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Characteristics and content of intrusive images in patients with eating disorders

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Abstract

The aim of this study was to examine the characteristics and content of intrusive images in patients with different subtypes of eating disorders (EDs). Data were collected from 74 ED patients, 22 dieting, and 29 nondieting controls. Participants completed a set of self-report questionnaires. Intrusive images of ED patients were significantly more repetitive, detailed, vivid, and distressing than intrusive images of dieting and/or nondieting controls. Most of the intrusive images were the same for the ED subtypes; however, patients with anorexia nervosa were more likely to report an observer vantage perspective than patients with bulimia nervosa, who were more likely to report a field vantage perspective. As expected, intrusive images' content was related to body checking (weight and shape) or negative self (evaluated by themselves or others). Finally, there were significant associations between intrusive images' vividness and weight and shape concerns. These findings indicate that intrusive images may be a core element of EDs and targeting intrusive images in therapy may be helpful.

KEYWORDS
eating disorders, eating disorder subtypes, intrusive images

1 | INTRODUCTION

Transdiagnostic cognitive theories of eating disorders (EDs) highlight the dysfunctional core beliefs of evaluating self-worth in terms of eating, weight, and shape (Cooper, 2005; Fairburn, 2008; Fairburn, Cooper, & Shafran, 2003). These underlying beliefs are represented in automatic thoughts and images that play a key role in maintaining the EDs (Cooper, Todd, & Wells, 1998). Although past research on EDs has primarily focused on the role of verbal cognition, recent research has identified that mental imagery plays a role in the onset of

mental disorders (Çili & Stopa, 2015) and is a possible core maintaining mechanism of EDs (e.g., Somerville, Cooper, & Hackmann, 2007).

Mental imagery refers to mental representations and the associated activation of sensory modalities without a direct external stimulus (Pearson, Naselaris, Holmes, & Kosslyn, 2015). Intrusive images are defined as mental representations triggered by situational or bodily cues, and they can involuntarily pop into consciousness and can be highly distressing to the individual (Krans, Näring, Becker, & Holmes, 2009). In fact, the intensity of emotions evoked by negative mental images exceeds the

intensity of emotions evoked by analogue verbal cognition (Holmes & Mathews, 2005).

Intrusive images have been identified as a common factor across different mental disorders (Pascual-Vera, Roncero-Sanchís & Belloch Fuster, 2017; Pearson & Krans, 2017), including posttraumatic stress disorder (PTSD; Ehlers et al., 2002), depression (Kuyken & Brewin, 1994), social anxiety (Hackmann, Clark, & Mcmanus, 2000), body dysmorphic disorder (Osman, Cooper, Hackmann, & Veale, 2004), obsessive compulsive disorder (Speckens, Hackmann, Ehlers & Cuthbert, 2007), and hypochondriasis (Muse, McManus, Hackmann, Williams, & Williams, 2010). These studies have highlighted that intrusive images tend to be repetitive, uncontrollable, and distressing (Brewin, Gregory, Lipton, & Burgess, 2010). They also appear to be closely related to negative early memories in content and meaning (Hackmann & Holmes, 2004). For instance, patients with bulimia nervosa (BN) linked intrusive images with memories related to negative comments about their weight/shape and being self-conscious about their appearance. In fact, it is proposed that intrusive images may maintain psychopathology because they represent the self and contain self-beliefs (e.g., I am a failure) that originate from previous negative experiences (Çili & Stopa, 2015). Intrusive images also represent goals that try to avoid the threat (or the state of the world) represented by the intrusive image (e.g., being overweight; Conway, Meares, & Standart, 2004; Çili & Stopa, 2015).

The occurrence of intrusive images is thus a transdiagnostic phenomenon; however, there is evidence that their content and nature may also have disorder-specific elements (Brewin et al., 2010). For example, patients with EDs tend to report negative images related to their appearance, with a focus on weight and body shape (Cooper et al., 1998; Somerville et al., 2007), whereas, for example, patients with social anxiety report images related to negative impressions of themselves in social situations (Wild, Hackmann, & Clark, 2008).

Few studies have specifically assessed intrusive images in ED patients. The available studies are limited to BN and overweight individuals with binge eating behaviours. Somerville et al. (2007) compared the occurrence and characteristics of intrusive images that are experienced when worrying about eating, weight, or shape in patients with BN, and in dieting and nondieting control groups. Patients with BN experienced more recurrent images that tended to be vivid and detailed and were marked by higher levels of negative emotions compared with both control groups. The authors further reported that even though the modality of the image was most often visual, images could also contain cutaneous (e.g., tight clothes) and organic (e.g., sense of heaviness) sensations. More

Highlights

- The majority of patients with an eating disorder (ED) experiences intrusive images, which were significantly more repetitive, detailed, vivid, negative, and distressing than images of dieting and/or nondieting control groups.
- Intrusive images are prevalent among patients with all ED subtypes but can have specific features for the different subtypes.
- There are significant associations between intrusive images′ vividness and ED severity, specifically weight and shape concerns.

recently, Dugué, Keller, Tuschen-Caffier, and Jacob (2016) reported that overweight individuals with binge eating behaviours experienced more intrusive images prior to binge eating episodes than a healthy group and a mixed clinical non-ED patient group and that these images were more distressing, distracting, more difficult to control, and followed by a higher desire to eat in binge eating disorder (BED; Dugué et al., 2016). Finally, Hinrichsen, Morrison, Waller, and Schmidt (2007) showed that patients with BN experience recurrent intrusive images related to adverse life events before self-induced vomiting (Hinrichsen et al., 2007).

