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The Daily Frequency, Type, and Effects of Appearance Comparisons on Disordered Eating

Katherine Drutschinin[1], Matthew Fuller-Tyszkiewicz[2,3], Tara De Paoli[1], Vivienne Lewis[4], and Isabel Krug[1]

Abstract

Using experience sampling methodology, we examined the effects of frequency and occurrence of appearance-based comparisons on disordered eating behaviors (binge eating, restrictive behaviors, and weight-related exercise). A total of 161 Australian women (aged 18–48) completed a baseline measure of eating pathology. An iPhone application prompted participants 6 times daily for 7 days to self-report on appearance comparisons and disordered eating behaviors since the last assessment. We hypothesized that contemporaneously reported occurrences of both upward and downward appearance comparisons, when compared to noncomparison situations, and frequency of upward comparisons would predict disordered eating behaviors. In prospective (lagged) analyses, only upward comparisons (relative to noncomparison situations) significantly predicted the likelihood of disordered eating outcomes. Trait eating pathology had a direct effect on each disordered eating variable and also moderated the influence of upward appearance comparisons (relative to noncomparison assessments) on binge-eating episodes. The lack of a differentiated effect between contemporaneously reported occurrences of upward and downward comparisons suggests that both forms of comparison increase the likelihood of disordered eating. Women may benefit from preventive programs that focus on the detrimental consequences of appearance comparisons on disordered eating; such programs may equip women with strategies to help reduce the frequency of these comparisons.

Keywords

appearance comparison, upward, downward, lateral, eating pathology, ecological sampling method

The tendency to compare one's appearance against others has been identified as a risk factor in the development of disordered eating (DE) behaviors through numerous longitudinal studies (e.g., Rodgers, McLean, & Paxton, 2015; van den Berg, Thompson, Obremski-Brandon, & Coovert, 2002). Body image researchers have utilized Festinger's (1954) social comparison theory to explain both the frequency and effects of appearance-related behaviors. Festinger theorized that individuals evaluate themselves based on comparisons to others in areas of perceived importance. Festinger's theory—when applied to the domain of physical appearance—suggests that upward comparisons against subjectively more attractive individuals would elicit negative consequences as a result of the perceived unfavorable discrepancy between appearances. In contrast, downward comparisons against subjectively less attractive individuals should garner beneficial effects because of a favorable difference between perceived appearances.

More recent social comparison theories, such as Fredrickson and Roberts's (1997) objectification theory and the tripartite influence model (Thompson, Coovert, & Stormer, 1999), postulate that upward social comparisons are particularly common for appearance and that these comparisons contribute to eating disorders (EDs). The tripartite influence model suggests that there are three primary sources of sociocultural influence that form the basis for later development of DE and body image disturbance: peers, parents, and media. The model hypothesizes that heightened appearance comparison tendencies lead to DE outcomes.

The tripartite influence model aligns with Fredrickson and Roberts' (1997) objectification theory, which was originally advanced to provide a framework for understanding

[1] Melbourne School of Psychological Sciences, University of Melbourne, Victoria, Australia
[2] School of Psychology, Deakin University, Geelong, Victoria, Australia
[3] Center for Social and Early Emotional Development, Deakin University, Geelong, Victoria, Australia
[4] Faculty of Health, University of Canberra, Australia

Corresponding Author:
Isabel Krug, University of Melbourne, Psychology Clinic, 14-20 Blackwood Street, Vic 3010, Melbourne, Australia.
E-mail: Isabel.krug@unimelb.edu.au

the consequences of being a woman in a sociocultural context that sexually objectifies the female body. Fredrickson and Roberts proposed that a woman's worth is equated with the appearance of her body to the exclusion of other significant aspects of her identity, the value of which is judged according to sociocultural ideals of attractiveness (e.g., thinness) and sexual functionality (Moradi & Huang, 2008; Rubin, Nemeroff, & Russo, 2004). When objectification is internalized, it can lead to habitual body surveillance (e.g., appearance comparisons), which increases women's opportunities for body shame, dissatisfaction, and anxiety, and, consequentially, DE behaviors to improve appearance and alleviate these negative emotions.

The proposed damaging effects of upward appearance comparisons are well established. Survey research on appearance comparisons has found that the tendency to engage in upward appearance-focused comparisons is associated with greater body image distortion, body dissatisfaction, appearance self-monitoring, and eating disturbances (e.g., Calogero, Davis, & Thompson, 2005; Moradi, Dirks, & Matteson, 2005; Myers & Crowther, 2009; Noll & Fredrickson, 1998; Rancourt, Schaefer, Bosson, & Thompson, 2016). In turn, experimental research has demonstrated increases in negative mood states, ED cognitions, body shame, and appearance-related anxiety, as well as decreases in self-esteem and positive affect following presentation of images of female bodies corresponding to the "thin-ideal" (i.e., low BMI; e.g., Blechert, Nickert, Caffier, & Tuschen-Caffier, 2009; Harper & Tiggemann, 2008; Legenbauer, Ruhl, & Vocks, 2008; Lindner, Hughes, & Fahy, 2008).

