Temporal Associations between Body Checking and Eating Pathology in Adolescent Girls with Binge-spectrum Eating Disorders: A Registered Protocol

Jannah Moussaoui, Stephanie Manasse, Laura D'Adamo

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Abstract

Background: Up to 92% of individuals with eating disorders (EDs) report engaging in body checking behaviors (e.g., repeated self-weighing and pinching of various body parts) to assess their weight and shape. These behaviors contribute to increased body dissatisfaction, negative affect, and dietary restriction, thereby maintaining ED symptomology.

Objective: The present study aims to first characterize the types and frequency of body checking behaviors (e.g., self-weighing, pinching) reported among adolescent girls with binge-spectrum EDs during a 21-day ecological momentary assessment (EMA) protocol. The second aim is to explore the prospective associations between body checking and cognitive and behavioral ED symptoms, namely body dissatisfaction, fear of weight gain, dietary restraint, dietary restriction, compensatory behaviors, and binge eating. The third aim is to assess whether body checking behaviors show reactive effects (i.e., produces change in the behavior subject to monitoring) to EMA, such that they decrease over time.

Methods: The study will recruit 70 adolescent girls aged 14-19 years with clinically significant binge eating. Participants will complete a semi-structured interview and a series of self-report measures at baseline to assess ED pathology. Then, participants will complete five daily EMA surveys to track body checking behaviors and related ED symptoms over 21 days.

Results: Recruitment is set to begin in January 2025, with data collection expected to conclude in March 2026.

Conclusions: This study will provide insights into the patterns and impacts of body checking behaviors among adolescent girls with binge-spectrum EDs. If body checking behaviors reduce in response to EMA, digital self-monitoring could be a scalable and cost-effective strategy for ED treatment and prevention. The findings may also inform the development of momentary interventions targeting body checking behaviors to mitigate ED symptoms. Future research should extend these observations over longer periods and include male participants to generalize findings across genders. Clinical Trial: Not applicable.

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Abstract

Background: Up to 92% of individuals with eating disorders (EDs) report engaging in body checking behaviors (e.g., repeated self-weighing and pinching of various body parts) to assess their weight and shape. These behaviors contribute to increased body dissatisfaction, negative affect, and dietary restriction, thereby maintaining ED symptomology. **Objective:** The present study aims to first characterize the types and frequency of body checking behaviors (e.g., self-weighing, pinching) reported among adolescent girls with binge-spectrum EDs during a 21-day ecological momentary assessment (EMA) protocol. The second aim is to explore the prospective associations between body checking and cognitive and behavioral ED symptoms, namely body dissatisfaction, fear of weight gain, dietary restraint, dietary restriction, compensatory behaviors, and binge eating. The third aim is to assess whether body checking behaviors show reactive effects (i.e., produces change in the behavior subject to monitoring) to EMA, such that they decrease over time. **Methods:** The study will recruit 70 adolescent girls aged 14-19 years with clinically significant binge eating. Participants will complete a semi-structured interview and a series of self-report measures at baseline to assess ED pathology. Then, participants will complete five daily EMA surveys to track body checking behaviors and related ED symptoms over 21 days. **Results:** Recruitment is set to begin in January 2025, with data collection expected to conclude in March 2026. **Conclusions:** This study will provide insights into the patterns and impacts of body checking behaviors among adolescent girls with binge-spectrum EDs. If body checking behaviors reduce in response to EMA, digital self-monitoring could be a scalable and cost-effective strategy for ED treatment and prevention. The findings may also inform the development of momentary interventions targeting body checking behaviors to mitigate ED symptoms. Future research should extend these observations over longer periods and include male participants to generalize findings across genders.

Trial Registration: Not applicable.

