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Prospectively predicting naturalistic exposure to fitspiration and thinspiration in young women with disordered eating by leveraging an ecological momentary assessment design

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Abstract

Objective: Although a growing body of research has examined the impacts of ED-salient content, such as fitspiration and thinspiration, on eating disorder (ED) symptoms, there is less known about the characteristics of who may be at risk for accessing this content on Instagram. Current research is limited by cross-sectional and retrospective designs. This prospective study used ecological momentary assessment (EMA) to predict naturalistic exposure to ED-salient content on Instagram.

Methods: Female university students with disordered eating ($N = 171$, $M_{age} = 20.23$, $SD = 1.71$, range = 18–25) completed a baseline session, followed by a seven-day EMA protocol, in which they reported on Instagram use and exposure to fitspiration and thinspiration. Mixed-effects logistical regressions were used to predict exposure to ED-salient content on Instagram from four principal components (e.g., behavioral ED symptoms and trait social comparison) controlling for duration of Instagram use (i.e., dose) and day of study.

Results: Duration of use was positively associated with all types of exposure. Purging/cognitive restraint and excessive exercise/muscle building prospectively predicted access to any ED-salient content and fitspiration only. Restricting positively predicted thinspiration only access. Purging/cognitive restraint positively predicted accessing fitspiration and thinspiration (dual exposure). Day of study was negatively associated with any exposure, fitspiration only, and dual exposure.

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Conclusions: Baseline ED behaviors were differentially associated with exposure to ED-salient Instagram content; however, duration of use was also a significant predictor. Limiting use of Instagram may be important for young women with disordered eating to reduce probability of encountering ED-salient content.

Keywords

Disordered eating; eating disorders; social media; Instagram; fitspiration; thinspiration; ecological momentary assessment

Growing evidence suggests deleterious associations between viewing fitspiration and thinspiration content on social media and poorer body image and increased eating disorder (ED) symptoms (e.g., Cataldo et al., 2021, 2022; DiBisceglie & Arigo, 2021; Griffiths et al., 2018; Pasko & Arigo, 2021). Young women with disordered eating may be at high risk for accessing such ED-salient content via Instagram, an image-centric social media application. Instagram engagement is common in this age demographic, which makes understanding use patterns critical. Three-quarters of young adults 18–29 years use Instagram, with 76% of users accessing it at least once per day, and 60% of users reporting multiple sessions per day (Smith & Anderson, 2018). Furthermore, although some past studies have found that Instagram use increased during the Covid-19 pandemic and was linked to higher body dissatisfaction and drive for thinness (Vall-Roqué et al., 2021), another longitudinal study found a rise in body dissatisfaction and physical appearance without a change in Instagram use frequency (Vall-Roqué et al., 2022). This may partially be because ED-salient content is readily available on Instagram; for example, over 74.9 million posts had been tagged with #fitspiration as of October 2022.

Young women with disordered eating may have psychological characteristics, such as a tendency to social comparison (Corning et al., 2006), that drive more frequent access to ED-salient content on Instagram. According to Social Comparison Theory (Festinger, 1954), individuals are driven to compare themselves to others to assess their social status. Research on ED development (Fitzsimmons-Craft et al., 2016) and body image (Tylka & Sabik, 2010) has extended Social Comparison Theory to encompass appearance-comparison processes and explain why social comparison is associated with increased eating pathology. The negative impacts of social comparison have been supported in a meta-analytic study, which found that increased social comparison was linked to higher body dissatisfaction (Myers & Crowther, 2009).

It is possible that the association between ED-salient content and ED pathology is bidirectional, such that 1) repeated exposure to ED-salient content increases ED symptoms and 2) certain high-risk users may be more likely to view ED-salient content. Research has primarily investigated the former pathway by examining the effects of ED-salient content exposure on psychological and behavioral outcomes.

For example, there is a growing body of research using experimental manipulations to understand the impacts of ED-salient content on constructs such as body dissatisfaction, body appreciation, affect, and ED pathology (e.g., Barron et al., 2021; Cha et al., 2022; Fioravanti, Svicher, et al., 2021; Fioravanti, Tonioni, et al., 2021; Krug et al., 2020;

Robinson et al., 2017; Slater et al., 2017; Tiggemann & Zaccardo, 2015). These studies are critical for establishing causal pathways between exposure to ED-salient content and psychological/behavioral outcomes; however, these designs do not allow for a robust examination of the extent to which baseline user characteristics, such as level of ED pathology, *predict* accessing ED-salient content.

Evaluating Naturalistic Exposure to ED-Salient Content

Given the potentially harmful impacts of viewing ED-salient content on Instagram, it is important to understand who may be most likely to access this content and the level of naturalistic exposure encountered by different users. Furthermore, certain characteristics of the Instagram application make the task of identifying at-risk users particularly important for intervention in problematic patterns of engagement. First, the algorithmic nature of Instagram means that viewing and engaging with (e.g., liking, sharing, commenting on) different types of images increases the probability that similar content will be displayed in the “Explore” function as well as within the user’s timeline. As such, at-risk users may increase their probability of unsolicited (i.e., not deliberately searched for) exposure to ED-salient content. Second, users can “follow” others and are displayed recommendations from Instagram for additional users to follow based on engagement. In other words, people who subscribe to fitspiration or thinspiration accounts are more likely to see these accounts in their timeline, be shown similar content in their “Explore” page, and receive recommendations for similar accounts to follow, thereby increasing potential exposure. Finally, based on application use patterns, users may receive targeted advertisements, which could include ED-salient content.

