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A Naturalistic Examination of Body Checking and Dietary Restriction in Women with Anorexia Nervosa

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Abstract

Body checking has been conceptualized as a behavioral manifestation of the core overvaluation of eating, shape, and weight concerns underlying eating disorder psychopathology. Cognitive-behavioral theories suggest that body checking behaviors may function to maintain dietary restriction. The current study examined the association between body checking frequency and dietary restriction among women with anorexia nervosa (AN) in the natural environment. Women (N = 118) with full or partial AN completed baseline clinical interviews and a two-week ecological momentary assessment protocol, during which they reported on body checking behaviors (i.e., checking whether one's thighs touch; checking joints/bones for fat) and dietary restriction (i.e., 8 waking hours without eating; consuming less than 1200 calories per day). Average daily body checking frequency was positively associated with baseline eating disorder symptoms and body mass index. Daily body checking frequency was associated with both forms of dietary restriction on the same day, as well as the following day. Results support the theorized association between body checking and overvaluation of shape and weight, and suggest that targeting such behaviors in treatment may have utility in reducing dietary restriction.

Keywords

anorexia nervosa; body checking; dietary restriction; ecological momentary assessment

Anorexia nervosa (AN) is a serious psychiatric disorder characterized by maintenance of less than minimally normal body weight, fear of gaining weight or becoming fat, and disturbances in body image (American Psychiatric Association, 1994). In addition to these core diagnostic criteria and the specific behaviors that characterize the two AN subtypes (i.e., binge eating-purging subtype and restricting subtype), many individuals with AN exhibit related behaviors that have been described as compulsive and ritualistic in nature

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(e.g., Mazure, Halmi, Sunday, Romano, & Einhorn, 1994; Steinglass et al., 2011). One set of body-related ritualistic behaviors that has received attention in the literature is body checking behaviors. Body checking has been conceptualized as a behavioral manifestation of the core overvaluation of eating, weight, and shape that is theorized to underlie eating disorder (ED) psychopathology (Fairburn, Cooper, & Shafran, 2003; Shafran, Fairburn, Robinson, & Lask, 2004). Characterized by the repeated checking of one's body as a whole or particular body features/areas, such behaviors can take many forms including examining specific body parts in the mirror, pinching one's stomach to check for fat, and checking whether one's thighs touch (e.g., Engel et al., 2005; Reas, Wisenhunt, Netemeyer, & Williamson, 2002; Shafran et al., 2004).

Although body checking behaviors are targeted in cognitive behavioral treatments of EDs (e.g., Fairburn, 2008), the empirical literature on body checking remains limited. Findings from studies with non-clinical samples suggest that body checking is associated with body dissatisfaction and other ED symptoms (Haase, Mountford, & Waller, 2011; Shafran, Lee, Payne, & Fairburn, 2007; Smeets et al., 2011; Vartanian & Grisham, 2012), as well as impairments in overall quality of life and mental health (Latner, Mond, Vallance, Gleaves, & Buckett, 2012). Within the ED literature, much of the existing research on body checking has been conducted with binge eating disorder (BED) or mixed ED samples. Findings suggest that body checking is common in BED, particularly among women, and is associated with dietary restraint, shape and weight overvaluation, and body dissatisfaction, as well as greater depression symptoms and lower self-esteem (Reas, Grilo, Masheb, & Wilson, 2005; Reas, White, & Grilo, 2006). Other studies of body checking in mixed ED samples have revealed similar results, indicating that body checking behaviors and cognitions are present across the range of ED presentations (Mountford, Haase, & Waller, 2007) and suggesting that ED patients exhibit higher levels of body checking than controls (Calugi, Dalle Grave, Ghisi, & Sanavio, 2006). Although few studies have examined body checking in AN specifically, body checking has been found to be frequent among women with AN (Engel et al., 2005), and body checking levels in AN have been shown to be elevated compared to those in controls (Calugi et al., 2006).

To date, few empirical studies have addressed the functional nature of body checking behaviors, although theoretical models of the maintenance of AN and other EDs suggest that body checking may function to maintain ED symptoms (Fairburn, 2008; Fairburn et al., 2003; Fairburn, Shafran, & Cooper, 1999). Specifically, body checking behaviors, which are often brief in duration but are repeated frequently, may serve to highlight and amplify the perceived imperfections in body shape or weight that commonly contribute to body dissatisfaction in AN (Fairburn, 2008; Fairburn et al., 1999). In turn, this perception of body features as being undesirable may exacerbate a sense of failure to control weight/shape, thereby motivating continued or increased dietary restriction (Fairburn et al., 1999).

