Consequences of Exposure to the Thin Ideal in Mass Media Depend on Moderators in Young Women: An Experimental Study

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This study examined the consequences of media exposure to thin ideals compared to pictures of landscapes in healthy young women and women with eating and mixed mental disorders and investigated whether appearance-related cognitive factors and cognitive distortions moderate the effects. Two hundred seventy-five women in a multisite laboratory trial (174 in- or outpatients and 101 healthy women; M age 22.87 years, SD = 3.94) were exposed to either thin ideals or to landscape pictures and guided through a vivid imagery of these pictures thereafter. Changes in body image dissatisfaction, mood, eating behavior, and physiological markers were assessed. After thin ideal exposure and even more after guided imagery, women’s body image dissatisfaction increased and mood declined. The effect on mood was most pronounced in women with eating disorders, less in women with mixed disorders, and smallest in healthy controls. No effects were found on physiological measures. Higher values of appearance-related cognitive factors moderated the effect of thin ideal exposure and guided imagery on all psychological outcomes. Cognitive distortions moderated the effect of thin ideal exposure and guided imagery on mood. Findings indicate an overall susceptibility to viewing thin ideal pictures in magazines in young and especially in women with eating disorders. Though exposure in the laboratory resulted in psychological effects, it did not lead to a physiological stress response. The impact of thin ideal exposure on mood is in line with affect-regulation models in eating disorders, with appearance-related cognitive factors and cognitive distortions potentially accelerating such effects.

General Scientific Summary
Body image concerns, which are often influenced by thin ideal exposure of mass media are a key feature of disturbed eating and eating disorders. This study supports that exposure to mostly unachievable thin ideals in mass media in the laboratory leads to body image dissatisfaction and impaired mood not only in young women with eating disorders, but further in those with mixed mental disorders and in healthy ones. In particular, impaired mood after thin ideal exposure...
activated disturbed eating behavior in women with eating disorders. Effects in all groups were more pronounced in case of increased cognitive processing relating the thin ideals in mass media with self-ideals and provoking a negative belief that the likelihood of an undesirable event (e.g., weight gain) will occur by the mere thinking about it (thin ideals).

**Keywords:** eating disorders, mixed mental disorders, media exposure, cognitive factors, psychophysiological correlates

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**Body dissatisfaction** is the degree to which individuals are concerned about or dissatisfied with their appearance, including related thoughts, beliefs, feelings, and behaviors (Cash et al., 2004; Cash & Smolak, 2011). Body image dissatisfaction in adolescents and young adults, especially for females, is currently of such high prevalence that it is deemed a “normative” condition (Fiske et al., 2014; Knauf, 2016). A large, multicenter intercultural study found that exposure to Western media, which typically depicts and promotes an unrealistic female thin ideal, is at least associated with, and hypothesized to be partly responsible for, the worldwide increase in body image dissatisfaction in regions with high socioeconomic status (Miceli et al., 2015; Swami et al., 2010). Repeated exposure to the thin ideal amplifies a felt discrepancy between one’s own and the ideal body shape, which fosters negative affect, and can lead to unhealthy eating and/or unhealthy weight regulation attempts (Dondzilo et al., 2018; Grogan, 2016).

Laboratory, cross-sectional, and longitudinal studies in nonclinical samples of young women have confirmed that repeated mass media exposure, such as viewing beauty magazines, fosters and is related to the development of body image dissatisfaction and eating disorder symptoms (Hausenblas et al., 2013; Levine & Murken, 2009; López-Guimerà et al., 2010). According to the dual pathway model of eating pathology (Stice, 2001; Thompson & Stice, 2001), body image dissatisfaction is often accompanied by unhealthy dieting behavior and/or negative affect, which may progress to disturbed or disordered eating, as shown in longitudinal studies (Keski-Rahkonen & Mustelin, 2016; Stice et al., 2017; Stice et al., 2011). The pursuit of the thin ideal, body image dissatisfaction, dieting, and unhealthy weight control behaviors have been specifically linked to binge/purge spectrum eating disorders in a large longitudinal study (Stice et al., 2017), whereas inherently lean young women who underate for other reasons than striving for thin ideal achievement were at a specific risk for anorexia nervosa (Stice & Desjardins, 2018; Stice et al., 2017).

In sum, body image dissatisfaction plays an important role in the development of unhealthy eating behavior, but also of low self-worth, anxiety, depressive, and somatoform symptoms (Paxton et al., 2006). In addition, sociocultural influences and associated appearance-related cognitive factors, such as constantly being aware of the thin ideal, the pressure to adhere to it, and the tendency to internalize and adopt thin ideals, promoted via mass media (Durkin et al., 2007; Knauss et al., 2007), might moderate the effect of thin ideal exposure on eating behavior. Several studies show that these factors influence the perceived discrepancy between one’s own and the thin ideal body in healthy females (Mussweiler et al., 2000; Myers & Crowther, 2009). Nevertheless, cognitive distortions (i.e., consistent, false, and skewed patterns of thinking often related to psychopathology) have hardly been investigated in eating disorders, until the concept of the food-related Thought Shape Fusion (TSF) gained researchers’ interest (Coelho et al., 2015; Radomsky et al., 2002; Wyssen et al., 2016; Wyssen et al., 2018). The original TSF concept includes irrational beliefs about the closeness of the relationship between thoughts about food and the physical world. The TSF concept was adapted from the concept of thought action fusion in individuals with obsessive-compulsive disorders (OCD), which holds that the likelihood of an undesirable event occurring is increased by a negative thought (likely thought action fusion) and that these negative thoughts are morally equal to the actual performance of the negative behavior (moral thought action fusion; Rachman & Shafran, 1999; Shafran et al., 1996). Originally, TSF was experimentally induced via the instruction to think about high caloric/fattening food, to imagine vividly eating large amounts of this food and then to write down the sentence “I am eating” (inserting the name of the food(s) they were imagining; Coelho et al., 2008). Thereafter, feelings of fatness, perceived weight gain, feelings of guilt, of moral wrong-doing and the pressure to neutralize the effects of such cognitions increased slightly in healthy individuals but increased significantly more in individuals with eating disorders (Coelho et al., 2015; Coelho et al., 2010; Ouellet-Courtis et al., 2015).

