Enhancing self-esteem in adults with body dysmorphic symptoms: experimental testing and initial evaluation of a brief internet-based training

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Abstract

Background: Low self-esteem is an important factor associated with body dysmorphic concerns. In treatment, self-esteem cannot always be adequately addressed. Internet-based interventions offer a low-threshold and cost-efficient possibility for treating body dysmorphic disorder (BDD).
Aims: For this reason, we conducted two studies to explore the effectiveness of an internet-based intervention targeting improving self-esteem in adults with BDD symptoms.
Method: The first study investigated the differential effects of a 1-week self-esteem training compared with a 1-week attention-focus training. Two hundred twenty adults with elevated body dysmorphic symptoms were randomly assigned to one of the two trainings. Our second study ($n = 58$ adults with body dysmorphic symptoms) evaluated an extended 2-week stand-alone self-esteem training.
Results: In the first study, self-esteem in different domains (appearance, performance and social), self-focused attention, and BDD symptom severity improved in both groups. Other-focused attention only increased in the attention training group. Participants' overall adherence was high. In the second study we observed significant improvements in self-esteem, BDD symptom severity, and other secondary outcomes, with additional improvements in most outcomes in the second week. Adherence was again high.
Conclusions: Together, these findings show that a brief internet-based intervention may be a highly accepted and effective way of improving self-esteem in people suffering from BDD symptoms.

Keywords: Body dysmorphic disorder; Cognitive behavioural intervention; Internet-based CBT; Internet interventions; Self-esteem

Introduction

Self-esteem refers to a person's positive or negative attitude toward themselves, representing an overall evaluation of their own value (Baumeister *et al.*, 2003; Rosenberg, 1965). Individuals with low self-esteem are more inclined to experience themselves negatively across various situations (De Ruiter *et al.*, 2017). Accordingly, low self-esteem is linked to various mental health problems such as depression, obsessive-compulsive disorder, and eating disorders (Colmsee *et al.*, 2021; Orth and Robins, 2013; Rahman and Husain, 2009). Higher self-esteem, on the other hand, is overall beneficial for healthy adjustment and adaptation to everyday challenges (Orth and Robins, 2022). For this reason, there are some approaches to increasing self-esteem in healthy populations and in those with mental health issues (Niveau *et al.*, 2021). Cognitive behavioural interventions,

in particular, have shown moderate to large effect sizes in enhancing global self-esteem in adults (Kolubinski *et al.*, 2018; Niveau *et al.*, 2021).

Self-esteem is particularly relevant to one's appearance satisfaction (Frederick *et al.*, 2016) and is a crucial factor in body dysmorphic disorder (BDD; Kuck *et al.*, 2021). BDD is characterized by an excessive pre-occupation with at least one perceived flaw in physical appearance that is not or only minimally recognized by others. Individuals with BDD spend much time checking or masking their area of concern, comparing their appearance with others, or even using plastic surgery to correct the perceived defect (American Psychiatric Association, 2013). The impairments in psychosocial functioning and quality of life are severe (Kelly *et al.*, 2017). Triggered by various external or internal stimuli, negative appraisal of internal body image is at the centre of the cognitive behavioural model of BDD (Veale, 2004; Veale and Neziroglu, 2010). Selective attention to the own negative body evaluation reinforces the relevance of appearance for self-evaluation. Negative appraisal of one's appearance is a central feature of the disorder and is involved in its maintenance as it interacts with negative mood, safety behaviours and rumination (Veale, 2004; Veale and Neziroglu, 2010). Low self-esteem is included among the risk factors of BDD (Kuck *et al.*, 2021; Trzesniewski *et al.*, 2006). It can also be involved in the maintenance of the disorder or be one of the consequences of the pathology (Schmidt and Martin, 2019; Schulte *et al.*, 2021). In a meta-analysis, Kuck *et al.* (2021) examine how strongly negative evaluations of physical appearance in BDD are associated with general feelings of unworthiness and low self-esteem. Across 25 studies, a moderate correlation of symptom severity with self-esteem was found ($r = -.45$), even when controlling for depressive symptoms (Kuck *et al.*, 2021). Increasing self-esteem is a goal of established treatment manuals (e.g. Wilhelm *et al.*, 2012). Yet, it is not explicitly addressed in a separate module there, but merely one aspect of advanced cognitive restructuring training (e.g. Wilhelm *et al.*, 2014).

Cognitive behavioural therapy effectively reduces BDD symptoms (Harrison *et al.*, 2016). Whether cognitive behavioural therapy also increases self-esteem in BDD is less clear. Thus far, only one randomized controlled study has assessed self-esteem as a secondary outcome. This study found an increase after the treatment (Rosen *et al.*, 1995). Addressing low self-esteem more explicitly as a possible maintaining factor could help improve the treatment of BDD. Additionally, enhancing self-esteem in subclinical populations might protect against the worsening of symptomatology or, in at-risk groups, act as a protective factor to prevent the onset of the disorder (e.g. O'Dea and Abraham, 2000).

Despite the high impairment, only 39.9% of self-diagnosed adults with BDD in a German sample received mental health treatment (Schulte *et al.*, 2020). This low treatment rate is attributed to the fact that individuals with BDD perceive various barriers to treatment, such as shame, but also structural deficiencies (Bosbach *et al.*, 2023; McCausland *et al.*, 2021; Schulte *et al.*, 2020). Internet-based interventions are independent of time and place and can be accessed relatively anonymously even without therapist contact. Therefore, they are proposed as a low-threshold therapy option to overcome perceived barriers (Andersson and Titov, 2014; Drüge *et al.*, 2022). Internet-based cognitive behavioural therapy interventions decreased BDD symptom severity and improved quality of life in previous studies (Enander *et al.*, 2016; Wilhelm *et al.*, 2022).