The overall goal of the current study was to examine the association between body checking and dietary restriction in women with AN using data collected via ecological momentary assessment (EMA). EMA involves collecting data from each participant in his/her natural environment when experiences of interest occur (e.g., specific events or behaviors; Stone & Shiffman, 1994), thus enhancing the ecological validity of the data and reducing recall bias. The specific objective of the present research was to examine whether the daily frequency of two body checking behaviors found to be common in women with AN (i.e., checking whether one's thighs touch; checking joints/bones for fat; Engel et al., 2005) was associated with daily dietary restriction (defined in two ways: going 8 waking hours without eating; consuming less than 1200 calories per day). In order to clarify the temporal sequence underlying these associations, two analyses were conducted with each of the dietary restriction variables, examining the association between body checking frequency and (a)

dietary restriction on the same day and (b) dietary restriction on the following day, controlling for dietary restriction on the previous day. It was hypothesized that body checking frequency would be positively associated with both forms of dietary restriction on the same day and the following day. Further, it was hypothesized that average daily body checking frequency would be positively associated with baseline ED symptoms, particularly shape and weight concerns.

Method

Participants

The current sample was composed of 118 women who met Diagnostic and Statistical Manual of Mental Disorders (4th Edition: *DSM-IV*; APA, 1994) criteria for full AN ($n = 59$) or subthreshold AN ($n = 59$). The latter group was defined as meeting all of the DSM-IV criteria for AN except (a) having a body mass index (BMI) between 17.6 and 18.5, or (b) absence of either amenorrhea or the cognitive features of AN. Participants were recruited from various clinical and community settings. A total of 601 individuals completed a phone screen to determine initial eligibility, with 166 of these individuals receiving further evaluation at the research facilities. Inclusion criteria for the study were being female, at least 18 years of age, and satisfying criteria for full or subthreshold AN. Ten participants met the full or subthreshold AN criteria but elected not to continue in the study. In total, 121 individuals met full study criteria, agreed to participate, and were enrolled in the study. Three participants with EMA compliance rates of less than 50% were excluded from analyses, leaving a final total of 118 participants. With regard to the breakdown of the AN diagnostic subtypes, forty-five (38.1%) participants were diagnosed with the binge eating-purging subtype and 73 (61.9%) were diagnosed with the restricting subtype. The final sample had a mean BMI of 17.1 (SD = 1.0; Range = 13.4-18.5) kg/m^2 and a mean age of 25.3 (SD = 8.4) years at baseline, and the majority of participants were Caucasian (96.6%) and single/never married (75.4%).

Measures

Baseline interviews—The Structured Clinical Interview for DSM-IV Axis I Disorders, Patient Edition (SCID-I/P; First et al., 1995), a semi-structured interview used to assess Axis I psychiatric disorders, was administered by trained assessors to assess the criteria for current full and subthreshold AN. All SCID interviews were recorded and a second independent assessor rated current ED diagnoses in a random sample of 25% (n = 30). Interrater reliability for current AN diagnosis based upon a kappa coefficient was 0.93.

The 15th edition of the Eating Disorder Examination (EDE; Fairburn, 2008) served as the primary measure of baseline ED symptoms. The EDE provides a global score and four subscale scores: restraint, eating concern, shape concern, and weight concern. The reliability and validity of the EDE have been well-documented (Fairburn, 2008). EDE interviews were recorded and 25% (n = 31) were rated by a second independent assessor. Intraclass correlations coefficients representing agreement between raters on the EDE scales ranged from 0.894 (shape concern) to 0.997 (restraint).

EMA measures—Frequency of body checking was assessed via two items addressing checking behaviors found to be common among women with AN (Engel et al., 2005): “I made sure my thighs didn’t touch” and “I checked my joints and bones for fat.” These selected items are consistent with items assessing body rituals on the Yale-Brown-Cornell Eating Disorders Scale (Mazure et al., 1994), as well as items from the Body Checking Questionnaire (Reas et al., 2002). Additionally, two forms of daily dietary restriction were assessed as part of end-of-day reports. Participants indicated if they went at least 8 waking

hours without eating and if they limited their food intake to less than 1200 calories during the day.

Procedure

Participants were recruited at three sites in the Midwestern United States from ED treatment facilities, mailings to ED treatment providers, advertisements in community and campus newspapers, on-line postings, and flyers posted in clinical, community, and campus settings. Following an initial phone screen, potential participants attended an informational meeting where they provided written informed consent. Final eligibility was determined during two assessment sessions involving structured interviews and questionnaires, as well as laboratory tests and a physical examination to ensure medical stability. Local institutional review boards provided study approval at each study site.