Understanding naturalistic exposure to ED-salient content on Instagram and predicting who is most at risk for accessing such content is an important direction of inquiry that has implications for prevention efforts. To date, most work on the association between social media use and ED psychopathology has been cross-sectional and retrospective, such that studies correlate current ED pathology with reports of typical or past engagement with ED-salient content on different applications or websites. For example, research suggests that people who engage with fitspiration or post this content are at higher risk for an ED (Carrotte et al., 2015; Holland & Tiggemann, 2017; Raggatt et al., 2018); however, this approach does not allow for the prediction of future engagement.

For studies that have examined naturalistic exposure to ED-salient content, one limitation is a reliance on self-report measures of exposure and duration of exposure (e.g., Cataldo et al., 2022; DiBisceglie & Arigo, 2021; Griffiths et al., 2018; Pasko & Arigo, 2021), which are subject to recall biases. For example, within a longitudinal design that assessed Instagram use and disordered eating during the Covid-19 pandemic (Vall-Roqué et al., 2022), retrospective reports were used at each timepoint. One way of reducing self-report or recall bias is by using an experience sampling method/ecological momentary assessment design, as in a study by Griffiths et al. (2019) on exposure to ED-salient content in daily life. In this study, the authors established frequency of overall exposure to ED-salient content; however, there remain questions about Instagram-based exposure, as the study evaluated all type of exposure, including Instagram, Facebook, internet forums, print media,

etc. Given the unique properties of Instagram related to algorithmic-based content display, understanding exposure for this application in particular is necessary for deriving actionable prevention strategies. Furthermore, in the Griffiths et al. study, participants self-reported their duration of use, rather than using an objective duration measurement, which could have resulted in unreliable estimates of time. Finally, their sample consisted of unselected male and female undergraduate students, which does not address concerns related to a group that may be at particularly high risk for the negative effects of ED-salient content exposure: young women with disordered eating.

Present Study

To build on past research, we used a prospective design to examine how baseline ED symptoms predicted naturalistic ED-salient content exposure on Instagram among young university women with disordered eating. Understanding risk for viewing ED-salient content and the frequency and duration of exposure among women with disordered eating has the potential to guide important decisions about prevention efforts, such as educational campaigns and alterations to algorithmic display patterns within the Instagram application.

We predicted that higher ED pathology at baseline, as measured by engagement in ED behaviors (binge eating, excessive exercise, muscle building, restriction, purging), greater cognitive features (cognitive restraint, body dissatisfaction), and higher trait self-comparison would predict higher proportion of naturalistic exposure to ED-salient images when accessing the Instagram application over a one-week period. We did not have a priori predictions about which symptoms would be the strongest predictors of exposure or if there would be differences in type of content exposure.

Methods

Participants

One hundred seventy-five participants were recruited for the study; however, two participants did not initiate the EMA protocol and two were outside of the recruited age range. Thus, the analytic sample consisted of 171 young women ages 18-25-years-old ($M_{age} = 20.23$, $SD = 1.71$) with current disordered-eating behaviors (DEBs). Participants were recruited from the Midwestern United States. Current DEBs were defined as at least four DEB episodes of any combination of type (objective binge eating, self-induced vomiting, diuretic or laxative use, fasting, or excessive exercise) per month over the past three months. The mean number of DEBs reported was 24.35 ($SD = 20.15$, Range = 4–95). 90.80% of the sample reported objective binge eating, 81.61% reported fasting, 70.11% reported compensatory exercise, 18.39% reported self-induced vomiting, and 15.52% reported laxative/diuretic misuse.

Additional eligibility criteria included owning a smartphone and using Instagram at least once per day. The sample was 78.95% White, 9.94% Asian or Pacific Islander, 8.19% Multiracial, and 1.17% Black (1.75% of participants did not provide racial information). Most participants identified as non-Hispanic (87.13%) and heterosexual (64.33%). Demographics and symptom measurements are reported in Table 1.

Procedure

Screening—Participants were recruited through advertisements placed on Instagram and Facebook and from a university-wide screen of eating behaviors. Interested participants completed an eligibility screening survey on REDCap. To evaluate current DEBs, participants reported the number of episodes of objective binge-eating, self-induced vomiting, fasting, excessive exercise, and laxative/diuretic use per month over the past three months.

Study Procedures—Participants completed a virtual baseline session and a seven-day ecological momentary assessment (EMA) period. This study is a secondary analysis of data collected from the parent study, which examined Instagram use, affective response, and DEBs. Complete study procedures can be found in a Stage 1 registered report (Christensen et al., 2021), with analyses of main study outcomes to be submitted for a Stage 2 publication.

Baseline Session. During the virtual baseline session, participants completed questionnaires and were oriented to the EMA application over Zoom. To standardize definitions of fitspiration and thinspiration, during the baseline session, participants were provided with definitions of these constructs and completed a 20-item interactive exercise in which they received feedback after classifying images as fitspiration, thinspiration, or neither. Participants then answered a free response question in which they wrote out their understanding of the study's definitions of fitspiration and thinspiration. A trained researcher reviewed responses and provided immediate clarification on definitions, as needed. Definitions of fitspiration and thinspiration were available for participants to access at any point during the study in a tab within the EMA application.