The module-based structure of internet-based interventions offers the possibility to investigate the isolated effects of single modules or contents. Furthermore, a module-based structure allows testing different modules for their specific effect on certain outcomes. For this reason, in our first study (Study 1) we experimentally offer two modules of the internet-based intervention program *imagin* for BDD (Schoenenberg *et al.*, 2023) separately and compare their effect on different outcome measures. In the self-esteem module, participants learn about the concept and role of an unstable self-esteem in BDD and explore additional facets of self-esteem beyond appearance. Participants will examine their own ideals and practise intentional self-care. We suggest that the 1-week self-esteem training increases different domains of state self-esteem to a greater extent

than a 1-week attention training. At the same time, only the attention training, which instructs participants to flexibly redirect their attention from internal processes towards experiencing the external environment, should change the focus of attention. Accordingly, we expect that participants should show lower self-focused and higher other-focused attention after the training. For both trainings, we examine the change in BDD symptom severity.

It has been demonstrated that self-esteem increased through intervention in non-clinical samples drawn from the general population, in people with increased symptoms but without a mental health diagnosis and in clinical samples consisting of people with any kind of psychiatric condition or disorder (Niveau *et al.*, 2021). Approaches targeting self-esteem effectively enhanced body satisfaction among adolescents in preventive settings (e.g. Norwood *et al.*, 2011). However, to the best of our knowledge, no stand-alone treatment is available to specifically modify self-esteem in adults with clinical symptoms of BDD. Considering the central role of low self-esteem in BDD and the potential of the internet format, we investigate the effect of the self-esteem training in an elaborated format as a stand-alone treatment in Study 2. Therefore, we complement the 1-week training with a second week to address self-attacking thoughts and foster the development of self-serving thoughts. We expect a positive effect of the 2-week self-esteem training on different domains of state self-esteem and BDD symptom severity. In addition, we examine whether the extension of the intervention leads to showing incremental symptom improvements in the second week of the intervention.

Study 1: Method

In a two-armed parallel randomized controlled trial, participants received a 1-week internet-based training module on either self-esteem or attention focus. Both groups completed online questionnaires before, right after, and 1 week after the training.

Participants

We recruited participants through advertisements in the university and social media. Participants had to be German-speaking, adult (i.e. ≥18 years of age), and present with dysmorphic symptoms (defined as a sum score ≥14 in the Body Dysmorphic Symptoms Inventory; FKS; Buhlmann *et al.*, 2009). The cut-off value of 14 has been demonstrated to best distinguish between a BDD- and a control group (sensitivity of 0.87, 1 − specificity of 0.07, area under the ROC curve of 0.96; Buhlmann *et al.*, 2009). Individuals reporting current psychotherapy or one of pre-defined clinical diagnosis (addiction, schizophrenia, borderline personality disorder and severe depression) were excluded from participation. Additionally, we excluded participants with suicidal tendencies (those who indicated having attempted suicide in the past or having experienced more than sparse suicidal thoughts in the last weeks). Eligibility was checked in a short online screening questionnaire. An independent employee of the university department conducted randomization using block randomization with a block size of eight. Figure 1 shows the flowchart for the participant selection. The final sample consisted of 220 participants, who completed the questionnaire before the training. The predominantly female (86.81%), educated (80.00% at least university-entrance diploma) participants were between 18 and 66 years old ($M = 28.87$; $SD = 9.28$). Participants' mean BDD symptom severity was moderate to high (FKS: $M = 27.1$; $SD = 8.1$). On average, the participants reported 2.34 ($SD = 1.19$) perceived areas of concern, with skin (51.4%), nose (26.8%) and chest (34.5%) being the most affected, followed by hair (19.1%) and muscles (20.5%). Table 1 displays the detailed sample characteristics separated according to the intervention conditions.
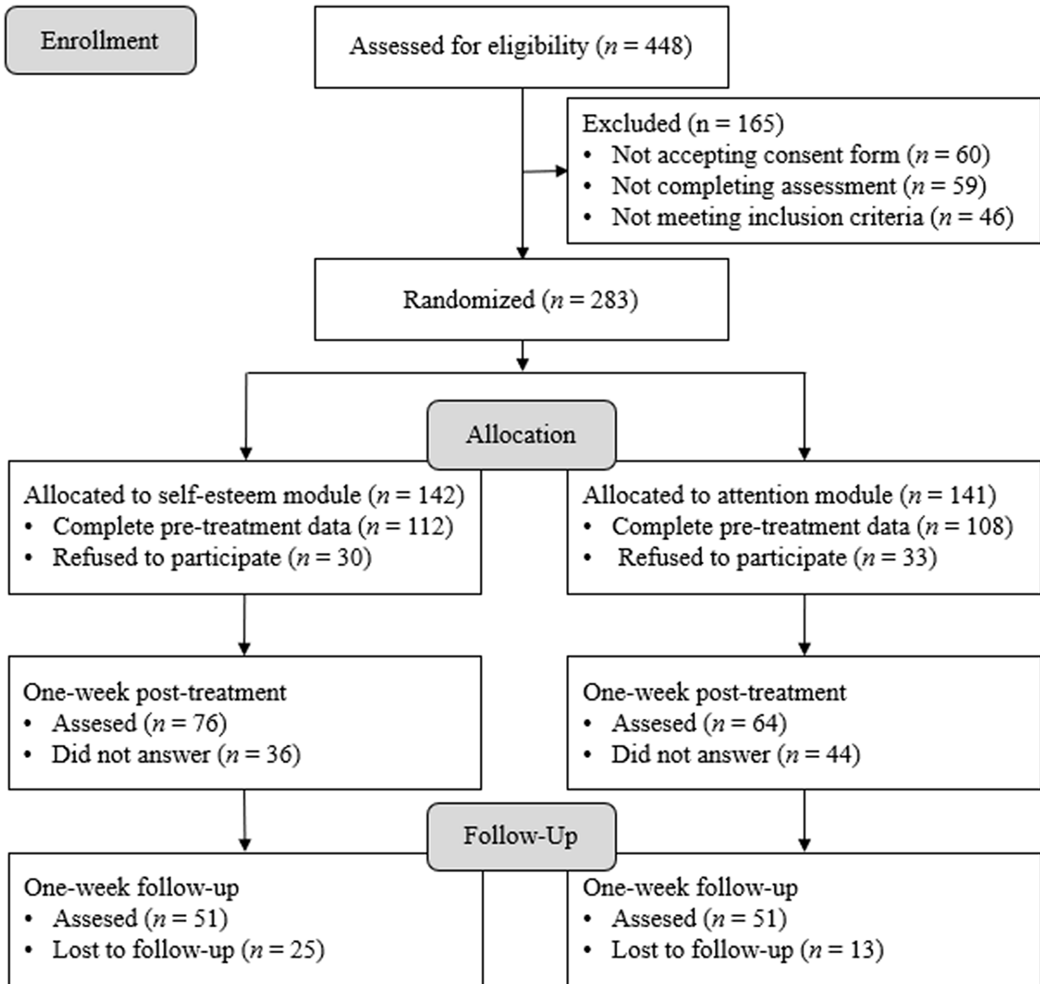
Figure 1. The flow of participants (Study 1).

