

RESEARCH ARTICLE

Immediate Effects of Body Checking Behaviour on Negative and Positive Emotions in Women with Eating Disorders: An Ecological Momentary Assessment Approach

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Abstract

Objectives: Cognitive-behavioural models of eating disorders state that body checking arises in response to negative emotions in order to reduce the aversive emotional state and is therefore negatively reinforced. This study empirically tests this assumption.

Methods: For a seven-day period, women with eating disorders ($n=26$) and healthy controls ($n=29$) were provided with a handheld computer for assessing occurring body checking strategies as well as negative and positive emotions. Serving as control condition, randomized computer-emitted acoustic signals prompted reports on body checking and emotions.

Results: There was no difference in the intensity of negative emotions before body checking and in control situations across groups. However, from pre- to post-body checking, an increase in negative emotions was found. This effect was more pronounced in women with eating disorders compared with healthy controls.

Discussion: Results are contradictory to the assumptions of the cognitive-behavioural model, as body checking does not seem to reduce negative emotions. Copyright © 2015 John Wiley & Sons, Ltd and Eating Disorders Association.

Keywords

body checking behaviour; negative and positive emotions; ecological momentary assessment

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Introduction

Checking behaviour comprises a variety of strategies, which are performed to prevent anticipated catastrophes related to disorder-specific topics and concerns. It is common in diverse mental disorders, such as obsessive-compulsive disorder (Salkovskis, Thorpe, Wahl, Wroe, & Forrester, 2003), social phobia (McManus et al., 2009), panic disorder (Levitt, Brown, Orsillo, & Barlow, 2005), agoraphobia (Salkovskis, Clark, Hackmann, Wells, & Gelder, 1999) and illness anxiety (Abramowitz & Moore, 2007). Moreover, checking behaviour plays an important role in eating disorders, as body checking is considered to be a behavioural manifestation of body image disturbance (Vocks, Legenbauer, Troje, & Schulte, 2006; Vocks et al., 2008a, 2008b; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). As in the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV), the relevance of body image disturbance in eating disorders continues to be reflected in the latest revision of the DSM-5 (American Psychiatric Association, 2013), as an undue influence of shape and weight on self-evaluation is specified as a diagnostic criterion for anorexia as well as for bulimia nervosa. In eating disorders, body checking behaviour is performed in order to judge shape or weight (Fairburn, Shafran, & Cooper, 1999; Shafran, Fairburn, Robinson, & Lask, 2004).

Examples of body checking behaviour are frequently weighing oneself, examining specific body parts in the mirror, checking the fit of clothes, touching one's hip bones, pinching flesh, measuring specific body parts as well as seeking reassurance about shape, and comparing one's own shape with the figure of other persons (Grilo et al., 2005; Shafran et al., 2004).

Various studies have indicated the clinical relevance of body checking behaviour. Although body checking is a widespread behaviour in women in general (Farrell, Shafran, & Fairburn, 2004; Haase, Mountford, & Waller, 2011), it occurs even more frequently in persons with eating disorders (Kachani, Brasiliano, Cordas, & Hochgraf, 2013; Shafran et al., 2004; Reas, Whisenhunt, Netemeyer, & Williamson, 2002). Furthermore, the extent of body checking behaviour is positively correlated with the degree of eating disorder pathology (Grilo et al., 2005; Lavender et al., 2013; Reas, Grilo, Masheb, & Wilson, 2005; Shafran et al., 2004; Reas et al., 2002). First hints concerning the relevance of body checking in the aetiology and maintenance of eating disorders were gained in a study by Shafran, Lee, Payne, and Fairburn (2007), in which the experimental intensification of body checking behaviour led to an increase in body dissatisfaction, feelings of fatness and body-related self-critical thinking in healthy women. In line with this, using mirror exposure, Walker,

Murray, Lavender, and Anderson (2012) found that a body checking procedure with an attentional focus on disliked body parts led to a decrease in state body image satisfaction in healthy men. Body checking also seems to have an impact on eating disorder treatment, as a higher extent of body checking behaviour was found to predict a lower effect of body exposure tasks (Vocks et al., 2008a, 2008b).