EMA Protocol. Beginning the morning after the baseline session, participants initiated the seven-day EMA protocol. Participants received six semi-random prompts per day between 10 a.m. and 10 p.m. within two-hour blocks. They had thirty minutes to respond to the prompt. For each prompt, participants provided the amount of time that they had used Instagram, as measured by the Instagram app, and if they had viewed fitspiration, thinspiration, both, or neither.

Measures

Demographics—Participants reported their age, race, ethnicity, and sexual orientation.

Comparison of Self-Scale (CoSS)—The CoSS is a 22-item measure of social comparison. Each item is rated on a seven-point scale (Laker & Waller, 2019). The CoSS has two subscales: Physical Appearance Comparison and Personality Comparison, as well as a total score. Psychometric evaluation of the CoSS items has found good internal consistency and test–retest reliability (Laker & Waller, 2019). In this study, internal consistency for the total score was excellent ($\alpha = .93$).

Eating Pathology Symptoms Inventory (EPSI)—The EPSI is a 45-item measure of past month ED pathology (Forbush et al., 2013). Each EPSI item is rated on a five-

point scale. Items are summed to create eight scales (Binge Eating, Body Dissatisfaction, Cognitive Restraint, Excessive Exercise, Muscle Building, Negative Attitudes Towards Obesity, Purging, and Restriction). Psychometric evaluation of the EPSI items found excellent convergent and discriminant validity (Forbush et al., 2013). In this sample, internal consistency for each scale was adequate to excellent ($\alpha = .79-.91$).

Instagram Use Duration—For each EMA prompt, participants reported the amount of time that they had spent on Instagram so far that day according to the application. Participants were instructed at the baseline session in how to enter this number for each EMA prompt. Our team calculated duration of use per viewing period by computing reported amount of time from the current prompt minus the reported amount of time from the previous prompt.

Naturalistic ED-Salient Content Exposure—At each EMA prompt, participants reported their Instagram total duration and whether they had viewed fitspiration only, thinspiration only, both, or neither on Instagram. For this analysis, we chose to examine only the sessions in which Instagram was accessed, when participants had an opportunity to experience exposure to ED-salient content. In each session, we coded a dichotomous fitspiration only variable (1 = exposure to fitspiration only, 0 = no exposure, thinspiration only, or both), a thinspiration only variable (1 = exposure to thinspiration only, 0 = no exposure, fitspiration only, or both), and a both types of exposure variable (1 = exposure to fitspiration and thinspiration 0 = no exposure, thinspiration only, or fitspiration only). We accounted for the participants' exposure to any ED-salient content by coding the three types of exposure (fitspiration only, thinspiration only, or both) as 1 while no exposure was marked as 0. Because the survey methodology did not measure if multiple exposures (i.e., opening the application multiple times) may have occurred over a sampling period, we were unable to account for multiple exposures in this study.

Statistical Analysis

We tested four models evaluating whether baseline ED pathology was associated with 1) any ED-salient content 2) exposure to fitspiration only, 3) thinspiration only, and 4) both fitspiration and thinspiration. We performed the analysis using mixed-effects logistic regressions. The mixed-effects logistic regression (Agresti, 2012) is a generalized linear mixed model that accounts for binary outcomes in a multilevel environment, which fits our data as the sessions were nested within participants. Outcome in this model was specified as the exposure to ED-salient content (fitspiration only, thinspiration only, both, and any content) in each session. The duration of Instagram access in each session, measuring the length of exposure opportunity, was included as a within-subject predictor with a random slope accounting for between-subject differences in the effect of Instagram duration. Due to high skew, we log-transformed the duration variable prior to analysis (skewness before transformation: 3.89, after: 0.39).

In our pre-analysis, we found that the rate of ED-salient exposure tended to decrease from the first to the last day of research, thus we also included the day of this study (ranging from Day 1 to Day 7) as a within-subject predictor with a random slope, so that it could

account for trends in ED-salient exposure across different days as well as between-subject differences.

Baseline ED pathology, including the eight EPSI scales and trait social comparison, was originally used as between-subject predictors in the model. However, we found signs of multicollinearity in this model. When we fit the model, purging was the only statistically significant predictor, however, when we excluded some ED pathology predictors, other correlated predictors become statistically significant (for example, the exclusion of trait social comparison and purging made cognitive restraint statistically significant). Several study factors may have led to this multicollinearity problem. Trait social comparison had statistically significant correlations with several EPSI measures, such as Binge Eating ($r = 0.41$), Body Dissatisfaction ($r = 0.75$), and Negative Attitudes Toward Obesity ($r = 0.31$), which resulted in multicollinearity. Although the EPSI is a well-established measure for ED pathology, in this specific sample, which included young female Instagram users with DEBs, some EPSI measures also had statistically significant correlation with each other, such as muscle building and excessive exercise ($r = 0.60$), cognitive restraint and purging ($r = 0.43$). To account for multicollinearity, we coupled the mixed-effects logistic model with a principal component analysis (Morzuch, 1980; Land et al., 1990; Yu et al., 2015).