Outcome measures

Primary outcomes

The first primary outcome was self-esteem measured with the revised German version of the State Self-Esteem Scale (SSES; Heatherton and Polivy, 1991; Rudolph *et al.*, 2020). The SSES is a multi-dimensional self-assessment questionnaire assessing fluctuations in self-esteem. The German SSES consists of 15 items assigned to three subscales: appearance, performance, and social self-esteem. Participants rate each item on a 5-point Likert scale ranging from 1 (= not at all) to 5 (= extremely). The German SSES has shown good validity, reliability and change-sensitivity in previous studies (Rudolph *et al.*, 2020). In Study 1, the internal consistency of all three domains at the three time points was satisfactory (α ≥ .73; Table 2).

The second primary outcome was the focus of attention assessed with the Focus of Attention Questionnaire (FAQ; Woody, 1996). Higher values indicate higher self-focused attention on one subscale and higher other-focused attention on the other subscale, both related to a specific situation. In the instruction we asked individuals to recall a challenging social situation of the past week and to answer the questions with respect to that situation. Participants report their

Table 1. Sociodemographic data of participants in self-esteem and attention training condition of Study 1 and the self-esteem training of Study 2

Variable	Study 1: Self-esteem (n = 112)		Study 1: Attention (n = 108)		Study 2: Self-esteem (n = 58)	
Age	M (SD) 28.73 (8.99)		M (SD) 29.02 (9.62)		M (SD) 31.50 (10.57)	
Body mass index (BMI)	24.23 (4.80)		25.44 (5.43)		24.27 (3.79)	
	n	%	n	%	n	%
Sex						
Female	96	85.71	95	87.96	45	77.59
Male	15	13.39	12	11.11	13	22.41
Other	1	0.89	1	0.93	0	0
Education						
Secondary school certificate	14	12.50	9	8.33	1	1.72
Advanced college entrance qualification	6	5.36	9	8.33	4	6.90
University-entrance diploma ('Abitur')	43	38.39	50	46.30	23	39.66
University degree	44	39.29	39	36.11	29	50.00
Other	5	4.46	1	0.93	1	1.72
Relationship status						
Single	47	41.96	42	38.89	20	34.48
Committed relationship	63	56.25	63	58.33	38	65.51
Other	2	1.79	3	2.78	0	0

agreement to each of the 10 items on a 5-point Likert scale ranging from 1 (= not at all) to 5 (= totally). The FAQ has shown acceptable psychometric properties (Woody, 1996). Internal consistency in the present work was α ≥ .66 for self-focused and α ≥ .62 for other-focused attention. See Table 2 for more details.

Secondary outcomes

The FKS (Buhlmann *et al.*, 2009) measures body dysmorphic symptom severity. Participants respond to the items using 5-point Likert scales ranging from 0 to 4, each scale accompanied by distinct verbal anchors. We utilize a sum score of 16 items, with higher values indicating greater symptom severity. There are two additional items to identify eating disorder symptoms and body areas of concern (Buhlmann *et al.*, 2009). We assessed dysthymia and euthymia with the two subscales of the State-Trait-Angst-Depressions-Inventory (STADI; Laux *et al.*, 2013) each summing up five items rated on a 4-point scale from 1 to 4. Cronbach's alpha values for secondary outcomes are displayed in Table 2.

Intervention and active control conditions

Two unguided 1-week internet-based trainings were compared regarding their effect on different mental health-related outcomes. Both trainings consist of five sessions, with each expected to take about 20 minutes. The trainings were original components of a comprehensive guided web-based cognitive behavioural treatment for BDD (*imagin*; Schoenenberg *et al.*, 2023). The *imagin* program is theoretically based on the cognitive behavioural model by Veale and Neziroglu (2010). The program aims to achieve changes through the relevant mechanisms and factors (e.g. cognitive processes, attention and dysfunctional behaviour). Both training modules commenced with psychoeducation, followed by the establishment of a connection to individual experiences through guided self-observation, followed by behavioural modification (see Table S1 in the Supplementary material for a content overview). We implemented the trainings in LimeSurvey 4.3 (LimeSurvey GmbH, 2003) and provided additional working sheets for download.

