How do you feel when you check your body? Emotional states during a body-checking episode in normal-weight females

Leonie Wilhelm1 · Andrea S. Hartmann1 · Martin Cordes1 · Manuel Waldorf1 · Silja Vocks1

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Abstract

Purpose Cognitive-behavioral theories posit that body checking decreases negative emotions, but increases levels of arousal. However, few studies have investigated the effects of body checking on the course of emotional states. Therefore, the current study examined how normal-weight females with higher and lower eating, weight, and shape concerns feel during a checking episode of their most-liked and least-liked body parts.

Methods In an online design, levels of negative emotions and arousal were retrospectively assessed before, during, immediately after, and 15 min after an individually remembered body-checking episode. Participants (N = 355) also rated their subjective satisfaction with specific body parts.

Results Levels of negative emotions were lower 15 min after the checking episode of most-liked and least-liked body parts than before the episode. However, negative emotions increased during the checking episode of least-liked body parts, but subsided thereafter. The levels of arousal increased during the checking episodes of most-liked and least-liked body parts and decreased afterwards, and females with higher concerns reported greater levels of arousal than females with lower concerns. Furthermore, females with higher concerns reported more body checking than those with lower concerns.

Conclusions The results support the assumptions of the cognitive-behavioral theories, as body checking led to a decrease in negative emotions in the longer term, and levels of arousal increased during the checking episode. The greater levels of arousal in females with higher concerns, and their pronounced body-checking behavior, might enhance their existing concerns and increase the risk of disordered eating.

Level of evidence Level V, descriptive study.

Keywords Body checking · Eating · Weight and shape concerns · Emotional states · Theory of eating disorders

Introduction

Body-checking behavior encompasses various checking strategies, for instance weighing oneself and measuring or pinching body parts [1], and is used to assess the weight, size, or shape of one’s own body [2]. The previous studies demonstrated that a high degree of body checking is associated with a greater extent of eating pathology [3–7]. Moreover, body checking is presumed to be a maintaining factor for eating disorders (ED) [8]. Given that ED are among the most dangerous psychological disorders, with devastating effects on health and quality of life [9, 10], it is important to examine how body-checking behavior might be maintained [8, 11].

In this context, two mutually compatible cognitive-behavioral theories have postulated what might maintain body-checking behavior. Both theories are based on the cognitive-behavioral approach, and the more recent of the two integrates assumptions of the earlier one. First, the cognitive-behavioral theory of ED [8], which refers to various cognitive-behavioral theories on ED, is based on numerous hypotheses regarding the development of different ED. The authors provide a conceptual and integrated model of ED by displaying risk factors (e.g., overconcern with body size/shape), cognitive biases (e.g., body size overestimation), and various harmful behaviors (e.g., body checking). Regarding the latter, the theory assumes that body checking is used to cope with negative emotions. In this context, it is assumed...
that body-checking behavior is negatively reinforced by successfully reducing aversive emotions. Second, the cognitive-behavioral theory of anorexia nervosa [12] provides a comprehensive overview of anorexia nervosa with an explicit focus on the maintenance of this disorder. Regarding maintaining factors for anorexia nervosa, the authors posit a vicious circle in which body checking increases the level of arousal, a physiological and psychological state of high alertness [13], which in turn leads to further body checking [12].

Despite its clinical relevance and the theoretical assumptions regarding the maintaining mechanism of emotional states on body-checking behavior, only a small number of studies have examined the effects of body-checking behavior on emotional and cognitive-evaluative states, e.g., body dissatisfaction [14–17]. A recent study found that body-checking behavior led not to a decrease, but to an increase in negative body-related emotions in non-clinical females [15]. The study used an ecological momentary assessment design in which participants reported their emotions after body-checking episodes in a natural environment via a handheld computer. Supporting these results, in a further ecological momentary assessment study, higher body-checking frequencies predicted greater body dissatisfaction and higher negative affect, which were all assessed five times per day [17]. However, in undergraduate females, the checking of one’s own wrist size every 15 min over a period of 8 h did not lead to more body dissatisfaction, which was assessed in the evening, but instead resulted in a greater fear of uncontrollable weight gain [14].