Beyond these empirical findings highlighting the clinical relevance of body checking, this behaviour also figures prominently in theoretical frameworks on the development and maintenance of eating disorders. For example, in their cognitive-behavioural model of eating disorders, Williamson, White, York-Crowe, and Stewart (2004) hypothesize that a body size- and shape-related negative self-schema, activated by body- or food-related cues, leads to a biased interpretation of information, such as selective interpretation bias or body size overestimation, consistent with the negative body self-schema. In turn, this biased information processing is assumed to elicit negative emotions such as anxiety. The model further postulates that in response to these negative emotions, body checking is performed in order to reduce this aversive emotional state. Accordingly, the effect of body checking in terms of blunting the extent of negative emotions negatively reinforces and thus maintains body checking behaviour.

Most of the assumptions in this cognitive-behavioural model have been empirically confirmed (Cash & Deagle, 1997; Cooper, 1997; McKenzie, Williamson, & Cubic, 1993; Williamson, Muller, Reas, & Thaw, 1999; Williamson, Perrin, Blouin, & Barbin, 2000), but to date, it is not known, first, whether body checking is indeed performed in response to negative emotions and, second, whether body checking actually leads to a reduction of negative emotions.

Nevertheless, similar questions have been addressed in other mental disorders. In their experimental analysis, Abramowitz and Moore (2007) showed that in patients with illness anxiety, the exposure to health-related stimuli led to a marked increase in anxiety and provoked urges to perform checking behaviour. When participants experienced this experimentally induced increased level of anxiety, the performance of checking behaviour was shown to result in a decrease in anxiety. Similarly, in a study by Rachman, De Silva, and Röper (1976), patients with obsessive-compulsive disorder reported an increase in anxiety and discomfort as well as a strong urge to engage in checking behaviour when they were exposed to an individually provoking stimulus, for example, a closed door, for a participant whose checking ritual was opening doors repeatedly to make sure that nobody is locked in. Again, when participants executed the checking ritual, a decrease in anxiety was observed. As the results of these studies indicate a relieving effect of checking behaviour, it can be assumed that body checking is maintained via negative reinforcement. However, to date, it is unclear whether these mechanisms can be transferred to body checking in eating disorders.

Based on these considerations, the aim of the present study was to test the negative and positive emotions prior to and following body checking episodes in patients with eating disorders as compared with healthy controls. In order to avoid retrospection effects (Cohen & Conway, 2008; Cohen & Java, 1995; Käßler, Brügger, & Fahrenberg, 2001; Pohl, 2004; Smith, Leffingwell, &

Ptacek, 1999) and measurement reactivity (Barta, Tennen, & Litt, 2012; Heron & Smyth, 2013) as well as to enhance the generalizability of the findings (Cone, 1999; Henry, Moffitt, Caspi, Langley, & Silva, 1994), we assessed the behaviour of interest during a seven-day period under daily life conditions using a computer-assisted ecological momentary assessment approach (Ebner-Priemer & Kubiak, 2007; Fahrenberg, Myrtek, Pawlik, & Perrez, 2007; Käßler et al., 2001). Using an event- and time-contingent design, negative and positive emotions were assessed during body checking episodes as well as at randomly selected time points. Owing to their benefits mentioned earlier, ecological momentary assessment methods are increasingly applied for the examination of behaviour and emotions in eating disorders in the natural environment (Smyth, Wonderlich, Crosby, Miltenberger, Mitchell, & Rorty, 2001; Stein & Cortes, 2003). In this regard, using an ecological momentary assessment approach, various studies investigated negative emotions in eating disorders and found that negative emotions seem to play an important role in the maintenance of anorexia nervosa (Engel et al., 2013; Lavender et al., 2013) and bulimia nervosa (Goldschmidt et al., 2014; Hilbert & Tuschen-Caffier, 2007) and that negative emotions appear to trigger binge eating and purging behaviour in bulimia nervosa (Berg et al., 2013; Crosby, Wonderlich, Engel, Simonich, Smyth, & Mitchell, 2009; Haedt-Matt & Keel, 2011; Selby et al., 2012). Therefore, ecological momentary assessment methods constitute a significant approach in eating disorder research.