Table 2. Descriptive statistics of Study 1 and Study 2

	Baseline				Post-treatment				1-week follow-up			
	Self-esteem (n = 112)		Attention (n = 108)		Self-esteem (n = 76)		Attention (n = 64)		Self-esteem (n = 51)		Attention (n = 50)	
Study 1 Outcomes	α	M (SD)	α	M (SD)	α	M (SD)	α	M (SD)	α	M (SD)	α	M (SD)
SSES-appearance	.85	2.33 (0.76)	.79	2.40 (0.75)	.90	2.68 (0.91)	.87	2.88 (0.86)	.92	2.81 (0.96)	.91	3.00 (1.00)
SSES-performance	.77	3.37 (0.76)	.77	3.48 (0.79)	.82	3.48 (0.86)	.73	3.68 (0.69)	.85	3.65 (0.85)	.88	3.82 (0.93)
SSES-social	.84	2.24 (0.83)	.83	2.32 (0.90)	.84	2.51 (0.85)	.80	2.76 (0.83)	.84	2.63 (0.86)	.83	2.94 (0.92)
FAQ-self[a]	.72	10.14[a] (4.00)	.70	8.93[a] (3.99)	.77	8.89 (3.93)	.71	6.81 (3.49)	.78	8.47 (3.96)	.66	6.88 (3.18)
FAQ-other	.63	9.61 (3.58)	.68	8.96 (4.16)	.65	9.86 (3.43)	.63	10.28 (3.27)	.62	9.67 (3.27)	.70	9.39 (3.47)
FKS	.84	27.97 (7.98)	.84	26.20 (8.16)	.89	23.57 (9.59)	.87	19.18 (8.16)	.89	22.29 (9.58)	.89	17.98 (8.52)
STADI-euthymia	.94	10.21 (3.31)	.94	9.94 (3.99)	.95	11.31 (3.96)	.95	11.26 (3.95)	.95	10.61 (4.08)	.96	11.08 (3.71)
STADI-dysthymia	.92	8.74 (3.78)	.93	8.36 (3.80)	.93	8.00 (3.79)	.93	7.58 (3.38)	.98	8.16 (4.54)	.92	7.47 (3.19)

	Baseline n = 58		Mid-Treatment n = 51		Post-Treatment n = 46	
Study 2 Outcomes	α	M (SD)	α	M (SD)	α	M (SD)
SSES-appearance	.86	2.52 (0.74)	.84	2.70 (0.72)	.85	2.84 (0.72)
SSES-performance	.59	3.46 (0.57)	.80	3.58 (0.71)	.66	3.75 (0.62)
SSES-social	.85	2.25 (0.76)	.84	2.51 (0.83)	.85	2.77 (0.86)
FKS	.90	25.69 (9.21)	.91	23.41 (9.82)	.90	20.13 (8.93)
STADI-euthymia	.95	9.14 (3.72)	.94	10.43 (3.56)	.95	11.35 (3.78)
STADI-dysthymia	.93	8.89 (3.94)	.95	8.22 (3.94)	.94	7.93 (3.66)

FKS, Body Dysmorphic Symptoms Inventory; SSES, State Self-Esteem Scale; FAQ, Focus of Attention Questionnaire; STADI, State-Trait-Angst-Depressions-Inventory; [a]significant group differences at baseline; α, Cronbach's alpha.

Self-esteem

The self-esteem training started with a psychoeducational unit on the relationship between self-critical thoughts, lack of self-care, and the development of unstable self-esteem. This unit explained how discrepancies between a person's self-perceptions and ideal-self cause negative cognitions and emotions. The next day, participants discovered their self-critical thoughts, ideals and inner rules. In further exercises, participants collected additional resources on self-esteem and practised intentional self-care for 3 days. The training finished with an overall reflection of the learned competencies.

Attention

The attention training began with a psychoeducational unit on the detrimental effect of self-focused attention. The following days, participants observed their attention focus using protocols in their everyday life. With the help of a guided mindful walk, the participants practiced consciously directing their focus of attention towards the environment. Participants were then asked to intentionally focus their attention externally on the situation as part of a behavioural experiment. The training closed with a reflection on the learned competencies.

Procedure

After providing their informed consent, included participants received daily emails with access to online questionnaires and assigned training content. The training was unguided and participants did not receive feedback to their answers. However, an emergency contact was provided for all participants. Pre-, post- and follow-up measurements were assessed online at intervals of 1 week from each other.

Data analysis

First, we tested between-group baseline differences in primary and secondary outcomes, and in sociodemographic characteristics using independent *t*-tests or χ^2-tests. Next, we compared the values of participants dropping out of the training with training completers (defined as participants who completed the entire 5 days of training). We included all randomized participants of whom at least pre-treatment values were available in the intention-to-treat analyses (ITT-analysis). We did not impute post-treatment or follow-up data to prevent bias in the results (e.g. Chakraborty and Gu, 2009). To evaluate the intervention, we estimated a linear mixed model (LMM) for each outcome. This approach includes all available data from participants at the three time points of assessment, appropriately accounting for missing data (Magezi, 2015). Inter-individual differences between participants were included in the model as random intercept. We further included time point (pre-, post-, follow-up), intervention group (self-esteem, attention), the baseline value of the particular outcome, and interaction of time point and intervention group as fixed effects. A significant interaction between the time point and intervention group indicates differences between the two intervention groups regarding changes in the respective outcome over time. In the instance of a significant interaction, specific contrasts were calculated based on the models to explicitly test for group differences in outcomes at the two time points (post-, follow-up). To examine significant changes over time in more detail, effects within groups were evaluated using the estimated trends of the respective model. This approach estimates the linear change in an outcome per measurement time point (i.e. the slope). To consider pre–post treatment effects, we additionally report the estimated trend for LMMs excluding the follow-up time point. We calculated all effect sizes using the effectsize 0.5.0 package (Ben-Shachar *et al.*, 2020). Additionally, we used IBM SPSS statistics version 28.0 for descriptive and baseline analyses (IBM Corporation, 2021) and JASP 0.17.1.0 (JASP Team, 2022) for the LMMs.