We first applied the principal component analysis on baseline ED pathology, including the eight EPSI scales and trait social comparison, and extracted less correlated components. EPSI scales and trait social comparison were standardized for the principal component analysis. The R package “psych” (Revelle & Revelle, 2015) was used to perform this analysis. We then used the extracted components as between-subject predictors in the mixed-effects logistic model. In the model, the outcomes (ED-salient content exposure) were regressed on duration (within-subject) and ED pathology components (between-subject) using the logistic method. A random intercept by participant ID was included to account for nesting. The R package “lme4” (Bates et al., 2009) was used to fit the mixed model to data. We evaluated the fit of each model by comparing it with a null model with only fixed and random intercepts. The R function “anova” was used for model comparison. For the reference of future studies, we also estimated the post-hoc statistical power for each estimator from our analyses. Statistical power was estimated using the bootstrap simulation method (Kleinman & Huang, 2016): for each analysis, we bootstrapped 100 data sets from the original data set with exposure to ED-salient content, Instagram duration, and the principal component scores for ED pathology, and fit the mixed-effects logistic model on the bootstrapped data sets. The statistical power of each prediction was estimated as the proportion of statistically significant results ($p < .05$) out of all 500 bootstrap simulations.

Results

Frequency of Exposure

Participants completed, on average, 77.21% of survey prompts ($SD = 17.40$). Participants reported frequently using the Instagram application (Table 2). On average, participants reported Instagram use on 79.01% ($SD = 17.48$) of their surveys; however, when Instagram was accessed, most of the time ($M = 62.95\%$, $SD = 23.03$) ED-salient content was not viewed. In other words, participants viewed ED-salient content on 37.05% of the surveys

for which Instagram was accessed. Fitspiration only was the most endorsed exposure ($M=16.16\%$, $SD=14.94$), followed by similar rates of thinspiration only ($M=10.61\%$, $SD=11.40$) and both fitspiration and thinspiration exposure ($M=10.29\%$, $SD=14.06$).

Prospective Analysis of Accessing Fitspiration and Thinspiration Content—

Out of all data points included in our analysis, no missing data were identified in the duration and EPSI scales. Three participants (1.75%) were missing trait social comparison data. We imputed missing data using the mean imputation method embedded in R function “pca” for principal component analysis. In the principal component analysis, while parallel analysis suggested three components, we extracted four components to reduce cross-loading on ED items. The “promax” rotation was used. Table 3 shows the standardized loadings of the four components extracted. The first component, accounting for 24% of total variance, was high on binge eating, body dissatisfaction, negative attitudes towards obesity, and trait social comparison. The second component (19%) was high on cognitive restraint and purging. The third component (17%) was high on excessive exercise and muscle building. The fourth component (15%) was high on restricting. In sum, they explained 75% of total variance in ED pathology.

Predicting exposure to any ED-salient content—We predicted exposure to any type of ED-salient content (1 = fitspiration only, thinspiration only, or both, 0 = no exposure) from baseline ED principal components. Fixed effects from the mixed-effects logistic model are shown in Table 4. This mixed-effects logistic model (AIC: 4716.2, BIC: 4799.4) had superior model fit compared with a null model with only fixed and random intercepts (AIC: 5265.3, BIC: 5278.1; $p < .001$ for model comparison). Instagram duration was a significant predictor of exposure to any ED-salient content (est = 1.03, $p < .001$, power = 1.00) such that longer duration spent on Instagram was associated with higher exposure to ED-salient content controlling for other predictors. Day of study was a significant predictor of exposure to any ED-salient content (est = -0.17, $p < .001$, power = 1.00) such that participants were exposed to less ED-salient content in later days of this study. Component 2 (est = 0.32, $p = 0.006$, power = 0.90), which consisted of cognitive restraint and purging, and Component 3 (est = 0.286, $p = 0.005$, power = 0.96), which consisted of excessive exercise and muscle building, were significant positive predictors of exposure.

Predicting exposure to fitspiration only—We predicted exposure to fitspiration-only content (1 = exposure to fitspiration only, 0 = no exposure, thinspiration only, or both) from baseline ED principal components. Fixed effects from the mixed-effects logistic model are shown in Table 5. This mixed-effects logistic model (AIC: 3495.6, BIC: 3578.9) had superior model fit compared with a null model with only fixed and random intercepts (AIC: 3650.4, BIC: 3663.2; $p < .001$ for model comparison). Instagram duration was a significant predictor of exposure to fitspiration-only content (est = 0.54, $p < .001$, power = 1.00) such that longer duration spent on Instagram was associated with higher exposure to fitspiration-only content, controlling for other predictors. Day of study was a significant predictor of exposure to fitspiration content (est = -0.155, $p < .001$, power = 0.98) such that participants were exposed to less fitspiration content in later days of this study. Component 2 (est = 0.251, $p = 0.046$, power = 0.51), which consisted of cognitive restraint and

purging, was a significant positive predictor of fitspiration exposure. This result indicated that participants who had higher levels of cognitive restraint and purging were more likely to access fitspiration-only content. Component 3 (est = 0.412, $p < 0.001$, power = 1.00), which consisted of excessive exercise and muscle building, was a significant positive predictor of fitspiration-only exposure. This result indicated that participants who had higher levels of excessive exercise and muscle building were more likely to access fitspiration-only content.