Furthermore, in eating disorder research, a transdiagnostic model is being increasingly endorsed (Stice, Rohde, Butryn, Menke, & Marti, 2014; Turner, Marshall, Stopa, & Waller, 2015; Wade, Bergin, Martin, Gillespie, & Fairburn, 2006) as anorexia nervosa, bulimia nervosa and eating disorder not otherwise specified share the same core-pathology (Fairburn, Cooper, & Shafran, 2003) and distinctive clinical symptoms (Brockmeyer et al., 2013; Treasure, Claudino, & Zucker, 2010). Moreover, these disorders often move across from one to another in the course of time (Agras, Walsh, Fairburn, Wilson, & Kraemer, 2000; Castellini et al., 2011; Eddy, Dorner, Franko, Tahilani, Thompson-Brenner, & Herzog, 2008; Milos, Spindler, Schnyder, & Fairburn, 2005; Sullivan, Bulik, Fear, & Pickering, 1998). In line with the transdiagnostic perspective, our clinical sample comprises participants with anorexia nervosa, bulimia nervosa and an eating disorder not otherwise specified.

In accordance with the assumptions of the cognitive-behavioural model of eating disorders (Williamson et al., 2004), we first hypothesize that the degree of negative emotions is higher and the degree of positive emotions is lower before an episode of body checking compared with control situations. Second, we expect that the degree of negative emotions decreases and the degree of positive emotions increases from pre- to post-body checking as indicated by the cognitive-behavioural model (Williamson et al., 2004). Third, in accordance with results of experimental studies indicating that the impact of shape- and body-related activities on mood is greater in women with eating disorder symptoms than in healthy women (Cooper & Fairburn, 1992; Hilbert, Tuschen-Caffier, & Vögele, 2002; Tuschen-Caffier, Vögele, Bracht, & Hilbert, 2003; Vocks, Hechler, Rohrig, & Legenbauer, 2009; Vocks et al., 2007a, 2007b; Vocks et al., 2007a, 2007b), we hypothesize that the change in negative and positive emotions from

pre- to post-body checking is higher in participants with eating disorders than in healthy controls.

Method

Participants

The whole sample consisted of $N = 55$ women, of whom $n = 26$ were women with eating disorders comprising women with anorexia nervosa ($n = 7$), bulimia nervosa ($n = 11$) and an eating disorder not otherwise specified ($n = 8$) according to the criteria of the DSM-IV, text revision (American Psychiatric Association, 2000; German version: Sass et al., 2003) and $n = 29$ were female healthy controls. Women with eating disorders were recruited from the Outpatient Psychotherapy Center at the Ruhr University Bochum and the Department of Psychosomatic Medicine and Psychotherapy at the University Medical Center Freiburg. The non-clinical sample mainly consisted of students of the Ruhr University Bochum, who received course credits for their participation. Inclusion criteria for participants of the clinical sample were a diagnosis of anorexia nervosa, bulimia nervosa or eating disorder not otherwise specified. Further inclusion criteria were female sex, an age between 17 and 55 years and a body mass index of $< 25 \text{ kg/m}^2$. Exclusion criteria were diagnoses of psychosis, acute suicidality and deliberate self-harm. For participants of the control group, exclusion criteria were a present or previous diagnosis of a mental disorder (including eating disorders), as assessed by corresponding questionnaire-based items ('Do you currently suffer from a mental illness?' and 'Have you suffered from a mental illness in the past?') and the *Eating Disorder Examination-Questionnaire* (Fairburn & Beglin, 1994). A further exclusion criterion was a body mass index of < 17.5 or $> 25 \text{ kg/m}^2$. For matching the two groups according to level of education, we randomly excluded three female healthy controls among those with the highest level of education, resulting in a non-significant group difference regarding level of education. The study was approved by the ethics committee of the University Medical Center Freiburg (protocol number 258/08).

Assessment of eating and body image pathology

The *Body Checking Questionnaire* (Reas et al., 2002) is a self-report questionnaire consisting of 23 items that assess the frequency of specific body-related checking behaviours. Each item is answered on a 5-point Likert-type scale ranging from 0 (*never*) to 4 (*very often*). The internal consistency of the German version of the Body Checking Questionnaire is $\alpha = .92$ for women with eating disorder pathology and $\alpha = .89$ for non-clinical women (Vocks et al., 2008a). The test-retest reliability for a sample of non-clinical women is $r_{tt} = .88$.

The Eating Disorder Examination-Questionnaire (Fairburn & Beglin, 1994) is a self-report questionnaire that assesses specific characteristics of eating disorder pathology as an indication of the amount and frequency of eating disorder symptoms in the past 28 days using 14 single items and a further 23 items to generate the four subscales 'Restraint', 'Eating concern', 'Weight concern' and 'Shape concern'. All items are answered on a 7-point Likert-type scale ranging from 0 (*no such days*) to 6 (*every day*). For the German version, the internal consistency of the different subscales ranges from $\alpha = .85$ to $\alpha = .93$. The test-retest reliability

lies between $r_{tt} = .67$ and $r_{tt} = .85$ (Hilbert, Tuschen-Caffier, Karwautz, Niederhofer, & Munsch, 2007).