Participants received training in use of the palmtop computers at the conclusion of the first assessment session. Research personnel discussed the study goals, what to expect during data collection, and how to address questions that might arise. Participants were instructed to complete entries at a later time if they felt unable to reply (e.g., during a class) or safety was a concern (e.g., while driving) when they received a signal. Participants completed two practice days of the EMA protocol to ensure familiarity with the momentary assessments and to minimize reactivity, although evidence suggests that EMA is not associated with significant reactivity in ED populations (Stein & Corte, 2003). These practice data (not used in the current analyses) were reviewed by research personnel during a subsequent visit and feedback regarding compliance was provided. Participants then completed EMA recordings for 2 weeks, during which time efforts were made to schedule 2-3 visits for each participant to provide compliance feedback and obtain recorded data to minimize loss in the event of technical difficulties. Compensation of $100 per week of EMA recordings was provided, along with a $50 bonus for a compliance rate of at least 80% to random signals.

The current study reports on data collected via two assessment methods utilized in the EMA protocol: signal-contingent (i.e., providing a rating in response to a random prompt) and interval-contingent, (i.e., providing a rating in at a specified interval). Participants provided signal-contingent data at six semi-random times across each day, with signal times normally distributed (standard deviation = 30 minutes) around six anchor points (8:30AM, 11:10AM, 1:50PM, 4:30PM, 7:10PM, 9:50PM). When signaled, participants were asked to indicate whether they had engaged in each of the body checking behaviors since their last report. Interval-contingent data were also collected via end-of-day reports (i.e., before bedtime), in which participants indicated whether they had engaged in two forms of dietary restriction during the day (i.e., not eating for 8 waking hours; eating less than 1200 calories during the day).

Statistical Analyses

Pearson correlations were computed to examine the association between average daily frequency of body checking (calculated as the total instances of body checking a participant reported during the study divided by the number of days that participant provided EMA reports) and the baseline variables of BMI and EDE global and subscale scores. A series of generalized estimating equation (GEE; Liang & Zeger, 1986) analyses with binary logit response functions were used to examine the extent to which daily frequency of body checking was associated with each form of daily dietary restriction on the same day and the following day. To further address the temporal association between body checking and dietary restriction, two additional GEE analyses with negative binomial response functions were used to examine whether each form of dietary restriction on a given day was associated with frequency of body checking on the following day.

Results

EMA Findings

Participants provided 9085 signal-contingent recordings and 1478 end-of-day recordings. Compliance rates to the semi-random signals averaged 87% (range = 58-100%), with 77% compliance to signals within 45 minutes. Compliance with end-of-day ratings averaged 89% (range = 24-100%). Across all days, participants reported a mean (SD) of 30.94 (38.71) instances of body checking (range = 0-142). Of the 1478 end-of-day recordings provided, 178 days were reported as restriction days as defined by not eating for 8 waking hours, and 469 days were reported as restriction days as defined by eating less than 1200 calories. Across all participants, the mean daily frequency of checking whether one's thighs touch was 0.69 (SD = 1.39) and the mean daily frequency of checking joints/bones for fat was 1.37 (SD = 1.96).

Body Checking and Baseline ED Symptoms

Pearson correlations between the average daily instances of body checking (calculated as the total number of body checking behaviors divided by the total number of days the participant completed EMA reports) and the EDE global scale and the four subscales were found to be significant (see Table 1). The average daily frequency of body checking was highly correlated with the global score. Consistent with the conceptualization of body checking as behavioral manifestation of overvaluation of shape and weight, the correlations between body checking frequency and the shape concern and weight concern subscales were similarly high. In fact, the weight concern subscale and the global scale score were equally correlated with body checking frequency. Correlations between body checking frequency and the eating concern and restraint subscales were lower, but still statistically significant. Further, average daily frequency of body checking was also found to exhibit a small, positive correlation with BMI.

Body Checking and Dietary Restriction

No Eating for 8 Waking Hours—Results of the same day and subsequent day analyses revealed significant associations between daily frequency of body checking and going 8 waking hours without eating (see Table 2). Specifically, daily body checking frequency was significantly and positively associated with an increased likelihood of dietary restriction on the same day (OR = 1.22, $p<.001$) and on the following day (OR = 1.14, $p<.001$), controlling for restriction on the first day. This measure of dietary restriction on the first day was also a significant predictor of the same measure of dietary restriction on the following day (OR = 43.02, $p<.001$). In contrast, results revealed that going 8 waking hours without eating on a given day was not a significant predictor of next day body checking frequency ($p>.05$).

