into the same model, neither interaction was significant (IPAQ, total, $B = -0.01$, $t(30) = -1.01$, $p = .323$; IPAQ, total squared, $B = 0.00$, $t(30) = 0.81$, $p = .426$). Based on the pseudo R^2 calculations from their separate models, it appears that the IPAQ squared total scores ($R^2 = 0.14$) compared to IPAQ total ($R^2 = 0.11$) explains greater variability in momentary thoughts of exercising. Therefore, a curvilinear trend is likely best suited for this model. Follow-up analyses with the IPAQ squared total scores were conducted with values 1 *SD* above and below the sample mean. For our sample, these values fell within the lowest and highest total weekly minutes measured by an accelerometer in a female student sample (Dinger & Behrens, 2006), suggesting these values are meaningful for interpreting these follow-up analyses. As shown in Table 4, there was a significant positive association between self-improvement ratings and thoughts of exercising for participants with less baseline exercise behaviors and a significant negative association between measures for participants with more baseline exercise behavior (see Fig. 3a). For participants who engage in lower exercise in general, when they engaged in comparisons low in self-improvement, they experienced less intense thoughts of exercising. When they engaged in comparisons high in self-improvement, they experienced more intense thoughts of exercising. The opposite was true for participants who engage in more exercise in general.

IPAQ squared total scores moderated the self-improvement and exercise minutes association (see Fig. 3b). Follow-up analyses with the IPAQ, squared total scores revealed a significant negative association between self-improvement ratings and exercise minutes in participants with more baseline exercise behaviors. For participants who engage in more exercise in general, when they engaged in comparisons low in self-improvement, they exercised longer. When they engaged in comparisons high in self-improvement, they exercised less. The association became non-significant for participants with low baseline exercise behaviors (see Table 4).

4. Discussion

The primary aim of this study was to examine the associations between naturally occurring self-improvement and self-evaluation upward body comparisons and college women's body dissatisfaction and exercise thoughts, intentions, and behaviors. The secondary aims were to examine the impact of these comparison types on changes in momentary outcomes between timepoints and to evaluate the moderating effects of person-level differences that are important in the study of these comparisons: trait-level body dissatisfaction, tendency to engage in appearance comparisons, and baseline exercise behavior. Previous experimental research demonstrated that women can differentiate between self-improvement and self-evaluation comparisons (Knobloch-Westerwick, 2015). The present study revealed that momentary variation in these constructs can be captured with EMA assessments. Although both types were associated with thoughts of exercising and not body dissatisfaction, person-level moderator analyses revealed noteworthy differences between the two.

These findings demonstrate important distinctions between patterns observed in laboratory versus naturalistic settings. Specifically, Knobloch-Westerwick (2015) found that self-improvement ratings following experimentally induced comparisons with thin-ideal images were associated with increased body satisfaction, whereas self-evaluation ratings resulted in

decreased body satisfaction. In contrast, the present study showed no significant associations between either self-improvement or self-evaluation and momentary body dissatisfaction when assessed in the natural environment This may be because people are exposed to a wide range of body shapes and sizes in everyday life and upward body comparisons may include more realistic targets than the thin-ideal images used in experimental research. However, important relations emerged among participants with differing baseline characteristics; among women with a greater tendency to engage in appearance comparisons, there was a positive association between momentary comparisons high in both self-improvement and self-evaluation and body dissatisfaction. This suggests that women who frequently make body comparisons may experience greater body dissatisfaction in response to comparisons, regardless of whether the comparisons are self-improvement or self-evaluation in nature.

In addition, previous research has not investigated associations between self-improvement and self-evaluation and exercise thoughts or intentions, or objectively assessed exercise in the natural environment Rancourt et al. (2015) found upward weight-focused social comparisons to be associated with increased thoughts of exercising and self-reports of exercise engagement in overweight young adult women. In the present study using young adult women with various BMIs, both self-improvement and self-evaluation were associated with greater thoughts of exercising, which is consistent with the findings of Rancourt et al. (2015). Although the lagged results of Aim 2 suggest these associations do not maintain for the two minimum hours between assessments, self-improvement and self-evaluation each accounted for high rates of variability in thoughts of exercising (65% self-improvement; 63% self-evaluation), suggesting these cognitive processes are particularly important when considering the everyday fluctuations in these thoughts for college women. Further, differences were found when baseline characteristics were added as moderators, suggesting that subsets of college women may respond differently to distinct comparison-related thoughts. Both baseline body dissatisfaction and exercise behaviors moderated the association between self-improvement comparisons and thoughts of exercising, such that women with greater body dissatisfaction and less baseline exercise behaviors experienced more thoughts of exercising when reporting comparisons higher in self-improvement These characteristics did not moderate the association between self-evaluation and thoughts of exercising; however, this association was moderated by a general tendency to engage in these comparisons. For women with a greater tendency, engaging in comparisons high in self-evaluation was associated with less intense thoughts of exercising. This is consistent with hypotheses, but demonstrates that the negative association may only apply to women with a greater tendency to engage in comparisons.

Results showed similar associations between self-improvement and both thoughts of exercising and objectively assessed exercise. At times when frequent exercisers engaged in higher self-improvement they experienced less intense thoughts of exercising. On days when frequent exercisers engaged in higher self-improvement they also engaged in fewer minutes of moderate-to-vigorous exercise. The latter two findings may suggest that women who regularly exercise think that the bodies of their comparison targets are attainable based on their current exercise regimens, and therefore, do not engage in more thoughts of exercising or planned exercise behaviors than what is typical for them. In contrast, women who have greater negative thoughts about their bodies and are not regular exercisers may think more

about exercising as a way to be more like their comparison targets. This may fit the Identification/Contrast Model that has been used to explain differences in individuals' responses to upward and downward comparisons (Buunk & Ybema, 1997). It suggests that women who identify with their comparison target may experience greater positive feelings toward self in response to these comparisons than those who contrast themselves against their targets (Leahey et al., 2011). In the present study, women who exercise regularly may identify with the targets of their upward body comparisons, who may also be frequent exercisers, more than women who exercise less frequently. Future research could test this by examining the comparer's perceived similarity with their comparison target with associated self-improvement and self-evaluation.