Ecological momentary assessment of body checking and emotions

For data acquisition concerning body checking behaviour and emotions, an ecological momentary assessment approach with an event- and time-contingent design was used. In the event-contingent condition, which comprises situations in which body checking behaviour occurs, participants were instructed to answer the electronic questionnaire item 'Which body checking strategy have you just used?' immediately after each body checking episode by choosing one of the body checking strategies presented on the screen, that is, (i) 'looking in the mirror', (ii) 'weighing', (iii) 'measuring a specific body part', (iv) 'touching bones', (v) 'comparing to other people', (vi) 'checking the fit of clothes and jewellery', (vii) 'pinching a specific body part', (viii) 'obtaining feedback from other persons' and (ix) 'other body checking behaviour'. In the time-contingent condition, which comprises control situations, the opening item prompted by an acoustic signal was 'Dear participant, please state whether or not you have just performed body checking behaviour', in order to ensure that the situation captured was not a body checking episode.

In order to quantify the changes in affect from pre- to post-body checking or the control period, respectively, the *Positive and Negative Affect Schedule* (PANAS; Watson, Clark, & Tellegen, 1988) was embedded in the electronic questionnaire. In the event-contingent condition, the PANAS was introduced by the question 'How did you feel directly before body checking?' for the time point before the body checking episode in order to assess the affect immediately before body checking behaviour. The question 'How did you feel directly after body checking?' introduced the PANAS for the time point after the body checking episode in order to assess the affect immediately after body checking behaviour. In the time-contingent condition, the PANAS was administered to assess the current affect and was introduced by the question 'How do you feel right now?' This measure is a well-established, 20-item inventory describing affects in two dimensions, with 10 items measuring positive affect and 10 items measuring negative affect rated on a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*extremely*). For the German version, the internal consistency of the two subscales ranges from $\alpha = .85$ (positive affect) to $\alpha = .86$ (negative affect; Krohne, Egloff, Kohlmann, & Tausch, 1996).

Hardware and software

For the ecological momentary assessment, a *Palm Tungsten E2™* (Sunnyvale, California, USA) handheld computer was used. Participants responded to the items using a stylus and a touchscreen. The electronic questionnaires were programmed using the *CyberTracker™* software (www.cybertracker.org), while the signals prompting participants to enter data were programmed using the *Palm Desktop™* software.

Procedure

First, participants were informed about the aims of the study, and written consent was obtained from each participant. Following this, different body checking strategies were explained to each participant and were defined in order to ensure that body checking behaviour was assessed in its entirety during the seven-day period

of measurement. Subsequently, participants were provided with a handheld computer, instructed on its application and asked to telephone the investigator if any questions or problems arose during the period of measurement in order to resolve them immediately. Furthermore, participants received a handout summarizing the most important of the aforementioned information. Next, participants were instructed to use the handheld computer immediately after each body checking episode in order to answer the programmed electronic questionnaire items assessing each body checking episode and body checking strategy as well as the PANAS assessing the current emotions occurring in the event-contingent condition. Finally, participants were given the self-report questionnaire battery consisting of the Body Checking Questionnaire and the Eating Disorder Examination-Questionnaire. In addition to the assessment of the body checking behaviour and the associated emotions, in the time-contingent condition, randomly triggered reports served as control conditions. Six times a day between 9 A.M. and 9 P.M. at an average of two-hour intervals, an acoustic signal from the handheld computer prompted the participants to specify whether or not body checking strategies were being used and to assess the current emotions. The acoustic signals were randomized in a time window of ± 30 minutes around the respective time points in order to prevent an anticipation of the exact beginning of data entry.

Statistical analyses

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS, version 20). First, the groups of women with and without eating disorders were compared in terms of age, body mass index and their scores on the Body Checking Questionnaire and the Eating Disorder Examination-Questionnaire using a two-sample *t*-test including Levene's test of homogeneity of variances. Additionally, to test for a group difference regarding the rank-scaled level of education, we performed a Mann-Whitney *U*-test. Furthermore, the two groups were compared regarding the frequency of body checking episodes and the use of specific body checking strategies using a two-sample *t*-test including Levene's test of homogeneity of variances.