Although these laboratory studies provide evidence for the negative effects of upward appearance comparisons, the experimental manipulations utilized may not accurately reflect the duration, type, or target of appearance comparisons in everyday life, as participants were provided with comparison targets rather than asked to choose their own; and their behaviors and states were measured in controlled, rather than naturalistic, environments. Researchers more recently have explored the frequency and consequences of comparison behaviors in daily life using the experience sampling methodology (ESM; Larson & Csikszentmihalyi, 1983). Unlike experimental studies, in which participants are typically located within a laboratory setting, ESM studies involve repeatedly sampling target emotions and behaviors, such as appearance comparisons and DE behaviors, in situ, and through self-report (e.g., "Have you engaged in a social comparison in the past 30 minutes?"). Participants in ESM studies monitor target symptoms for extended periods of time (e.g., 5–10 assessments per day for a period of 1–2 weeks). The methodology allows evaluation of frequency of behavior, concurrent and lagged associations, and duration of impact of a predictor on the outcome of interest (e.g., for how long an upward comparison may affect mood). Thus, although experimental control is reduced when using ESM, it allows participants to engage in the target behavior in the manner in which they commonly do in their daily lives, hence enhancing ecological validity (Piasecki, Hufford, Solhan, & Trull, 2007).

To date, ESM studies have demonstrated that upward appearance-based comparisons are associated with increases in negative affective states, such as guilt, body dissatisfaction, and negative mood (Fitzsimmons-Craft et al., 2015; Leahey, Crowther, & Ciesla, 2011; Leahey, Crowther, & Mickelson, 2007; Myers, Ridolfi, Crowther, & Ciesla, 2012; Ridolfi, Myers, Crowther, & Ciesla, 2011), as well as increased thoughts about exercising and dieting (Leahey & Crowther, 2008; Leahey et al., 2011). There also is evidence to suggest that both the occurrence and negative effects of upward comparisons may be more pronounced for individuals with greater trait-level body image disturbances, internalization of the thin ideal, and DE pathology (Leahey & Crowther, 2008; Leahey et al., 2011; Myers et al., 2012).

We assumed, based on the literature, that individuals with eating pathology would be likely to be particularly vulnerable to appearance comparisons. This might be because individuals with eating pathology (a) overevaluate the importance of their weight and shape in judgments of self-worth, relative to their perceived performance in a range of other life domains (Fairburn, Cooper, & Shafran, 2003); (b) have internalized and strive to meet an unrealistic thin-ideal (Cooper & Fairburn, 2011; Fingeret & Gleaves, 2004); and (c) are more likely to attend to appearance-related stimuli in their environment, particularly stimuli that support internalized conceptions of the thin-ideal (Thompson & Stice, 2001). Consequently, the act of comparison may reinforce negative body image concerns and spur further attempts toward thin-ideal attainment through DE behaviors.

Considerably less attention has been given to whether instances of appearance-based social comparisons lead to actual DE behaviors. Fitzsimmons-Craft, Ciao, and Accurso (2016) found in an undergraduate sample of women that although body comparisons prospectively predicted increased thoughts about restriction and exercise, these comparisons did not predict engagement in DE behaviors (food restriction, binge eating, or vomiting). Instead, Fitzsimmons-Craft et al. found that DE behaviors were better predicted by eating- and exercise-related comparisons. In contrast, Leahey et al. (2011) found a significant association between appearance comparisons and restrictive eating, but only among women with both elevated trait-level eating pathology and body dissatisfaction. Hence, it is possible that these links are specific to individuals with more severe symptomatology.

It is also possible that the null effects found by Fitzsimmons-Craft et al. (2016) were due to how appearance comparisons were operationalized. Whereas Leahey et al. (2011) evaluated occurrences of upward comparisons as the predictor of DE, Fitzsimmons-Craft et al. (2016) used frequency of comparisons (regardless of direction) as the predictor. Given the inconsistent evidence of the effect of downward comparisons on body image and DE (e.g., Leahey

& Crowther, 2008; Leahey et al., 2011; Leahey et al., 2007; Myers et al., 2012), failure to separate downward from upward comparisons may have masked effects in these analyses. Such an explanation also may account for why the occurrence of upward social comparisons predicted DE behaviors more than the frequency of comparisons (regardless of direction) in prior work. This explanation also highlights that the reference category used (e.g., no comparison or downward comparison) may affect estimates of the effect of upward appearance comparisons on DE behaviors.

The Current Study

In light of the limited and inconsistent prior findings from previous research, as well as concerns about the influence of operationalization of appearance comparisons in many studies, the present study re-evaluated within an ESM framework, the effects of frequency and occurrence of upward appearance-based comparisons on DE in a female population. Appearance-based comparisons were modeled separately as frequency of occurrence and then as mere occurrence (upward vs. downward comparisons and upward vs. noncomparison events). Consistent with objectification theory and the tripartite influence model, we predicted that (1) for all three operationalizations of appearance comparison, upward comparisons would be associated with increases in DE behaviors; (2) effects of upward comparison instances on DE behaviors would be stronger when compared against noncomparison events than when compared against downward comparisons; and (3) these state-based effects (regardless of operationalization of appearance comparison) would be strongest for individuals with higher trait eating pathology. The decision to include only women in this study was twofold. First, DE and appearance comparisons have been found to be more common in females than males (Allen, Byrne, Oddy, & Crosby, 2013; Leahey et al., 2011), and second, there is currently a lack of research including males on the factors of interest, meaning there would be little literature on which to base our hypotheses.