Analogous to thinking about food, the mere vivid imagination of thin ideals has also been associated with body-related cognitive distortions in both healthy controls as well as in those with eating disorders (TSF Body [TSF-B]; Wyssen et al., 2016; Wyssen et al., 2017). According to a previous study by our group, where the TSF-B questionnaire has been validated, a core belief measured in the subscale “imagination of thin ideals” is that the mere vivid imagination of a thin women increases the likelihood of gaining weight or changing shape, and a typical belief of the subscale “striving for own thin ideal” is that simply thinking about giving up the thin ideal is as morally objectionable as giving it up for real (Wyssen et al., 2017). In a previous pilot study, TSF-B was experimentally induced by exposing healthy women in a waiting room to thin ideals via fashion magazines, who were then asked to imagine the images seen in the magazines as vividly as possible (guided imagery), which resulted in decreased mood and increased body image dissatisfaction, especially in women with subclinical eating disorder symptoms (Wyssen et al., 2016). In sum, people who are susceptible to cognitive distortions, such as TSF-B, experience a fusion of thoughts and their perception of their own body similar to the process involved in thought action fusion in OCD. Even though they probably realize that merely thinking about certain foods (Coelho et al., 2015) or a thin body (Wyssen et al., 2017)
cannot influence their body shape or weight, they nevertheless have anxiety about this potential outcome. However, there is still limited data on a potential moderating role of such body-related cognitive distortions in clinical samples exposed to thin ideals.

Daily exposure to unachievable thin ideals may have such a detrimental impact on mental health that it meets the criteria of an environmental stressor such as, for example, being in an unpleasant company or feeling lonely (Jacobs et al., 2007; Kirschbaum & Hellhammer, 1989; Matias et al., 2011). Its effects are enhanced by the inherent ego-involvement of the content and ensuing feelings of shame and guilt (Ehert et al., 1999), especially in young women, for whom body image is particularly salient and might result in increased stress levels and activations of the two physiological stress systems: the hypothalamic pituitary adrenal (HPA) axis and the autonomic nervous system (ANS). However, previous studies did not find any consistent HPA activation after body confrontations (Servían-Franco et al., 2015; Svaldă et al., 2009; Vocks et al., 2007) and ANS responses have not been investigated so far. Therefore, it has not yet been examined whether being exposed to a daily challenge such as to thin ideals and guided imagery thereafter leads to physiological stress responses of both stress systems, even though physiological correlates of stress have the potential to contribute to the vicious cycle of body image dissatisfaction, negative mood, and impaired eating and nutritional behavior thereafter, as eating under stress is known to be associated with altered food choices (Epel et al., 2001; Oliver et al., 2000). There is further mixed evidence for the effects of body salience on body-related stress and it remains unclear whether thin ideal stressors should provoke physiological stress responses (i.e., an increase in cortisol level or decrease in heart rate variability [HRV]). Existing studies on the exposure to one’s own body do not find consistent responses of the HPA axis and the sympathetic branch of the autonomic nervous system (anorexia nervosa) in individuals with eating disorders, when compared to healthy women (Vocks et al., 2007). A later study involving mirror exposure revealed greater negative effects, in terms of higher body image dissatisfaction and more intense negative cognitions, after viewing one’s own body in young women from the general population with high body image dissatisfaction, as compared to women with low body image dissatisfaction (Servién-Franco et al., 2015). Interestingly, these self-reported psychological effects were not accompanied by increased skin conductance or heart rate. In sum, raising body salience can have detrimental effects on the human psyche in vulnerable individuals. However, evidence on physiological effects remains limited by the generally small sample sizes in prior studies, and by the typical lack of parallel physiological assessment of the two stress branches, the ANS including heart rate variability (capturing the parasympathetic nervous system, PNS; Thayer et al., 2012), salivary alpha-amylase release (capturing the sympathetic nervous system, SNS; Chatterton et al., 1996), and salivary cortisol (capturing HPA activation).

Overall, studies in nonclinical samples of young women indicate that the pursuit of the thin ideal is associated with increased levels of body image dissatisfaction, which contributes to dieting, maladaptive weight control behaviors and to an increased risk for eating disorders (Stice et al., 2017). Nevertheless, studies on how cognitive processes influence the relationship between thin ideal exposure and body image dissatisfaction, mood or eating disorders symptoms are scarce. In addition, research on the specificity of such processes, and on potential physiological responses in larger groups, including healthy women and women with mental disorders, is lacking.