Consistent with the Identification/Contrast Model, Leahey et al. (2011) also found women with higher trait body dissatisfaction to experience greater thoughts of exercising following upward body comparisons. The authors suggest that these comparisons have additional negative consequences for this subset of women, such as greater negative feelings about self and risk of developing eating disorders. Other research suggests that this subset of women may seek out these comparisons more often than experience additional negative consequences (Fuller-Tyszkiewicz, 2019). The present study's findings on self-improvement add to our understanding of the cognitions involved in their comparisons. In addition to negatively evaluating their bodies, they are also thinking about ways they can improve themselves to be more like the women they compare themselves to, such as engage in exercise. Although these thoughts of exercising may be ruminative and associated with decreases in negative moods, they may also have a positive impact if they were more closely tied to (healthy) exercise intentions and behaviors. Further research on translating these self-improvement cognitions to self-improvement behaviors could reduce the deleterious effects associated with upward body comparisons in these women.

The present study did not find any significant associations between upward body comparisons, either motivated by self-evaluation or self-improvement, and intentions to exercise the next day. This may be because other factors that were not measured in this study, such as exercise ability, the weather, time availability, attitudes towards exercising, and exercise self-efficacy (Conroy et al., 2013), influenced participant intentions to exercise more than their upward body comparisons. Future research may benefit from assessing the reasons women do not intend to exercise each day and considering study eligibility criteria to include positive attitudes and self-efficacy towards exercise to examine these associations among participants who have moderate-high intentions to exercise.

4.1. Implications and Future Directions

The present study provided evidence of important distinctions between self-improvement and self-evaluation comparisons. The correlation between self-improvement and self-evaluation ratings was high ($r = .59$), but not perfect, suggesting that participants' responses on the self-evaluation items differed from their responses on the self-improvement items. Further, examining the person-level differences in each of their associations with the outcome measures revealed differences between the two. Together with experimental evidence, this suggests that additional cognitive processes are involved in upward body

comparisons besides evaluative thoughts that receive the majority of attention in body image studies. Many of these comparisons also involve thoughts about making positive changes in order to look more like their comparison targets (i.e., self-improvement). Given this was one of the first studies to examine the natural occurrence of self-improvement and self-evaluation comparisons, there is still much left to be examined in future research. The present study examined the two separately, but perhaps there are certain combinations of self-evaluation and self-improvement that are more strongly associated with lower body dissatisfaction and greater exercise thoughts, intentions, and behaviors than others. For instance, lower self-evaluation and higher self-improvement may be more indicative of a pattern of lower body dissatisfaction and more thoughts of exercising than they are individually and may be important to examine in future research.

In addition to theoretical implications, there are also potential clinical implications that may inform body image interventions on college campuses targeted to women. The findings that self-improvement ratings were negatively associated with thoughts of exercising and exercise minutes in women with more baseline exercise behaviors suggests that women who regularly exercise may think that the bodies of their comparison targets are attainable based on their current exercise regimens and, therefore, do not have more thoughts of exercising than what is typical for them. In other words, these self-improvement comparisons may have protective effects against maladaptive exercise thoughts and behaviors for some women. Further research on the self-improvement comparisons frequent exercisers engage in could increase our understanding of their cognitive strategies and help us translate these strategies into teachable techniques that could be distributed to other women experiencing deleterious effects associated with these comparisons (e.g., body dissatisfaction, eating pathology).

4.2. Strengths and Limitations

A notable strength of this study was the research design used. The design used EMA to capture self-improvement and self-evaluation upward body comparisons as they occurred in real life as well as to assess both concurrent and lagged momentary assessments. Moreover, the study used an objective measure of exercise, which has not been included in many previous body comparison EMA studies. In addition to the measurement tools, the study also measured the natural occurrence of self-improvement and self-evaluation that have been shown to be important in the study of body comparisons by experimental studies.

Despite the strengths of the research design, there are also several limitations. The five surveys participants answered each day reduced the chance of missing comparisons that occurred during the course of the day, but did not eliminate it. It is possible that participants engaged in upward body comparisons quickly and automatically (Gilbert, Geisler, & Morris, 1995) and, therefore, were unable to report them in the surveys. Additionally, the EMA items that assessed self-improvement and self-evaluation were displayed after participants were instructed to think about their most recent comparison. Although this instruction was given to increase the accuracy of their reports, it also prevented the gathering of information about earlier comparisons. An event-related EMA design, in which participants were instructed to self-initiate a survey each time they engaged in a social comparison, would have increased the likelihood of capturing all comparisons as they occurred. However, event-

based reporting also presents burden and compliance challenges (Moskowitz & Sadikaj, 2012). There was also a limitation in the items used to assess self-improvement and self-evaluation. The items were adapted from those used by Knobloch-Westerwick (2015), but were never used before. Given the novelty of assessing social comparison constructs with EMA, this limitation was unavoidable. Future researchers may want to explore additional items that capture self-improvement and self-evaluation and examine the reliability and validity of these measures to aid the development of formal measures.