In these non-clinical samples, the empirical findings on body checking and the course of affective and body-image states seem to contradict the theoretical assumption of the cognitive-behavioral theory of ED that body checking is negatively reinforced by reducing the negative affect [8]. However, the aforementioned research did not assess the valence of the body parts (i.e., most-liked, least-liked). This might have affected the results, as the checking of most-liked body parts was found to decrease feelings of fatness immediately after the checking episode, whereas the checking of least-liked body parts led to an increase in these feelings and to greater body dissatisfaction in non-clinical women [16]. Interestingly, the immediate negative effects of checking least-liked body parts were found to have reversed after 30 min, insofar as participants’ body dissatisfaction was lower than before the checking instruction [16]. Given this finding, the increase of negative emotions found immediately after a body-checking episode [15] might also be reversed at a later point in time. Therefore, it is important to assess the levels of negative emotions not only directly after the checking episode, but also again after some time has passed. Furthermore, the samples in the aforementioned ecological momentary assessment studies consisted of a small number of females, which might limit the validity of the results [15–17].

In addition, there is no evidence with regard to the assumptions of the cognitive-behavioral theory of anorexia nervosa [12], as participants were not asked about their levels of arousal before and after a body-checking episode. Finally, not only the effects of body checking on emotional states, but also the frequencies of body checking might differ between the checking of most-liked and least-liked body parts. It is assumed that by checking one’s least-liked body parts, body checking enhances one’s own focus on these body parts [18]. However, to date, no study has compared the body-checking frequencies of most-liked and least-liked body parts between non-clinical women with higher and lower eating, weight, and shape concerns.

To sum up, given that no study so far has assessed the levels of negative emotions and arousal before, during, and after a body-checking episode, it is not known whether body-checking behavior decreases negative emotions in the longer term, as is postulated by Williamson et al. [8]. Furthermore, the assumption of the cognitive-behavioral theory of anorexia nervosa that body checking leads to an increase in arousal [12] has not yet been investigated. Moreover, it remains unclear whether the negative emotions found directly after a checking episode [15] increase or decrease over time. Therefore, the first aim of the present study was to retrospectively assess normal-weight women’s levels of negative emotions and arousal before, during, immediately after, and 15 min after a body-checking episode of their most-liked and least-liked body parts. Second, the checking frequencies of the most-liked and least-liked body parts were compared between two groups of women with higher and lower eating, weight, and shape concerns. In this context, we also compared the frequencies of six different body-checking strategies between the two groups. To obtain a large sample size, a web-based community design was chosen.

In line with the previous studies and theoretical assumptions [8, 12, 15, 16], we predicted that levels of negative emotions and of arousal would decrease during the checking episode of most-liked body parts, but would increase during the checking episode of least-liked body parts. Based on findings by Shafran et al. [19], we predicted that women with higher eating, weight, and shape concerns would check least-liked body parts more often than women with lower concerns. Lastly, given the positive correlation between shape concerns and mirror checking [20], it was assumed that females with higher eating, weight, and shape concerns would report higher frequencies of all assessed checking strategies compared to those with lower concerns.
Materials and methods

Participants

Inclusion criteria were female sex, a minimum age of 18 years, and a normal weight according to the World Health Organization criteria for body mass index (BMI; weight [kg]/height [m²]) [21]. Therefore, participants with a BMI under 18.5 kg/m² or over 24.9 kg/m², which was calculated based on participants’ self-reported weight and height, were excluded. Participants who completed the survey in less than 10 min were excluded from the data analysis, as trial runs showed that a minimum of 10 min is necessary to fill out the survey carefully. Of N = 3,294 persons who clicked on the link for the survey, n = 1601 participants actually began the survey (48.6%) and n = 682 completed it (20.7%). Compared to other web-based studies on body image [22], the completion rate can be rated as satisfactory. In line with the inclusion and exclusion criteria, n = 73 persons were excluded from the study due to male sex, n = 1 due to an age under 18 years, n = 149 due to their BMI, and n = 104 due to too short survey completion times. Thus, in total, n = 355 women were included in the data analysis.

Measures

Eating Disorder Examination-Questionnaire

The self-report Eating Disorder Examination-Questionnaire [23] (German-language version [24]) was utilized to assess the main behavioral features of ED during the past 28 days and their intensity or frequency. The Eating Disorder Examination-Questionnaire is divided into four subscales: Restraint [5 items; example item: “Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded?)”], eating concerns (5 items; example item: “On how many of the past 28 days have you had a definite fear of losing control over eating?”), weight concerns (5 items; example item: “On how many of the past 28 days have you had a strong desire to lose weight?”), and shape concerns (8 items; example item: “Over the past 28 days, has your shape influenced how you think about (judge) yourself as a person?”), which are rated on a 7-point Likert scale ranging from 0 (no days/not at all) to 6 (every day/markedly). Good internal consistencies have been found for its total score and the four subscales, ranging from $\alpha = 0.85$ to $\alpha = 0.97$ [25]. In the current study, Cronbach’s alpha ranged from $\alpha = 0.77$ to $\alpha = 0.94$ for the subscales and the total score.