The present laboratory study addresses these gaps in being the first to focus on shared versus specific effects of the exposure to thin ideals via beauty magazines, followed by guided imagery of these thin ideals, on state measures of body image dissatisfaction, mood, eating behavior, and on physiological responses in healthy young women and in a sample of women with eating disorders as well as in a sample including anxiety, depressive or somatiform disorders (mixed mental disorders). To clarify the role of cognitive processes, we assessed the moderating effect of appearance-related cognitive factors such as awareness, thin ideal internalization, perceived pressure to conform to a thin ideal and the susceptibility to body-related cognitive distortions on the relationship between thin ideal exposure, guided imagery and body image dissatisfaction, mood, eating behavior, and on measures of physiological stress.

This study employed a laboratory design from prior research (Munsch, 2014; Wyssen et al., 2016) to test three hypotheses. First, compared to exposure and guided imagery of neutral landscape images, exposure followed by guided imagery of thin ideal images was expected to lead to a decrease in mood, to an increase in body image dissatisfaction and in internal pressure to engage in dysfunctional eating behavior in the overall sample (Green et al., 2009; Junne et al., 2016). Second, the aforementioned effects were expected to be more pronounced in women with mental disorders than in healthy women, and within women with mental disorders to be more pronounced in the eating disorder sample than in the mixed mental disorder sample (Rawana et al., 2010; Stice et al., 2017). Third, dysfunctional cognitive processes (i.e., appearance related cognitive factors and body-related cognitive distortions), were expected to moderate responses to thin ideal exposure and guided imagery in the overall sample. Finally, we explored to which extent women showed physiological stress responses to thin ideal compared to landscape exposure and guided imagery (i.e., changes of HPA activation and of ANS activation) with respect to all three hypotheses stated.

Method

Participants

Recruitment was conducted over a three-year period from 2014 to 2017 in a multisite trial including 10 different treatment facilities (in and outpatient clinics) in Switzerland (N = 4) and Germany (N = 6); the study protocol is detailed out in Munsch (2014). During this period, all 362 incoming patients were routinely invited by collaborating staff members to participate in the study. Study eligibility criteria for clinical participants included female gender, age between 18 and 35 years, meeting diagnostic criteria for an anorexia or bulimia nervosa (eating disorders sample), and anxiety, depressive or somatiform disorder (mixed mental disorders sample), based on a structured clinical interview according to the DSM-IV: the DIPS (Diagnostisches Interview für psychische Störungen; Schneider & Margraf, 2011). Participants provided informed consent to participate in the study. Exclusion criteria for all participants were current pregnancy, breastfeeding, or intake of...
Diagnostic interviews were conducted either by telephone or face-to-face. Participants were interviewed shortly after participation agreement and within the first week of treatment start in the case of the patient sample. In addition, medication and use of oral contraceptives were assessed. One week after the interview, self-report questionnaires were sent to all participants using an open-source online survey tool. Healthy participants were invited to a testing afternoon the following week at our lab and patients to a testing afternoon at the corresponding clinical institution. Participants were told not to eat, not to drink anything else but water, not to brush their teeth or use mouth-rinse, and not to smoke within one hour before the start of the testing afternoon due to the assessment of salivary cortisol and salivary alpha amylase (sAA). The testing took place between 2 and 4.30 p.m. with respect to circadian rhythm of physiological stress branches. Assessment of psychological and physiological responses followed a fixed time line (see Figure 2).

Psychological measures on body image dissatisfaction, eating behavior, and mood, as well as physiological measures (HRV and saliva sampling) were assessed before and after media exposure and before and after guided imagery. Saliva was sampled using salivettes at specific time points to capture the peak release after exposure to the stressor (thin ideal vs. landscape exposure and guided imagery; Dickerson & Kemeny, 2004) and participants were asked to wear a Movisens ekgMove ECG chest belt (Movisens, GmbH, Karlsruhe, Germany) during the whole testing afternoon whereof time periods for baseline and expected stress response of PNS were analyzed.

As a cover story, all participants were told that a baseline measurement of physiological parameters would take place. Heretofore, participants were seated in a second room and asked to remain as still as possible during the next 10 min. During this “waiting time,” a magazine was given to participants and participants were asked to look at the magazine closely. In the media exposure condition, the most recent edition of Vogue Germany magazine (June 2014 edition) was used. In the control condition, the Geo Special Germany magazine (cover theme: “Islands”, January 2010 edition) was presented. Both magazines displayed a similar amount of pictures and text. The same magazines were used across all study centers. Exposure started 40 mins after the beginning of the experiment based on an adapted waiting room study design according to Turner et al. (1997) and Wyssen et al. (2016). Participants were asked to wait for 10 min in a second room, being informed that baseline of physiological measures was assessed during this period and were told to look at the pictures in the magazine they were given. Thereafter experimenters applied a standardized protocol to instruct participants to the guided imagery of pictures they viewed in the magazines and found most attractive according to Coelho et al. (2008). This procedure aimed at inducing body-related cognitive distortions of the TSF-B type. Afterwards, participants watched a nature movie during 8 min to assess the salivary amylase peak and HRV reactivity. Participants were asked to close their eyes and to vividly imagine for 5 minutes the thin ideals (Vogue Germany) they found most attractive or the most impressive landscapes (Geo Special Germany) of the magazine previously viewed. After the guided imagery, participants wrote down a short description of the thin ideals or the landscape they just imagined by using the description of “I imagine . . .” increase ego-involvement (Coelho et al., 2010). Afterward, an implicit picture recognition task was carried out, ratings of
Figure 1
CONSORT Flow Diagram of Recruitment and Progress Throughout the Study