1.1 | Purpose of the current study

Taken together, intrusive images may be a prominent feature of EDs with a key role in the maintenance of ED symptoms. It is important to explore characteristics and content of intrusive images in all ED subtypes, as current studies are limited to BN. In the present study, we examined the characteristics and content of intrusive images in patients with different subtypes of EDs, and in dieting and nondieting controls. First, we hypothesized that ED patients would report intrusive images that are more repetitive, vivid, have a more negative valence, are more distressing, and are higher in number of sensory modalities than both control groups (Dugué et al., 2016; Somerville et al., 2007). Second, within the ED group, we did not expect to find significant differences among ED subtypes in characteristics of intrusive images (i.e., repetitiveness, number of modalities, vividness, valence, anxiety inducing, and vantage perspective), based on the transdiagnostic model (Fairburn, 2008). Given that ED patients have high levels of comorbidity with other disorders that are characterized by intrusive images, symptoms

of anxiety and depression were also assessed to control for their effects on intrusive images in our ED sample. Third, we expected that the content of intrusive images would be congruent with ED themes such as body checking (weight and shape), food images, or negative self (evaluated by themselves or others; Fairburn, 2008). Fourth, we expected to find positive associations between characteristics of the intrusive images (vividness, negative valence, and anxiety associated with the images) and ED severity.

2 | METHODS

2.1 | Participants

The sample consisted of 74 ED patients who were receiving treatment in inpatient and outpatient units in Belgium and the Netherlands at the time of testing. The study included patients with anorexia nervosa, restrictive subtype (AN-R; $n = 20$, 27%), anorexia nervosa, binge eating/purging subtype (AN-BP; $n = 13$, 17.6%), BN ($n = 24$, 32.4%), BED ($n = 11$, 14.9%), and other specified feeding and EDs ($n = 6$, 8.1%). In case of suicidality or substance dependency or if the subject was in crisis, they were not invited for the study. The ED diagnosis was based on self-report and cross-validated using the Eating Disorder Examination-Questionnaire (EDE-Q; see Section 2.2). Two control groups consisted of 22 female dieting participants and 29 female nondieting participants who were recruited from a university participant pool and from health and slimming clubs. Control group participants were assigned to the dieting or nondieting group based on their average scores on the revised version of the EDE-Q's restraint scale, which included three items indicating normal dieting (Items 1, 3, and 4; average score of 4 or higher indicated healthy dieting; based on Belon, 2012). The majority of ED participants ($n = 67$, 90.5%) and all controls were female, and participants' age ranged from 16 to 51 years ($M = 24.73$, $SD = 7.03$). See Table 1 for descriptive data.

2.2 | Materials

Reported Cronbach alpha coefficients were calculated in the present sample.

2.2.1 | Demographic data

Data on age, gender, level of education, employment status, marital status, nationality, and diagnosis were collected through a questionnaire.

TABLE 1 Means and standard deviations for all participants on self-report measures

	ED (n = 74)		Dieting (n = 22)		Nondieting (n = 29)	
	M	(SD)	M	(SD)	M	(SD)
Age	26.7	(8.42)	22.7	(2.47)	21.35	(2.17)
BMI	22.3	(6.53)	22.9	(3.09)	22.07	(4.2)
EDE-Q total score	3.5	(1.26)	2.25	(0.68)	1.2	(0.82)
EDI-2 subscales						
Perfectionism	23.7	(6.36)	17.9	(7.37)	15.2	(6.47)
Dieting	31.5	(7.98)	22.8	(6.45)	16.8	(6.48)
Bulimia	22	(9.64)	13.2	(4.01)	11.7	(4.12)
Body dissatisfaction	41.9	(9.55)	32.3	(8)	28	(10.79)
DASS-21 subscales						
Depression	8.8	(5.83)	2.6	(2.57)	3.1	(4.62)
Anxiety	5.9	(4.81)	2.7	(1.88)	3.9	(4.28)
Stress	9.9	(4.98)	6.9	(5.32)	5.9	(5.01)
PSS-SR	13.6	(8.99)	5.7	(5.29)	6.5	(7.53)
Current treatment	N (%)					
Inpatient	7 (9.5)					
Outpatient	67 (90.5)					

Note. BMI: body mass index; EDE-Q: Eating Disorder Examination-Questionnaire; EDI-2: Eating Disorders Inventory-2; DASS-21: Depression Anxiety Stress Scale; PSS-SR: PTSD Symptoms Scale Self-Report.