Body-Checking Questionnaire

To assess body checking, the self-report Body-Checking Questionnaire [7] (German-language version [26]) was applied. It is divided into three subscales, which are rated on a 5-point Likert scale ranging from 1 (never) to 5 (very often). The subscale Overall appearance (10 items; example item: “I try to elicit comments from others about how fat I am.”) assesses whether one compares one’s own shape with that of others or whether one checks one’s own reflection in car windows or other reflecting surfaces. The subscale Specific body parts (8 items; example item: “I pinch my stomach to measure fatness.”) focuses on the checking of thighs, stomach, and upper arms, e.g., checking one’s thighs to look for cellulite. Lastly, the subscale Idiosyncratic checking (5 items; example item: “I check to make sure my rings fit the same way as before.”) encompasses items assessing various behaviors to monitor weight gain, e.g., pinching one’s cheeks to measure fatness. Internal consistencies range from $\alpha = 0.72$ to $\alpha = 0.89$ for non-clinical female samples [26]. Cronbach’s alpha ranged from $\alpha = 0.74$ to $\alpha = 0.91$ for the subscales and the total score in the present study.

Subjective satisfaction with body parts

To identify which parts of their own body participants like the most and the least, they were asked to rate their subjective satisfaction with 13 body parts (i.e., face, shoulders, décolleté, chest, back, upper arms, forearms, bottom, waist, hip, stomach, thighs, lower legs; example item: “How satisfied are you with your face?”) on a scale from 1 (very satisfied) to 5 (not at all satisfied). In accordance with the previous research [27], we chose these 13 body parts, because they cover most regions of the body, enabling participants to select their most-liked and least-liked parts. This measurement was based on similar self-report measures of physical attractiveness (e.g., [28, 29]). For each participant, body parts rated as 1 or 2 were subsequently classified as the most-liked, whereas those rated as 4 or 5 were classified as the least-liked body parts. Participants who did not report any most-liked and least-liked body parts ($n = 127$) were excluded from analyses regarding the most-liked or least-liked body parts.

Body-checking strategies

To assess the frequencies of various body-checking strategies, participants were asked whether they show one or more of the following six checking strategies (example item: “Do you show one or more of the following behaviors?”), which were selected after reviewing the pertinent literature on body checking (e.g., [7, 30–35]): pinching body parts, measuring body parts, comparing one’s appearance to others or asking...
other people for body- or weight-related feedback, checking body parts in the mirror or in other reflecting surfaces, evaluating body parts when sitting or standing in a specific position, and weighing oneself. For each endorsed checking strategy except for weighing, participants were asked which of the 13 body parts (e.g., face, stomach) they check and how often they check these parts using the respective strategy over the course of 1 week by indicating frequencies in whole numbers. In the case of weighing, participants only stated how often they weigh themselves over 1 week.

**Self-Assessment Manikin**

The non-verbal Self-Assessment Manikin [36] was utilized to assess participants’ negative emotions and arousal (example item: “How do you feel before checking your face in the mirror?”). The nine pictorial figures of the Self-Assessment Manikin range from 1 (unhappy) to 9 (happy) on the emotional dimension and from 1 (relaxed) to 9 (excited) on the arousal dimension. For statistical reasons, the emotional dimension was recoded as 1 (happy) to 9 (unhappy). With \( r = 0.02 \), the two dimensions did not correlate significantly in a computerized version of the Self-Assessment Manikin [35]. When presenting the respective item more than once, internal consistencies amounted to \( \alpha = 0.82 \) for the emotional dimension and to \( \alpha = 0.98 \) for the arousal dimension [36]. As only one item per dimension was used in the present study, Cronbach’s alpha could not be calculated.