A

Recruited patients:
236 (CH), 126 (G) patients contacted and informed about RCT
(assessed for eligibility)

Study participants:
119 (CH), 94 (G) patients enrolled in RCT
(randomized)

Recruited healthy controls:
Appr. 1000 healthy controls contacted and informed about RCT through flyers
(assessed for eligibility)

Study participants:
128 healthy controls enrolled in RCT
(randomized)

Ineligible patients & study refusers:
Excluded (nCH = 117, nG = 32): ● not meeting inclusion
criteria (nCH = 78, nG = 0) ● declined to participate
(nCH = 35, nG = 32) ● other reasons (nCH = 3, nG = 0)

Thin ideal exposure (nCH = 59, nG = 48)
● Patients with AN (nCH = 17, nG = 15)
● Patients with BN (nCH = 20, nG = 14)
● Mixed mental disorders (nCH = 22, nG = 19)
(nCH = 16, nG = 5, nCH = 0) (1 CH), nDEP = 12,
nANX = 6, nSOM = 0 (G)

Landscape exposure (nCH = 60, nG = 46)
● Patients with AN (nCH = 18, nG = 14)
● Patients with BN (nCH = 20, nG = 12)
● Mixed mental disorders (nCH = 22, nG = 20)
(nCH = 15, nANX = 6, nSOM = 1 (CH), nDEP = 11,
nANX = 0, nSOM = 0 (G))

DIPS completers (nCH = 56, nG = 47)
Questionnaire completers (nCH = 52, nG = 46)
Experiment completers (nCH = 48, nG = 42)
Dropout (nCH = 11, nG = 6)
Meeting exclusion criteria (nCH = 5, nG = 4)
Declined to participate (nCH = 1, nG = 0)
Discontinued experiment (nCH = 6, nG = 9)
Unavailable (nCH = 0, nG = 2)

DIPS completers (nCH = 54, nG = 43)
Questionnaire completers (nCH = 47, nG = 39)
Experiment completers (nCH = 46, nG = 38)
Dropout (nCH = 14, nG = 6)
Meeting exclusion criteria (nCH = 7, nG = 4)
Declined to participate (nCH = 4, nG = 3)
Discontinued experiment (nCH = 3, nG = 1)
Unavailable (nCH = 0, nG = 0)

B

Note. Recruitment and progress throughout the study in the clinical (A) and healthy sample (B). nCH = Swiss patients; nG = German patients; nDEP = patients with depressive disorders; nANX = patients with anxiety disorders; nSOM = patients with somatoform disorders.
intensity of imagination vividness as well as anthropometric measures (weight and height) were taken, and participants were debriefed.

**Psychological Measures**

**Diagnostic Interview to Assess Mental Disorders**

The DIPS (Diagnostisches Interview für psychische Störungen; Schneider & Margraf, 2011) is a structured interview based on the DSM-IV-TR (Diagnostic and Statistical Manual of Mental Disorders, 4th ed.; American Psychiatric Association, 2000) with interrater reliability values ranging from .57 to .92, and retest-reliability values (Cohen’s Kappa) ranging from .35 to .94 (Margraf, Cwik, Pflug, & Schneider, 2017). For the purpose of our study, only the DIPS eating disorders section was adapted to the DSM-5 (American Psychiatric Association, 2013; Margraf, Cwik, Suppiger, & Schneider, 2017). Interviewers were trained and supervised by the principal investigator. 10% of the interviews were coded twice by two independent raters based on the audio recordings of the interviews. Interrater reliability for primary diagnoses included the raters’ and the interviewer’s ratings achieved high values (Fleiss K = .850; Fleiss K = .803).

**Visual Analogue Scales to Assess Body Image Dissatisfaction, Mood, and Urge to Engage in Dysfunctional Eating**

Body image dissatisfaction was assessed using Visual Analogue Scales (VAS; 0–100) at four time points over the whole experiment. The measure included 11 items assessing state-dependent body image dissatisfaction on a scale of 0 (low) to 100 (high). Items 1 to 4 were reverse-coded to identify body image dissatisfaction and hence had to be recoded prior to further processing. Examples for body image dissatisfaction are “Right now, how satisfied are you with your body/weight, general appearance?”; “How much do you have problems accepting your body at this very moment?”; “How much do thoughts about your body bother you at this very moment?” Lower scores on the scale indicated lower body image dissatisfaction. Cronbach’s alpha was .95 at baseline.

The modified version of the Brief Mood Scale (Wilhelm & Schoebi, 2007), assessing state levels of valence and calmness was used for momentary assessment of mood on eight Visual Analogue Scales, ranging from 0 (low) to 100 (high), at four time points over course of the experiment. Examples are “Right now, how happy/unhappy, relaxed/nervous, awake/tired, do you feel?” Cronbach’s alpha was .90 at baseline.

Another VAS scale on disturbed eating behavior including seven items was used to assess the tendency toward the urge to engage in binge eating, dieting, excessive exercising, use of laxatives, or medication, and so forth. It assessed urges on a scale ranging from 0 (low) to 100 (high). The scale was administered four times over the whole experiment. Examples are “Right now, how much urge to diet, exercise, vomit, eat, and so forth do you feel?” Cronbach’s alpha was .79 at baseline.