2.2.2 | ED symptoms

The EDE-Q (Fairburn & Beglin, 1994) is a 32-item self-report questionnaire that assesses ED psychopathology over the past 28 days. Twenty-two items are rated on a scale ranging from 0 (*not at all*) to 6 (*every day*), and 10 items assess the presence (yes or no) and the frequency of specific behavioural features. The EDE-Q comprises four subscales: restraint ($\alpha = 0.77$), eating concern ($\alpha = 0.82$), weight concern ($\alpha = 0.86$), and shape concern ($\alpha = 0.92$), as well as a global score that is the average of the subscales ($\alpha = 0.95$). The EDE-Q has well-established psychometric properties (Berg, Peterson, Frazier, & Crow, 2011).

The Eating Disorders Inventory-2 (EDI-2; Garner, 1991) is a self-report questionnaire used to assess the presence of ED and related symptoms. The EDI-2 consists of 91 items to be rated on a 1 (*never*) to 6 (*always*) point Likert scale and has 12 subscales. In the present study, we used four subscales: drive for thinness ($\alpha = 0.92$), bulimia ($\alpha = 0.93$), body dissatisfaction ($\alpha = 0.92$), and perfectionism ($\alpha = 0.87$), total score: $\alpha = 0.95$.

2.2.3 | Stress, anxiety and depression

The Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995b) is a 21-item self-report questionnaire that assesses the current level of depression, anxiety, and stress. Items are rated on a 0 (*never*) to 3 (*almost always*) point Likert scale. It has satisfactory psychometric properties (Lovibond & Lovibond, 1995a). Cronbach alpha coefficients in the present sample were: total score ($\alpha = 0.95$), depression ($\alpha = 0.93$), anxiety ($\alpha = 0.84$), and stress ($\alpha = 0.90$).

The PTSD Symptoms Scale Self-Report (PSS-SR; Foa, Riggs, Dancu, & Rothbaum, 1993) is a 17-item self-report questionnaire that assesses the frequency of symptoms of PTSD according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (American Psychiatric Association, 1994). Items are rated using a Likert scale ranging from 0 (*not at all or only one time*) to 3 (*almost always or five or more times per week*). It has adequate validity (Foa et al., 1993). The PSS-SR had a good reliability in the current study: total score ($\alpha = 0.90$), re-experiencing ($\alpha = 0.82$), avoidance ($\alpha = 0.84$), and arousal ($\alpha = 0.74$).

2.2.4 | Intrusive images

The Spontaneous Images Questionnaire is a self-report questionnaire based on the work of Somerville et al. (2007) and was further developed for the specific purpose of the current study. The Spontaneous Images Questionnaire collects information on intrusive mental images that ED patients experience when worrying about their eating, weight, and/or shape. Participants were asked to identify whether they had experienced any spontaneous mental images when they were worrying about their eating, weight, and/or shape, and if they had, they were requested to report how often they experienced intrusive images (recurrence). Then, participants were asked to provide a detailed description of the image content in terms of sensory modalities of the image: visual, auditory, gustatory, olfactory, kinaesthetic, cutaneous, and organic. For the visual modality, participants also rated the vantage perspective in the image, with "0" being "completely from field perspective" or first-person perspective and "100" being "completely from observer perspective" or third person perspective. For all modalities, participants rated the vividness on a Likert scale ranging from 0 (*not vivid*) to 100 (*highly vivid*). They were also asked to rate the valence on a Likert scale from −3 (*extremely negative*) to +3 (*extremely positive*), and the degree of anxiety that was induced by the image at its worst, from 0 (*not at all*) to 100 (*extreme*).

2.3 | Coding scheme

The content of intrusive images reported by ED patients was coded independently by two raters (F. K. and J. K.). The same intrusive image could be assigned to more than one category. Interrater agreement was $\kappa = 0.87$ before discussion, and all disagreements were resolved after discussion. Intrusive images reported by controls were coded by one rater (F. K.). Intrusive images were categorized in themes inferred from the transdiagnostic cognitive behavioural theory on EDs (Fairburn, 2008; Fairburn et al., 2003).

Self-worth ($\kappa = 0.86$) describes dysfunctional cognitions of self-worth being based on body weight, shape, size, and its control (e.g., "If I gain weight, then I am a failure/worthless"; Cooper, Wells, & Todd, 2004; Fairburn, 2008). Mental images that linked perceived appearance with overall self-worth were assigned to this category.

Social-evaluation ($\kappa = 0.96$) describes ideas that acceptance by others is based on one's body weight, shape, and control over eating. For example, "being fat" may be associated with being rejected, bullied, or disliked. Images that conveyed such descriptions were placed in this category.

Global body checking ($\kappa = 0.84$) included images of the whole body rather than focusing on a specific body part. Excessive concern about weight and shape is manifested through frequent checking or avoidance of knowing one's size or perceived body shape (Fairburn, 2008). Body checking often goes along with self-criticism; hence, it maintains the overvaluation of shape and weight (Shafran, Fairburn, Robinson, & Lask, 2003). Overweight individuals with BED may also engage in body checking and body shape avoidance, which may evoke or maintain feelings of disgust, which in turn hinders efforts at weight loss (Reas, Grilo, Masheb, & Wilson, 2005).

Selective body checking ($\kappa = 0.88$) included images of specific body parts. It is suggested that selective body part checking constitutes a cognitive bias by focusing on disliked body parts (Shafran et al., 2003). These are then evaluated in negative terms or may be interpreted as indicators of failure of control over their eating, thereby motivating behaviours that help achieve the valued goals of controlling eating, shape, and weight (Fairburn, Shafran, & Cooper, 1999).