Results

Baseline and drop-out analysis

Participants in the self-esteem training ($n = 112$) did not differ in sociodemographic data from participants in the attention training ($n = 108$; all $p \geq .082$). The baseline values of outcome measures are displayed in Table 2. Randomized participants in the two conditions differed only in their FAQ scores, with the self-esteem group scoring higher on the self-focused attention scale, $t_{218} = 2.26$, $p = .025$, $d = 0.31$. We adjusted for baseline values in later LMMs. Overall, $n = 166$ participants accessed all five training days, and $n = 140$ answered the post-treatment questionnaire. Detailed information on patient adherence can be found in Table S2 in the Supplementary material. To identify predictors of treatment adherence, we compared the $n = 166$ completers with $n = 54$ (24.54%) persons who dropped out during the intervention. Completers showed higher baseline euthymia, $t_{218} = 2.13$, $p = .035$, $d = 0.33$. There were no other differences in baseline or sociodemographic characteristics (all $p \geq .106$). The drop-out rate did not differ between treatment conditions, $\chi^2(1) = .61$, $p = .531$.

Primary outcomes: self-esteem and focus of attention

Self-esteem

The detailed results of the LMMs for all primary outcomes are displayed in Tables S3 to S7 in the Supplementary material. Figure S1 contains a graphical representation of the results regarding self-esteem. Appearance self-esteem (SSES-appearance) increased over the three points of measurement for participants in both the self-esteem training ($B = 0.17$, $p < .001$, $d = .29$) and the attention training ($B = 0.20$, $p < .001$, $d = .33$). For the within-group comparisons, B represents the average change in the analysed outcome per measurement time point (slope). Detailed within-group intervention effects (estimated trends) for primary and also secondary outcomes assessed at pre-, post- and follow-up can be found in Table S11 in the Supplementary material. In an additional pre–post comparison excluding the follow-up time point, the increase was significant with small effect sizes in both the self-esteem ($B = 0.32$, $p < .001$, $d = 0.36$) and attention groups ($B = 0.32$, $p < .001$, $d = 0.34$). The time point × intervention group interaction in the LMM was not significant ($B = -0.02$, $p = .491$).

Estimated trends showed a significant increase of the SSES-performance in the self-esteem training ($B = 0.14$, $p < .001$, $d = 0.23$) and in the attention training ($B = 0.09$, $p = .006$, $d = 0.14$). The pre–post intervention effect was significant for self-esteem ($B = 0.18$, $p < .001$, $d = 0.19$), but not for attention training ($B = 0.09$, $p = .078$, $d = 0.09$). However, there was no significant time point × intervention group effect ($B = 0.03$, $p = .226$).

In the self-esteem training improvement of social self-esteem (SSES-social) was $B = 0.13$, $p < .001$ with a small effect size ($d = 0.19$), and the pre–post intervention effect was also significant ($B = 0.26$, $p < .001$ $d = 0.25$). In the attention training, social self-esteem increased with a larger effect size over all three points of measurement ($B = 0.27$, $p < .001$, $d = 0.40$), and improved in an additional pre–post comparison ($B = 0.37$, $p < .001$, $d = 0.34$). The time point × intervention group interaction for social self-esteem reached statistical significance ($B = -0.07$, $p = .003$), confirming a different change in the outcome between the two intervention groups. The specific contrasts indicated lower improvement of social self-esteem in participants of the self-esteem training compared with those of the attention training at post-measure ($B = 0.12$, $p = .016$, $d = 0.32$) and at 1-week follow-up ($B = 0.22$, $p < .001$, $d = 0.39$). For those between-group comparisons, B is the unstandardized estimator of the specific contrast for the respective time point.

Attention

Over the three points of measurement, self-focused attention decreased in both, the self-esteem training group ($B = -0.78$, $p < .001$, $d = -0.20$) and the attention training group ($B = -1.08$,

$p < .001$, $d = -0.27$). The LMM analysis for the self-focused attention scale of the FAQ did not reveal a significant time point × intervention group interaction effect ($B = 0.15$, $p = .305$). Furthermore, pre–post comparisons showed significant within effects in both trainings (self-esteem: $B = -1.37$, $p < .001$, $d = -0.21$; attention: $B = -2.05$, $p < .001$, $d = -0.29$).

While there was no within-subject effect of other-focused attention in the self-esteem group over time ($B = -0.06$, $p < .733$, $d = -0.02$), other-focused attention increased in the attention group over all three points of measurement ($B = 0.50$, $p = .004$, $d = 0.15$) and in pre–post intervention comparison ($B = 1.39$, $p < .001$, $d = 0.25$). In line with this, the time point × intervention group interaction was significant ($B = -0.28$, $p = .022$). Specific contrast analysis indicated a higher increase in the attention training than in the self-esteem training at the post ($B = 0.45$, $p = .049$, $d = 0.26$) and follow-up measurement ($B = 0.89$, $p = .004$, $d = 0.31$).

Secondary outcomes: body dysmorphic symptom severity, dysthymia and euthymia

The body dysmorphic symptom severity decreased significantly over the three points of measurement in the self-esteem training ($B = -3.07$, $p < .001$, $d = -0.49$) and the attention training ($B = -3.35$, $p < .001$, $d = -0.52$). There was no specific effect of one of the trainings for the FKS, with non-significant time point × intervention group interaction in the LMM ($B = 0.14$, $p = .554$). Symptom severity decreased with medium effect sizes in both the self-esteem ($B = -4.87$, $p < .001$, $d = -0.46$) and attention groups ($B = -5.38$, $p < .001$, $d = -0.48$) in the pre–post comparison.

Both STADI scales did not show changes over time in either condition (all $p \geq .304$). Time point × intervention group interaction revealed no specific intervention effect for dysthymia ($B = -0.02$, $p = .891$), and euthymia ($B = -0.05$, $p = .755$). Tables S8 to S10 (Supplementary material) contain the complete results of the LMM for all secondary outcomes assessed over the three measurement points.