Additional limitations were the college women study sample and the exclusion of an eating pathology assessment. While the sample of college women limits the generalizability of study findings to other women or to college men, it can also be perceived as a strength. As described earlier, body dissatisfaction is a major health concern for college women due to its prevalence and association with eating disorder development and maintenance (Stice & Shaw, 2002). Related to this high rate of body dissatisfaction, this group is also at risk for both ends of the exercise spectrum (over-exercising [Cook, Hausenblas, & Rossi, 2013] as well as under-exercising [American College Health Association, 2019]). This is why understanding the factors related to exercise is just as important as those related to body dissatisfaction in this population. However, it is a limitation of the study that it did not assess for eating pathology in the sample and, therefore, interpretations of the findings cannot be made in the context of eating disorders. An additional limitation of the study sample is the skewed BMI distribution. While the majority of the sample were in the normal weight and overweight BMI ranges, there were more women in the obese (17.6%) and morbidly obese (8.1%) and less in the underweight (0%) ranges than what is typical in other body comparison studies with college samples (Leahey et al., 2011, Myers et al., 2012). Therefore, the study findings may not be generalizable to college samples that include more women with lower BMI scores.

4.3. Conclusions

To our knowledge, the present study was the first to examine the natural occurrence of self-improvement and self-evaluation upward body comparisons in real-life settings and to use an objective measure of physical activity to examine the associations between these comparisons and exercise behavior. Similar patterns were found for self-improvement and self-evaluation comparisons and their associations with body and exercise thoughts and behaviors in young women’s daily lives. However, an examination of additional person-level moderators suggests that the associations between self-improvement comparisons and body and exercise thoughts and behaviors may differ from the associations between the same constructs and self-evaluation comparisons for certain individuals. In particular, a greater emphasis on self-improvement comparisons (but not self-evaluation comparisons) was associated with fewer thoughts of exercising among participants with high baseline exercise behaviors. This suggests certain groups of women, such as frequent exercisers, engage in comparisons in different ways. Further research is needed to understand the differences between self-improvement and self-evaluation and how self-improvement may offer protection against momentary ruminative thoughts associated with these comparisons.

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References

American College Health Association. (2019). American College Health Association-National College Health Assessment II: Reference group executive summary spring 2019. Silver Spring, MD: American College Health Association.

Arigo D, Schumacher L, & Martin LM (2014). Upward appearance comparison and the development of eating pathology in college women. International Journal of Eating Disorders, 47, 467–470. 10.1002/eat.22240

Bai Y, Welk GJ, Nam YN, Lee JA Lee J, Kim Y, … & Dixon PM (2016). Comparison of consumer and research monitors under semistructured settings. Medicine & Science in Sports & Exercise, 48, 151–158. 10.1249/MSS.0000000000000727 [PubMed: 26154336]

Booth ML (2000). Assessment of physical activity: An international perspective. Research Quarterly for Exercise and Sport, 71, S114–S120. 10.1080/02701367.2000.11082794 [PubMed: 10925833]

Buunk BP, & Ybema JF (1997). Social comparisons and occupational stress: The identification-contrast model In Buunk BP & Gibbons FX (Eds.), Health, coping and well-being: Perspectives from social comparison theory (pp. 359–388). Hillsdale, NJ: Erlbaum.

Carey RN, Donaghue N, & Broderick P (2014). Body image concern among Australian adolescent girls: The role of body comparisons with models and peers. Body Image, 11, 81–84. 10.1016/j.bodyim.2013.09.006 [PubMed: 24148894]

Cash TF, Fleming EC, Alindogan J, Steadman L, & Whitehead A (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. Eating Disorders, 10, 103–113. 10.1080/10640260290081678 [PubMed: 16864251]

Cash TF, & Green GK (1986). Body weight and body image among college women: Perception, cognition, and affect Journal of Personality Assessment, 50, 290–301. 10.1207/s15327752jpa5002_15 [PubMed: 3761129]

Cook B, Hausenblas H, & Rossi J (2013). The moderating effect of gender on ideal-weight goals and exercise dependence symptoms. Journal of Behavioral Addictions, 2, 50–55. 10.1556/JBA.1.2012.010 [PubMed: 26165771]

Conroy DE, Elavsky S, Doerksen SE, & Maher JP (2013). A daily process analysis of intentions and physical activity in college students. Journal of Sport & Exercise Psychology, 35, 493–502. 10.1123/jsep.35.5.493 [PubMed: 24197717]

Corning A,F, Krumm AJ, & Smitham LA (2006). Differential social comparison processes in women with and without eating disorder symptoms. Journal of Counseling Psychology, 53, 338–349. 10.1037/0022-0167.53.3.338

Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, … & Oja P (2003). International Physical Activity Questionnaire: 12-country reliability and validity. Medicine & Science in Sports & Exercise, 35, 1381–1395. 10.1249/01.MSS.0000078924.61453.FB [PubMed: 12900694]

Diaz KM, Krupka DJ, Chang MJ, Peacock J, Ma Y, Goldsmith J, … & Davidson KW (2015). Fitbit: An accurate and reliable device for physical activity tracking. International Journal of Cardiology, 185, 138–140. 10.1016/j.ijcard.2015.03.038 [PubMed: 25795203]

Dinger MK & Behrens TK (2006). Accelerometer-determined physical activity of free-living college students. Medicine & Science in Sports & Exercise, 38, 774–779. 10.1249/01.mss.0000210191.72G81.43 [PubMed: 16679996]

Dinger MK, Han JL, & Behrens TK (2006). Convergent validity and reliability of the International Physical Activity Questionnaire in college students. Medicine & Science in Sports & Exercise, 38, S562 10.1249/00005768-200605001-03212

Evans C (2003). Body Shape Questionnaire (BSQ) and its shortened forms Retrieved from https://www.psyctc.org/tools/bsq/. PSYCTC.