Body comparison ($\kappa = 1.0$) is another form of body checking, which includes comparing one's body to that of other people. Given that the process of comparison is characterized by cognitive biases (e.g., selective attention to disliked parts of one's body and/or choosing biased reference groups), patients usually conclude that their body is less attractive than that of others (Fairburn, 2008). Images that emphasized the comparison of the body with that of others were assigned to this category.

Distorted body image ($\kappa = 0.60$) can be defined as an unrealistic view of one's body. Fairburn (2008) suggests that body scrutinizing is sometimes associated with magnification of apparent defects (e.g., overestimating the body size). Intrusive images that portrayed a clearly distorted body view, relative to the participant's reported body mass index, were coded as "distorted body image."

Feeling fat/swollen/tightness ($\kappa = 0.75$) included mental images containing these sensations. It is suggested that these sensations may be equated by ED patients with being fat, regardless of the actual weight or body shape and size (Fairburn, 2008).

Food images ($\kappa = 0.87$) include images of food and eating, which reflect the preoccupation with eating and its control.

Categories that were found in five or fewer intrusive images were not included in the analyses. These included post binge eating images ($n = 2$; shame and disgust, fullness, etc.), purging ($n = 4$; e.g., vomiting), thin ideal ($n = 5$; e.g., perfect body), and feeling handicapped or disabled due to weight or body size ($n = 2$; e.g., not being able to move or bumping into other people due to being overweight or large).

2.4 | Procedure

All measures were provided to the participants in pen and paper format. Clinicians or master students of the psychology department (for the control groups) distributed the informed consent form and the questionnaires in envelopes to their clients or volunteers. After participants had completed the questionnaires (which could be at home or in the inpatient clinic), they returned their informed consent and questionnaires in a sealed envelope to the clinician or to the student, who handed them over to one of the researchers. Data were collected from 2017 to 2018. We received ethical approval for this study by the medical/ethical committee of the KU Leuven (ML10927).

2.5 | Data analysis

Analyses were carried out with the statistical software package IBM SPSS 22 for Windows. We performed chi-square tests for categorical data and analysis of variance for continuous data. We collapsed data from the healthy dieting and nondieting control groups when testing differences on occurrence (frequency) and repetitiveness of intrusive images, due to the small sample size. We used covariance analyses with PSS-SR and DASS-21 scores as covariates to compare ED group, dieting, and nondieting control groups on the characteristics of intrusive images. We explored the content categories of intrusive images across groups using chi-square tests. Finally, we used Spearman rank correlation and linear regression analyses to investigate whether intrusive images' characteristics are associated with ED severity.

3 | RESULTS

3.1 | Descriptive data

Comparison of the total ED group and the control groups revealed no significant differences in gender, body mass index, work status, and marital status (all $p < 0.05$). However, ED patients were older than the nondieting controls ($U = 667.5$, $p = 0.003$) but did not significantly differ from the dieting controls. ED patients also had a higher level of education than both dieting and nondieting control groups ($U = 486$, $p = 0.008$; $U = 734.5$, $p = 0.025$). Comparisons of ED subtypes did not reveal any significant differences in demographic variables (all $p < 0.05$).

ED patients were more depressed than both the dieting and the nondieting control groups (respectively $U = 285$, $p = 0.000$; $U = 404$, $p = 0.000$), more stressed ($U = 546.5$, $p = 0.012$; $U = 578.5$, $p = 0.000$), and had higher levels of PTSD symptoms ($U = 336.5$, $p = 0.000$; $U = 489.5$, $p = 0.000$) and ED symptoms as measured by EDE-Q and EDI-2 (all comparisons $p < 0.002$). ED patients were more anxious than dieting participants only ($U = 538.5$, $p = 0.012$).

Comparisons between ED subtypes revealed differences in PTSD symptoms, $F(4, 65) = 5.23$, $p = 0.001$, $\eta_p^2 = 0.244$; Bonferroni post hoc tests indicated that patients with AN-BP had higher levels of PTSD than patients with AN-R ($p < 0.005$) and BN ($p < 0.000$).

3.2 | Group comparisons (Aims 1 and 2)

3.2.1 | Frequency of intrusive images

Spontaneous intrusive images occurred in 93.2% of the ED patients, 95.5% of the dieting, and 75.9% of the nondieting participants. ED patients were not more likely than controls to report intrusive images. We could not analyse the ED subtypes due to small sample size.

3.2.2 | Frequency and repetitiveness of intrusive images

In total, 64.5% of the ED participants, 9.1% of the dieting participants, and 3.4% of nondieting participants described their intrusive images as recurrent (defined as often or always). The difference in the recurrence of

intrusive images (on a continuous scale) between ED patients ($M = 1.74$, $SD = 0.89$) and the two control groups ($M = 0.45$, $SD = 0.67$; $M = 0.31$, $SD = 0.54$) was statistically significant, $F(2, 110) = 44.25$, $p = 0.000$, $\eta_p^2 = 0.44$. Bonferroni post hoc analyses showed both comparisons to be significant at $p < 0.001$.