**Physiological Measures**

**HRV**

HRV was assessed continuously during the experimental procedure by Movisens ekgMove chest belts (ambulatory monitoring system; Movisens GmbH, Karlsruhe, Germany) with a sampling frequency of 1,024 Hz throughout the testing afternoon. Raw data were visually inspected and divided into different segments according to the registered time stamps. Interbeat interval (R-R) data were analyzed using Kubios software (University of Eastern Finland, Kuopio, Finland) for the baseline, media exposure, and guided imagery (see Figure 2 and Munsch, 2014), considering a smooth priors detrending method (λ = 500) and correction for artifacts. Spectral values based on the autoregressive method were used to assess PNS activation (high frequency band HF-HRV). Because of severe artifacts in some cases, only data from a total of 271 participants could be included in the analyses.
sAA

Salivary cortisol and sAA were collected repeatedly during the experimental procedure (see Figure 2 and study protocol from Munsch, 2014), before and after media exposure, and before and after guided imagery, using Salivettes (Sarstedt, Nümbrecht, Germany). Samples were stored and frozen at -20°C at the study sites in Switzerland and Germany, prior to analysis at the Laboratory of University of Zürich (Swiss samples) and the Laboratory of the Department of Genetic Psychology at Ruhr-University Bochum (German samples). Salivary cortisol levels were analyzed on a Synergy2 plate reader (Biotek, Winoski, VT), using commercial enzyme-linked immunosorbent assays (ELISAs; free cortisol in saliva; Demeditec, Germany), according to the manufacturer’s instructions. Intraassay and interassay coefficients of variation were <9%. Sensitivity of the assay was .019 ng/ml. To measure salivary alpha amylase, a colorimetric test using 2-chloro-4-nitrophenyl-α-maltrotriosoide (CNP-G3) as a substrate reagent was applied (Lorentz et al., 1999). Intraassay and interassay coefficients of variation were <10%. Sensitivity was at .65 U/ml.

Moderators

Appearance Related Cognitive Factors

The Sociocultural Attitudes Toward Appearance Questionnaire (German version; Knauss et al., 2009) includes 19 items. We selected the mean score which summarizes the item values of three subscales: pressure (to achieve thin ideals), awareness (of thin ideals promoted by media), and internalization (of the promoted thin ideal as a self-reference for an ideal body). Scores range from 1 (not at all) to 5 (absolutely true). Cronbach’s alpha across all involved items was .93.

Body-Related Cognitive Distortions

We used the previously validated German version of the TSF-B to assess cognitive distortions related to the imagination of thin ideals (Wyssen et al., 2017). The TSF-B Questionnaire includes 12 items representing the concept section with two subscales: “imagination of thin ideals” (e.g., “the mere thought of thin women makes me want to exercise”; “if I think about thin women, I want to check that my clothes aren’t fitting more tightly”), and “striving for thin ideals” (e.g., “thinking about giving up my thin ideal is almost as immoral to me as actually giving it up”; “thinking about giving up my thin ideal can make me gain weight”), and seven additional items to assess frequency, impact, suppression, and uncontrollability of TSF-B related thoughts (Clinical impact scale). Cronbach’s alpha for the scale across the 19 items was .96 at baseline.

Covariates

Use of Medication and Hormonal Contraceptives

Participants were asked about their intake of hormonal contraceptives and medication intake 1 week (numerals should be used with units) prior to the experiment, by assessing the exact name and use of the medical product. Current medication was then classified into one of two categories, according to its potential effect on the cardiovascular system and/or HPA axis (specified information is available by the authors).

Vividness of Imagery Check

At the end of the guided imagery, all participants rated the perceived vividness of imagination during the task using a scale from 0 (little vivid) to 10 (very vivid).

Implicit Memory Check

According to our experimental protocol, overall, 98% reported having viewed the magazines as instructed (99% in the landscape condition and 97% in the thin ideal condition). During the implicit picture recognition task, 10 images taken from the magazine of the corresponding condition, and 10 pictures from another issue of the magazine were presented, and participants were asked to select the pictures previously seen in the magazine. To define the level of implicit memory, we calculated a kappa value for each participant, which was based on the four proportions: image correctly identified as previously presented, image correctly identified as previously not presented, image incorrectly identified as previously presented, and image incorrectly identified as previously not presented.

Statistical Data Analysis

We performed an a priori power analysis (see study protocol from Munsch, 2014). The power analysis referred to comparisons between clinical and control groups but did not include comparisons within clinical subsamples.