**Procedure**

To recruit participants, advertisements were placed on websites (e.g., Facebook), through different mailing lists (e.g., universities), and posters in university buildings including the link for the online survey. The survey was available online between March 2016 and February 2017 by means of an electronic survey tool, EFS survey (Questback GmbH, Cologne, Germany). No cover story was used and participants were told that the survey was about body checking. Before being presented with demographic questions, participants were asked to read and agree to the terms and conditions of data privacy protection. Subsequently, they rated their subjective satisfaction with body parts. Then, participants individually reported their body-checking behavior and their respective feelings. Based on all endorsed checking strategies and body parts checked using these strategies, each individual combination of checking episode (e.g., measuring waist circumference, measuring thigh circumference, checking one’s face in the mirror) was presented to the participant and she was asked to rate levels of negative emotions and arousal before, during, immediately after, and 15 min after the respective episode (e.g., “How do you feel before checking your face in the mirror?”). This one-time self-rating assessing pre- and post-levels retrospectively is recommended to avoid response shift effects, which might occur when collecting data at different timepoints [38]. Finally, all participants answered the Body-Checking Questionnaire and the Eating Disorder Examination-Questionnaire. After finishing the survey, which took an average of 20 min, participants were given the opportunity to enter a lottery to win gift cards or they were given student course credits. The Ethics Committee of the University approved this study.

**Statistical analysis**

The Statistical Package for the Social Sciences SPSS 24 (IBM; Armonk, USA) was used to carry out the data analysis. First, a median split of Eating Disorder Examination-Questionnaire total scores was conducted to assign the participants to the two groups (higher and lower eating, weight, and shape concerns) [22]. In addition, two-sample \( t \) tests and \( \chi^2 \) tests were calculated to compare the two groups with respect to BMI, age, relationship status, and educational background. Second, a multivariate analysis of variance (MANOVA) was conducted with group as independent variable and the Body-Checking Questionnaire subscale scores as dependent variable.

To test whether levels of negative emotions and arousal differ between the two groups and between the four assessed timepoints, participants’ ratings for levels of negative emotions and arousal were aggregated across the respective reported number of most-liked and least-liked body parts. As not all participants reported checking both most-liked and least-liked body parts, the analyses were conducted separately for most-liked and least-liked body parts, resulting in different sample sizes. A \( 2 \times 2 \times 4 \) repeated measures multivariate analysis of variance (rmMANOVA) was conducted for most-liked and least-liked body parts with Group as a between-subject factor (higher concerns versus lower concerns) and Emotional states (negative emotions versus arousal) and Time (before versus during versus immediately after versus 15 min after) as within-subject factors. A series of Bonferroni-adjusted post-hoc \( t \) tests were calculated to test whether levels of negative emotions and arousal differed between the two groups (two sample \( t \) test) or across the four timepoints (paired \( t \) test).

Before analyzing the body-checking frequencies, Winsorization was utilized to replace outliers, which were defined as checking frequencies above \( 1.5 \times \) interquartile range. Winsorization is a standard method for replacing outliers with more plausible values, because completely excluding the values would have substantially lowered the mean checking frequencies [39, 40]. In the current study, outliers were replaced with the respective highest included checking frequency. Then, mean frequency scores for the checking
strategies except for weighing were calculated by averaging the frequency scores on a given checking strategy across all endorsed body parts. In the case of weighing, the indicated number was utilized as mean frequency.

Two-sample \( t \) tests were used to test whether checking frequencies of most-liked and least-liked body parts differ between the groups. The frequencies of the various checking strategies were compared between the groups by calculating six two-sample \( t \) tests (two-tailed; Bonferroni-corrected \( \alpha = 0.0083 \)). Generally, the level of significance was set at \( p < 0.05 \) (two-tailed), which was adjusted when conducting multiple group comparisons. In the case of significant omnibus tests, pairwise comparisons with Bonferroni correction were calculated and adjustments were also made to correct for violations of sphericity, i.e., using the Greenhouse–Geisser procedure. Regarding comparisons between the two groups and the four timepoints, Cohen’s \( d \) was used to measure effect sizes. According to conventional classifications, \( d = 0.2 \) indicates small effects, \( d = 0.5 \) medium effects, and \( d = 0.8 \) large effects [41, 42].