No significant differences in the recurrence of intrusive images were found between patients with the different ED subtypes, $F(4, 57) = 1.59$, $p = 0.188$.

3.2.3 | Characteristics of intrusive images

Most of the intrusive images of ED patients, healthy dieting, and nondieting participants were predominantly visual in nature (73.2%; 68.2%; 58.6%), followed by bodily sensations (organic; 44.1%; 27.6%; 17.2%), and performing actions (kinaesthetic; 37.7%; 13.6%; 27.6%). Other modalities (e.g., smell or taste) were not often found. The mean number of sensory modalities was $M = 2.25$ ($SD = 1.70$) for ED patients, $M = 1.5$ ($SD = 1.18$) for dieting control, and $M = 1.34$ ($SD = 0.42$) for nondieting controls. Nondieting participants, but not dieting participants, compared with ED patients reported a significantly lower mean score on sensory modalities (overall model: $F(2, 110) = 4.23$, $p = 0.017$, $\eta_p^2 = 0.07$; Bonferroni post hoc test: $p = 0.030$). There were no significant differences between patients with different ED subtypes in the mean number of sensory modalities per image, $F(4, 68) = 4$, $p = 0.300$.

ED patients rated their intrusive images as more vivid and more anxiety provoking than controls, more negative than nondieting participants only, and they did not differ in vantage perspective (see Table 2). PTSD symptoms, depression, and anxiety scores (DASS-21) were added as covariates to control for their effects on group differences. Vividness remained significantly higher in ED than in nondieting participants ($p = 0.009$), but not compared with dieting participants ($p = 0.144$), $F(2, 82) = 5.24$, $p = 0.007$, $\eta_p^2 = 0.113$. The differences in valence became nonsignificant, $F(2, 80) = 2.71$, $p = 0.148$. The covariate depression scores remained significantly related to valence, $F(1, 80) = 5.41$, $p = 0.022$. Differences in anxiety related to intrusive images remained significant ($p = 0.017$; $p = 0.000$, respectively), $F(2, 81) = 10.98$, $p = 0.000$, $\eta_p^2 = 0.213$.

Patients with different ED subtypes did not differ in the mean rating of vividness, valence, and anxiety, but they did differ in vantage perspective (see Table 2). Bonferroni post hoc comparisons indicated that patients with AN-R ($p = 0.039$) and AN-BP ($p = 0.007$) were more likely to take the observer perspective than BN patients. However, with PTSD, depression, and anxiety scores as covariates, the differences became nonsignificant, $F(4, 41) = 2.01$, $p = 0.111$.

TABLE 2 Mean ratings and group comparisons (between ED and control groups and between ED subtypes) on valence, anxiety, vividness, and vantage perspective associated with intrusive images

	ED participants		AN-R		AN-BP		BN		BED		Dieting		Nondieting		ANOVA comparisons between EDs and control groups	ANOVA comparisons between ED subtypes
	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)		
Valence	−1.79	1.33	−2.6	0.86	−1.65	1.92	−2.15	0.71	−1.82	1.97	−0.97	1.46	−0.89	1.06	$F(2, 88) = 8.36$, $p = 0.000$, $\eta_p^2 = 0.096$	$F(4, 51) = 0.664$, $p = 0.620$
Anxiety	68.1	25.8	58.8	32	71.4	23.7	75.1	19.4	63.3	26.7	36	27.7	31.3	26	$F(2, 88) = 4.69$, $p = 0.012$, $\eta_p^2 = 0.304$	$F(4, 52) = 0.890$, $p = 0.477$
Vividness	66.9	19.5	57.6	18	69	22.1	65.3	21.6	76.2	12.1	50.9	20.9	46.6	25.3	$F(2, 89) = 19.47$, $p = 0.000$, $\eta_p^2 = 0.160$	$F(4, 51) = 1.47$, $p = 0.225$
Vantage perspective	49.3	30.3	61.7	27.9	70	19.7	30.7	26.4	42.8	34	58.7	36.8	48	38.2	$F(2, 81) = 0.550$, $p = 0.579$	$F(4, 47) = 4.21$, $p < 0.01$, $\eta_p^2 = 0.26$

Note. ANOVA: analysis of variance; ED: eating disorder; AN-R: anorexia nervosa restrictive subtype; AN-BP: anorexia nervosa binge purging subtype; BN: bulimia nervosa; BED: binge eating disorder.

Further, none of the covariates were significantly related to the vantage perspective in the adjusted model.

3.3 | Categorization of intrusive image content

Among ED patients, the most common categories were body distortion (41.1%), selective body checking (40%), global body checking (36.4%), and social evaluation (34.5%; see Table 3). Among dieting and nondieting participants, the most common categories were global body checking (54.5%; 58.6%), selective body checking (27.3%; 31%), and body distortion (22.7%; 20.7%). The rest of the categories were rarely reported in the control groups. Group comparisons suggested that ED patients compared with control groups had more images of body distortion, social evaluation, and bodily sensations. Cramer's V indicated weak group differences in their content of intrusive images of body distortions, social evaluation, and bodily sensations. We did not test differences between ED subtypes due to small sample sizes.