For each of these analyses, DE was split into three separate components: binge eating, efforts to restrict intake and/or lose weight (skipping a meal and restricting intake), and exercising for more than an hour for weight-related reasons. This division was deemed necessary from a conceptual perspective; binge eating, even though it can be directly related to body dissatisfaction, is often also viewed as a comfort or distraction from negative thoughts, including those about appearance (Meyer & Waller, 1999), whereas the restriction efforts typically are undertaken to directly address dissatisfaction with one's appearance (Fitzsimmons-Craft et al., 2016). Although weight-related reasons are a primary, and generally healthy, motivation for many people to engage in exercise, engaging in excessive exercise for weight-related reasons is a more concerning DE practice. Instances of exercising for more than an hour for weight-related reasons was therefore assessed separately as an alternate means of attempting to lose/control weight (Gonçalves & Gomes, 2012). Because the focus of this study was on behaviors of reasonably frequent occurrence in the general population, we decided not to include purging behavior.

Method

Participants

Participants were recruited from three Australian Universities and also from the general public via advertisements on ED-related organizations' websites. To be eligible for the study, participants needed to be female, aged 18 years or older, and own an iPhone with an i0S8 (or newer) operating system. Altogether, 211 participants took part in the study; however, the following were excluded because of (a) being low-scoring outliers ($z < -1.96$; Field, 2013) in terms of number of ESM assessments completed ($n = 27$); (b) no baseline measures completed ($n = 11$); or (c) not entering their unique ID number to identify their data ($n = 10$). Although we initially excluded males from the study, two males ended up participating in the study and were subsequently excluded from analysis. The remaining 161 female participants, aged 18–48 ($M = 22.1$, $SD = 6.7$), were included in the analyses. Sample sizes greater than 100 have been found to be adequate for multilevel modeling (Maas & Hox, 2005). More than half of the participants were Caucasian, single, employed, and had completed secondary education. The mean body mass index (BMI) of the sample was 22.30 ($SD = 4.24$). Table 1 provides details on the sociodemographic characteristics of the sample. This study was approved by the ethics committees from all three institutions.

Procedure

Participants were required to own an iPhone with an i0S8 (or newer) operating system in order to run the ESM application. Participants completed an initial baseline assessment (Phase 1) followed by a 7-day experience sampling assessment phase (Phase 2). In Phase 1, participants read an online plain language statement and gave informed consent. The online survey platform then gave instructions on how to download a purpose-built mobile application for the ESM data collection before being prompted to enter their unique ID (assigned to them via the iPhone application after they downloaded it), linking the subsequent baseline questionnaire data to the participant's Phase 2 experience sampling data.

The day after Phase 1, the iPhone application began signaling six times per day, buzzing briefly at random intervals between 9 a.m. and 10 p.m. These signals alerted the participant to complete a brief 1–2-minute survey containing items about appearance comparisons and DE behaviors. Participants had a 30-minute window within which to complete the survey before it was no longer accessible to them and counted as missing data. This procedure was repeated for a

Table 1. Demographic Characteristics of the Sample.

Descriptive Variable	Statistic
Age ($M \pm SD$)	21.84 ± 5.68
BMI ($M \pm SD$)	22.30 ± 4.24
Ethnicity (%)	
Caucasian	75.0
Asian	20.0
Other	5.0
Level of education (%)	
Year 12 or less	61.3
Certificate/diploma	7.5
Bachelor	23.1
Postgraduate	8.1
Employment status (%)	
Yes	62.5
Relationship status (%)	
Single	50.6
Relationship	33.8
De facto	7.5
Married	6.9
Divorced/separated	1.3

Note. BMI = body mass index.

period of 7 days (maximum of 42 assessments). In line with previous studies (e.g., Fuller-Tyszkiewicz et al., 2013), this study chose 7 days to reduce participants' response burden but still attain ecologically valid information by capturing all weekdays and the weekend.

Measures

Baseline trait measures. We administered two measures in Phase 1 to assess baseline data. A demographics questionnaire obtained information concerning age, ethnicity, current employment status, weight and height to calculate body mass index (BMI), relationship status, employment status and highest level of education completed. Disordered eating attitudes and behaviors were assessed with the Eating Attitudes Test–26 (EAT-26; Garner, Olmsted, Bohr, & Garfinkel, 1982). The EAT-26 consists of 26 items and is made up of three subscales—dieting (13 items; an example is "I am terrified about being overweight"), bulimia and food preoccupation (6 items; an example is "I find myself preoccupied with food"), and oral control (7 items; an example is "I avoid eating when I am hungry"). Items were rated on a 6-point scale from 0 (*never*) to 5 (*always*). Higher scores on the EAT-26 indicate greater levels of eating pathology, with scores of 20 or above indicating a high level of risk for problematic eating behavior. In the current study only the total EAT-26 score was used. Good internal consistency ($\alpha = .83$–$.90$) and test–retest reliability ($r = .84$) have been demonstrated in samples of young women for this total EAT-26 scale (Carter & Moss, 1984; Garner et al., 1982). In the current study, the internal consistency coefficient was high for the total scale ($\alpha = .90$). Finally, good convergent validity was reported by Doninger, Enders, and Burnett (2005), who found high correlations with four external criteria including BMI, the difference between self-reported ideal and actual weights, and the drive for thinness subscale of the Eating Disorders Inventory–2 (EDI-2; Garner, 1991), and the body dissatisfaction subscale of the EDI-2.