**Results**

**Participants’ characteristics**

Participants were divided into two groups based on their Eating Disorder Examination-Questionnaire total scores. The median split (Mdn = 0.89) of the respective scores [22] resulted in a group with higher (\( M = 1.93, SD = 0.90, n = 179 \)) and a group with lower (\( M = 0.42, SD = 0.25, n = 176 \)) Eating Disorder Examination-Questionnaire total scores (\( d = 2.28 \)), hereinafter referred to as “higher eating, weight, and shape concerns” versus “lower eating, weight, and shape concerns”. As displayed in Table 1, the groups differed significantly in terms of BMI, number of participants with a university degree, and their Body-Checking Questionnaire subscale scores [7], but did not differ regarding age, relationship status, and number of current students.

### Checking of most-liked body parts

The \( 2 \times 2 \times 4 \) rmMANOVA with the factors Group, Emotional states, and Time did not reach significance, Wilks’ \( \lambda = 0.979, F(3, 229) = 1.617, p = 0.168 \). However, a significant main effect was found for Time, \( F(2.656, 613.526) = 12.780, p < 0.001 \), with subsequent post-hoc tests indicating that levels of negative emotions and of arousal differed between the four timepoints (see Table 2). Furthermore, the interaction between Emotional states and Time reached significance, \( F(2.496, 576.496) = 16.321, p < 0.001 \), displaying different time courses for the levels of negative emotions and arousal (see Fig. 1). A significant effect emerged for Emotional states, \( F(1, 231) = 772.646, p < 0.001 \), and for the interaction between Group and Emotional states, \( F(1, 231) = 16.704, p < 0.001 \). Levels of emotional states differed depending on the specific state, i.e., negative emotions or arousal, and on the extent of eating, weight, and shape concerns. In both groups, levels of negative emotions were significantly greater than levels of arousal at all assessed timepoints (see Fig. 1). Compared to women with lower eating, weight, and shape concerns, women with higher concerns reported greater levels of negative emotions during and immediately after the checking episode of most-liked body parts (see Table 2). Furthermore, women with higher concerns reported greater levels of arousal than those with lower concerns at all assessed timepoints (see Table 2).

<table>
<thead>
<tr>
<th>Table 1 Group characteristics for body mass index (BMI), age, partnership status, educational level, and the Body-Checking Questionnaire (BCQ) subscales (( N = 355 ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>BMI</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Number of participants being in a current relationship</td>
</tr>
<tr>
<td>Educational level</td>
</tr>
<tr>
<td>Number of current students</td>
</tr>
<tr>
<td>Number of participants with an university degree</td>
</tr>
<tr>
<td>BCQ</td>
</tr>
<tr>
<td>Overall appearance</td>
</tr>
<tr>
<td>Specific body parts</td>
</tr>
<tr>
<td>Idiosyncratic checking</td>
</tr>
</tbody>
</table>

\( **p < 0.001; *p < 0.05 \)
Checking of least-liked body parts

Again, the $2 \times 2 \times 4$ rmMANOVA with the factors Group, Emotional states, and Time did not reach significance, Wilks' $\lambda = 0.992, F(3, 174) = 0.454, p = 0.715$. However, the factor Group turned out to be significant, $F(1, 176) = 5.671, p = 0.018$, with subsequent post-hoc tests indicating differences in emotional states between females with higher and lower eating, weight, and shape concerns (see Table 2). Moreover, a significant main effect was found for Time, $F(2.811, 494.661) = 3.105, p = 0.029$, with subsequent post-hoc tests revealing that levels of negative emotions and of arousal differed between the four assessed timepoints (see Fig. 2). In addition, the factor Emotional states yielded a significant effect, $F(3, 176) = 69.265, p < 0.001$, indicating that in both groups, levels of negative emotions were significantly greater than

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**Table 2** Participants' scores on negative emotions and arousal before, during, immediately after, and 15 min after the body-checking episode of most-liked ($N = 233$) and least-liked body parts ($N = 178$)