3.4 | Associations between intrusive images and ED symptoms

Spearman rank correlations were calculated to examine whether valence, anxiety, vividness, and vantage perspective associated with the intrusive image were correlated with ED severity (as measured by EDE-Q and EDI-2). To control for Type I error, the Bonferroni correction was used. Thus, correlations at p values lower than 0.006 were considered statistically significant.

First, we tested these associations in the total sample, including ED patients and control groups. Vividness, negative emotional valence, and anxiety of intrusive images, but not vantage perspective, were positively correlated with all subscales of the EDE-Q and EDI-2. All correlations were statistically significant ($p < 0.006$), except for the correlations between emotional valence and eating restraint ($r = -0.26$, $p = 0.012$) and emotional valence and perfectionism ($r = -0.24$, $p = 0.023$).

In the ED group only, vividness of the image, but not its emotional valence, vantage perspective or anxiety, was significantly associated with weight and shape concern only (see Table 4).

Two linear regression analyses were performed to examine if vividness predicted weight concerns and shape concerns. Vividness was indeed found to significantly predict participants' weight concern, explaining 18% of the variance, $F(1, 54) = 22.6$, $p = 0.001$; $\beta = 0.42$ and participants' shape concern, explaining 14% of the variance, $F(1, 53) = 8.55$, $p = 0.005$; $\beta = 0.37$.

4 | DISCUSSION

The current study sought to explore characteristics and content of intrusive images of individuals with different subtypes of EDs, compared with a dieting and nondieting control group. In line with our first hypothesis, intrusive images in ED versus nonclinical participants were more repetitive, vivid, negative, and anxiety provoking and were richer in sensory modalities (in line with e.g., Dugué et al., 2016; Osman et al., 2004; Pratt, Cooper, & Hackmann, 2004). Second, as expected, the intrusive image characteristics of patients with different subtypes of EDs were similar but unexpectedly differed in vantage perspective. Third, as predicted, the content of intrusive images was ED-congruent. ED patients had more images of their distorted body, being socially evaluated for their body, and more bodily sensations (e.g., fullness or heaviness) than controls. And fourth, only partially supporting our hypothesis, there was a link between intrusive image vividness, but not other characteristics of images, and body weight and shape concerns.

4.1 | Group comparisons

4.1.1 | Comparison of ED patients with healthy controls

Overall, a large proportion of participants reported intrusive images (93.2% of ED patients and 89.6% of the total sample), supporting the idea that intrusive images are also a feature of cognition in a healthy population, rather than being specific to psychological disorders (Krans, Bree, & Moulds, 2015; Newby & Moulds, 2011). However, intrusive images of ED patients were more repetitive, vivid, and anxiety provoking than those of participants in both control groups. ED patients also reported a more negative emotional tone and a higher number of sensory modalities in their imagery than nondieting participants.

Similar findings were reported in other studies, most consistently suggesting that intrusive images evoke higher levels of anxiety or distress in a clinical sample (e.g., ED or social anxiety) than in controls (e.g., Hackmann, Surawy, & Clark, 1998). This may indicate that ED patients assign more importance to intrusive images, a meaning that it is more threatening to the self (Çili & Stopa, 2015; Holmes & Hackmann, 2004). Although ED patients experienced imagery more vividly, the difference in vividness with dieting controls became nonsignificant after controlling for comorbidity. It has been suggested that dietary restraint is associated with enhanced sensory awareness, that is, also more vividness of mental images (Somerville et al., 2007). There are also findings that negative mood

TABLE 3 Examples of intrusive images in each content category in eating disorder (ED) patients, frequency of intrusive images in ED patients, dieting (DC) and nondieting control (NDC) groups, and group comparisons on the frequency between ED and control groups

	Frequency				
	ED	DC	NDC	Chi square	Cramer's V
Self worth					
"A fat girl, apathetic, ridiculous, stupid and ugly. There is no reason to love her. She is looking at herself in the mirror, she hates herself. Rubbish from a binge and some food lies in the background. She is nauseous and wants to throw up. She feels outcasted and alone, she wants to die, and she wants to die slim."	23.60%	22.70%	3.4%	$\chi^2(2, N = 106) = 3.61, p = 0.164$	0.185
Social evaluation					
"The image I see that's me. I'm way too fat, have fat rolls and am laughed at by everyone."	34.50%	18.20%	10.3%	$\chi^2(2, N = 106) = 6.61, p = 0.037$	0.25
Global body checking					
"I'm sitting in the kitchen at work, next to the oven. It's very big and reflects. So I see myself in the oven (side profile). I startle every time I see myself because I always imagine that I'm much less broad."	36.40%	54.50%	41.4%	$\chi^2(2, N = 106) = 1.88, p = 0.535$	0.11
Selective body checking					
"Fat stomach. Jeans that are too tight around the stomach, causing fat stomach and hips bulging over."	40%	27.30%	31%	$\chi^2(2, N = 106) = 2.12, p = 0.345$	0.142
Body distortion					
"In the image I see myself obese, with very fat thighs and a fat stomach." (BMI = 17.44).	41.80%	22.70%	20.7%	$\chi^2(2, N = 106) = 6.09, p = 0.047$	0.24
Body comparison [a]					
"That my thighs and stomach are obviously fatter compared with my sister (also an eating disorder patient), that I generally look like a "normal BMI person" by her side, whilst my own being underweight is my pride, my prize."	14.50%	18.20%	0		
Sensation of fat, swollen and tightness					
"I really experience the sensation of being fat, I'm over-aware of the size of my stomach and the food in my stomach I feel"	28.10%	9.10%	6.90%	$\chi^2(2, N = 108) = 7.33, p = 0.025$	0.261
Food images [a]					
"A very good cherry bake that I meant to buy for a long time. I was confronted with a dilemma at the bakery: cherry bake or chocolate cake after all (which I cannot have very often, that's why). I bought the cherry bake and regretted it."	14.50%	4.50%	0		