Discussion

In our first study, we assessed two 1-week internet-based trainings with distinct thematic focus in adults with dysmorphic concerns. Both trainings were associated with small to medium improvements in appearance, performance and social self-esteem, self-focused attention, and BDD symptom severity. Other-focused attention and social self-esteem increased more strongly in the attention training. Participants in both groups showed high adherence and drop-out rates were relatively low.

Both trainings demonstrated improvements in the three domains of state self-esteem. Effect sizes were small, but nearly comparable to other internet-based interventions assessing self-esteem (e.g. Bruhns *et al.*, 2021). The fact that the attention training also resulted in improved self-esteem aligns with the plausibility of the *Self-Organizing Self-Esteem Model*. The model describes the three levels of trait self-esteem, state self-esteem, and self-experiences. Interactively self-esteem develops based on experience, but, in turn, influences how a person evaluates situations (De Ruiter *et al.*, 2017). It seems plausible that performing practical exercises in the attention training and achieving success were positive self-experiences and, thus, changed the state self-esteem. This explanation is supported by the fact that the performance self-esteem in the attention group was not significantly increased at post-intervention, but only at follow-up. Experienced successes during training may have translated into more positive self-experiences during the week following the training and reflected in improved performance self-esteem. The results align with findings, in which internet-based CBT without a specific self-esteem module improved self-esteem as a secondary outcome (e.g. Bruhns *et al.*, 2021). Further unexpectedly, social self-esteem increased even more in the attention group participants than in those who received the self-esteem training. This may indicate that, to improve social self-esteem, it is more helpful to experience success in

social situations (behavioural experiment in attention training) than to treat oneself as valuable outside of the social context (intentional self-care in self-esteem training).

In line with our expectations, the attention training increased other-focused attention more than the self-esteem training did. This effect was not found for self-focused attention, which decreased in both groups. This might be due to the content of the self-esteem training, on the one hand, and the items of self-focused attention in FAQ, on the other hand. Exploring 'facets of self-esteem' and conducting intentional self-care are active and resource-oriented tasks that might decrease self-focused attention as it is operationalized in FAQ (e.g. focusing on level of anxiety, focusing on past social failures). At this point, the results regarding the FAQ should be interpreted with caution due to weak internal consistencies. Possibly, the found effects can be attributed exclusively to individual items.

In addition, we found that both brief trainings reduced body dysmorphic symptom severity. Former research conducted in both face-to-face and online settings within the context of body image concerns has shown that targeted treatments, specifically addressing perfectionism, can result in improvements in body image and BDD symptom severity (Johnson *et al.*, 2019; Robinson and Wade, 2021). Transdiagnostic treatment targeting underlying factors of emotional disorders also improved BDD symptoms (Mohajerin *et al.*, 2019). Considering that both low self-esteem and attention focus are recognized as maintaining factors of BDD, it is not surprising that targeting one of them leads to improvements in overall symptomatology (Veale, 2004; Veale and Neziroglu, 2010). However, it is remarkable that this process seems to occur already after a 1-week training. To summarize, trainings focusing on an isolated topic seem to improve specific outcomes and contribute to overall improvement of body dysmorphic symptoms. To further investigate the contribution of individual modules within a comprehensive treatment program, dismantling studies should be conducted in the future.

In addition to these promising results immediately after the training, the improvements in self-esteem, attention focus, and symptom severity remained significant at short-term follow up, 1 week after completion of the training. Moreover, both trainings were well accepted by participants. The treatment drop-out of 24.54% is comparable to guided (Fernandez *et al.*, 2015) and low compared with other unguided internet-based interventions (Christensen *et al.*, 2009). Adherence with an average of more than four out of five active training days, was additionally high (Musiat *et al.*, 2022).

While the lack of a waiting control group limits the strength of evidence, the presence of medium effect sizes unlikely for BDD symptom severity renders the possibility of exclusively time-related improvement. The absence of changes in euthymia and dysthymia also stands against a pure time effect.

Overall, these results indicate the potential for low-threshold and effective treatment of individuals with BDD. To exploit this potential, the second study examined an elaborated version of the self-esteem training as a stand-alone intervention for adults with BDD symptoms. We supplemented the content focus of the 1-week training on strengthening diverse self-esteem facets, incorporating further cognitive restructuring by questioning self-attacking and developing self-serving thoughts. The main goals were to examine the training's acceptability and effectiveness, and to examine whether a second week of training shows an additional benefit to clinical outcomes.

Study 2: Method

As part of a pre–post within-subject design, participants with distinct BDD symptoms underwent a 2-week version of the unguided internet-based training for self-esteem. The assessment took place before the program, after the first week, and right after the second week of training.

Participants

We recruited participants through university advertisements, social media, and 1000 letterbox flyers. Eligibility was checked in an online screening questionnaire. Individuals had to meet the following criteria for participation: be German-speaking, adult (i.e. ≥18 years of age), and exhibit dysmorphic symptoms (sum score ≥14 in FKS). Individuals currently undergoing psychotherapy, having been diagnosed with addiction, schizophrenia, borderline personality disorder or bipolar disorder, displaying suicidal tendencies (for assessment, see Study 1) or reporting severe depression in Patient Health Questionnaire (PHQ-8 > 14; Kroenke *et al.*, 1999) were not eligible to participate. After participating in a short experimental investigation (effect of an information video on the acceptance of the web-based treatment; Bosbach *et al.*, 2023), participants received an automated invitation to the self-esteem training if inclusion criteria were met.

Figure S2 in the Supplementary material shows the flow of participants. After examining 203 participants for eligibility, 73 of them gained access to the self-esteem training. Fifty-eight participants completed the pre-intervention assessment and formed the analysed sample. This sample was predominantly female (77.59%), well-educated (89.66% with at least a university-entrance diploma), and between 19 and 58 years old ($M = 31.5$; $SD = 10.6$). The mean BDD symptom severity was moderate to high (FKS: $M = 25.7$; $SD = 9.2$). Participants reported an average of 2.09 ($SD = 1.44$) perceived flaws. Most commonly, the concerns were related to skin (48.3%), hair (39.7%), chest (36.2%) and nose (31.0%). Detailed sample characteristics can be found in Table 1.