Evans C & Dolan B (1993). Body Shape Questionnaire: Derivation of shortened “alternate forms. International Journal of Eating Disorders, 13, 315–321. 10.1002/1098-108X(199304)13:3<315::AID-EAT2260130310>3.0.CO;2-3

Fardouly J, Pinkus RT, & Vartanian LR (2017). The impact of appearance comparisons made through social media, traditional media, and in person in women’s everyday lives. Body Image, 20, 31–39. 10.1016/j.bodyim.2016.11.002 [PubMed: 27907812]

Fitzsimmons-Craft EE (2011). Social psychological theories of disordered eating in college women: Review and integration. Clinical Psychology Review, 31, 1224–1237. 10.1016/j-cpr.2011.07.011 [PubMed: 21903047]

Fitzsimmons-Craft EE, Bardone-Cone AM, Wonderlich SA, Crosby RD, Engel SG, & Bulik CM (2015). The relationships among social comparisons, body surveillance, and body dissatisfaction in the natural environment. Behavior Therapy, 46, 257–271. 10.1016/j.beth.2014.09.006 [PubMed: 25645173]

Fuller-Tyszkiewicz M (2019). Body image states in everyday life: Evidence from ecological momentary assessment methodology. Body Image, 31, 245–272. 10.1016/j.bodyim.2019.02.010 [PubMed: 30852080]

Fuller-Tyszkiewicz M, Chhouk J, McCann L, Urbina G, Vuo H, Krug I, & Richardson B (2019). Appearance comparison and other appearance-related influences on body dissatisfaction in everyday life. Body Image, 28, 101–109. 10.l016/j.bodyim.2019.01.002 [PubMed: 30639976]

Gardner B, de Bruijn G-J, & Lally P (2011). A systematic review and meta-analysis of applications of the Self-report Habit Index to nutrition and physical activity behaviours. Annals of Behavioral Medicine, 42, 174–187. 10.1007/s12160-011-9282-0 [PubMed: 21626256]

Gilbert DT, Giesler RB, & Morris KA (1995). When comparisons arise. Journal of Personality and Social Psychology, 69, 227–236. 10.1037/0022-3514.69.2.227 [PubMed: 7643304]

Halliwell E, & Dittmar H (2005). The role of self-improvement and self-evaluation motives in social comparisons with idealised female bodies in the media. Body Image, 2, 249–261. 10.1016/j.bodyim.2005.05.001 [PubMed: 18089192]

Knobloch-Westerwick S (2015). Thinspiration: Self-improvement versus self-evaluation social comparisons with thin-ideal media portrayals. Health Communication, 30, 1089–1101. 10.1080/10410236.2014.921270 [PubMed: 25317922]

Leahey TM, & Crowther JH (2008). An ecological momentary assessment of comparison target as a moderator of the effects of appearance-focused social comparisons. Body Image, 5, 307–311. 10.1016/j.bodyim.2008.03.002 [PubMed: 18585108]

Leahey TM, Crowther JH, & Ciesla JA, (2011). An ecological momentary assessment of the effects of weight and shape social comparisons on women with eating pathology, high body dissatisfaction, and low body dissatisfaction. Behavior Therapy, 42, 197–210. 10.1016/j.beth.2010.07.003 [PubMed: 21496506]

Leahey TM, Crowther JH, & Mickelson KD (2007). The frequency, nature, and effects of naturally occurring appearance-focused social comparisons. Behavior Therapy, 38, 132–143. 10.1016/j.beth.2006.06.004 [PubMed: 17499080]

Mills JS, Polivy J, Herman CP, & Tiggemann M (2002), Effects of exposure to thin media images: Evidence of self-enhancement among restrained eaters. Personality and Social Psychology Bulletin, 28, 1687–1699. 10.1177/014616702237650

Moskowitz DS, & Sadikaj G (2012). Event-contingent recording In Mehl MR & Conner TS (Eds.), Handbook of research methods for studying daily life (pp. 160–175). New York, NY: The Guilford Press.

Myers PN, & Biocca FA (1992). The elastic body image: The effect of television advertising and programming on body image distortions in young women. Journal of Communications, 108–133. 10.1111/j.1460-2466.1992.tb00802.x

Myers TA, & Crowther JH (2009). Social comparison as a predictor of body dissatisfaction: A meta-analytic review. Journal of Abnormal Psychology, 118, 683–698. 10.1037/a0016763 [PubMed: 19899839]

Myers TA Ridolfi DR, Crowther JH, & Ciesla JA (2012). The impact of appearance-focused social comparisons on body image disturbance in the naturalistic environment: The roles of thin-ideal

internalization and feminist beliefs. Body Image, 9, 342–351. 10.1016/j.bodyim.2012.03.005 [PubMed: 22520342]

Rancourt D, Leahey TM, LaRose JG, & Crowther JH (2015). Effects of weight-focused social comparisons on diet and activity outcomes in overweight and obese young women. Obesity, 23, 85–89. 10.1002/oby.20953 [PubMed: 25407550]

Raudenbush SW, & Bryk AS (2002). Hierarchical linear models: Applications and data analysis methods (2nd ed.). Thousand Oaks, CA: Sage.

Raudenbush SW, Bryk AS, & Congdon R (2011). HLM 7.00 for Windows [Computer software]. Lincolnwood, IL Scientific Software International, Inc.