In order to test for group differences in the extent of negative and positive emotions before body checking and in the control situations, a two-way analysis of variance (ANOVA) with the within-subjects factor Situation (body checking condition versus control

condition) and the between-subjects factor Group (patients with eating disorders versus healthy controls) was calculated. Furthermore, in order to test for group differences in the change in negative and positive emotions from pre- to post-body checking, a two-way ANOVA with the within-subjects factor Time (pre-body checking versus post-body checking) and the between-subjects factor Group (patients with eating disorders versus healthy controls) was calculated. For all analyses, in accordance with the existing conventions, the significance level was set at $p < .05$ (two tailed).

Results

Participants' characteristics

Participants' characteristics are presented in Table 1. No significant group differences between participants with eating disorders and healthy controls were found for age and body mass index. However, as expected based on the diagnoses examined, the two groups differed in their score on the Body Checking Questionnaire and on each scale of the Eating Disorder Examination-Questionnaire, with participants with eating disorders showing higher values than those of the control group (Table 1). Furthermore, the Mann-Whitney *U*-test revealed no significant group difference regarding level of education ($z = -1.907$, $p = .056$), indicating that participants with eating disorders and healthy controls seem to be comparable in level of education. The median was $\mu_{1/2} = 4$ for women with eating disorders and for healthy controls, which corresponds with A levels after 13 years of school education according to the German education system.

Comparison of the participants with eating disorders and healthy controls regarding the frequency and strategies of body checking behaviour

Regarding the frequency of body checking behaviour assessed by the handheld computers, participants with eating disorders showed a significantly higher frequency of body checking than healthy controls. However, there were no significant group differences in the use of the specific body checking strategies looking in the mirror, weighing, measuring a specific body part, touching bones, checking the fit of clothes and jewellery, pinching a specific body part and obtaining feedback from other persons (Table 2). Nevertheless, a group difference for the body checking strategy

Table 1 Means (*M*) and standard deviations (*SD*) of participants' characteristics and questionnaire measures for participants with eating disorders and healthy controls

Dependent variable	Participants with eating disorders		Healthy controls		Group comparison		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Age (in years)	26.92	7.63	24.00	3.90	-1.758	36, 305	.087
Body mass index (kg/m ²)	20.06	3.22	20.82	2.11	1.020	40.80	.315
BCQ (total score)	1.80	0.75	0.70	0.55	-6.115	51	<.001
EDE-Q							
Restraint	3.98	1.19	0.99	1.30	-8.766	52	<.001
Eating concern	3.30	1.22	0.46	0.65	-10.409	52	<.001
Weight concern	3.82	1.35	1.08	1.21	-7.864	52	<.001
Shape concern	4.33	1.29	1.37	1.26	-8.528	52	<.001

Note: BCQ, Body Checking Questionnaire; EDE-Q, Eating Disorder Examination-Questionnaire.

Table 2 Means (*M*) and standard deviations (*SD*) of number of body checking episodes and body checking strategies for participants with eating disorders and healthy controls

Dependent variable	Participants with eating disorders		Healthy controls		Group comparison		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Number of body checking episodes	11.16	7.59	4.84	3.42	-3.792	33.362	.001
Body checking strategies							
Looking in the mirror	30.16	20.98	38.99	29.83	1.280	50.275	.206
Weighing	20.39	25.60	15.07	27.02	-0.746	53	.459
Measuring a specific body part	3.37	10.96	0.29	1.55	-1.420	25.894	.168
Touching one's bones	3.39	9.99	0.74	2.92	-1.305	28.834	.202
Comparing to other people	8.77	12.69	2.27	6.98	-2.316	37.924	.026
Checking the fit of clothes and jewellery	9.08	10.79	8.22	20.39	-0.191	53	.849
Pinching a specific body part	9.81	16.86	7.85	14.39	-0.467	53	.643
Obtaining feedback from other persons	1.24	3.14	0.43	2.32	-1.082	45.67	.285
Other body checking strategies	4.69	6.82	2.52	9.63	-0.954	53	.344

comparing to other people was found, indicating a higher frequency in participants with eating disorders than healthy controls.