Keywords: adolescents; body checking; eating disorders; ecological momentary assessment

Introduction

Binge-spectrum eating disorders (EDs), including bulimia nervosa (BN) and binge eating disorder (BED), are serious psychological disorders characterized by recurrent episodes of binge eating (i.e., eating an excessive amount of food while experiencing a sense of loss-of-control over one's eating) and may be accompanied by behaviors intended to compensate for these episodes (e.g., vomiting or restricting food intake). Binge-spectrum EDs typically onset during adolescence [1] and have a 7-8% prevalence among adolescents [2,3]. Critically, gold standard treatments for binge-spectrum EDs fail to produce remission in 60-75% of adolescents [4–6], and only about 50% of individuals stay remitted 5 years following treatment [7]. These low remission rates indicate that available treatments do not sufficiently address all mechanisms maintaining the ED. Indeed, following treatment, many continue to experience ED symptoms, despite no longer meeting diagnostic criteria for an ED [6,8]. In particular, body image disturbances remain elevated following treatment [9,10] and studies have identified elevated body image disturbances as a risk factor for relapse [11]. These findings are consistent with the transdiagnostic model of cognitive behavioral therapy (CBT) for EDs, which points to overvaluation of weight, shape, eating, and their control as the core psychopathology underlying these disorders [12], thereby suggesting that until overvaluation is addressed, individuals may continue to experience ED symptoms.

One behavioral manifestation of overvaluation with weight, shape, eating, and their control is body checking [13]. Body checking refers to a broad range of behaviors used to assess one's weight or shape (e.g., self-weighing, checking how clothes fit, pinching or feeling various body parts) [14]. These behaviors are used by as many as 92% of individuals with EDs, are often engaged in compulsively, and are brief, typically lasting less than two minutes [13]. Although the daily frequency of body checking behaviors among adolescents or in binge-spectrum EDs has yet to be reported, studies using ecological momentary assessment (EMA; i.e., an ecologically valid data sampling approach which prompts participants multiple times over the study period) demonstrate that these behaviors occur multiple times throughout the day. Among adult women with anorexia nervosa, participants body checked an average of twice a day; however, because this study defined body checking solely as either (1) examination of whether one's thighs touch or (2) feeling for fat around one's joints and bones, this number is likely a severe underestimate [15]. Other studies among female college students with high weight and shape concern have considered a broader range of body checking behaviors (e.g., self-weighing, checking for fat jiggling, checking the mirror, feeling one's thighs, pinching various body parts) and estimated that body checking occurs an average of 16 to 28 times a day [16,17]. Critically, body checking behaviors are typically aimed toward disliked body parts [14], and selectively attending to disliked body parts and their perceived changes may contribute to increased ED cognitions and behaviors [20]. In one meta-analysis, significant cross-sectional correlations were reported between body checking and ED pathology [21]. In non-clinical adult samples, body checking behaviors have been observationally linked to increased body- and weight-related shame and guilt [22] and higher body dissatisfaction [16] and experimentally linked to higher body dissatisfaction [18,23] and fear of weight gain [24]. In clinical adult samples, body checking is associated with increased dietary restriction, meal skipping, use of fluids to curb appetite [15,19], increased negative affect [25,26], and, among those with binge-spectrum EDs, is indirectly tied to binge eating through increased body shame and appearance anxiety [27]. Among adolescents, one study found that higher body checking at one time point was associated with development of ED symptoms four months later [28], underscoring the need for early and targeted interventions for body checking behaviors.

Although there are no evidence-based treatments that exclusively target body checking, emerging research has demonstrated reactive effects (i.e., changes in a behavior subject to monitoring) of body checking during EMA [16,17]. One study found significant reductions in body checking behaviors female college students with high body shape concern (as determined by a cut-off score on the Body Shape Questionnaire [29]) who completed a 5-day EMA protocol in which they reported the frequency of various body checking behaviors and related ED cognitions five times a day [16]. In a follow-up study, the same research group conducted another 5-day EMA study and tested a set of micro-interventions (e.g., psychoeducation on the links between body checking and negative affect) for body checking behaviors delivered on the fourth and fifth days of the EMA period. As in the first study, significant reductions in body checking were observed from the first to fifth day of reporting (i.e., mean scores on the Body Checking Questionnaire dropped from 82.61 to 67.16). Significant reductions were also observed in body dissatisfaction and internalization of the thin ideal. However, it is unclear to what extent the micro-interventions, delivered only on the fourth and fifth days of the study (versus simply self-monitoring), may have contributed to these effects. There were no differences in body checking directly following a micro-intervention compared to not directly following a micro-intervention, suggesting that self-monitoring may be the key driver for these reductions.