Ridolfi DR, Myers TA, Crowther JH, & Ciesla JA (2011). Do appearance focused cognitive distortions moderate the relationship between social comparisons to peers and media images and body image disturbance? Sex Roles, 65, 491–505. 10.1007/s11199-011-9961-0

Rosen JC, Jones A, Ramirez E, & Waxman S (1995). Body shape questionnaire: Studies of validity and reliability. International Journal of Eating Disorders, 20, 315–319. 10.1002/(SICI)1098-108X(199611)20:3<315::AID-EAT11>3.0.CO;2-Z

Schaefer LM, & Thompson JK (2014). The development and validation of the Physical Appearance Comparison Scale-Revised (PACS-R). Eating Behaviors, 15, 209–217. 10.1016/j.eatbeh.2014.01.001 [PubMed: 24854806]

Smyth JM, & Stone AA (2003). Ecological momentary assessment research in behavioral medicine. Journal of Happiness Studies, 4, 35–52. 10.1023/A:1023657221954

Stice E & Shaw HE (2002). Role of body dissatisfaction in the onset and maintenance of eating pathology: A synthesis of research findings. Journal of Psychosomatic Research, 53, 985–993. 10.1016/S0022-3999(02)00488-9 [PubMed: 12445588]

Tiggemann M, Polivy J, & Hargreaves D (2009). The processing of thin ideals in fashion magazines: A source of social comparison or fantasy? Journal of Social and Clinical Psychology, 28, 73–93. 10.1521/jscp.2009.28.1.73

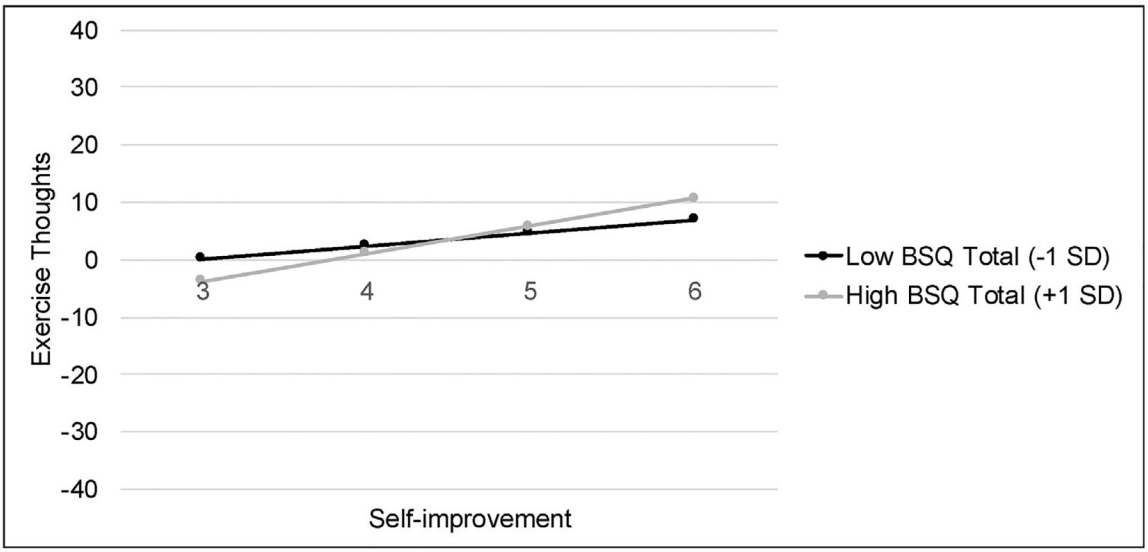

Fig. 1.

The association between self-improvement and exercise thoughts moderated by baseline body dissatisfaction. As shown in the legend, the Low BSQ Total line represents lower levels of baseline body dissatisfaction, measured by the Body Shape Questionnaire-16, and the High BSQTotal line represents greater levels of baseline body dissatisfaction.

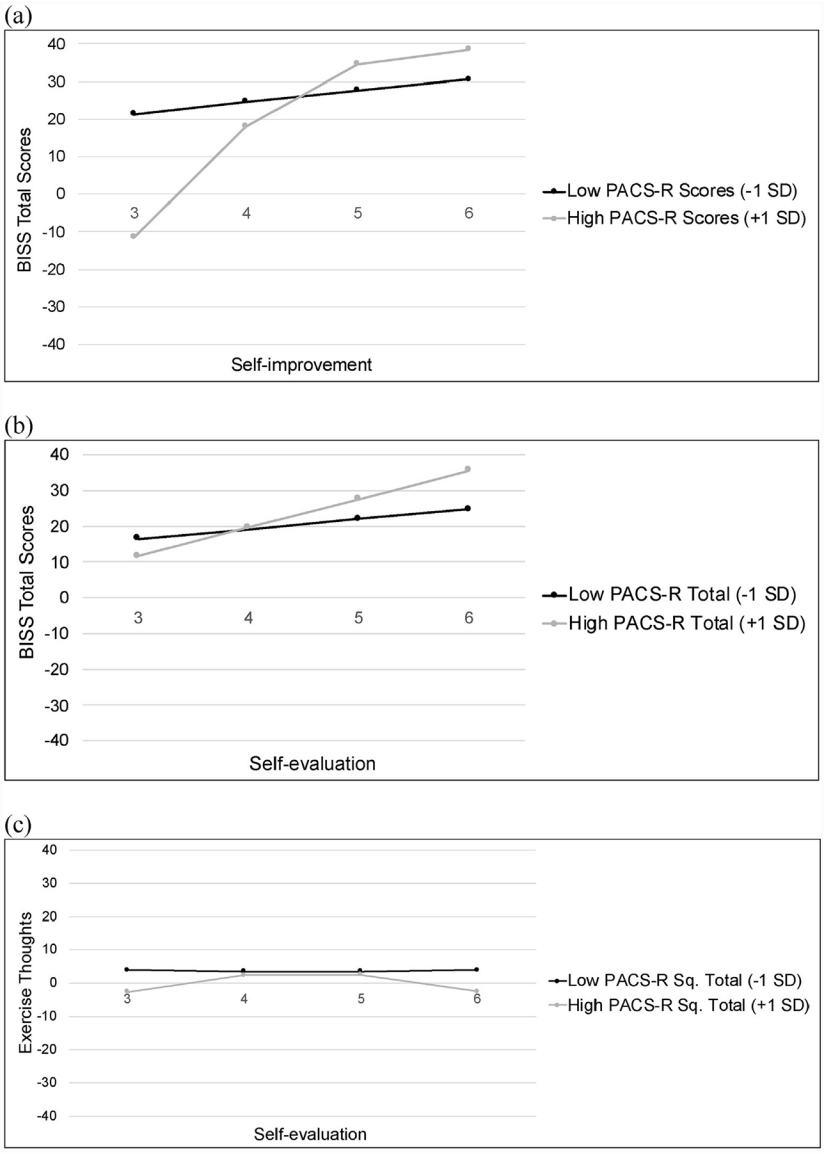

Fig. 2.