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Timepoint</th>
<th>Higher concerns</th>
<th>Lower concerns</th>
<th>Bonferroni-adjusted post-hoc tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$M$</td>
<td>SD</td>
<td>$M$</td>
</tr>
<tr>
<td><strong>Most-liked</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotions</td>
<td>Before</td>
<td>3.78</td>
<td>1.51</td>
<td>3.42</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>3.71</td>
<td>1.45</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>3.68</td>
<td>1.48</td>
<td>3.14</td>
</tr>
<tr>
<td></td>
<td>15 min after</td>
<td>3.55</td>
<td>1.42</td>
<td>3.12</td>
</tr>
<tr>
<td>Arousal</td>
<td>Before</td>
<td>2.68</td>
<td>1.69</td>
<td>2.01</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>3.02</td>
<td>1.70</td>
<td>2.19</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>2.79</td>
<td>1.77</td>
<td>2.07</td>
</tr>
<tr>
<td></td>
<td>15 min after</td>
<td>2.56</td>
<td>1.80</td>
<td>1.73</td>
</tr>
<tr>
<td><strong>Least-liked</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotions</td>
<td>Before</td>
<td>5.40</td>
<td>1.21</td>
<td>5.13</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>6.16</td>
<td>1.12</td>
<td>5.81</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>6.00</td>
<td>1.32</td>
<td>5.57</td>
</tr>
<tr>
<td></td>
<td>15 min after</td>
<td>5.16</td>
<td>1.45</td>
<td>4.54</td>
</tr>
<tr>
<td>Arousal</td>
<td>Before</td>
<td>3.59</td>
<td>1.52</td>
<td>2.64</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>4.29</td>
<td>1.54</td>
<td>3.24</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>3.84</td>
<td>1.57</td>
<td>2.93</td>
</tr>
<tr>
<td></td>
<td>15 min after</td>
<td>3.01</td>
<td>1.58</td>
<td>2.07</td>
</tr>
</tbody>
</table>

$**p < 0.001; *p < 0.05$

$a,b,c,d$ Differ significantly from each other ($p < 0.05$)

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**Fig. 1** Time course of level of negative emotions for the checking of most-liked and least-liked body parts in women with higher (black lines) and lower (gray lines) concerns. Continuous lines indicate most-liked body parts, whereas dashed lines display least-liked body parts.
levels of arousal at all assessed timepoints (see Fig. 2). Furthermore, the interaction between Group and Emotional states reached significance, $F(1, 176) = 18.770, p < 0.001$. Women with higher concerns reported greater levels of negative emotions 15 min after the checking episode of least-liked body parts (see Table 2). Furthermore, compared to women with lower concerns, those with higher concerns reported greater levels of arousal at all assessed timepoints (see Table 2).

**Body-checking strategies**

The frequency scores for the checking of most-liked and least-liked body parts are displayed in Table 3, and indicate that women with higher concerns checked least-liked body parts more frequently than women with lower concerns. Regarding the various body-checking strategies, the two groups differed significantly in their use of the six strategies (see Table 3). Compared to women with lower concerns, women with higher concerns showed more frequent checking behavior.

**Discussion**

The first aim of the present study was to retrospectively assess normal-weight women’s level of negative emotions and arousal before, during, and twice after a body-checking episode. To test the assumptions of two cognitive-behavioral theories regarding the maintaining mechanism of emotional states on body-checking behavior, the effects of body-checking behavior on the time course of negative emotions and arousal were examined. Supporting the previous findings [16, 17], the effects of body checking on the time course of negative emotions and arousal varied depending on whether most-liked or least-liked body parts were checked and on the extent of eating, weight, and shape concerns.

Regarding the checking of most-liked body parts, negative emotions decreased during the checking in females with lower concerns, thus confirming our hypothesis, but this decrease proceeded more slowly in women with higher concerns. However, in both groups, levels of negative emotions were higher before and after checking.