Predicting exposure to thinspiration only—We predicted exposure to thinspiration-only content (1 = exposure to thinspiration only, 0 = no exposure, fitspiration only, or both) from baseline ED principal components. Fixed effects from the mixed-effects logistic model are shown in Table 6. This mixed-effects logistic model (AIC: 2701.2, BIC: 2784.4) had superior model fit compared with a null model with only fixed and random intercepts (AIC: 2761.8, BIC: 2774.6; $p < 0.001$ for model comparison). Instagram duration was a significant predictor of exposure to thinspiration-only content (est = 0.49, $p < .001$, power = 1.00) such that longer duration spent on Instagram was associated with higher exposure to thinspiration-only content, controlling for other predictors. Component 4 (est = 0.35, $p = 0.005$, power = 0.92), which consisted of restricting, was a significant positive predictor of thinspiration exposure. These results indicated that individuals with higher restricting were more likely to access thinspiration-only content.

Predicting exposure to both fitspiration and thinspiration (dual exposure)—We predicted exposure to both types of ED-salient content (1 = exposure to fitspiration and thinspiration, 0 = no exposure, fitspiration only, or thinspiration only) from baseline ED principal components. Fixed effects from the mixed-effects logistic model are shown in Table 7. In this model, the inclusion of a random slope for duration resulted in singular boundary in model estimation, so that we dropped the random slope and included only the random intercept in the model. This mixed-effects logistic model (AIC: 2357.7, BIC: 2421.7) had superior model fit compared with a null model with only fixed and random intercepts (AIC: 2552.2, BIC: 2565.0; $p < 0.001$ for model comparison). Instagram duration was a significant predictor of exposure to both content (est = 0.90, $p < .001$, power = 1.00). Day of study was a significant predictor of exposure to both content (est = -0.16, $p = 0.001$, power = 0.85) such as participants were exposed to less ED-salient content with both fitspiration and thinspiration in later days of this study. Component 2 (est = 0.40, $p = 0.019$, power = 0.70), which consisted of cognitive restraint and purging, was a significant positive predictor of exposure to both fitspiration and thinspiration. This finding indicated that individuals with higher cognitive restraint and purging were more likely to seek both fitspiration and thinspiration content in the same timepoint.

Discussion

Instagram is a frequently used application among young women; however, questions remain about the ubiquity of exposure to ED-salient content, such as fitspiration and thinspiration, on the application and which psychological variables may allow clinicians and researchers to identify those most at risk for viewing this content. In the present study, purging/cognitive restraint, excessive exercise/muscle building, day of survey, and mean duration of Instagram use per session in young women with disordered eating prospectively predicted whether any

exposure to ED-salient content was viewed; however, these findings require replication. This study adds to a growing body of literature on naturalistic exposure to ED-salient content and vulnerability to viewing this content.

The first finding was that purging/cognitive restraint and excessive exercise/muscle building positively predicted viewing ED-salient content on Instagram. This was consistent with our hypothesis that higher ED pathology would predict exposure to this content; however, contrary to hypothesis, we did not find associations between other forms of ED pathology (e.g., binge eating, body dissatisfaction) or trait social comparison. Our findings converged with a study demonstrating that liking or following fitspiration pages was associated with greater purging (diet pill/laxative misuse) (Carrotte et al., 2015). The overall model including all ED scales was significant, meaning that our findings were partially consistent with and build upon previous cross-sectional studies that demonstrated that self-reported frequency of viewing fitspiration was associated with higher disordered eating (Griffiths et al., 2018; Holland & Tiggemann, 2017; Wu et al., 2022); however, previous studies primarily examined models in which exposure to fitspiration or thinspiration led to higher disordered-eating or examined cross-sectional associations between disordered eating and ED-salient content engagement in people who reported using being frequent consumers or posters of such content. Notably, our study differed in that we used a prospective design to examine who may be most likely to view ED-salient content. Given that this is one of the first studies in this area, more research is needed to replicate this finding.

In the specific ED-content analysis, excessive exercise/muscle building and cognitive restraint/purging significantly positively predicted accessing fitspiration only. In other words, those actively engaging in high exercise behaviors or muscle building and those elevated in cognitive restraint and purging were more likely to view fitspiration. It would be of interest to know if these users explicitly sought out fitspiration content, or if this content was algorithmically featured due to a general interest in fitness. Future studies could explore how these users engage with the application to help evaluate this question. In these analyses, restricting positively predicted thinspiration only exposure, such that those high in restricting were more likely to access this content type. These results are interesting when compared to the findings about exposure to dual fitspiration/thinspiration exposure, which did not find that restricting was a significant predictor. Rather, in the fitspiration and thinspiration dual exposure model, purging/cognitive restraint was a significant predictor. Purging/cognitive restraint was also a significant predictor in the fitspiration only model, so it is possible that for the dual exposure, results may have been more driven by exposure to fitspiration images. In the dual exposure condition, we were unable to evaluate the proportion of images that were fitspiration vs. thinspiration (e.g., some users may have viewed 90% fitspiration images and 10% thinspiration, whereas others may have viewed 10% fitspiration images and 90% thinspiration images). Future research may wish to investigate the number of exposures to better understand the predictive role of the different baseline ED pathologies.

In terms of face validity, these findings are consistent with core features of fitspiration and thinspiration. It is logical that individuals with an elevated principal factor comprising of excessive exercise and muscle building would be more likely to access fitspiration only content, which focuses on the idealization of fitness and lean, muscular bodies. Similarly,

it also intuitive that people with an elevated principal factor comprising restricting would endorse viewing thinspiration only images, which idealize highly thin bodies. Interestingly, dual exposure, as well as any exposure were not predicted by restricting. It is possible thus that people who access thinspiration only may be a different group than those who access both fitspiration and thinspiration within the same time period. In other words, dual exposure perhaps should not be considered an additive exposure of fitspiration only and thinspiration only.