The momentary analyses in Aim 1 moderated by baseline appearance comparison tendency. Panels a and b represent the associations between self-improvement and self-evaluation and BISS total scores (momentary body dissatisfaction measured by modified Body Image States Scale total scores). Panel c shows the moderating effect of appearance comparison tendency on the exercise thoughts and self-evaluation association. As shown in the legends. Low PACS-R Total and Sq. Total lines represent the association at lower levels of appearance comparison tendency as measured by the Physical Appearance Comparison Scale-Revised and High PACS-R Total and Sq. Total lines represent the association at greater levels.

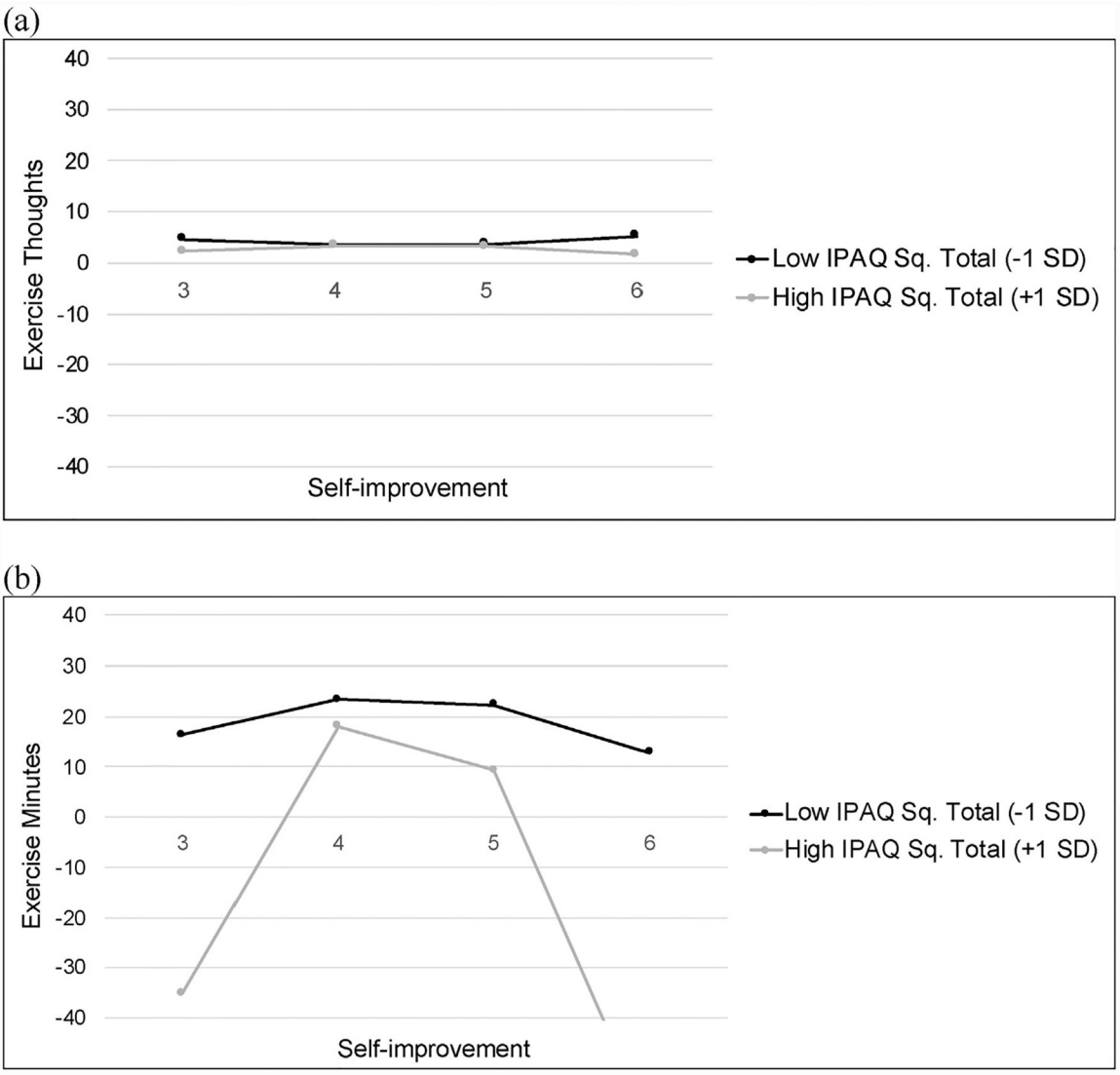

Fig. 3.

The associations between self-improvement and exercise thoughts (panel a) and exercise minutes (panel b) moderated by baseline exercise behaviors. As shown in the legend, the Low IPAQ Sq. Total line represents lower levels of baseline exercise behaviors, measured by the International Physical Activity Questionnaire, and the High IPAQ Sq. Total line represents greater levels of baseline exercise behaviors.

Table 1

Descriptive Statistics of Study Measures.