Comparison of the participants with eating disorders and healthy controls regarding negative and positive emotions before body checking and in control situations

Negative and positive emotions before body checking and in control situations for both groups are reported in Table 3. For negative emotions, a significant main effect of Group was found, with higher scores of negative emotions in the eating disorder group than in the control group across the two situations ($F(1, 48) = 19.17, p < .001$). However, there was no significant main effect of Situation, indicating no difference in negative emotions before body checking behaviour and in control situations across the two groups ($F(1, 48) = 0.11, p = .743$). Results of the ANOVA revealed no significant Situation \times Group interaction, indicating that the two groups did not differ in terms of their discrepancy of negative emotions between body checking and control situations ($F(1, 48) = 0.66, p = .421$).

For positive emotions, a significant main effect of Group was found, with lower scores for positive emotions in the eating

Table 3 Means (*M*) and standard deviations (*SD*) of the scores of the Positive and Negative Affect Schedule before (pre) body checking episodes, after (post) body checking episodes and in control situations for participants with eating disorders and healthy controls

Dependent variable	Participants with eating disorders		Healthy controls	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pre-body checking				
Negative affect	15.80	5.18	11.01	3.37
Positive affect	20.18	5.73	23.91	7.90
Post-body checking				
Negative affect	17.90	6.60	11.66	4.02
Positive affect	19.20	5.98	23.02	7.73
Control situation				
Negative affect	15.53	4.25	11.49	1.84
Positive affect	24.25	4.75	27.25	4.97

disorder group than in the control group across the two situations ($F(1, 48) = 4.56, p = .038$). Additionally, a significant main effect of Situation was found, with a lower degree of positive emotions before body checking behaviour compared with control situations across the two groups ($F(1, 48) = 29.91, p < .001$). The Situation \times Group interaction did not reach statistical significance ($F(1, 48) = 0.32, p = .571$).

Comparison of the participants with eating disorders and healthy controls regarding negative and positive emotions before and after body checking

Negative and positive emotions before and after body checking for both groups are listed in Table 3. For negative emotions, a main effect of Group was found, indicating a higher degree of negative emotions in the eating disorder group compared with healthy controls across the two time points before and after body checking ($F(1, 48) = 16.35, p < .001$). Additionally, there was a significant main effect of Time, indicating an increase in negative emotions from pre- to post-body checking across the two groups ($F(1, 48) = 18.81, p < .001$). Furthermore, a significant Time \times Group interaction was observed, indicating a greater increase in negative emotions from pre- to post-body checking behaviour in participants with eating disorders compared with healthy controls ($F(1, 48) = 5.28, p = .026$).

For positive emotions, there was no significant main effect of Group, indicating that participants with eating disorders and healthy controls displayed the same degree of positive emotions before and after body checking ($F(1, 48) = 3.86, p = .055$). However, a significant main effect of Time was found, with a decrease in positive emotions from pre- to post-body checking across both groups ($F(1, 48) = 7.07, p = .011$). The Time \times Group interaction did not reach statistical significance for positive emotions ($F(1, 48) = 0.02, p = .903$).

Discussion

The aim of the present study was to test the hypothesis that, as proposed by the cognitive-behavioural theory of eating disorders (Williamson et al., 2004), the degree of negative emotions is higher and the degree of positive emotions is lower before an

episode of body checking compared with control situations. Furthermore, we hypothesized that the degree of negative emotions decreases and the degree of positive emotions increases from pre- to post-body checking. Additionally, we expected that the change in negative and positive emotions from pre- to post-body checking is higher in participants with eating disorders than in healthy controls. To our knowledge, this is the first study to empirically address these postulations of the cognitive-behavioural model of eating disorders as well as to examine body checking behaviour in women with eating disorders and healthy controls under daily life conditions using an ambulatory assessment method.