It is not surprising that duration of Instagram use positively predicted probability of viewing ED-salient content. This is consistent with a finding by Griffiths et al. (2018) that more frequent social media use was associated with higher exposure to ED-salient content. There are a few possibilities that may account for this finding. First, increased opportunity for exposure may influence likelihood of viewing content, which could occur regardless of one's own preference for different types of images. Second, high-volume users of Instagram may have viewing patterns that correspond to higher levels of ED-salient content. Third, there may be an interaction, such that people who view Instagram for longer periods of time have higher likelihood of exposure as a function of time on the application *and* may have viewing patterns that promote increased probability of seeing ED-salient content. Understanding the algorithmic nature of the application and conducting studies that examine how images are viewed over the course of an Instagram use session may help to better understand this phenomenon. For example, researchers could have participants naturalistically use Instagram while recording the phone screen to determine how the user seeks out or is passively presented with content, as well as interactive behaviors such as reposting, commenting, or liking. Our findings may be placed alongside another study that found that the type of social media content viewed, but not duration, was associated with body-image disturbance and binge eating (Sanzari et al., 2023). At first the two sets of findings may appear contradictory, but we propose these two studies are examining components of an iterative process. In our study, we examined duration and baseline ED symptoms in relation to the probability of viewing fitspiration/thinspiration images, whereas Sanzari et al. examined duration and weight-loss content in relation to body image and ED symptoms. Thus, our study may represent the earlier processes that contribute to viewing problematic social media content, whereas the study by Sanzari et al. may capture downstream processes that result from viewing ED-related social media content. It is possible that the same variable, such as duration, may vary in significance, depending on the outcome of interest (e.g., accessing fitspiration content vs. body dissatisfaction that occurs as a result of viewing ED-related content). Exploring differential factors that influence when, how, and why people engage with fitspiration/thinspiration content and the consequences of social media engagement are important for identifying specific elements and optimal timing for intervention.

An unexpected finding was that day of survey was negatively associated with exposure to any type of fitspiration/thinspiration, fitspiration only, and exposure to both fitspiration and thinspiration in the same time period. In other words, as the study progressed, it appears participants reported lower exposure to these types of images. Day of survey was not associated with exposure to thinspiration, however, suggesting that this effect may be driven by decreased viewing of fitspiration images over the course of the study. It is unclear why

this occurred. It is possible that drawing attention to these images as fitspiration may have had some sort of intervention effect. This finding evokes the body of literature suggesting that self-monitoring could be used for intervening on mental and physical health conditions such as sedentary behaviors (Compernelle et al., 2019), hypertension (Kassavou et al., 2022) and substance use (Gass et al., 2021). There is some evidence that self-monitoring, which is an essential component of treatments such as Enhanced Cognitive Behavioral Therapy for Eating Disorders (CBT-E; Fairburn, 2008), can reduce binge eating (Latner & Wilson, 2002). Although our findings require replication, they point to the potential utility of using self-monitoring to reduce engagement with problematic social media content. Such monitoring easily could be incorporated into existing logs for treatments such as CBT-E and aided by the use of digital-based tracking programs. For example, a recent review suggested that EMA has potential to be used for routine outcome monitoring in clinical practice (van Os et al., 2017).

It is important to note that when this study was conducted, Instagram had some protections in place to limit exposure to thinspiration images, which could partially explain why thinspiration only content was less commonly reported than fitspiration only. During this time, searches such as “thinspiration” would not return images and instead displayed a message connecting users to help resources. However, at the time of the study (and to the present day), fitspiration-related hashtags could be easily searched. However, it should be noted that images of celebrities, models, influencers, or non-famous thin people, which are frequently used for thinspiration, were not likely to be filtered by the application. Similarly, images of others may elicit self-comparison, even when they are not thinspiration or fitspiration. For example, viewing influencer content, which typically consist of highly curated and “aspirational” images promoting certain lifestyles, is associated with greater body dissatisfaction and negative mood (Lowe-Calverley & Grieve, 2021) and lower body appreciation (Pedalino & Camerini, 2022). Similarly, posts by peers may elicit “Fear of Missing Out” or FOMO responses, which may be associated with negative affectivity (e.g., Elhai et al., 2018), and could, in turn, influence eating pathology. For example, a meta-analysis found that experimental paradigms of interpersonal stress elicit significantly higher negative affect in people with eating disorders as compared to those without (Monteleone et al., 2018). Finally, pro-ED content could be circulated without the use of the banned thinspiration hashtags, as hashtags may evolve to evade detection and other covert language can be used to signal this content (Gerrard, 2018). Additionally, recent research has demonstrated that it is relatively easy to access “seed accounts” that advocate for disordered eating (Designing for Disorder: Instagram’s Pro-Eating Disorder Bubble, 2022).