Measure	*N*	*M* (*SD*)	Range [Min, Max]	Skewness (*SE*)	Kurtosis (*SE*)	ICC M	ICC D	ICC P
Person-level								
BSQ	74	40.77 (16.09)	78 [17,95]	0.99 (0.28)	0.92 (0.55)			
PACS-R	74	18.13 (10.93)	44 [0,44]	0.38 (0.28)	−.31 (0.55)			
IPAQ	74	437.30 (492.23)	2000 [0, 2000]	1.76 (0.28)	2.90 (0.55)			
Day-level								
Exercise Minutes	607	22.03 (25.55)	130 [0,130]	1.47 (0.10)	2.30 (0.20)		.22	.78
Exercise Intentions	607	1.58 (1.06)	4 [0,4]	0.79 (0.10)	0.58 (0.20)		.44	.56
Moment-level								
BISS	1388	15.95 (8.51)	36 [0,36]	−0.08 (0.07)	−0.58 (0.13)	.25	.10	.65
Exercise Thoughts	1388	2.49 (2.06)	6.00 [0, 6]	0.17 (0.07)	−1.29 (0.13)	.29	.07	.64
Self-improvement	107	4.36 (1.02)	4.81 [1.19, 6]	−0.96 (0.23)	1.01 (0.46)	.29	.13	.59
Self-evaluation	107	4.51 (1.04)	6.00 [0, 6]	−1.28 (0.23)	3.19 (0.46)	.28	.00	.72

Note. BSQ = Body Shape Questionnaire-16 total score, PACS-R = Physical Appearance Comparison Scale-Revised total scores, IPAQ = International Physical Activity Questionnaire total scores. Exercise Minutes = daily minutes in moderate and vigorous exercise, Exercise Intentions = daily intentions to exercise the next day, Body Dissatisfaction = total scores of the modified Body Image States Scale, Exercise Thoughts = ratings of momentary thoughts of exercising, Self-improvement = ratings of self-improvement, Self-evaluation = ratings of self-evaluation, ICC M = Intraclass correlation coefficient at the moment level, ICC D = Intraclass correlation coefficient at the day level, and ICC P = Intraclass correlation coefficient at the person level.

Table 2

Summary of Multilevel Analyses for Self-improvement and Self-evaluation Upward Body Comparisons Predicting Body Dissatisfaction and Exercise Thoughts, Intentions, and Behaviors.

Predictors	*B*	*SE B*	*t*	*df*	*p*
Concurrent Moment-level					
Body Dissatisfaction					
Self-improvement	−0.27	0.63	−0.43	32	.668
Self−evaluation	−0.15	1.19	−0.13	32	.901
Exercise Thoughts					
Self-improvement	0.83	0.27	3.08 **	73	.003
Self-evaluation	0.58	0.24	2.36 **	32	.025
Lagged Moment-level					
Body Dissatisfaction					
Self-improvement	2.11	1.40	1.51	1312	.131
Self-evaluation	1.08	0.84	1.29	1312	.198
Exercise Thoughts					
Self-improvement	−0.21	0.51	−1.41	1312	.158
Self-evaluation	−0.23	0.04	1.23 †	1312	.082
Day-level					
Exercise Intentions					
Self-improvement	0.02	0.19	0.14	41	.886
Self-evaluation	0.03	0.20	0.14	41	.289
Exercise Minutes					
Self-improvement	−4.88	5.92	−1.82	78	.472
Self-evaluation	−0.51	7.03	−0.07	78	.955

Note. The Concurrent Moment-level and Day-level results are the results of Aim 1. Lagged Moment-level are the results of Aim 2. Body Dissatisfaction = total scores of the modified Body Image States Scale, Exercise Thoughts = ratings of momentary thoughts of exercising, Self-improvement = ratings of self-improvement, Self-evaluation = ratings of self-evaluation, Exercise Intentions = daily intentions to exercise the next day, Exercise Minutes = daily minutes in moderate and vigorous exercise.

† $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 3

Summary of Multilevel Analyses for Aim 2 Moderated by Baseline Body Dissatisfaction.

Predictors	*B*	*SE B*	*t*	*df*	*p*
Moment-level					
Body Dissatisfaction					
Self-improvement × BSQ	0.04	0.08	0.52	31	.607
Self-improvement × BSQ Sq.	0.00	0.00	0.96	31	.342
Self-evaluation × BSQ	0.03	0.10	−0.27	31	.792
Self-evaluation × BSQ Sq.	0.00	0.00	0.49	31	.625
Exercise Thoughts					
Self-improvement × BSQ	0.08	0.03	2.48*	31	.019
Self-improvement × BSQ Sq.	0.00	0.00	1.99†	31	.056
Self-evaluation × BSQ	0.01	0.05	0.11	31	.913
Self-evaluation × BSQ Sq.	−0.00	0.00	−0.05	31	.960
Day-level					
Exercise Intentions					
Self-improvement × BSQ	−0.00	0.01	−0.35	40	.701
Self-improvement × BSQ Sq.	−0.00	0.00	−0.43	40	.672
Self-evaluation × BSQ	0.01	0.01	1.14	40	.262
Self-evaluation × BSQ Sq.	0.00	0.00	1.27	40	.212
Exercise Minutes					
Self-improvement × BSQ	0.26	0.52	0.51	40	.611
Self-improvement × BSQ Sq.	0.00	0.00	0.29	40	.774
Self-evaluation × BSQ	0.31	0.34	0.91	40	.368
Self-evaluation × BSQ Sq.	0.00	0.00	0.58	40	.564

Note. BSQ = Body Shape Questionnaire-16 total score, BSQ Sq. = Body Shape Questionnaire-16 total score squared, Moment-level Body Dissatisfaction = total scores of the modified Body Image States Scale.

† $p < .10$,

* $p < .05$,

** $p < .01$,

$^{***}p < .001$.

Table 4

Summary of Moderator Follow-up Analyses.