Less than 1200 Calories across the Day—Results of the same day and subsequent day analyses also revealed significant associations between daily frequency of body checking and eating less than 1200 calories in a day (see Table 2). Specifically, daily body checking frequency was positively associated with an increased likelihood of dietary restriction on the same day (OR = 1.11, $p<.001$) and on the following day, controlling for restriction on the first day (OR = 1.14, $p=.002$). This measure of dietary restriction on the first day was also a significant predictor of the same measure of dietary restriction on the following day (OR = 125.67, $p<.001$). In contrast, results revealed that eating less than 1200 calories on a given day was not a significant predictor of next day body checking frequency ($p>.05$).

Discussion

This study examined the association between body checking and dietary restriction in a large sample of women with AN using data collected via EMA. Consistent with findings from experimental and cross-sectional studies with non-clinical samples suggesting an association between body checking and overvaluation of shape and weight (Haase et al., 2011; Shafran et al., 2007; Smeets et al., 2011; Vartanian & Grisham, 2012), results from the current study supported the hypothesized positive association between average daily frequency of body checking behaviors and ED symptoms in AN, with the strongest associations found for shape and weight concerns. Body checking frequency was also found to exhibit a small but significant positive association with BMI, suggesting that body checking may occur at a greater rate among women with AN who have a higher BMI.

Given theoretical accounts suggesting that body checking may promote dietary restriction via the increased body dissatisfaction and perceived lack of control over body shape/weight resulting from such behaviors (Fairburn et al., 1999; Fairburn et al., 2003), the primary goal of this investigation was to examine the association between the daily frequency of body checking and the occurrence of dietary restriction. Consistent with the hypotheses, daily body checking frequency was found to significantly predict two forms of daily dietary restriction in AN: going 8 waking hours without eating and eating less than 1200 calories across the day. Further support for the hypothesized relationship between these variables was found in the second set of analyses, which revealed that daily body checking frequency on a given day was significantly associated with both forms of daily dietary restriction on the following day, controlling for restriction on the first day. These results therefore provide evidence supporting an association between body checking and dietary restriction in AN, and lend preliminary support to the theorized temporal relationship between these variables.

One construct related to body checking that has been addressed in the theoretical and empirical literature is body avoidance (Shafran et al., 2004), which is characterized by efforts to avoid seeing one’s body weight/shape (e.g., avoiding mirrors, wearing loose-fitting clothing). Although body checking and avoidance could be viewed as opposing constructs, they are both theorized to serve as maintaining factors for ED psychopathology (Fairburn et al., 2003). Specifically, body avoidance may promote continued body dissatisfaction by preventing an individual from receiving disconfirming evidence related to their body concerns (i.e., avoiding seeing herself in a mirror prevents a woman with AN from seeing that she is not overweight, though she may feel that way; Shafran et al., 2004). As such, body checking may exacerbate perceived bodily imperfections, and subsequent body avoidance could preclude the opportunity to disconfirm those perceived imperfections, thus functioning to maintain dietary restriction for weight and shape control purposes. Future studies should address the role of both of these constructs as maintenance factors for ED symptoms.

There are several limitations that should be considered in interpreting the findings of the current study. First, although this is the first naturalistic study to examine the link between body checking and dietary restriction in AN, the construct of body checking as defined in this study was limited by the content of the assessment (i.e., focus on two specific behaviors) and the nature of the assessment (i.e., behaviors were assessed via random signals versus asking participants to report each time a body checking behavior occurred). The true frequency of such behaviors is thus likely much higher than what was found in the current study, such that requiring participants to report every instance of body checking might not be feasible. Future research should include a more comprehensive assessment of body checking, both in cross-sectional designs and in EMA protocols, given that there are many forms that body checking behaviors can take, and there may be heterogeneity in the

most frequent types of body checking across individuals. Second, although the analyses examining the association between body checking on one day and restriction on the subsequent day provide some evidence in support of the temporal relationship between these variables, the fact that the restriction variables were only assessed at the daily level precluded the ability to utilize momentary data to more intensively examine the association. Third, the dietary restriction outcome variables were limited in that they were dichotomous and based on self-report. Fourth, the current study did not have data appropriate for testing the full theoretical model in which body checking promotes body dissatisfaction, which in turn motivates dietary restriction. Future studies should assess these three constructs with appropriate temporal ordering to test for a potential mediational relationship. Finally, although this study contributes to the small existing literature on body checking in AN, the nature of the current sample (e.g., only females with AN) may limit the generalizability of these findings to other populations.