**Table 3** Participants’ weekly frequency scores on body checking ($N=355$)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Higher concerns ($n=179$)</th>
<th>Lower concerns ($n=176$)</th>
<th>Bonferroni-adjusted group comparison</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checking of most-liked body parts</td>
<td>17.60 ± 27.31</td>
<td>16.16 ± 27.95</td>
<td>0.490</td>
<td>0.624 0.05</td>
</tr>
<tr>
<td>Checking of least-liked body parts</td>
<td>15.57 ± 20.77</td>
<td>4.00 ± 11.11</td>
<td>6.562**</td>
<td>273.156 &lt; 0.001 0.69</td>
</tr>
<tr>
<td>Body-checking strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Checking body parts in the mirror</td>
<td>26.01 ± 28.89</td>
<td>17.60 ± 26.11</td>
<td>2.875*</td>
<td>350.529 0.024 0.31</td>
</tr>
<tr>
<td>Evaluating body parts in a specific position</td>
<td>6.23 ± 12.95</td>
<td>2.46 ± 8.40</td>
<td>3.253*</td>
<td>305.802 0.006 0.35</td>
</tr>
<tr>
<td>Pinching into body parts</td>
<td>5.18 ± 7.13</td>
<td>2.59 ± 5.51</td>
<td>3.838**</td>
<td>334.516 &lt; 0.001 0.41</td>
</tr>
<tr>
<td>Comparing to or feedback from others</td>
<td>2.77 ± 6.86</td>
<td>1.10 ± 3.81</td>
<td>2.838*</td>
<td>279.328 0.03 0.30</td>
</tr>
<tr>
<td>Measuring body parts</td>
<td>1.38 ± 3.10</td>
<td>0.36 ± 1.63</td>
<td>3.897**</td>
<td>269.896 &lt; 0.001 0.41</td>
</tr>
<tr>
<td>Weighing oneself</td>
<td>1.49 ± 1.73</td>
<td>0.91 ± 1.18</td>
<td>3.664**</td>
<td>314.101 &lt; 0.001 0.39</td>
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</table>
emotions were lower 15 min after the checking episode than prior to the episode, supporting the previous findings that feelings of fatness decreased after the checking of liked body parts [16]. The findings also confirm the assumption of the cognitive-behavioral theory of ED that body checking decreases negative emotions [8]. Possibly, as the theory presumes, the checking behavior might be negatively reinforced by reducing the negative affect. As females with ED diagnoses generally report higher levels of negative emotions than non-clinical females [43], our finding is of considerable clinical relevance, as it suggests that the negative affect of patients with ED diagnoses needs to be reduced to ultimately decrease their body-checking behavior. However, in view of the cross-sectional and retrospective design of the study, future experimental studies should induce negative emotions to examine their causal effects on body-checking behavior.

The levels of arousal increased during the checking episode of most-liked body parts, subsided immediately afterwards, and had reversed after 15 min. The increase during the checking episode was more pronounced in females with higher concerns, confirming the assumption of the cognitive-behavioral theory of anorexia nervosa [12]. However, given the huge drop in levels of arousal after the checking episode of most-liked body parts, it could be assumed that the confrontation with one’s most-liked body parts did not have a long-term effect on the level of arousal. Whereas the time course of levels of arousal did not differ between the two groups, females with higher concerns reported greater levels of arousal than those with lower concerns across all assessed timepoints. With regard to the cognitive-behavioral theory of anorexia nervosa [12], for women with higher eating, weight, and shape concerns, the confrontation with one’s own body parts might be a more stressful experience, which is linked to a greater alertness and, therefore, led to the greater levels of arousal. As greater levels of arousal, in turn, might be linked to more frequent checking behavior [12], low-threshold methods should be developed to reduce levels of arousal during the confrontation with one’s own body parts in women with high concerns. In this context, body exposure sessions, which are often conducted in clinical contexts to reduce negative emotions when confronted with one’s own body [34], might serve as a model.

Regarding the checking of least-liked body parts, levels of negative emotions peaked during the checking episode than before the episode, supporting the assumption of the cognitive-behavioral theory of ED that body checking decreases negative emotions [8]. In contrast to the previous research, which only assessed negative emotions immediately after a checking episode [15], in the present study, we assessed levels of negative emotions again 15 min after the checking episode. In view of these differences in the design of the studies, it might be possible that the increase in negative emotions found in the previous research [15] might also reverse after some time. To investigate whether levels of negative emotions after a checking episode in a natural environment also decrease in the longer term, future ecological momentary assessment studies should assess the level of negative emotions at least twice after a checking episode.

In line with our hypothesis, the levels of arousal increased during the checking of least-liked body parts, thus supporting the assumption of the cognitive-behavioral theory of anorexia nervosa [12] that body checking increases the level of arousal. However, they decreased immediately after the checking episode, with the highest drop found 15 min afterwards. Levels of arousal were lower 15 min after the checking episode than before the episode. As was the case for most-liked body parts, the confrontation with one’s least-liked body parts did not seem to have a long-term effect on the levels of arousal. With regard to eating, weight, and shape concerns, females with higher concerns reported greater levels of arousal than females with lower concerns at all assessed timepoints. Given that our sample consisted of normal-weight women from a community sample, it is not clear whether patients with ED diagnoses would show different levels of arousal immediately after and 15 min after body-checking episodes. Therefore, future studies should replicate the findings in women with ED diagnoses.