Outcome measures

Outcome measures of self-esteem, body dysmorphic symptom severity, euthymia and dysthymia were similar to those in Study 1. Again, we utilized the appearance, performance and social self-esteem subscales of the SSES as primary outcome measures. Following the results from Study 2, we now capture symptom severity measured with FKS as a primary outcome. The two STADI affect scales were again used as secondary outcome measures. Table 2 includes all internal consistencies.

Intervention

The implementation of content was parallel to Study 1. Besides the content of the 1-week self-esteem training, the second week focused on further improvements in self-esteem by additionally questioning self-attacking thoughts and developing friendly and self-serving thoughts based on one's individual resources. The training closed with an overall reflection of the content and techniques learned (see Table S1 in the Supplementary material). The 2-week version of the self-esteem training consists of 10 sessions, with each unit intended to take approximately 20 minutes.

Procedure

Once all participants provided their informed consent, they were sent daily emails granting access to the online questionnaires and the self-esteem training. Mid- and post-assessments took place 1 and 2 weeks after the baseline.

Data analysis

First, we conducted drop-out analysis using independent *t*-tests or χ^2-tests to compare treatment drop-outs with training completers (i.e. participants who signed up at all of the ten training days). Participants who provided at least pre-treatment data were included in the analysis (ITT-analysis). As in Study 1, we did not impute missing data and estimated LMMs for any outcome. Individual

differences between participants were again included as random effects, and we included time point (pre-, mid-, post-) and the baseline value of the respective outcome as fixed effects. To examine the additional effect of the second intervention week on the outcomes, we additionally report the estimated trend for LMMs including only mid- and post-time points. For the data analysis, we again used SPSS version 28.0 (IBM Corporation, 2021), JASP 0.17.1.0 (JASP Team, 2022), and the effectsize 0.5.0 package (Ben-Shachar *et al.*, 2020).

Results

All descriptive outcome values at the three points in time are reported in Table 2. With $n = 41$ training completers (taking part in every day of training), the drop-out rate was 29.31%. Another eight participants only missed one training day (for more details on adherence, see Table S2 in the Supplementary material). While completers showed higher baseline social self-esteem, $t_{56} = 2.25$, $p = .030$, $d = 0.72$, than those who dropped out, there were no other differences in baseline outcomes or sociodemographic characteristics (all $p \geq .201$).

LMMs conducted for each outcome revealed significant improvements in all primary and secondary outcomes over the three measurement points pre-, mid- and post-intervention. The estimated trends are displayed in Table 3. The three domains of self-esteem (appearance: $d = 0.47$, performance: $d = 0.36$, and social: $d = 0.53$) increased significantly (all $p < .001$). Furthermore, BDD symptom severity decreased with a medium effect ($B = -2.53$, $p < .001$, $d = -0.67$). While euthymia increased with a medium effect ($p < .001$, $d = 0.45$), dysthymia decreased with a small effect ($p = .035$, $d = -0.21$). Tables S12 to S17 (see Supplementary material) contain the LMMs fixed effects for all outcomes over the three measurement points.

Comparisons of mid- and post-assessment revealed significant additional improvements after the second week in appearance ($p = .030$, $d = 0.33$) and social ($p = .012$, $d = 0.37$) self-esteem, BDD symptom severity ($p < .001$, $d = -0.60$), and euthymia ($p = .030$, $d = 0.33$). There was no additional benefit of the second week for performance self-esteem ($p = .056$, $d = 0.28$) or dysthymia ($p = .378$, $d = -0.13$). The complete estimated trends of the second week of training are displayed in Table S18 in the Supplementary material.

Table 3. Within-group intervention effects (estimated trends) for pre-, mid- and post-intervention assessment of Study 2

Variable	Slope	*SE*	d.f.	95 % CI Lower	95 % CI Upper	*t*	*p*	*d*
SSES-appearance	0.16	.03	109.08	0.09	0.22	4.87	<.001	0.47
SSES-performance	0.14	.03	109.37	0.07	0.21	3.78	<.001	0.36
SSES-social	0.21	.04	110.35	0.13	0.28	5.54	<.001	0.53
FKS	−2.53	.36	109.29	−3.25	−1.82	−7.00	<.001	−0.67
STADI-euthymia	1.12	.24	108.03	0.64	1.59	4.67	<.001	0.45
STADI-dysthymia	−0.52	.24	107.57	−1.00	−0.04	−2.13	.035	−0.21

FKS, Body Dysmorphic Symptoms Inventory as an indicator of symptom severity; SSES, State Self-Esteem Scale; STADI, State-Trait-Angst-Depressions-Inventory; *SE*, standard error; d.f., degrees of freedom; CI, confidence interval.

Discussion

We conducted a 2-week self-esteem training for adults with body dysmorphic symptoms. The training improved all three domains of state self-esteem. In addition, BDD symptom severity and dysthymic mood decreased while euthymic mood increased. The second training week additionally improved all of the clinical outcome measures except performance state self-esteem

and dysthymic mood. Extension through an additional intervention week can thus be considered beneficial.

The medium effect sizes found for improvements in state self-esteem align with the effect sizes reported by Niveau *et al.* (2021) in a meta-analysis on self-esteem changes of various online interventions ($d = 0.24$). It is promising and expected that an intervention focusing on self-esteem improves BDD symptom severity as well. In this study, even a medium effect size was achieved. According to the Self-Organizing Self-Esteem Model, higher self-esteem contributes to more positive processing of the self in everyday experiences (De Ruiter *et al.*, 2017). Considering the role of self-esteem in the maintenance of BDD, the improvement in self-esteem over time may have caused changes in symptomatology. A more positive evaluation of the self may have led to higher appearance self-esteem ratings. The increases in social and performance-related self-esteem may suggest that individuals attribute less importance to their appearance for self-esteem. As this is a desired effect of the training, in future research, the level of self-esteem and self-esteem contingencies should be examined, for example, using the Contingencies of Self-Worth Scale (Crocker *et al.*, 2003).