In this respect, the results of the present study indicate a significantly higher frequency of body checking behaviour in participants with eating disorders than in healthy controls, which is in accordance with findings from previous research using retrospective designs (Kachani et al., 2013; Mountford, Haase, & Waller, 2006; Reas et al., 2002; Shafran et al., 2004; Vocks et al., 2008a). Moreover, the current results extend previous findings by demonstrating that the higher frequency of body checking episodes in eating disorders is also detectable under daily life conditions and therefore does not seem to be a result of a memory bias. The most common body checking strategy in each group was 'looking in the mirror', a finding which is in line with the results of a questionnaire-based investigation (Kachani et al., 2013). However, no group differences were found in the use of specific body checking strategies, except for the strategy comparing to other people, indicating that participants with eating disorders more frequently compare their shape to that of other people. Some studies suggest that this behaviour in particular might be regarded as critical, as women with eating disorders were shown to make upward comparisons, leading to an increase in negative affect (Jansen, Nederkoorn & Mulken, 2005; Leahey, Crowther, & Ciesla, 2011). The study further demonstrated that there was no difference in the extent of negative emotions before body checking behaviour and in control situations. This result does not confirm our hypothesis and stands in contrast to the postulation of the cognitive-behavioural model of eating disorders that body checking is performed in response to negative emotions (Williamson et al., 2004). However, there was a lower degree of positive emotions before body checking behaviour compared with control situations across groups, meaning that it cannot be ruled out that a low degree of positive emotions (via an 'adverse balance' of emotions) initiates body checking behaviour. Nevertheless, as the results of the present study show that body checking behaviour is not undertaken in response to negative emotions, it is not evident which factors contribute to the activation of body checking behaviour under daily life conditions. Accordingly, future studies should investigate and identify the conditions which activate body checking behaviour in eating disorders.

Moreover, there was an increase in negative emotions from pre- to post-body checking with an even greater increase in negative emotions from pre- to post-body checking in women with eating disorders compared with healthy controls. Additionally, we found a general decrease in positive emotions from pre- to post-body checking. These findings indicating that body checking increases negative emotions and decreases positive emotions are contradictory to our hypothesis and to the assumption of the cognitive-behavioural model of eating disorders that body checking

behaviour is followed by a reduction of negative emotions (Williamson et al., 2004). Furthermore, the findings are not in line with the results of investigations of checking behaviour in other mental disorders such as illness anxiety and obsessive-compulsive disorder, in which checking behaviour leads to a decrease in negative emotions (Abramowitz & Moore, 2007; Rachman et al., 1976). Therefore, the current findings seem to contradict the assertion that body checking in eating disorders is maintained via negative reinforcement by a reduction of negative emotions (Williamson et al., 2004). Instead, body checking leads to an increase in negative emotions and thereby amplifies an aversive state. This finding provides a first hint that this aspect of the cognitive-behavioural theory of eating disorders should be revised (Williamson et al., 2004). Furthermore, the results are in line with previous studies and theoretical assumptions that body checking transiently amplifies aversive emotions, body dissatisfaction and weight concerns (Fairburn et al., 1999; Shafran et al., 2007), which may encourage compensatory behaviour, dietary restrictions (Lavender et al., 2013) and further body checking behaviour in the sense of a vicious circle in order to retain control over shape and weight (Engel et al., 2013; Fairburn et al., 1999; Fairburn et al., 2003; Williamson et al., 2004). Accordingly, it can be assumed that body checking behaviour contributes to the maintenance of eating disorders (Shafran et al., 2007), leading to the suggestion that reducing body checking behaviour improves the prognosis (Kachani, Barroso, Brasiliano, Hochgraf, & Cordas, 2014) and, therefore, constitutes a suitable target in the treatment of eating disorders (Cash & Hrabosky, 2004; Lavender et al., 2013).

In addition to the findings of an increase in negative emotions and a decrease in positive emotions from pre- to post-body checking across groups, our findings demonstrated an interaction effect indicating a greater increase in negative emotions from pre- to post-body checking in women with eating disorders than in healthy controls, which is in accordance with our third hypothesis. This stronger emotional reaction of women with eating disorders is consistent with the results of previous studies indicating that the impact of shape- and body-related activities is greater the higher the extent of eating disorder symptoms is (Cooper & Fairburn, 1992; Hilbert et al., 2002; Tuschen-Caffier et al., 2003; Vocks et al., 2009; Vocks et al., 2007a, 2007b). Moreover, this finding is in accordance with the cognitive-behavioural model of eating disorders (Williamson et al., 2004), which hypothesizes that in women with eating disorders, body checking behaviour, considered as a body-related cue, leads to an activation of the negative body size- and shape-related self-schema and a biased interpretation of information that elicits negative emotions such as anxiety. Furthermore, the assumption that women with eating disorder symptoms shows biased information processing and an associated increase in negative emotions is supported by the findings of Jansen et al. (2005), who demonstrated that during an exposition with pictures of their own body, women with eating disorder symptoms showed an increased focus on disliked body parts and a decrease in mood, whereas female healthy controls focused on positively evaluated body parts without any negative influence on mood. Therefore, it seems reasonable to assume that owing to its negative effect on emotions in women with eating disorders, biased information processing during an episode of body checking should be tackled in the treatment of eating

disorders, as negative emotions such as anxiety and fear of loss of control over shape, weight and eating (Fairburn et al., 1999; Williamson et al., 2004) as well as adverse mood states (Fairburn et al., 2003) are considered to be a relevant factor in maintaining the vicious circle of eating disorders (Engel et al., 2013; Goldschmidt et al., 2014; Hilbert & Tuschen-Caffier, 2007).