Limitations and Strengths

There are certain limitations to this study that impact interpretation of results. First, data collection took place between 10 a.m. and 10 p.m., which means that late-night use of the application was not assessed and some exposures may have been missed. Second, the study design did not assess the number of times Instagram was accessed during the sampling periods or the number of images viewed, therefore, some participants may have used the application multiple times between prompts and may have viewed different numbers of pictures. However, we were able to provide information about duration of Instagram

use for each period, which offers a metric on the dose of exposure. Future studies may wish to increase EMA sampling frequency to better capture use patterns or to include estimations of number of times the application was accessed to examine this variable. Third, the duration variable was calculated as the amount of time that had elapsed since the last prompt. This means that duration may have been longer if a prompt was skipped, as it would have calculated time over a longer period of available access. However, given that previous studies have relied on self-report data, we believe that the use of the objective data outweighs this concern. Fourth, our study only examined fitspiration and thinspiration exposure, however, other types of ED-salient content, such as images of food may also be associated with disordered eating (Kinkel-Ram et al., 2022). Finally, our participants were primarily White, which leads to questions about the generalizability of findings to minoritized racial or ethnic groups. All participants also identified as women, which limits generalizability of findings to men. Examining these associations in men is particularly important as fitspiration or thinspiration images may hold differ levels of salience between men and women, although one study found that gender did not moderate between photo-based social media behaviors and eating disorder symptoms among Australian adolescents (Lonergan et al., 2020). One reason we chose to use a female sample was to limit potentially confounding cross-gender effects of social comparison when viewing images of people of different genders. Future studies should use more ethnically and racially diverse samples, as well as examine associations among men.

Despite limitations, this study has several notable strengths, with methodological choices that advance the literature on social media use and ED-related constructs. The use of EMA design to collect information about Instagram use, rather than retrospective recall or questionnaire measures, allowed for greater confidence in evaluating if ED-salient content was viewed during the study period. Similarly, this study used an objective measurement of Instagram use duration, which reduces concerns related to the accuracy of self-reported durations. A recent review of measurement issues in social media research found that few studies of social media use and body image used EMA designs for predictive or causal analyses, with all published EMA studies using self-reported time on social media (Jarman et al., 2022). The authors identified the registered report for the parent study (Christensen et al., 2021) as the first to propose application-measured social media use. Finally, this study used a high-risk sample of women with DEBs which increases the ecological validity of the design; however, it should be noted that with some non-predicted null findings for eating disorder variables, these findings require replication in larger sample sizes.

Conclusions

Overall, findings from this study suggest that ED-salient content is often viewed when young women with disordered eating access Instagram. Preliminary findings suggest ED behavioral and cognitive variables differentially predict access to fitspiration and thinspiration; however, more research is needed to replicate these findings. Future studies should examine predictors of access in individuals across the range of severity of eating pathology, from no ED pathology to diagnosable EDs, to create actionable insights for algorithmic development and prevention efforts.

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Data are not publicly available as participants did not provide informed consent for their information to be shared.

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Highlights

- Fitspiration and thinspiration have been associated with eating disorder (ED) symptoms
- Few studies have examined who is most at risk for accessing ED-salient content
- Study prospectively predicted exposure to ED-salient content on Instagram
- ED pathology differentially predicted probability of exposure
- Novel methods include ecological momentary assessment and objective measurement of use duration

Table 1:

Characteristics of the Sample (N = 171)

	M (SD)	Range
Age	20.23 (1.71)	18–25
Trait Social Comparison	3.79 (1.07)	1.41–6.77
EPSI Body Dissatisfaction	16.95 (5.31)	2–28
EPSI Binge Eating	14.02 (7.48)	0–32
EPSI Cognitive Restraint	6.77 (3.09)	0–12
EPSI Excessive Exercise	7.19 (5.69)	0–20
EPSI Muscle Building	3.54 (3.46)	0–16
EPSI Negative Attitudes Toward Obesity	3.95 (4.46)	0–20
EPSI Purging	3.09 (4.08)	0–19
EPSI Restriction	9.43 (5.86)	0–24
Self-reported monthly number of DEBs	24.35 (20.15)	4–95
<i>Compensatory exercise episodes</i>	5.69 (7.06)	0–40
<i>Fasting episodes</i>	9.56 (10.96)	0–60
<i>Laxative/diuretic episodes</i>	1.09 (3.98)	0–31
<i>Objective binge eating episodes</i>	7.02 (6.85)	0–40
<i>Self-induced vomiting episodes</i>	1.04 (3.37)	0–20
	n	%
Race		
<i>White</i>	135	78.95
<i>Asian or Pacific Islander</i>	17	9.94
<i>Multiracial</i>	14	8.19
<i>Black</i>	2	1.17
<i>Missing or invalid response</i>	3	1.75
Ethnicity		
<i>Non-Hispanic</i>	149	87.13
<i>Hispanic</i>	22	12.87
Sexual Orientation		
<i>Heterosexual</i>	110	64.33
<i>Sexual minority orientation</i>	61	35.67

Note: Eleven participants did not provide their age ($n = 160$). Three participants were missing trait self-comparison data ($n = 168$). DEBs = Disordered-eating behaviors. DEBs were reported as an average per month of the previous three months. Sexual minority students included those who identified as lesbian, bisexual, pansexual, queer, or another non-heterosexual orientation.