In cognitive-behavioral models of psychopathology, self-monitoring of behaviors and psychological states is key for reducing engagement in undesirable behaviors and cognitions [30], including body dissatisfaction [31], ruminative thinking [32], suicidal ideation [33], depressive symptoms [34], sedentary behaviors [35], and substance use [36]. Self-monitoring theoretically increases awareness of the frequency, antecedents, and consequences of problematic thoughts and behaviors [30], allowing individuals to make changes either independently or with the support of a clinician. If body checking behaviors show reactivity to EMA in adolescents with EDs, then digital self-monitoring may be a powerful intervention for reducing body checking and associated symptoms, either as a standalone treatment or as an adjunct to evidence-based treatments. Given the large ED treatment gap (e.g., less than 20% of individuals with EDs receive care [37]), the scalability of digital self-monitoring could prove valuable among those engaging in body checking [16,17] or as a prevention tool, particularly among adolescents.

Present Study

Despite the relevance of body checking as a maintenance factor for ED pathology, relatively little is known about the nature of body checking and its prospective associations with ED cognitions and behaviors, particularly among adolescents with binge-spectrum EDs. Thus, the present study aims to fill three specific gaps. The first aim of the present study is to characterize the types and frequency of body checking behaviors among adolescent girls (ages 14-19) with binge-spectrum EDs during a 3-week EMA protocol. Although body checking behaviors are present among boys [28], consistent with other studies [16,17], we elected to restrict this study to girls because measures in the present study would fail to capture the different behaviors used to body check and their associations with ED behaviors in boys [38,39]. We expect that participants will report a broad range of body checking behaviors and that they will engage in body checking behaviors several times a day on average. The second aim of the study is to test prospective associations between body checking and other ED symptoms. Consistent with the CBT model for EDs, we expect that body checking will be

concurrently and prospectively associated with cognitive (i.e., body dissatisfaction, fear of weight gain) and behavioral (i.e., dietary restriction/restraint, compensatory behaviors) ED symptoms. The third aim is to assess whether self-monitoring of body checking produces decreases in body checking over time. We hypothesize that body checking will decrease over the study period and that participants will report lower frequencies of body checking on the last three days of the protocol as compared to the first three days [16,17].

Methods

Participants

We will enroll 70 adolescent girls with clinically significant binge eating (i.e., engaging in at least one binge eating episode per week over the past 12 weeks). Both subjective and objective binge episodes will be counted given literature demonstrating that the feeling of loss of control, rather than the size of the binge episode, is more closely linked to ED severity [41,42]. Thus, to be included in the study, participants will need to be between 14-19 years old, be able to speak, read, and write English, have a smartphone they would be willing to complete daily surveys on for the course of the study, and were assigned female at birth. Participants will be excluded if they are currently receiving treatment for binge eating and/or weight loss or if they will be starting treatment during the course of the study, if they are at imminent suicide risk, if they have begun a course of or changed the dosage of any medication known to affect appetite or body composition in the past 3 months, if they are currently pregnant or have plans to become pregnant, or if they have a mental handicap or are currently experiencing other severe psychopathology that would limit their ability to engage in the study (e.g., severe depression, substance dependence, active psychotic disorder).

Study Procedures

Recruitment and Screening

Participants will be recruited nationwide through online advertising and through a registry of adolescents who are either waitlisted or in the screening process for participation in a clinical trial for binge-spectrum EDs at [REDACTED]. Participants who appear to be eligible following the screening process and are interested in participating will be invited to a baseline assessment held either virtually via Zoom or in person. During this assessment, informed consent will be obtained from the parent or from the adolescents if they are 18 or older. Adolescents under 18 will also need to provide assent to participate. All study procedures have received approval from the [REDACTED] Institutional Review Board.

Baseline Measures

Participant characteristics, namely race, ethnicity, age, socioeconomic status, year in school, and history of ED diagnoses, will be measured through a demographics survey.

Diagnostic status will be established using the binge and compensatory modules from the Eating Disorder Examination [EDE; 40], a well-validated interview used to evaluate ED pathology.