[a]Analyses could not be carried out due to violation of assumptions.

and higher arousal are related to increased imagery vividness (Bywaters, Andrade, & Turpin, 2004). Indeed, dieting participants had similar scores to ED patients in their rating of emotional tone of intrusive images, which may have played a role in heighten image vividness in dieting participants.

As noted, ED patients and healthy dieting participants did not significantly differ in the mean number of sensory modalities and emotional valence of intrusive images.

These patterns are inconsistent across studies (e.g., Osman et al., 2004; Somerville et al., 2007). Like in Osman et al. (2004), ED patients in our study did report more sensory modalities than the control groups, albeit unexpectedly the difference with dieting participants was not significant. In theory, intrusive images reflect goals that stem from the perceived discrepancy between ideal and current state (e.g., goals related to body weight and shape; Conway et al., 2004). Dieting participants may experience

TABLE 4 Spearman rank correlation between intrusive images characteristics and eating disorder symptoms in eating disorder patients

	EDE-Q restraint	EDE-Q eating concern	EDE-Q weight	EDE-Q shape concern	EDE-Q total	EDI-2 perfectionism	EDI-2 dieting	EDI-2 bulimia	EDI-2 body dissatisfaction
Vantage perspective	0.14	0.18	0.08	0.03	0.1	0.23	0.20	−0.13	0.08
Emotionality	−0.21	−0.25	−0.31*	−0.29*	−0.27*	−0.08	0.17	−0.23	−0.36*
Anxiety	0.13	0.28*	0.32*	0.26	0.23	0.24	0.23	0.34*	0.16
Vividness	0.27*	0.24	0.42***	0.37**	0.36*	0.32*	0.32*	0.16	0.33*

Note. EDE-Q: Eating Disorder Examination-Questionnaire; EDI-2: Eating Disorders Inventory-2.

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.006 level.

***Correlation is significant at the 0.001 level.

intrusive images as more negative and may be more sensitive to different sensory modalities, as now these represent the state they aim to overcome/avoid (i.e., images depicting undesired body weight and shape).

Intrusive images across all groups were typically visual in nature, which aligns with previous studies that report that the visual modality is often dominant in mental imagery in the general population (Krans et al., 2015) as well as in BN patients (Somerville et al., 2007). Bodily sensations (organic) were the second most endorsed modality in ED patients and were reported significantly less often in the control groups, which is also in line with previous findings (Somerville et al., 2007). ED patients reported sensations of fatness or heaviness. About one third of the intrusive images of ED patients was also related to movement sensations (kinaesthetic), rather than experiencing intrusive images as "a picture in the mind." Other modalities were typically not reported in any group.

Intrusive images were largely rated negative in valence. However, a small percentage (*n* = 12, 13.2%) of the intrusive images reported by both, ED patients and controls, had a positive valence. The content of the positive intrusive images was related to an ideal body image described as a very slim body (e.g., "a thin person with nice clothing + thin legs"). The positive image of an ideal body may promote the motivation to maintain dysfunctional ED behaviours, such as dietary restraint. Similarly, ED patients who experienced intrusive cognitions as ego-syntonic (i.e., thoughts that are considered rational or reflect a desirable outcome) would often try to do what the intrusive thoughts "tell them" (Roncero, Belloch, Perpiñá, & Treasure, 2013).

4.2 | Comparison of ED subtypes

Additionally, we hypothesized that ED subtypes would not differ in characteristics of intrusive images. First, intrusive images were present among patients with all subtypes of ED and can therefore be viewed as a robust feature of EDs. And second, we found no group differences among

ED subtypes in intrusion vividness, anxiety, or valence, except for vantage perspective. After controlling for PTSD, depression, and anxiety, differences became nonsignificant. Indeed, AN-BP patients had significantly higher PTSD scores than patients with BN (and AN-R patients). Because, in PTSD, intrusive images are associated with an observer perspective, presumably to avoid emotional arousal (e.g., Kenny et al., 2009), this may have accounted for this difference between AN-BP and BN. However, it is more difficult to infer from our data what accounts for the differences between AN-R and BN in the vantage perspective.

Future studies may want to examine other factors that can contribute to vantage perspective, because vantage perspective is influenced by but can also influence the information that is recalled, emotions, and behaviours (Libby & Eibach, 2011), and hence may have clinical implications for ED patients. For instance, AN is characterized by rumination about weight/shape, which is closely linked to negative affect (Furtjes et al., 2018), and it would be interesting to investigate whether an observer vantage perspective is also associated to more abstract processing of information (i.e., ruminative mode) in ED patients. Indeed, there is evidence that abstract processing of information versus more concrete processing has a causal effect in adopting observer vantage perspective in high and low dysphoric individuals (Hart-Smith & Moulds, 2018) and that the causal relation may be bidirectional (Libby, Shaeffer, & Eibach, 2009). If that is the case in AN patients, changing the vantage perspective from observer to field along with tackling dysfunctional cognitive processing modes may be helpful in enabling emotional processing (Hart-Smith & Moulds, 2018).