Table 2:

Fitspiration and Thinspiration Exposure on Instagram (N = 171)

	M (SD)	Range
Survey completion rate (percentage)	77.21 (17.40)	21.43–100
Time on Instagram per timepoint (in minutes)	10.67 (7.35)	2.56–41.80
Percentage of surveys with Instagram access	79.01 (17.48)	13.89–100
Percentage of surveys with Instagram access with no ED-salient content	62.94 (23.03)	0–100
Percentage of surveys with Instagram access with any ED-salient content	37.05 (23.03)	0–100
<i>Fitspiration only</i>	16.16 (14.94)	0–64.71
<i>Thinspiration only</i>	10.61 (11.40)	0–60.53
<i>Fitspiration and thinspiration</i>	10.29 (14.06)	0–76.47

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Table 3:

Baseline ED Characteristics: Standardized loadings from principal component analysis

	Comp 1	Comp 2	Comp 3	Comp 4
Binge eating	0.82	0.07	-0.02	-0.35
Body dissatisfaction	0.59	0.14	0.05	0.41
Cognitive restraint	-0.16	0.91	0.11	-0.08
Excessive exercise	0.02	0.37	0.71	-0.08
Muscle building	0.02	-0.19	0.98	0.05
Purging	0.20	0.78	-0.24	0.07
Restricting	-0.26	-0.03	0.00	0.95
Negative attitude towards obesity	0.77	-0.18	0.02	-0.20
Trait self-comparison	0.70	0.00	0.06	0.38

Bolded values indicate symptoms that are included within each factor.

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Table 4:

Mixed-effects logistic model fixed effects: Any ED-salient content

Fixed effects	Estimate	SE	Z statistic	p-value
Intercept	-2.171	0.18	-12.31	<.001 ***
Instagram duration	1.028	0.06	16.60	<.001 ***
Day	-0.167	0.03	-6.60	<.001 ***
Component 1	0.140	0.11	1.31	0.191
Component 2	0.322	0.12	2.77	0.006 **
Component 3	0.286	0.10	2.83	0.005 **
Component 4	0.003	0.10	0.03	0.977

Random effects	Variance	SD
Participant intercept	1.91	1.38
Instagram duration	0.13	0.36
Day	0.03	0.18

Note: In this model, coefficients for Instagram duration reflect log-transformed values.

**
<.01

<.001

Component 1: Binge eating, body dissatisfaction, negative attitudes toward obesity, trait social comparison.

Component 2: Cognitive restraint, purging.

Component 3: Excessive exercise, muscle building.

Component 4: Restricting.

Table 5:

Mixed-effects logistic model fixed effects: Fitspiration only

Fixed effects	Estimate	SE	Z statistic	p-value
Intercept	-2.644	0.22	-12.17	<.001 ***
Instagram duration	0.540	0.07	7.26	<.001 ***
Day	-0.155	0.04	-4.35	<.001 ***
Component 1	-0.031	0.11	-0.28	0.776
Component 2	0.251	0.13	1.99	0.046 *
Component 3	0.412	0.10	4.14	<.001 ***
Component 4	-0.205	0.11	-1.94	0.053
Random effects	Variance	SD		
Participant intercept	1.59	1.26		
Instagram duration	0.10	0.32		
Day	0.05	0.22		

Note: In this model, coefficients for Instagram duration reflect log-transformed values.

**
<.01

<.001

Component 1: Binge eating, body dissatisfaction, negative attitudes toward obesity, trait social comparison.

Component 2: Cognitive restraint, purging.

Component 3: Excessive exercise, muscle building.

Component 4: Restricting.

Table 6:

Mixed-effects logistic model fixed effects: Thinspiration only

Fixed effects	Estimate	SE	Z statistic	p-value
Intercept	-3.47	0.28	-12.24	<.001 ***
Instagram duration	0.491	0.09	5.35	<.001 ***
Day	-0.069	0.04	-1.78	0.078
Component 1	0.208	0.12	1.70	0.089
Component 2	0.056	0.13	0.42	0.672
Component 3	-0.151	0.12	-1.25	0.210
Component 4	0.353	0.13	2.83	0.005 **
Random effects	Variance	SD		
Participant intercept	1.76	1.33		
Instagram duration	0.15	0.39		
Day	0.02	0.12		

Note: In this model, coefficients for Instagram duration reflect log-transformed values.

**
<.01

<.001

Component 1: Binge eating, body dissatisfaction, negative attitudes toward obesity, trait social comparison.

Component 2: Cognitive restraint, purging.

Component 3: Excessive exercise, muscle building.

Component 4: Restricting.

Table 7:

Mixed-effects logistic model fixed effects: Both fitspiration and thinspiration

Fixed effects	Estimate	SE	Z statistic	p-value
Intercept	-4.451	0.30	-14.83	<.001 ***
Instagram duration	0.901	0.08	11.77	<.001 ***
Day	-0.163	0.05	-3.23	0.001 **
Component 1	0.168	0.15	1.10	0.273
Component 2	0.396	0.17	2.34	0.019 *
Component 3	0.102	0.14	0.71	0.476
Component 4	0.211	0.16	1.36	0.173
Random effects	Variance	SD		
Participant intercept	2.36	1.54		
Day	0.05	0.22		

Note: In this model, coefficients for Instagram duration reflect log-transformed values.

**
<.01

<.001

Component 1: Binge eating, body dissatisfaction, negative attitudes toward obesity, trait social comparison.

Component 2: Cognitive restraint, purging.

Component 3: Excessive exercise, muscle building.

Component 4: Restricting.