State measures using ecological sampling. In Phase 2 of the study, all of the state measures we included consisted of one or two items, in accordance with other ESM studies in the field (e.g., Engel et al., 2013; Goldschmidt et al., 2014; Heron, Scott, Sliwinski, & Smyth, 2014; Leahy et al., 2007; Ridolfi et al., 2011).

Frequency and occurrence of appearance comparisons. Participants indicated the frequency of appearance comparisons they had engaged in since their last assessment using a 10-point continuous scale (*none at all* to *constantly*). Higher scores indicated higher frequency of appearance comparison engagement. A response of 0 was classified as a noncomparison. Participants were also asked to indicate how they thought and felt after their recent appearance comparison, which indirectly measured the type of comparison engaged in (i.e., upward or downward). A 5-point Likert scale was used: "Compared to the other individual you felt you looked: (1) *much worse*, (2) *worse*, (3) *same*, (4) *better*, (5) *much better*." For analysis, responses *much worse* and *worse* were coded as an upward comparison, *better* and *much better* as a downward comparison, and *same* as a lateral comparison. These response options were dummy coded into two binary comparisons: (a) downward comparisons (coded 1) versus upward comparisons (coded 0), and (b) noncomparison assessments (coded 1) versus upward comparisons (coded 0). Lateral comparisons were discarded.

We are not aware of any studies that directly compared this form of recall against objective measures of actual appearance comparisons. However, studies have shown that appearance comparison frequency and type are consistent with theoretical postulations that these negative comparisons are more common among women with trait-level body image disturbances (e.g., Leahy et al., 2007). Our measure of appearance comparison frequency was similar to that used in an ESM study by Ridolfi and colleagues (2011), which showed predictive validity in terms of association with body checking, negative affect, and body image disturbances. As we were interested primarily in the frequency of upward comparisons, frequency values for instances of downward or lateral comparisons were excluded from analysis. This was deemed necessary to avoid conflation of potential positive effects of downward and lateral comparisons with negative effects of upward comparisons.

Our use of binary comparisons for types of appearance comparison (e.g., upward, downward) is consistent with prior ESM studies analyzing the effects of comparison behaviors (e.g., Leahey et al., 2007; Ridolfi et al., 2011). The validity of this measure has been previously demonstrated in terms of

association with variables theoretically relevant to comparisons, such as body checking and guilt (Ridolfi et al., 2011) and DE attitudes and behaviors (Fitzsimmons-Craft et al., 2016; Leahey et al., 2011).

Engagement in disordered eating behaviors. Participants were asked to indicate *yes* or *no* to whether they had engaged in DE behaviors since their last assessment, "Did you engage in any of the following behaviors since you last responded?": (1) "binge eating" (2) "dietary restriction," (3) "skipping a meal," and (4) "exercising for over an hour for weight-related reasons." For analysis, these items were separated into three variables: (a) binge eating (single item), (b) restriction efforts (dietary restriction + skipping a meal), and (c) exercise for weight-related reasons (single item). Support for these single item approaches can be seen from previous ESM studies assessing DE behaviors (Engel et al., 2013; Goldschmidt et al., 2014; Heron, Scott, Sliwinski, & Smyth, 2014). The validity of these measures has been previously demonstrated in terms of association with variables theoretically relevant to DE behaviors such as mood, loss of control (LOC) eating, eating large amounts of food, purging, drinking fluids to curb appetite, and weighing oneself multiple times per day (Engel et al., 2013; Goldschmidt et al., 2014; Heron et al., 2014).

Data Analytical Plan

We used multilevel modeling to test the influences of trait eating pathology and instances or frequency of upward appearance comparisons on the DE variables (binge eating, restriction efforts, and weight-related exercise). We used a Bernoulli distribution to model binge-eating episodes and weight-related exercise as dichotomous outcomes, whereas a Poisson distribution was used to model restriction efforts (with possible scores on this outcome ranging from 0 to 2 as a tally of the two different restriction-type behaviors).

We ran models twice: once with lagged relations between state-based variables (e.g., appearance comparison at time $t-1$ predicting binge eating at time t), and once with relations between contemporaneously measured state-based variables (e.g., appearance comparison at time t predicting binge eating at time t). This enabled evaluation of sensitivity of results to time lag between predictor and outcome measures, with the lagged analyses facilitating evaluation of whether appearance comparisons could prospectively predict DE outcomes. As this increased the number of model parameters to test for significance, alpha was set at .01 instead of .05 to adjust for Type I error inflation for these multilevel models. Type I error rates increase as a function of the number of comparisons made rather than sample or effect size. We based the adjustment on the number of comparisons made, and chose a conservative approach to correct for this (hence setting alpha at .01 instead of .05).