Clinical Implications

The results of the current study provide support for a link between frequency of body checking and dietary restriction in women with AN. Although the nature of the analyses does not allow for a determination of the precise temporal order underlying this association, the finding that body checking frequency on a given day was associated with an elevated likelihood of dietary restriction on a following day (controlling for the propensity to engage in restriction generally) is consistent with the theory that body checking can function to maintain or possibly exacerbate dietary restriction in AN. Body checking in those with EDs is characterized by repeatedly turning one's attention to disliked body features, potentially magnifying perceived imperfections and overall body dissatisfaction, which may in turn motivate continued or increased dietary restriction for body shape or weight control. Consistent with the focus on weight checking and shape checking in cognitive behavior therapy for EDs (Fairburn, 2008), these findings highlight the potential utility of addressing body checking in the treatment of AN. For instance, given the increased body dissatisfaction likely resulting from these behaviors, helping a patient with AN to increase awareness of the nature and consequences of these behaviors may prove useful in reducing one source of motivation for ongoing dietary restriction. Additionally, the positive association between BMI and body checking frequency in this study may suggest the importance of monitoring body checking throughout AN treatment given that these behaviors may become more frequent with weight restoration, potentially contributing to an increased risk of relapse.

Conclusion

The present study examined the association between body checking and dietary restriction among women with AN using an EMA protocol. Findings revealed that the frequency of body checking in the natural environment was associated with baseline ED symptoms, particularly weight and shape concerns. Further, body checking frequency was associated with an elevated likelihood of engaging dietary restriction on the same day and on the subsequent day. These results are consistent with theoretical models positing that body checking may function to maintain dietary restriction (Fairburn et al., 1999; Fairburn et al., 2003). Further, these findings suggest that among women with AN, body checking behaviors are a common occurrence, thus highlighting the potential utility of addressing such behaviors in treatment.

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Highlights

- Body checking (BC) is a behavioral manifestation of overvaluation of shape and weight.
- Cognitive-behavioral models propose that BC may maintain dietary restriction.
- Women with AN completed baseline measures and 2 weeks of ecological momentary assessment.
- BC frequency was positively associated with baseline eating disorder symptoms.
- BC frequency was associated with dietary restriction on the same and subsequent day.

Table 1

Means, Standard Deviations, and Intercorrelations of Baseline Variables and Average Daily Body Checking Frequency (N = 118)

	1	2	3	4	5	6	7
1. EDE Global	-						
2. EDE Restraint	.80***	-					
3. EDE Eating Concern	.79***	.57***	-				
4. EDE Shape Concern	.87***	.54***	.57***	-			
5. EDE Weight Concern	.87***	.55***	.57***	.79***	-		
6. BMI	.18	.13	.02	.24**	.18*	-	
7. Body Checking	.54***	.40***	.36***	.49***	.54***	.23*	-
Mean	2.75	2.79	2.08	3.05	3.09	17.15	2.08
Standard Deviation	1.29	1.61	1.35	1.59	1.62	1.03	2.59

Note. EDE = Eating Disorder Examination; BMI = Body Mass Index; Body Checking = Average Daily Frequency of Body Checking.

* p<.05

** p<.01

*** p<.001.

Table 2

Parameter Estimates for Generalized Estimating Equation Models Predicting Same and Next Day Dietary Restriction by Daily Body Checking Frequency

Model	*IV*	*DV*	*B*	Odds Ratio	95% CI		*p*
					Lower CI	*Upper CI*	
No Eating for 8 Waking Hours							
1	BC_{d1}	DR_{d1}	0.19	1.22	1.13	1.31	<.001
2	BC_{d1}	DR_{d2}	0.13	1.14	1.07	1.22	<.001
	DR_{d1}	DR_{d2}	3.76	43.02	25.06	73.86	<.001
Eating Less than 1200 Calories							
1	BC_{d1}	DR_{d1}	0.10	1.11	1.05	1.18	<.001
2	BC_{d1}	DR_{d2}	0.13	1.14	1.05	1.23	=.002
	DR_{d1}	DR_{d2}	4.83	125.67	68.86	229.35	<.001

Note. IV = Independent variable; DV = Dependent Variable; CI = Confidence Interval; BC = Daily body checking frequency; DR = Dietary Restriction (dichotomous: No = 0, Yes = 1). Subscripts indicate same day (d1) or next day (d2).