This study's drop-out rate of 29.31% was comparable to studies using guided e–therapy (Fernandez *et al.*, 2015) and lower than in other unguided internet-based interventions for body image disorders (e.g. Geraghty *et al.*, 2010). The adherence was remarkably high, with 84% of the participants accessing at least nine of the 10 training days (Musiat *et al.*, 2022). Even though the study was a within-subject design without a control condition, the medium effect sizes for improving BDD symptom severity are notable considering the short intervention duration.

General discussion and conclusion

Overall, Study 1 showed promising effects of two short internet-based trainings. Both trainings were well accepted by participants and improved relevant outcomes such as self-esteem, attention focus, and BDD symptom severity. The effects persisted also 1 week after the brief training. We could confirm differential effects of the attention-focus and self-esteem training only to a limited extent. Self-esteem increased, and self-focused attention decreased in both interventions. Although the content of the two trainings does not overlap, and they explicitly address different mechanisms, the impact of an intervention is not restricted to one outcome. Complex inter-relationships, such as those suggested by the cognitive behavioural model of BDD (Veale, 2004; Veale and Neziroglu, 2010) or the Self-Organizing Self-Esteem Model (De Ruiter *et al.*, 2017), lead to treatment mechanisms that we do not yet understand well enough. Our study does not assess whether directly addressing self-esteem has a particular beneficial effect, e.g. in terms of the long-term outcomes. The differential effects of particular modules or trainings should be further investigated, for example by conducting dismantling studies to develop optimal treatment manual compositions. For example, one could conduct complete therapy programs with and without a self-esteem module or alter the placement of the self-esteem module within the therapy.

Considering self-esteem as a crucial factor in BDD explicitly addressing it seems valuable. For this reason, we extended the training to a 2-week stand-alone training with additional content focusing on restructuring negative thoughts about oneself. Study 2 replicated the improvements in three domains of self-esteem and BDD symptoms, and showed positive effects of the self-esteem training for euthymia and dysthymia. Furthermore, we confirmed the additional benefit of the second week with respect to most outcomes. The effect sizes regarding observed changes in self-esteem and in body dysmorphic symptoms descriptively exceeded those of the 1-week training in Study 1.

Due to the structure of our sample, the results should be interpreted primarily for female, younger and educated individuals with elevated BDD symptoms. In the reported studies, we did not examine clinical samples, but individuals with moderate to high baseline BDD symptom

severity. The internet-based self-esteem trainings showed positive results in these samples. Self-esteem may constitute a risk factor for the development and maintenance of BDD. The self-esteem training may thus have the potential to contribute to prevention in at-risk groups or may prevent the onset of the full disorder (Kuck *et al.*, 2021). Even though the FKS (Buhlmann *et al.*, 2009) specifically assesses symptoms of BDD, it is plausible that individuals in our sample may also express concerns related to body shape and body dissatisfaction. This may also be because around one-third of individuals with BDD also receive a lifetime diagnosis of eating disorders (Ruffolo *et al.*, 2006). Previous work using structural equation models shows that BDD symptoms are best classified together with eating disorder symptoms in a category of body image disorder (Hartmann *et al.*, 2020). An examination of the internet-based training for self-esteem in people with other body image related disorders, such as eating disorders, could be interesting in the future because self-esteem is central to their etiology, too (Colmsee *et al.*, 2021; Hartmann *et al.*, 2014).

In both studies participants showed low drop-out, good adherence, and relatively high rates of training uptake despite multiple known perceived barriers for treatment in BDD (McCausland *et al.*, 2021; Schulte *et al.*, 2020). There is some supporting evidence that positive and resource-oriented intervention content leads to less drop-out in unguided internet-based interventions for body dissatisfaction (Geraghty *et al.*, 2010). Therefore, offering low-threshold internet-based training focusing on a more general and resource-oriented topic could potentially motivate individuals with BDD to obtain psychotherapeutic help. In a stepped-care model, they may receive access to more comprehensive treatment alternatives later. Motivation to take up psychotherapy may be higher if the first training has already brought improvements. Future research to examine the effects of the self-esteem intervention in BDD thus seems reasonable to exploit the potential of our training fully. It would be of interest to evaluate both the longer-term effects of this stand-alone intervention and its effect on readiness for more comprehensive therapy. In addition to clinical intervention outcomes, engagement, and user behaviour (e.g. usage times) should be measured carefully and reported. It might also be of interest to afford elevated consideration to self-esteem in established therapy programs and to examine whether this exerts a beneficial impact on levels of acceptance, adherence, or even treatment efficacy. Furthermore, future research should explore strategies to engage individuals with BDD who are hard to reach due to sociodemographic reasons and explore the feasibility and efficacy of resource-oriented self-esteem training in these samples.

The limitations of the present pilot trials should be addressed in future pre-registered studies. For better generalization to clinical samples and distinction to primary eating disorders, clinical diagnostic interviews and clinician assessments of symptoms should be conducted. Additionally, more heterogeneous samples in terms of sociodemographic data should be collected in future research. In this process, it should also be checked whether the improvements are also reflected at the trait level of self-esteem. In addition, inactive or non-specific control groups would control for non-specific or time-only effects.

In summary, a 1-week internet-based self-esteem training and an attention training improved self-esteem and self-focused attention. Thus, mechanisms of change should be further explored. The second study emphasizes that a brief stand-alone internet-based training focusing on self-esteem improves different domains of state self-esteem and alleviates BDD symptoms. This intervention can potentially serve as an accessible, highly accepted, and effective method to enhance self-esteem in adults affected by BDD.

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