In all models (lagged and contemporaneous), we included time of day and order of assessment (from first to last assessment in the participants' ESM phases) as covariates, because several correlations with DE outcomes were observed in preliminary analyses (see Results section), and also due to evidence for these effects in prior studies (e.g., Leahey et al., 2011; Smyth et al., 2009). In all lagged models, we used appearance comparison at the previous time point (time $t-1$) to predict scores on the DE outcome at the current time-point (time t). Scores on the dependent variable at $t-1$ were included as a covariate, as was time lag between times t and $t-1$, since random ESM scheduling meant the time interval between consecutive assessments varied within and across individuals. These lagged associations were limited to within the same day, as per Fitzsimmons-Craft et al. (2016).

Results

Data Preparation and Preliminary Analyses

Although multilevel modeling is statistically robust to missing data, it is important to consider the pattern of missingness and how much missingness is acceptable, because of implications for interpretability and generalizability of findings (Hox, 2002). Little's MCAR test (1988) was performed on Level 2 data (the baseline data) and proved nonsignificant, $\chi^2(383, n = 160) = 396.71, p = .163$, indicating the data were missing completely at random. This missingness (0.13%) was dealt with using expectation maximization. There were no incomplete or half-completed assessment points in Level 1 data (ESM data), as participants either completed the state-based measures or not during the ESM phase.

A related concern, however, is that procedural noncompliance during the ESM phase may undermine result generalizability. The average number of ESM surveys completed per participant was 21.8 ($SD = 9.2$) out of 42 possible assessments (52.21%). We evaluated whether the likelihood of missing ESM data was related to individual difference variables. Compliance was significantly, yet weakly, related with eating pathology ($r = -.22$, $p = .006$); age ($r = -.20$, $p = .013$); level of educational attainment ($r = -.23$, $p = .003$); ethnicity, $F(2, 158) = 3.81$, $p = .024$; and employment status ($r = -.21$, $p = .008$); but unrelated to BMI ($r = -.05$, $p = .542$) or relationship status, $F(4, 156) = 0.47$, $p = .757$. Specifically, compliance was lower among individuals with more pathological eating symptoms who were older, were currently employed, and reported higher levels of educational attainment. Individuals who reported ethnicity as Caucasian or Asian completed more assessments than participants grouped in the "Other" category for ethnicity.

Table 2 presents the frequencies, means, standard deviations, and possible range of scores for the current studies for Level 1 and Level 2 variables of interest. As shown by the intraclass correlation values, most of the Level 1 variables had more variance between individuals than within, with the exception of frequency of appearance comparisons. Nevertheless, there was still at least one-third variance within

Table 2. Descriptive Statistics for all Level-1 and Level-2 Variables.

Level	Variable	%	*M*	*SD*	Possible Range	ICC
Level 1	Binge Eating	5.8	n/a	n/a	0 or 1	.67
	Restriction Efforts	17.8[a]	n/a	n/a	0–2	.66
	Excessive Exercise	11.4	n/a	n/a	0 or 1	.60
	Upward Comparison	26.5	n/a	n/a	0 or 1	.52
	Downward Comparison	9.0	n/a	n/a	0 or 1	.52
	Same Comparison	24.3	n/a	n/a	0 or 1	.51
	No Comparison	40.2	n/a	n/a	0 or 1	.69
	Frequency of Comparisons	n/a	3.01	2.11	0–10	.49
Level 2	Eating Pathology	n/a	11.86	12.40	0–64	n/a

Note. Level 1 variables are state measures, whereas Level 2 variables are trait measures. n/a = not applicable, ICC = intraclass correlation.
[a]At least one of two symptoms reported. Both symptoms were reported 209 times (6.0%).

individuals for each of these variables, justifying exploration at the state level. Level of eating pathology was moderate for the sample as a whole. Although not shown in the table, 32 participants (20%) exceeded a score of 20 on the EAT-26, suggesting a high level of risk for developing an ED.

Reactivity and Time of Assessment Effects

We explored reactivity to the ESM protocol by evaluating potential increased frequency of reporting of behaviors across the testing period. Aggregates were obtained for each day within participant. One-way analyses of variance revealed small yet significant differences in reporting of exercising for an hour or more for weight-related reasons, $F(6, 990) = 2.54$, $p = .019$, $\text{eta}^2 = .02$, and restrictive behaviors, $F(6, 990) = 2.57$, $p = .018$, $\text{eta}^2 = .02$, across the days of assessment (from first to seventh); but no significant differences for appearance comparison frequency, $F(6, 990) = 0.82$, $p = .557$, $\text{eta}^2 = .01$, and binge episodes, $F(6, 990) = 0.92$, $p = .483$, $\text{eta}^2 = .01$. For both the exercise and restraint variables, there was a clear drop-off in reported activity across the week, which could reflect initial reactivity because of novelty of the ESM protocol, or simply time-related decline in these behaviors.