The various strengths of the present study include the ambulatory assessment method, which provides an enhanced interpretability and generalizability of findings owing to its precise real-time monitoring of behaviour and emotions under daily life conditions (Cohen & Conway, 2008; Cone, 1999; Fahrenberg et al., 2007; Henry et al., 1994; Käppler et al., 2001; Pohl, 2004), the well-defined patient sample with healthy controls having the same means of age, body mass index and level of education, and the careful preparation of the participants through a comprehensive operationalization of body checking behaviour before the assessment. Nevertheless, some limitations should also be considered when interpreting the results. First, it cannot be ruled out that the instruction to assess each body checking episode during the period of measurement might have led to an attentional bias affecting the frequency of body checking behaviour and leading to an overestimation of the frequency of body checking behaviour. Furthermore, we assessed emotions immediately after body checking behaviour once only, meaning that there was no examination of the progression of emotions at various time points after body checking. In particular, examining the progression of emotions at various time points after body checking might clarify whether negative emotions decrease and positive emotions increase at a later point in time. Additionally, the intervals between body checking behaviour and the assessment of the body checking strategies as well as of the associated emotions were not measured. Although participants were instructed to use the handheld computer immediately after each body checking episode, it cannot be ruled out that the time points of data entry are temporally discordant both within a participant as well as between participants. We refrained from assessing the intervals between body checking behaviour and data entry, as owing to the laborious design of the study, participants were already faced with numerous time points of data acquisition and a large number of questionnaire items within each of these during the seven-day period of measurement. Moreover, in accordance with the transdiagnostic perspective of eating disorders (Fairburn, Cooper, & Shafran, 2003), our clinical sample comprised women with anorexia nervosa, bulimia nervosa and an eating disorder not otherwise specified, as these disorders feature the same core psychopathology, such as over-evaluation of shape and weight, restriction of food intake, binge eating, excessive exercise or the misuse of diuretics or laxatives (Fairburn et al., 2003). However, besides these commonalities,

several studies indicate that there are also differences between the subgroups of eating disorders regarding the performance of body checking and body avoidance. For example, in a questionnaire-based study, Kachani et al. (2013) showed that women with bulimia nervosa more often engaged in body avoidance and body checking behaviour than women with anorexia nervosa. Furthermore, Vocks et al. (2008a, 2008b) found higher scores on the Body Checking Questionnaire in participants with bulimia nervosa, and an eating disorder not otherwise specified, than in participants with anorexia nervosa. For this reason, within our clinical sample, we additionally tested for possible differences between the three diagnostic groups in the frequency of body checking behaviour and in the use of specific body checking strategies as well as in negative and positive emotions before and after body checking and in control situations using the non-parametric Kruskal–Wallis test (owing to the low sample size within each group). Furthermore, we calculated confidence intervals for group means. Our results indicated no significant group differences between participants with anorexia nervosa, bulimia nervosa and an eating disorder not otherwise specified. Nevertheless, as these effects might be due to the low power of the analyses, we did not perform a Bonferroni correction in order to maintain a balance between alpha error, power, sample size and expected effect size. However, further studies should investigate possible group differences in the frequency of body checking behaviour and body checking strategies as well as in associated emotions comparing women with anorexia nervosa, bulimia nervosa and an eating disorder not otherwise specified, using larger sample sizes for each of the diagnostic groups. Despite these limitations, the results of the present study provide important insights into the immediate effects of body checking behaviour in eating disorders under daily life conditions. In this respect, the findings provide hints regarding the necessity to revise the aspect of the cognitive-behavioural theory of eating disorders that body checking reduces negative emotions and is therefore maintained via negative reinforcement (Williamson et al., 2004). Furthermore, owing to the immediate negative consequences of body checking in the present study, direct interventions aiming at a reduction of body checking, for example, exposure with response prevention, are warranted (Cash & Hrabosky, 2004; Lavender et al., 2013), which require a better understanding of the nature of this symptom (Kachani et al., 2014).

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