The list of outcomes included the three self-reported variables body image dissatisfaction, mood, and urge to engage in dysfunctional eating behavior. In addition, we explored changes in the three physiological measures cortisol, sAA, and HF-HRV. A random-intercept model was used to analyze all hypotheses,1 with the 10 treatment facilities as Level 3, subjects within study sites as Level 2, and time within subjects as Level 1 variables. The base model contained the two predictors “prepost” and “thin ideal exposure versus landscape exposure,” as well as “guided imagery of thin ideal versus landscape pictures,” and the interaction between the two, plus the covariate’s country of recruitment (Switzerland/Germany), vividness of imagery and the reliability measure kappa which indicates how well a participant recognized pictures previously seen (implicit memory test). To facilitate the reading, we report the combined results for the two factors “thin ideal exposure versus landscape exposure” and “guided imagery of thin ideal versus landscape pictures,” and the interaction between the two, plus the covariate’s country of recruitment (Switzerland/Germany), vividness of imagery and the reliability measure kappa which indicates how well a participant recognized pictures previously seen (implicit memory test). For the exploratory analyses of the three physiological characteristics (cortisol, sAA, and HF-

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1 The analyses of all hypothesis were according to as planned in the study design (Munsch, 2014), with the following exceptions: We added appearance related cognitive factors (Sociocultural Attitudes Towards Appearance Questionnaire) to the moderator analysis included those covariates as reported in this section.
HRV), the two covariates use of hormonal contraceptives and medication were used in the base model. For Hypothesis 1, the base model was used, while focusing on the interaction effect between prepost and thin ideal exposure plus guided imagery versus landscape exposure plus guided imagery. Effect sizes were calculated according to Feingold (2009), whereby estimates of the standard deviation were based on the baseline measurements of the entire sample.

For Hypotheses 2, the study sample was added as a factor with the levels “eating disorders,” “mixed mental disorders,” and “healthy controls.” An omnibus test, testing the unspecific hypothesis of differences between the three levels was not performed, as we did not consider it of scientific importance. Rather, we expected healthy subjects and eating disorder patient to lie at opposite ends of the spectrum with respect to their effect on the investigated outcomes and the mixed disorder patients lying in between. Therefore, the factor study sample was tested as a linear contrast (i.e., largest effects were expected in the eating disorder sample, intermediate effects in the mixed mental disorder sample, and smallest effects in the healthy controls). Thus, a significant result for this contrast means that indeed the effect of the factor study sample referred to such a pattern.

In statistical terms, the three-way interaction effect Prepost × Thin Ideal Exposure Plus Guided Imagery vs. Landscape Exposure Plus Guided Imagery × Linear [Sample] was of interest. For Hypothesis 3, each of the moderator variables was added separately to the base model: The Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ-G; appearance related cognitive factors) and TSF-B (body-related cognitive distortions). The three-way interaction effects between prepost, thin ideal exposure plus guided imagery versus landscape exposure plus guided imagery, and the respective moderator variable was of main interest. To deal with the multiple testing problem, familywise error rates were controlled for, and all p-values are hence adjusted accordingly using Hochberg’s method (Hochberg, 1988). Each family of tests thereby included the three outcomes examined. For Hypothesis 3, each family contained the three outcomes times the two moderators, resulting in six tests per family. The outcomes urge to engage in dysfunctional eating behavior, sAA, and cortisol were moderators, resulting in six tests per family. The outcomes urge to engage in dysfunctional eating behavior slightly increased after thin ideal exposure and remained on the same level after landscape exposure (H1: Pre_Post × Exposure: b = −4.49, SE = .89, p < .001, d = .17; see Figure S1 in online supplementary materials). This effect was lower after media exposure ($b = -2.34, SE = 1.05, p = .027, d = .1$) than after guided imagery ($b = -6.65, SE = 1.09, p < .001, d = .25$; difference between these two effects: $p = .014$) but did not vary between samples (H2: Pre_Post × Exposure × Linear [Sample]: $b = -1.30, SE = 1.42, p = .360$).

Mood declined after thin ideal exposure followed by guided imagery but increased after landscape exposure pictures followed by guided imagery (H1: Pre_Post × Exposure: $b = -7.56, SE = 1.14, p < .001, d = .39$). This effect was much lower after media exposure ($b = -3.18, SE = 1.35, p = .019, d = .17$) than after guided imagery ($b = -11.95, SE = 1.47, p < .001, d = .62$; difference between these two effects: $p < .001$). Also, this effect was most pronounced in the eating disorder sample, somewhat less in the mixed mental disorder sample, and least so in healthy controls (see Figure 3; H2: Pre_Post × Exposure × Linear [Sample]: $b = -5.66, SE = 1.88, p = .066$).

The urge to engage in dysfunctional eating behavior slightly increased after thin ideal exposure and remained on the same level after landscape exposure (H1: Pre_Post × Exposure: $b = .15, SE = .08, p = .054, d = .07$; see Figure S2 in online supplementary materials). This effect was virtually absent after media exposure ($b = .11, SE = .10, p = .943, d < .01$) but considerable after guided imagery ($b = .32, SE = .09, p < .001, d = .15$; difference between these two effects: $p = .020$). As for body image dissatisfaction, this effect did not vary between samples (H2: Pre_Post × Exposure × Linear [Sample]: $b = .12, SE = .12, p = .330$).

Exploratory analyses revealed no significant results for the three outcomes of physiological stress responses (cortisol, sAA, and HF-HRV) for all hypotheses (H1 and H2: p > .05 for all effects tested). That is, the changes between before and after thin ideal exposure plus guided imagery did not differ from those in the landscape exposure plus guided imagery group (cortisol: $b = .01, SE = .03, p = .762$; sAA: $b = .08, SE = .19, p = .679$; HF-HRV: $b = -.05, SE = .06, p = .415$), nor was this effect influenced by the study samples (cortisol: $b = .03, SE = .05, p = .581$; sAA: $b = -.13, SE = .30, p = .650$; HF-HRV: $b = .05, SE = .10, p = .603$). Notably, baseline values (before media exposure) were 7.86 ($SD = 5.37$) for cortisol, 106.61 ($SD = 108.51$) for sAA, and 886.23 ($SD = 1386.21$) for parasympathetic activation, and they all significantly differed among the four groups: cortisol: $F(3, 270) = 7.43, p < .001$; sAA: $F(3, 271) = 4.38, p = .005$; parasympathetic activation: $F(3, 240) = 3.65, p = .013$. Values for cortisol and sAA decreased after exposure (independent of exposure type: $b = -.181, SE = .016, p < .001$ for cortisol; $b = -.508, SE = .092, p < .001$ for sAA).
Amylase), whereas values for HF-HRV remained constant ($b = .038, SE = .031, p = .221$).