Body concern will be measured using the Body Shape Questionnaire [BSQ; 29], a 34-item self-report questionnaire. Items inquire about the frequency of concerns related to one's body and are rated on a 6-point scale ranging from 1 ("Never") to 6 ("Always"). A total score will be calculated by summing all of the items.

Body checking will be measured using the Body Checking Questionnaire [BCQ; 43] a 23-item self-report measure. Items inquire about the frequency of various body checking behaviors and are rated on a 5-point scale ranging from 1 ("Never") to 5 ("Very often"). The BCQ contains three subscales that assess body checking related to overall appearance, specific body parts, and idiosyncratic rituals. A total score will be calculated by summing all of the subscale items.

ED pathology will be measured using the Eating Disorder Examination Questionnaire [EDE-Q; 44], a 28-item self-report. Items pertaining to frequency are rated on a 7-point scale ranging from 0 ("No days") to 6 ("Every day"); items pertaining to distress are rated on a 7-point scale ranging from 0 ("Not at all") to 6 ("Markedly"). The EDE-Q contains four subscales measuring eating concern, weight concern, shape concern, and dietary restraint. A global score will be calculated by taking the mean of all the subscale scores.

Ecological Momentary Assessment

EMA surveys will be facilitated by the EMA application Avicenna. Following administration of the interview and self-report measurements at the baseline visit, research staff will assist with installing the EMA application and how to use it. During the 3-week EMA protocol, signal-contingent (i.e., participants are prompted to complete surveys at pre-set times) and event-contingent (i.e., participants will be instructed to initiate surveys when they engage in binge eating or a compensatory behavior outside of signal-contingent survey windows) will be used. The timing of the first and last EMA surveys will be tailored to participants' self-reported weekday/weekend bedtimes and wake times such that they arrive at random times within one hour of waking up and within one hour of going to bed. The remaining three surveys will come between those windows, excluding hours during which adolescents are in school. To promote high compliance, participants will complete a test day ("day zero") and will be provided with feedback from a research assistant. Then, participants will receive 5 signal-contingent surveys a day for 21 days, for a total of 105 surveys. Surveys will pertain to engagement in body checking and both cognitive and behavioral symptoms of EDs (see questions below). Participants will earn $2.14 for each completed survey and earn a $50 bonus if they complete 85% or more surveys, for a maximum possible compensation of $275. To promote high response rates, participants will receive personalized reminder texts coupled with memes and GIFs throughout the EMA period [45].

Body checking will be measured using the same set of questions included in previous EMA studies [16,17] and will require participants to report the number of times they had engaged in the following behaviors since the last survey: (1) weighing oneself, (2) feeling thighs for fatness or checking to see if thighs spread while sitting down, (3) sucking in the stomach, (4) feeling/pinching stomach to measure fatness, (5) comparing one's body to other individuals, (6) checking body size in the mirror, and (7) checking for fat jiggling. In aim 1 (characterizing body checking), engagement in specific forms of body checking will be examined descriptively. In aim 2 (prospective associations between body checking and ED symptoms), body checking will be collapsed and treated as a binary variable representing engagement in *any* form of body checking at each survey. In aim 3 (body checking reactivity during EMA), body checking will be defined as a count variable representing the number of times each participant engaged in *any* form of body checking in a given day.

Body satisfaction will be measured through a single question: "Right now, how satisfied do you feel with your body shape or weight?" Responses will be rated on a Likert scale ranging from 1 ("Not at all satisfied") to 5 ("Very satisfied")". Body satisfaction will be treated as a continuous variable representing current degree of body satisfaction at each survey.

Fear of weight gain will be measured through a single question: "To what extent are you currently afraid of gaining weight?" Responses will be rated on a Likert scale ranging from 1 ("Not at all afraid") to 5 ("Very afraid"). Fear of weight gain will be treated as a continuous variable representing current degree of fear of weight gain at each survey.