We also explored effects on reporting with respect to time of day and day of week. Aggregated day-level scores on binge episodes, $F(6, 1064) = 0.78$, $p = .588$, $\text{eta}^2 = .00$; exercise, $F(6, 1064) = 1.74$, $p = .109$, $\text{eta}^2 = .01$; restraint, $F(6, 1064) = 0.66$, $p = .679$, $\text{eta}^2 = .00$; and appearance comparison frequency, $F(6, 1064) = 0.48$, $p = .827$, $\text{eta}^2 = .00$, did not differ by day of the week. To test for time of day effects, we categorized time by hour, with continuous coding from first possible hour to last (9:00–9:59 a.m. = 0 to 9:00–9:59 p.m. = 12), and treated as a predictor in multilevel models with the DE behaviors and appearance comparisons as outcome variables. Time of day was unrelated to reported binge eating ($b = .04$, $t = 1.18$, $p = .238$); comparison frequency ($b = –.01$, $t = –1.13$, $p = .259$); or exercising for an hour or more for weight-related reasons ($b = –.04$, $t = –1.67$, $p = .095$); but was associated with restrictive behaviors ($b = –.10$, $t = –4.58$, $p < .001$).

Multilevel Models

Contemporaneous associations. As shown in Table 3, frequency of upward appearance comparisons and engagement in appearance comparisons (relative to noncomparison contexts) were associated with elevated likelihood of binge eating, restrictive behaviors, and exercising for an hour or more for weight-related reasons across the same time period. Upward comparisons relative to downward comparisons were also associated with higher likelihood of restraint behavior. Upward versus downward comparisons were not associated with binge eating or the exercise variable. All three of the DE behaviors were more common among individuals with heightened eating pathology. Eating pathology also moderated the association between upward versus noncomparison and binge eating, such that the likelihood of binge eating when engaging in upward comparisons was lower for individuals with elevated trait eating pathology (see Figure 1).

Lagged associations. Table 4 shows lagged effects of state-based predictors. Neither appearance comparison frequency nor upward vs downward comparison occurrence predicted subsequent DE behaviors. However, upward comparisons (relative to noncomparison contexts) were predictive of increased likelihood of subsequent binge eating and exercising for an hour or more for weight-related reasons, but unrelated to dietary restriction efforts. Main effects for eating pathology were significant, as per the contemporaneous models. Moderating effects of eating pathology were all nonsignificant at $p < .01$.

Discussion

Using an ESM framework, in the present study, we examined the effects of frequency and occurrence of upward appearance-based comparisons on DE (e.g., binge eating, restrictive behaviors, and weight-related exercise for an hour or more), in women of differing levels of trait eating pathology. Multilevel modeling analyses revealed that instances of binge eating, restrictive behaviors, and exercising for an hour or more for weight-related reasons were predicted by contemporaneously

Table 3. Multilevel Modeling Results for the Impact of Trait Eating Pathology and Concurrently Measured Appearance Comparison Behaviors on Dependent Variables.

		Binge eating			Dietary restraint			Exercise		
Model	Predictor	*b*	*t*	*p*	*b*	*t*	*p*	*b*	*t*	*p*
1	Upward comparison frequency	0.19	4.17	<.001	0.15	4.18	<.001	0.24	5.76	<.001
	Eating pathology	0.06	3.67	<.001	0.09	5.90	<.001	0.05	3.43	.001
	Up Comp × Eating Pathology	0.00	−1.47	.141	0.00	−0.77	.439	−0.01	−2.48	.013
2	Upward vs. noncomparison	−1.25	−2.91	.004	−0.63	−2.99	.003	−1.89	−7.00	<.001
	Upward vs. downward comparison	−0.63	−1.11	.268	−0.57	−2.24	.025	−0.18	−0.72	.473
	Eating pathology	0.07	4.12	<.001	0.09	6.68	<.001	0.05	3.75	<.001
	Up vs. Noncomp × Eating Pathology	0.05	2.63	.009	0.01	0.27	.791	0.04	2.21	.027
	Up vs. Down Comp × Eating Pathology	0.05	1.50	.134	0.04	1.86	.064	0.00	0.05	.960

Note. Upward comparison is coded as 0 in both upward vs. downward and upward vs. noncomparison variables. Thus, negative coefficients indicate the outcome is more likely when upward comparisons occurred. Significance tested at $p < .01$ to control Type I error rate.

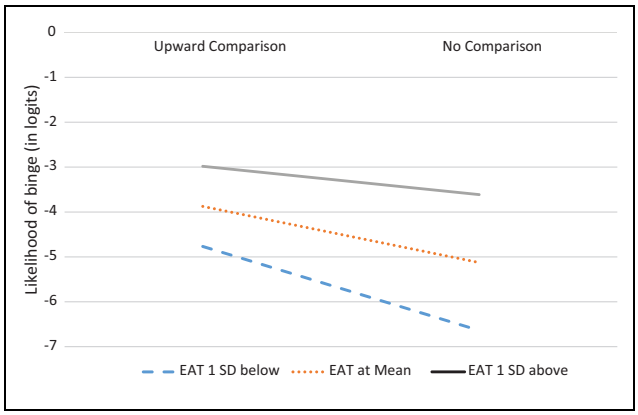

Figure 1. The relations between daily binge-eating episodes (in logit form), EAT-26 scores, and upward relative to no appearance comparison.

reported frequency of upward comparisons and occurrences of upward comparisons when compared with noncomparison situations (but not when in relation to downward comparisons). In the lagged models, only upward comparisons versus no comparison significantly predicted the likelihood of DE outcomes. Trait eating pathology was also found to have a direct effect on each of the state-based DE outcomes, as well as moderating the influence of upward appearance comparisons (relative to noncomparison assessments) on binge episodes. The contributions of these findings to the existing empirical base and to theory are discussed below.