**Hypothesis 3: Moderating Influence of Cognitive Factors (Awareness, Experienced Pressure, and Internalization) as Well as of Cognitive Distortions on the Impact of Exposure**

The correlation between the two moderators tested was .67. The mean score of SATAQ-G moderated the effect of thin ideal exposure plus guided imagery versus landscape exposure plus guided imagery on all three outcomes examined (body image dissatisfaction; $b = -1.45, SE = .18, p = .033$; mood; $b = -1.69, SE = .22, p = .010$; urge to engage in dysfunctional eating behavior; $b = .043, SE = .015, p = .020$), with higher values of SATAQ-G relating to stronger linear increases in body dissatisfaction, and stronger declines in mood when exposed to thin ideal followed by guided imagery rather than landscape pictures followed by guided imagery (see Figure 4A).

Body-related cognitive distortions, measured with the TSF-B, moderated the effect of thin ideal exposure plus guided imagery versus landscape exposure plus guided imagery on mood ($b = -2.30, SE = .09, p = .001$; see Figure 4B), with higher values of TSF-B relating to a stronger linear decline of mood when exposed to thin ideal followed by guided imagery rather than landscape pictures followed by guided imagery. The corresponding effects on body image dissatisfaction ($b = -1.09, SE = .07, p = .196$) and on the urge to engage in dysfunctional of eating behavior ($b = .012, SE = .006, p = .051$) were, in contrast, not significant.

**Discussion**

Building on preliminary research (Loeber et al., 2016; Wyssen et al., 2016), the current study applied a rigorous approach to examining the impact of exposure to thin ideals via beauty magazines, plus guided imagery, on body image, mood and eating behavior, thereby investigating cognitive processes contributing to a higher susceptibility toward such effects in young healthy and women with mental illness. The presence or absence of an eating disorder or of mixed disorders was verified using structured diagnostic interviews. Efforts to validate the effect of the experimental manipulation included an implicit memory test and the assessment of the vividness of the imagination of thin ideal versus landscape pictures thereafter. Findings of both measures revealed that women recognized more than two third of the pictures they had seen before correctly, independent of the sample they were in. Vividness of imagery was comparable to other studies (Coelho et al., 2012; Ouellet-Courtois et al., 2015).

As hypothesized (Hypothesis 1), after exposure to thin ideals and even more pronounced after guided imagery, state-dependent measures of body image dissatisfaction and mood deteriorated in women across all samples. In contrast, the urge to engage in dysfunctional eating behavior was only affected after guided imagery but not in response to the mere exposure to thin ideal pictures. Overall, effect sizes were moderate for mood, small for body image dissatisfaction, and very small for urge to engage in dysfunctional eating behavior. Also, media exposure effects were smaller throughout the paradigm compared to effects provoked by guided imagery. Interestingly, mood
increased after exposure to and imagery of landscape pictures, consistent with the findings of Blackwell and colleagues in depressive patients (Blackwell et al., 2015). The decline of mood after thin ideal exposure and guided imagery was also found in prior research (Turner et al., 1997). According to negative affect models of disturbed eating behavior, the deterioration of mood after viewing thin ideals in a magazine and processing them during guided imagery could contribute to an increased reward of high-calorie food and to overconsumption, dieting or purging behavior to alleviate aversive mood in daily life. After overconsumption, for example, negative mood might increase again and perpetuate the vicious circle (Aldao, 2016; Haedt-Matt et al., 2014; Stice et al., 2017).

Note. Moderating effect of appearance related cognitive factors (Sociocultural Attitudes Toward Appearance Questionnaire [SATA-Q]; A) and eating and body-related cognitive distortions (Thought-Shape Fusion [TSF]/Thought-Shape Fusion Body [TSF_B] trait; B) on changes in mood following either thin ideal exposure plus guided imagery or landscape exposure plus guided imagery. Values denote predicted values from a multilevel model.
body image dissatisfaction are mostly small (Hausenblas et al., 2013; López-Guimerà et al., 2010). Women’s attitudes toward their own body tends to be remarkably stable during life span, while the importance of body shape and weight seems to decrease until they are elderly (Tiggemann, 2004). It might be assumed that the mere exposure to thin ideals in magazines does not lead to larger effects unless it is accelerated by a daily repeated exposure or a more personalized comparison process via social media such as Instagram, for example (Hogue & Mills, 2019). Only such multiply-determined processes might funnel into more pronounced negative feelings about one’s own body (Haedt-Matt et al., 2012; Wyssen et al., 2020).