Predictors	*B*	*SE B*	*t*	*df*	*p*
Moment-level					
Body Dissatisfaction × *Self-improvement*					
PACS-R 1 SD Above	5.26	1.02	5.18***	31	<.001
PACS-R 1 SD Below	−2.04	0.65	−3.15**	31	.004
PACS-R Sq. 1 SD Above	6.23	2.11	2.95**	31	.006
PACS-R Sq. 1 SD Below	−2.08	1.07	−1.95†	31	.060
Body Dissatisfaction × *Self-evaluation*					
PACS-R 1 SD Above	3.69	1.40	2.64*	31	.013
PACS-R 1 SD Below	−1.64	1.30	−1.26	31	.217
Exercise Thoughts × *Self-improvement*					
BSQ 1 SD Above	1.65	0.60	2.74*	31	.010
BSQ 1 SD Below	−0.81	0.41	−1.98†	31	.057
IPAQ Sq. 1 SD Above	−0.81	0.28	−2.87**	31	.007
IPAQ Sq. l SD Below	1.12	0.43	2.59*	31	.015
Exercise Thoughts × *Self-evaluation*					
PACS-R Sq. 1 SD Above	−1.03	0.51	−2.02*	72	.047
PACS-R Sq. 1 SD Below	1.39	0.35	4.01***	72	<.001
Day-level					
Exercise Minutes × *Self-improvement*					
IPAQ Sq. 1 SD Above	−22.46	10.24	−2.19*	36	.035
IPAQ Sq. 1 SD Below	7.11	11.26	0.63	36	.532

Note. Moment-level Body Dissatisfaction = total scores of the modified Body Image States Scale, BSQ = Body Shape Questionnaire-16 total score, BSQ Sq. = Body Shape Questionnaire-16 total scores squared, PACS-R-Physical Appearance Comparison Scale-Revised total scores, PACS-R Sq. = Physical Appearance Comparison Scale-Revised total scores squared, IPAQ = International Physical Activity Questionnaire total scores, IPAQ Sq. = IPAQ total scores squared, 1 *SD* Above = scores were centered 1 *SD* above the mean, 1 *SD* Below-scores were centered 1 *SD* below the mean.

† $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 5

Summary of Multilevel Analyses for Aim 1 Moderated by Baseline Appearance Comparison Tendency.

Predictors	*B*	*SE B*	*t*	*df*	*p*
Moment-level					
Body Dissatisfaction					
Self-improvement × PACS-R	0.33	0.05	5.31***	31	<.001
Self-improvement × PACS-R Sq.	0.01	0.00	2.75**	31	.010
Self-evaluation × PACS-R	0.24	0.10	2.39*	31	.023
Self-evaluation × PACS-R Sq.	0.01	0.00	1.43	31	.162
Exercise Thoughts					
Self-improvement × PACS-R	0.05	0.06	0.84	31	.408
Self-improvement × PACS-R Sq.	0.00	0.00	0.28	31	.778
Self-evaluation × PACS-R	−0.07	0.04	−1.99*	72	.051
Self-evaluation × PACS-R Sq.	−0.00	0.00	−3.81***	72	<.001
Day-level					
Exercise Intentions					
Self-improvement × PACS-R	−0.00	0.02	−0.05	40	.960
Self-improvement × PACS-R Sq.	−0.00	0.00	−0.21	40	.837
Self-evaluation × PACS-R	0.01	0.01	1.67	40	.103
Self-evaluation × PACS-R Sq.	0.00	0.00	1.57	40	.124
Exercise Minutes					
Self-improvement × PACS-R	−0.13	0.76	−0.17	40	.868
Self-improvement × PACS-R Sq.	−0.01	0.01	−0.34	40	.738
Self-evaluation × PACS-R	0.21	0.61	0.34	40	.734
Self-evaluation × PACS-R Sq.	0.00	0.01	0.05	40	.959

Note. PACS-R = Physical Appearance Comparison Scale-Revised total scores, PACSR Sq. = Physical Appearance Comparison Scale-Revised total scores squared. Moment-level Body Dissatisfaction = total scores of the modified Body Image States Scale.

† p < .10,

* *p* < .05,

** *p* < .01,

***$p < .001$.

Table 6

Summary of Multilevel Analyses for Aim 1 Moderated by Baseline Exercise Behaviors.

Predictors	*B*	*SE B*	t	*df*	*p*
Moment-level					
Body Dissatisfaction					
Self-improvement × IPAQ.	−0.00	0.00	−0.28	31	.781
Self-improvement × IPAQ Sq.	0.00	0.00	0.31	31	.763
Self-evaluation × IPAQ	0.00	0.00	0.60	31	.556
Self-evaluation × IPAQ Sq.	0.00	0.00	1.75†	31	.090
Exercise Thoughts					
Self-improvement × IPAQ	−0.00	0.00	−2.73*	31	.010
Self-improvement × IPAQ Sq.	−0.00	0.00	−2.80**	31	.009
Self-evaluation × IPAQ	−0.00	0.00	−0.95	31	.350
Self-evaluation × IPAQ Sq.	−0.00	0.00	0.43	72	.667
Day-level					
Exercise Intentions					
Self-improvement × IPAQ	−0.00	0.00	−1.38	40	.175
Self-improvement × IPAQ Sq.	−0.00	0.00	−1.70*	40	.097
Self-evaluation × IPAQ	0.00	0.00	1.18	40	.247
Self-evaluation × IPAQ Sq.	0.00	0.00	0.52	40	.604
Exercise Minutes					
Self-improvement × IPAQ	−0.02	0.01	−1.79†	40	.081
Self-improvement × IPAQ Sq.	−0.00	0.00	−2.21*	36	.033
Self-evaluation × IPAQ	−0.01	0.01	−0.89	40	.382
Self-evaluation × IPAQ Sq.	−0.00	0.00	−0.91	36	.369

Note. IPAQ = International Physical Activity Questionnaire total scores, IPAQ Sq. = IPAQ total scores squared, Moment-level Body Dissatisfaction = total scores of the modified Body Image States Scale.

†p <. 10,

$^{*}p < .05$,

$^{**}p < .01$,

$^{***}p < .001$.