The second aim of the study was to examine the differences in checking frequencies of most-liked and least-liked body parts between women with higher and lower eating, weight, and shape concerns. The groups did not differ regarding the checking frequencies of most-liked body parts. Our prediction that women with higher concerns would check least-liked body parts more often than women with lower concerns was confirmed by the findings. The results also support a previous eye-tracking study [44] which investigated differences between women with higher and lower eating, weight, and shape concerns with regard to the fixation time on most-liked and least-liked body parts: Women with higher concerns showed a greater orientation towards their least-liked body parts, which led to negative emotions and fears of weight gain [14, 15], and might be linked to their more frequent body checking [19]. In this context, the results of the present study showed that, as expected, women with higher eating, weight, and shape concerns reported higher frequencies of various body-checking strategies, i.e., checking body parts in the mirror, evaluating body parts in a specific position, pinching body parts, comparing one’s appearance to others or asking for feedback from others.
measuring body parts, and weighing oneself, than women with lower concerns, thus supporting the previous findings (e.g., [5, 7, 19, 20]). Mirror checking was found to be the most commonly used checking strategy, confirming the previous results (e.g., [15, 45]), whereas measuring body parts was the least used strategy in both groups. Possibly, subtle and culturally accepted checking strategies like mirror checking are utilized more often than more conspicuous and time-consuming strategies like measuring body parts or trying on specific clothes [15].

To sum up, the present study was the first to measure negative emotions and arousal before, during, and twice after a body-checking episode of most-liked and least-liked body parts, thus contributing to the few empirical findings regarding the effects of body checking on emotional states. Nevertheless, there are some limitations. First, the non-experimental design prohibits causal interpretations of the findings. In addition, participants were not asked whether they were currently on a diet, which might influence concerns with one’s body. Furthermore, the generalization of the results is limited, as only normal-weight women from a community sample took part in the study and because many participants did not complete the study. Most of the dropouts occurred on the first page; therefore, no systemic reasons for the high dropout rates can be assumed, but it can clearly not be ruled out that a selective effect occurred, which might have affected the generalization of the results. An important limitation is the retrospective design, which might have affected the outcome measurement given that memory effects, e.g., recall bias, cannot be fully ruled out. Moreover, the fine-grained design of the survey might have led to difficulties in differentiating negative emotions and arousal between the four timepoints. In addition, there was no manipulation check, as participants were not asked whether they had successfully imagined a body-checking situation, which could have affected their ratings of negative emotions and arousal. Given that single items were used to assess the emotional states, problems with reliability might have arisen. However, despite these methodological limitations, the validity of the results is supported, as they are in accordance with the previous non-retrospective findings [15–17]. To investigate whether the present findings can be replicated in a natural environment, ecological momentary assessment studies should be conducted.

The strengths of the study were that it was the first to include arousal as a dependent variable, and that it assessed four timepoints, albeit in a retrospective fashion. Furthermore, as participants were asked to recall an actual, individual checking episode, the study has high ecological validity. Supporting the previous research, the effects of body checking on emotional states differed depending on whether most-liked or least-liked body parts were checked and on the extent of eating, weight, and shape concerns. Whereas the checking of most-liked body parts led to a decrease in negative emotions, the checking of least-liked body parts increased this level for a short time. However, in both cases, the levels of negative emotions were found to be greater before the checking episode than 15 min afterwards, supporting the assumption of the cognitive-behavioral theory of ED that body checking decreases negative emotions [8]. Moreover, in line with the assumption of the cognitive-behavioral theory of anorexia nervosa [12] that body checking increases the level of arousal, the checking episodes of most-liked and least-liked body parts were found to increase the level of arousal. However, in accordance with the previous studies stating short-term negative effects of body checking on emotional states, the levels of arousal had reversed after 15 min [16, 17].

Regarding body-checking frequencies, women with higher eating, weight, and shape concerns were found to check their body parts more frequently than women with lower concerns. As body checking is assumed to be a key factor in maintaining the preoccupation with body size or shape [8, 12], which, in turn, is discussed as a risk factor for ED [8], the pronounced body-checking behavior of women with higher eating, weight, and shape concerns might increase their risk of developing an ED. Therefore, ED prevention programs should pay attention to the greater body-checking behavior of women with higher concerns, and low-threshold prevention programs, which could be disseminated via the internet [17], should be developed to train these women to reduce their checking behavior.

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Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Statement of human rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Data availability The local ethics committee of the University Osnabrück stipulated that data must not be passed on to third parties. Therefore, data sharing is not applicable to this article.
References