Binge eating will be measured by first asking whether participants have eaten since the last survey. If so, participants will answer "While you were eating, did you feel a sense of loss of control (e.g., like a car without brakes that could not stop)?" on a Likert scale ranging from 1 ("Not at all") to 5 ("Extremely"). Consistent with previous EMA studies, participants were counted as having endorsed loss-of-control eating if they reported a "3" or higher on either question at least once during the recording period [46]. Binge eating will be treated as a binary variable representing whether a binge eating episode occurred at each survey.

Dietary restraint will be measured by asking, "Since the last survey, to what extent have you attempted each of the following, even if you were not successful?" Answer choices included: (1) "Tried to limit the amount you ate," (2) "Tried to avoid eating certain foods that you like," and (3) "Tried to delay eating." Responses will be rated on a Likert scale ranging from 1 ("Did not attempt") to 5 ("Attempted as hard as I could"). Dietary restraint will be treated as a binary variable representing a response of 3 ("Moderately attempted") or higher on any of the dietary restraint choices.

Dietary restriction will be measured by asking, "Since the last survey, were you successful in actually _____ in order to influence your shape and/or weight?" where the blank field will be replaced with (1) "limiting the amount that you ate," (2) "avoiding eating certain foods that you like," and (3) "trying to delay eating." Responses will be in a "Yes/No" format. Dietary restriction will be treated as a binary variable representing engagement in *any* form of dietary restriction at each survey.

Compensatory behaviors will be measured by asking, "Since the last survey, have you engaged in any of the following? Select all that apply." Options will include (1) "self-induced vomiting," (2) "taking laxatives to influence your shape and/or weight," (3) "taking diet pills to influence your shape and/or weight," (4) "taking diuretics to influence your shape and/or weight," (5) "exercise to influence your shape and/or weight," and (6) "other behavior to influence your shape and/or weight." Compensatory behaviors will be collapsed and treated as a binary variable representing engagement in *any* compensatory behaviors at each survey.

Statistical Analysis

Sample Size Determination and Data Exclusions

Sample size was determined through power curve analyses in R version 4.2.3 [47] using the package *EMATools* [48] which indicated that to detect a medium-sized effect with 80% power using mixed-effects models, we would need to recruit a minimum of 70 participants.

Data from the test day will be excluded from analyses. To promote high survey compliance, participants who achieve less than 50% compliance on the test day will receive a warning message. Participants who achieve less than 50% compliance on the test day and the first day of the study will be removed from the study.

Study Aims

Aim 1 of the present study is to characterize body checking among adolescents with binge-spectrum EDs. To evaluate aim 1, descriptive statistics (i.e., means and standard deviations) will be calculated for the frequency of each type of body checking behavior and the percentage of participants who endorsed each type of behavior over the EMA period, both in the full sample and by diagnostic category (BED-spectrum vs. BN-spectrum). Additionally, the distribution of body checking frequency will be examined to capture when body checking behaviors most frequently occur throughout the day.

Aim 2 of the study is to assess whether frequency in body checking at one observation is associated with other ED symptoms at the same observation and at the next observation. To preserve analytic power, we plan to define body checking frequency as a composite binary variable representing occurrence of body checking that aggregates counts across all types of body checking behaviors. However, it is possible that body checking may be reported so frequently that it fails to have any predictive ability. Thus, we will conduct sensitivity analyses that group the body checking items into three categories (i.e., overall appearance, specific body parts, idiosyncratic rituals), consistent with the three subscales of the BCQ [43]. We will use linear mixed-effects models for continuous outcomes (i.e., ratings of body dissatisfaction and fear of weight gain) and generalized mixed-effects models using a binomial distribution with a logit link function for binary outcomes (i.e., binge eating, compensatory behaviors, dietary restraint, and dietary restriction). All models will include body checking as a fixed predictor and a random intercept per participant. Consistent with other studies [49], models assessing binge eating and dietary restraint/restriction will control for binge eating and dietary restraint/restriction, respectively, at the previous observation. False discovery rate corrections will be used to correct for multiple comparisons.