Effect of Upward Appearance Comparisons on Disordered Eating Symptoms

While a growing body of literature has demonstrated the effect of upward appearance comparisons on mood states, body image, and thoughts of exercising and dieting (Fitzsimmons-Craft et al., 2015; Leahey & Crowther, 2008; Leahey et al., 2011; Leahey et al., 2007; Myers et al., 2012; Ridolfi et al., 2011), there has been limited evaluation of whether such comparisons actually lead to episodes of DE behaviors. The one study to date that examined this (Fitzsimmons-Craft et al., 2015) failed to predict instances of food restriction, binge eating, or vomiting in a college sample. Our speculation that these results may be due to the operationalization of appearance comparisons was supported, but our analyses also show some surprising results. First, our results show that the effect of upward comparisons on DE behaviors is observed when compared against instances of noncomparison, but not when compared against downward comparison occasions. This finding was consistent across both the contemporaneous and the lagged models, indicating robustness in the evaluation that appearance comparisons prospectively predicted DE outcomes. Our finding is in agreement with prior findings that have shown downward comparisons may also promote negative appearance, mood, and DE outcomes (e.g., Leahey & Crowther, 2008; Leahey et al., 2011; Leahey et al., 2007; Myers et al., 2012). Objectification theory may explain this if the act of comparison—whether upward, downward, or lateral—encourages a focus on appearance, and this in turn may activate negative appearance-related schema about the thin ideal and one's distance from this unrealistic goal.

Second, the finding that frequency of appearance comparisons was not a significant predictor of DE behaviors in the lagged models was unexpected. On the basis of concern that Fitzsimmons-Craft et al.'s (2015) null findings may be due to a conflation of comparisons of differing direction, we excluded downward and lateral comparisons when analyzing impact of appearance frequency on DE behaviors. This decision did not produce a significant result either. It may be that a single instance of comparison is sufficient to influence DE behaviors and, hence, these effects were captured by the binary operationalization of appearance comparisons. Alternatively, it may be that the wording of the frequency item missed the important aspect of appearance comparison that

Table 4. Multilevel Modeling Results for the Lagged Impact of Appearance Comparison Behaviors and Trait Eating Pathology on Dependent Variables.

		Binge Eating			Dietary Restraint			Exercise		
Model	Predictor	*b*	*t*	*p*	*b*	*t*	*p*	*b*	*t*	*p*
1	Upward comparison frequency	0.03	0.37	.711	0.04	0.59	.554	0.05	0.59	.556
	Eating pathology	0.05	3.11	.002	0.07	5.66	<.001	0.04	3.35	.001
	Up Comp × Eating Pathology	0.00	0.23	.816	0.00	0.20	.839	0.00	0.73	.468
2	Upward vs. noncomparison	–1.51	–3.93	<.001	–0.17	–0.77	.441	–1.14	–2.61	.009
	Upward vs. downward comparison	–0.40	–0.71	.478	–0.17	–0.43	.666	–0.34	–1.36	.173
	Eating pathology	0.04	2.68	.007	0.07	5.46	<.001	0.04	2.79	.005
	Up vs. Noncomp × Eating Pathology	0.06	2.50	.012	0.03	2.06	.040	0.03	1.10	.271
	Up vs. Down Comp × Eating Pathology	0.02	0.41	.685	0.03	0.72	.471	0.01	0.40	.688

Note. Upward comparison is coded as 0 in both upward vs. downward and upward vs. noncomparison variables. Thus, negative coefficients indicate the outcome is more likely when upward comparisons occurred. Significance tested at $p < .01$ to control Type I error rate.

influences DE. Insofar as duration of engagement is crucial, the number of comparisons may be a poor proxy, because two individuals could report the same number of comparisons but experience these for different durations. Furthermore, the items used in the present study—as per prior ESM studies of comparison behaviors (Ridolfi et al., 2011)—did not evaluate the effects of these comparisons on appearance self-consciousness, self-objectification, or preoccupation with appearance that may be the intermediary steps between comparison and DE behaviors. Further testing of whether participants report increased appearance preoccupation or self-objectification following different types of comparisons may help to establish whether this interpretation of present findings is plausible.

Effect of Trait Eating Pathology on Appearance Comparison and Disordered Eating

Although upward appearance comparisons (relative to noncomparison events) were predictive of binge eating for the sample as a whole, this effect was unexpectedly weaker for individuals with higher trait eating pathology. Prior findings have shown that state-based effects involving body image are more pronounced for individuals with elevated trait body dissatisfaction, internalization of appearance standards, or ED pathology (Fitzsimmons-Craft et al., 2016; Leahey et al., 2011); and it has been suggested that increased sensitivity to triggers for negative body image and DE behaviors and cognitions may be characteristic of—and predispose some individuals to—EDs (Leahy et al., 2011).