Mood was the only outcome where the observed effects varied among samples, with women with eating disorders being most impaired, followed by women with mixed mental disorders, and healthy women. This finding partly supports our assumption regarding the specificity of the effects of thin ideal exposure for women with eating disorders (Hypothesis 2). Future studies should investigate whether women with bulimia nervosa would exhibit more pronounced effects in response to thin ideal exposure than women with anorexia nervosa, as recently pointed out by Stice and colleagues (Stice & Desjardins, 2018; Stice et al., 2017).

The present study also explored whether thin ideal exposure via magazines followed by guided imagery would provoke physiological stress responses (Kudielka & Wüst, 2010) but did not find any evidence for such an effect. Instead, we found a general decline of salivary cortisol and sAA, and no change in HF-HRV during the experimental paradigm, indicating that if the expectations related to an unknown forthcoming condition provoke physiological stress responses at all, then independent of the content of exposure. Therefore, our findings are in line with other studies where body confrontation led to self-reported impairments, but repeatedly failed to result in consistent HPA axis activation (Servián-Franco et al., 2015; Svaldi et al., 2009; Vocks et al., 2007). The high levels of HF-HRV in the clinical samples with ED patients at baseline can be explained by the impact of a limited caloric intake as found in previous studies (Martin et al., 2007; Peschel et al., 2016). Further low HF-HRV levels are expected in depressed samples, which corresponds with the results showing lower HF-HRV levels in the mixed groups than in other groups. In addition, similar group differences in cortisol levels have been reported previously in other studies which had been discussed to be influenced by the current malnutrition status, and potentially by preexisting trauma (Lelli et al., 2019; Luz Neto et al., 2019).

The mismatch of mood change and physiological responses to the tasks has previously been reported in many other studies (see review in Campbell & Ehler, 2012) and might be related to the independently varying components of the stress response structure and to moderating factors (e.g., assessment features, psychological and physiological dispositions of the individuals; Campbell & Ehler, 2012). The mismatch in this study could be related to the time differences in peak assessment that the different physiological stress responses demand and which might not overlap with the fast changes of mood states in individuals during and after a task. Further, other aspects such as physiological and psychological dispositions (i.e., psychological traits and physiological preconditions) might have influenced these results (Campbell & Ehler, 2012).

More pronounced appearance related cognitions (SATAQ-G) were related with an increased effect of exposure and guided imagery of thin ideals on body image dissatisfaction, mood and on the urge to engage in dysfunctional eating behavior, while more pronounced body-related distortions (TSF-B) accelerated mood decline (Hypothesis 3). An increase in body-related distortions and appearances related cognitive factors by 1 SD was associated to a mood decline after thin ideal exposure and guided imagery by 3.83 and 3.47 points, respectively. Although cognitive distortions seem to propel negative mood induction (Coelho et al., 2015), appearance related cognitive factors foster the repetitive comparison of one’s own body to an internalized unrealistic ideal, leading to an increased self-ideal discrepancy, decreased mood, and increased body image dissatisfaction (Hausenblas et al., 2013; Stice et al., 2017). Our findings add to the understanding of the role of cognitive factors in the dual pathway and the negative affect model of disturbed eating behavior. Future studies should specify, whether certain individuals are more vulnerable to the influence of cognitive processes which relate daily thin ideal exposure to a negative body image and to negative mood.

The findings of the present study have to be interpreted against the background of several limitations. We applied an adapted version (Wyssen et al., 2016) of the waiting room paradigm according to Turner et al. (1997), favoring ecological validity of the laboratory media exposure and guided imagery. Although the majority of the women actually viewed the pictures during the laboratory paradigm, and the majority of pictures were correctly recognized or rejected thereafter, we did not control for gaze behavior, which would have allowed to refer to attentional processes during exposure. For future studies, it would be interesting to investigate which of the picture or pictures the participants imagined during guided imagery, and whether specific features of a picture, such as color palette, influenced the effect of exposure and guided imagery. As mentioned, we did not find mere exposure to have an influence on mood, body image dissatisfaction, and urge to engage in dysfunctional eating behavior. These parameters were only impaired after the induction of guided imagery. Nevertheless, future studies should include an additional mere exposure condition, to detail out the effect of a longer time span of engagement versus the specific effect of guided mental processing during guided imagery. It should further be examined, whether viewing thin ideal pictures in social media elicits qualitatively and quantitatively different processes (Twenge & Campbell, 2019). Finally, it would be interesting to know whether similar processes apply in male participants, where body ideals are known to include both the thin but also the muscular ideal (Murray et al., 2017). We recruited a large sample of 275 young female patients, which allowed us to detect clinically meaningful effects between clinical and control groups, while effects among clinical subsamples or higher order-effects such as the moderating influence of cognitive factors would probably require even larger sample sizes (Heo & Leon, 2010). In addition, women in the healthy control sample were recruited at one study site only and were primarily university students. Our findings cannot be generalized to women outside the age range of 18–35 years, nor to women suffering from binge eating disorder, or to males.

Conclusion

Given the effect of a single laboratory-based exposure to thin ideals followed by guided imagery of the most attractive bodies on
self-reported mood and body image dissatisfaction, it can be assumed that such effects are multiplied and influence psychological wellbeing of a majority of young women (especially in women with eating disorders) on a daily basis. After mere exposure, negative affect was accelerated as soon as women imagined the most attractive bodies. These findings highlight the importance of the processing of thin ideal stimuli. Previously neglected appearance related cognitive mechanisms and cognitive distortions (Culbert et al., 2015) might propel the vicious circle between dysfunctional attitudes toward the own body and the self and negative mood.

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