Aim 3 is to assess whether body checking behaviors are reactive to EMA, such that they decrease over the course of the EMA period. To evaluate aim 3, we will first create a composite count score that aggregates frequencies of all body checking behaviors per person per day. Then, we will fit a generalized linear mixed model with a Poisson distribution to examine whether the count of body checking behaviors decreases as a function of time. We will include a fixed effect of time (i.e., day of study) and a random intercept per subject. If the model yields poor fit (i.e., there is over- or under-dispersion), then a Quasi-Poisson will be employed and data will be examined for both zero-truncation and zero-inflation. To examine differences in body checking counts between the start and end of study participation, we will conduct a Poisson regression to examine associations between counts on day 1-3 and day 19-21. We elected to examine the first and last three days to obtain a more stable metric of frequency. Additionally, we will regress body checking behaviors across two time windows, day 1 to day 10 and day 11 to day 21, and control for the frequency of surveys completed to examine the rate of reduction in body checking behaviors in the first and second halves of the study period.

Results

Recruitment is planned to begin in January 2025 and data collection is expected to conclude in March 2026. Data analyses and dissemination of results will be completed by August 2026.

Discussion

Study Implications and Future Directions

To date, there is limited literature on the role of body checking in maintaining binge-spectrum EDs among adolescents [12,14,18,27]. Thus, the present study will provide valuable insights into the types, frequencies, and effects of body checking behaviors on ED symptoms among adolescents with binge-spectrum EDs. Findings from the present study will clarify whether body checking behaviors are prospectively associated with engagement in other ED symptoms, which is critical for better understanding maintaining mechanisms of EDs in adolescents. Furthermore, this study will evaluate whether body checking shows reactive effects to EMA such that body checking behaviors reduce over the course of the study. If our hypotheses are supported and body checking behaviors decrease, this study could inform the development of highly scalable interventions to reduce body checking behaviors. We will also be able to detect whether reactive reductions in body checking are prospectively associated with reductions in other ED symptoms, which will inform whether targeting body checking with self-monitoring interventions could improve ED treatment outcomes more broadly. Such interventions represent a low-cost, accessible option for individuals with EDs which could be used as an adjunct to traditional treatments or a brief, standalone intervention. Digital self-monitoring could also have high utility as a tool for ED prevention, given literature which supports that higher engagement in body checking in adolescents is longitudinally linked to development of ED symptoms [28].

Strengths and Limitations

Strengths of this study include the use of a transdiagnostic sample of adolescents with binge-spectrum EDs, which will improve generalizability of the results. Furthermore, the inclusion of a broad range of body checking behaviors, as opposed to assessing body checking with one or two items as past literature has done [15], will provide critical insights into the frequency and timing of these behaviors among adolescents. Limitations of this study include the lack of follow-up assessments which make it difficult to assess reactive effects to self-monitoring whether body checking continues to decrease, plateaus, or eventually increases back to baseline. Future work should examine these behaviors over longer periods and include follow-up assessments to better understand how effectively self-monitoring intervenes on body checking and how decreases in body checking may correlate with reductions in other indices of ED pathology. Of note, given the EMA design of this study, it is possible that reductions in other ED behaviors may be driven by self-monitoring or may arise from reductions in overvaluation of shape and weight, as manifest by body checking. This study is further limited by its exclusion of boys. Given that boys use a different set of methods to body check, future work should use questionnaires tailored to assess body checking in boys [38,39].

Conclusion

In conclusion, the present study will elucidate the nature and frequency of body checking, body checking's prospective relations to ED symptoms, and the potential reactivity of body checking to digital self-monitoring (via EMA) among adolescent girls with binge-spectrum EDs. The data afforded by this study will be critical for understanding the presentations of body checking in adolescents' daily lives and how it may maintain binge-spectrum EDs. This study will also inform optimal strategies for intervening on body checking and improving long-term ED treatment outcomes in adolescents with EDs.

Acknowledgements

Data Availability

The analytic data generated for the present analyses will be available through protected access on Synapse.

Conflicts of Interest

None declared.

Abbreviations

BCQ: Body checking questionnaire
BED: Binge eating disorder
BN: Bulimia nervosa
BSQ: Body shape questionnaire
ED: Eating disorders
EDE: Eating disorder examination
EDE-Q: Eating disorder examination questionnaire
EMA: Ecological momentary assessment

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