The direct effect of trait eating pathology on DE behaviors in the present study suggests that these individuals are more susceptible to instances of DE behaviors in daily life, but that upward appearance comparisons may not be a sufficient trigger for binge-eating episodes for these individuals. This could be because these individuals were already intending (precomparison and regardless of comparison event) to engage in these behaviors. Alternatively, it may be that they are more likely to engage in these behaviors in private (Phillips, Kelly-Weeder, & Farrell, 2016), and hence binge episodes may be more likely to follow periods of isolation and noncomparison. It may also be that other contextual factors, such as negative mood (Haedt-Matt & Keel, 2011), are stronger contextual determinants of DE events. Indeed, Fitzsimmons-Craft and colleagues' (2015) findings suggested that other forms of comparison (eating and exercise) were better predictors of these DE behaviors. A broader comparison with other established and theorized state-based predictors of DE behaviors (e.g., mood and body dissatisfaction) would help to ascertain the relative importance of comparison behaviors in predicting instances of DE. Such an approach may also allow for testing of more sophisticated models in which comparison behaviors interact with other contextual factors to increase likelihood of an episode of DE.

Practice Implications

Based on the findings of our study, preventive programs could educate women on the detrimental consequences that the act of appearance comparison may have on their eating behaviors and overall well-being, and encourage women to consciously reduce comparison behaviors. Furthermore, the possibility that appearance comparisons activate negative body-related self-schemata underscores the potential utility of equipping women with strategies on how to be more satisfied with their body (e.g., concentrate on how your body feels, not looks) to help reduce the frequency of comparisons and attenuate their impact, potentially assisting the prevention of developing an eating disorder.

Limitations

It is necessary to place the current results in the context of its limitations. First, the current sample was primarily

composed of Caucasian female university students within a normal BMI range. Second, participants required an iPhone with the latest operating system, potentially limiting the sample to young, normal-weight, affluent, White, and educated women, and undermining the generalizability of results to men and individuals with a more diverse BMI and sociodemographic range. Therefore, extension into more varied populations, and particularly within men and women with a range of BMIs, is needed. Third, the generalizability of results may have been compromised by the reported associations between procedural noncompliance in the ESM phase and a number of demographic variables. Fourth, the present study limited its focus to the association between appearance comparisons and several key DE-related outcomes. Broadening the scope in future studies to evaluate the relative, combined, and interactive contributions of appearance comparisons and other predictors of these outcomes would permit more complete modeling at the state level of causal pathways that lead to DE outcomes.

Future Directions

Appearance comparison research would potentially benefit from replications of the current findings in a clinical ED population to see if effects generalize, and in male samples, given that body image concerns have been found to also be prevalent in men (Mitchison & Mond, 2015). It is also important that researchers identify the mechanisms by which the act of appearance comparison affects daily DE behaviors. For instance, Lavender and colleagues, (2012), in an ESM study, found that DE behaviors were the highest when an individual experienced increased anxiety; potentially, comparing appearance is related to increases in body anxiety, which may lead to increased daily DE behaviors. It may be important also to examine other potential moderators that could attenuate or exacerbate the effect of appearance comparisons. Indeed, research suggests that the effects of appearance comparisons are not absolute, but likely depend on a multitude of factors. For example, studies have found that the impact of appearance comparisons were moderated by contextual cues, such as whether the comparison target was a peer or media figure, and by the perceived attainability of the comparison target's appearance (Leahey & Crowther, 2008). Trait characteristics also have been implicated in moderating the impact of appearance comparisons, such as internalization of thin-ideal (Myers et al., 2012), social physique anxiety (Fitzsimmons-Craft, Harney, Brownstone, Higgins, & Bardone-Cone, 2012), and negative affect and body shame (Colautti et al., 2011). Finally, although potentially difficult to measure, it would be valuable for future researchers to explore the effects of state-level influences related to appearance comparisons on DE behaviors, such as the intent behind making the appearance comparison.

Conclusions

The present study extends previous ESM findings of appearance comparison processes and their detrimental effects on DE. Results indicate that an upward comparison in relation to a noncomparison occurrence is likely a proximal cue for DE behaviors, such as binge eating and weight-related exercise. This is an important finding because most current literature largely focuses on DE thoughts, not behaviors in daily life. It reveals that upward comparisons can elicit ED behavioral symptomology in the normal population. The null effects of upward comparison compared with downward comparison occurrences and frequency of appearance comparisons in prospective (lagged) models suggests that future studies should consider operationalizing appearance comparisons not by frequency but in relation to noncomparison occurrences to capture the full effect. In addition, higher trait eating pathology significantly weakened the appearance comparison–binge eating association, highlighting the utility of using ESM to capture the complex relations between proximal cues and DE behaviors in daily life. The next step for research in this area is to identify key moderators of the effects of appearance comparisons in order to better equip ED prevention and intervention efforts.

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