4.3 | Categorization of the content of intrusive images

As expected, most of the content of the intrusive images fits well with categories related to body weight and shape and their link to self-worth and social evaluation (e.g., Cooper

et al., 1998). Generally, the most frequently reported theme was body checking (i.e., global, body parts, and social comparison). ED patients' images of their body were more distorted, included more social evaluation themes, and more bodily sensations. Dugué et al. (2016) reported similar content in intrusive images in individuals with binge eating, the most frequent being images related to body shape, food, negative self, and social rejection. Contrary to their findings, in our study, images of food were not widely reported. Differences in sample population (individuals with binge eating vs. mixed ED participants) may explain this difference. Overall, findings are in congruence with other studies reporting that body checking is a common feature in EDs, which reflects the overevaluation of body shape and weight (Shafran et al., 2003). The current findings indicate that mental imagery of body checking may be involved in the maintenance of this problematic behaviour, although experimental studies (e.g., using imagery rescripting techniques) are required to test any causal relations.

4.4 | Associations between characteristics and content of intrusive images and ED symptoms

The last aim of our study was to explore whether characteristics and content of intrusive images were associated with ED severity. Characteristics of intrusive images (i.e., vividness, negative emotional valence, and anxiety, but not vantage perspective) were found to be positively associated with ED severity in the total sample. Within ED patients only, vividness of intrusive images was associated with stronger weight and shape concerns. Previous studies reported that more vivid images are likely to be experienced as more realistic (Johnson, 2006) and tend to be emotional rather than neutral (Bywaters et al., 2004), which may lead to more symptomatology. Further, there is evidence that highly vivid food imagery is associated with food craving (Harvey, Kemps, & Tiggemann, 2005).

Our study does not allow for causal interpretations. Yet we can hypothesize from these findings that ED patients may appraise intrusive images more negatively (e.g., being more self-critical) and hence tend to experience them as more distressing and negative (than for controls). It is also likely that more severe symptomatology (i.e., preoccupation with weight, shape, and eating) leads to higher vividness of intrusive images, which is then experienced as more realistic and distressing. That would be in line with the idea suggesting that intrusive images are functionally linked with autobiographical memories and their associated negative self-beliefs (Çili & Stopa, 2015), and they represent dysfunctional goals (Conway

et al., 2004). To summarize, vivid intrusive imagery in ED patients may induce negative self-beliefs (e.g., I am ugly or out of control) and represent goals to avoid the perceived threat (e.g., gaining weight), thus driving ED symptoms of weight and shape concern. For instance, a study by Hinrichsen et al. (2007) reported that self-induced vomiting in BN is preceded by distressing intrusive images of previous negative experiences and activation of negative core beliefs of defectiveness, shame, failure, and social isolation. Further studies are needed to test causal relations between intrusive images, autobiographical memory and self-beliefs, and ED symptoms.

4.5 | Limitations of the present study

Several limitations of the present study need to be addressed. First, the overall sample size is small, which may have affected the statistical power and increased the chance of Types I and II error. Participant in control groups were not perfectly matched with clinical patients, as controls were all females (although, over 90% of clinical patients were also females), were younger in age and dieting controls had lower level of education. Hence, future studies may want to have a better matched clinical and control groups. Patients were in different stages in their therapeutic process at the time of testing, which may have coloured the results (e.g., lower frequency and altered characteristics of intrusive images due to the treatment, or overreporting due to heightened awareness of symptoms). Hence, future studies may want to assess history and current status of psychological and pharmacological interventions in order to estimate their influence on intrusive imagery. Hence, future studies may want to assess history and current status of psychological and pharmacological interventions in order to estimate their influence on intrusive imagery. The measure to assess intrusive images was a new one and has no established reliability and validity yet. Further, the retrospective nature of the measure may have made it difficult for some participants to recall intrusive images, which may have led to underreporting in our samples. In addition, it may have also hampered the accuracy of recall, although the intrusions were often recurrent and may be well rehearsed. Future studies may want to ensure an immediate report of intrusive images, for example, using a diary method. Finally, the study recorded and assessed only one intrusive image per participant. It is possible that participants experienced various intrusive images, and future studies may want to record additional intrusive images as well.

5 | CONCLUSION

The majority of ED patients experiences intrusive images related to weight, body shape, and eating that are more repetitive, vivid, and distressing than those of control groups. Intrusive images that were more vivid were associated with more severe weight and shape concerns, which indicates that intrusive images may play a crucial role in maintaining the disorder. These findings are in line with the theory and previous studies of intrusive images, while contributing to the growing evidence documenting intrusive images as a crucial factor in ED by comparing different ED subtypes and controlling for comorbidity. Finally, results suggest that it may be useful to target intrusive images in therapy (e.g., through imagery rescripting).

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