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Emotion regulation and emotional eating in anorexia nervosa and bulimia nervosa

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ABSTRACT

Individuals with anorexia nervosa (AN) and bulimia nervosa (BN) show emotion regulation deficits. While individuals with BN use binge eating to regulate negative affect, individuals with restricting-type AN may use self-starvation for this purpose. The current study examined the emotion regulatory function of over- and undereating in response to different emotional states in women with restrictive AN ($n = 54$), BN ($n = 47$), and women without eating disorders ($n = 68$). Participants completed self-report measures assessing the use of emotion regulation strategies and emotional eating. Both patient groups reported using more dysfunctional and less functional emotion regulation strategies than controls. The BN group reported eating more than usual in response to negative emotions but less than usual in response to positive emotions. In contrast, the AN group reported eating more than usual in response to positive emotions and less than usual in response to negative emotions. More dysfunctional emotion regulation related to eating less in response to negative emotions in the AN group. Less functional emotion regulation related to eating less when being happy in the BN group. The current study highlights the need to differentiate between different eating outcomes and different emotional states when examining emotion effects on food intake.

Clinical Implications

- AN patients eat less than usual in response to negative affect but more than usual in response to positive affect.
- BN patients eat more than usual in response to negative affect but less than usual in response to positive affect.

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- The emotion regulatory function of eating in BN and not eating in AN is not restricted to negative affect.
- Eating in AN may be fostered by inducing positive affect.
- BN patients tend to eat too little when in a good mood, which may require attention in treatment.

Introduction

Emotion regulation refers to extrinsic or intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions—especially their intensive and temporal features—to accomplish one's goals (Thompson, 1994). According to the process model of emotion regulation, different emotion regulation strategies can be distinguished by the point in the emotion-generative process at which they have their primary impact: situation selection and modification, attentional deployment, cognitive change, and response modulation (Gross & Thompson, 2007). Within this framework, a considerable amount of research has focused on the latter two forms of emotion regulation, indicating that certain strategies such as reappraisal (i.e., changing a situation's meaning in a way that alters its emotional impact) are more effective in downregulating negative affect than other strategies such as suppression (i.e., decreasing emotion-expressive behavior while emotionally aroused; Gross, 2013).

The idea that eating can also be used to regulate emotions figures prominently among current theories of emotional eating and underlies many psychotherapeutic approaches to eating disorders (e.g., Macht, 2008; Safer, Telch, & Agras, 2001). Fittingly, individuals with restricting-type anorexia nervosa (AN) and bulimia nervosa (BN) report more difficulties in regulating emotions and use more dysfunctional (e.g., suppression) and less functional (e.g., reappraisal) emotion regulation strategies (Brockmeyer et al., 2014; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012). According to this emotion regulation account of emotional eating, such emotion regulation deficits should translate directly into disordered eating. Yet, eating behavior differs significantly across disorders. Specifically, while both individuals with restricting-type AN and individuals with BN show emotion regulation deficits, their pathological eating patterns differ substantially. Assuming that emotion regulation deficits and eating behavior are related implies that the two groups differ in their emotion–eating relationships. For example, a study that used ecological momentary assessment in individuals with AN could demonstrate that higher negative affect on a given day was associated with a greater likelihood of dietary restriction on the following day, suggesting that self-starvation is used in order to cope with negative emotions (Engel et al., 2013). In individuals with BN, however, negative affect usually precedes binge eating (Haedt-Matt & Keel, 2011).

Yet, increased or decreased food intake in response to negative affect is only one way of how emotions can influence eating behavior (Macht, 2008). In addition to the need to differentiate between eating more and eating less when examining emotion effects on food intake, it seems crucial to differentiate between different emotional states as well. For example, there is evidence based on experimental studies showing increased food intake in response to positive emotions in non-clinical samples (Evers, Adriaanse, de Ridder, & de Witt Huberts, 2013; Turner, Luszczynska, Warner, & Schwarzer, 2010). Moreover, while the majority of individuals in non-clinical samples report eating more when being sad, they report eating less than usual when being angry or anxious (Meule, Reichenberger, & Blechert, 2018a). In addition, these emotion-specific effects on food intake seem to have diverging correlates. For example, eating more in response to negative emotions has been related to higher body weight and eating disorder symptomatology, while eating more in response to positive emotions has been related to lower body weight and eating disorder symptomatology (Geliebter & Aversa, 2003; Meule et al., 2018a; Nolan, Halperin, & Geliebter, 2010).

Given these findings, we (Meule et al., 2018a) and others (Bourdier et al., 2018) have argued previously that there is a need to not only examine negative affect-induced eating but to consider emotional eating as any alteration in food intake (which can include eating less or eating more than usual) in response to any affective state (which can include positive and negative emotions). Yet, no study has investigated emotion regulation, emotional eating, and their relationships in individuals with restricting-type AN and BN by differentiating between different emotional states (including both positive and negative emotions) and between increased and decreased food intake in response to these emotions. Therefore, the current study examined the use of emotion regulation strategies, emotional eating, and their associations in women with restricting-type AN and BN and women without eating disorders.

Hypotheses

We expected that both the AN and BN group would report using more dysfunctional and less functional emotion regulation strategies than the control group, in line with previous findings (Brockmeyer et al., 2012, 2014; Svaldi et al., 2012). Regarding emotional eating, however, we expected that individuals with AN and BN would show opposite patterns. As eating more in response to negative emotions and eating less in response to positive emotions has been found to relate to higher eating disorder symptomatology in non-clinical samples (Meule et al., 2018a; Nolan et al., 2010), we expected that the BN group would report eating more in response to negative emotions and less in response to happiness, relative to the control group. As eating less in response to negative

emotions and eating more in response to positive emotions has been found to relate to lower body mass index in non-clinical samples (Meule et al., 2018a; Nolan et al., 2010), we expected that the AN group would report eating more in response to happiness and eating less in response to negative emotions, relative to the control group.

Finally, we examined the relationships between the use of emotion regulation strategies and emotional eating. Previous studies have found that using more dysfunctional (and less functional) emotion regulation strategies relates to higher emotional eating scores in terms of eating more in response to negative affect in individuals with binge eating (Gianini, White, & Masheb, 2013; Meule & Kohlmann, 2017). However, if individuals with restricting-type AN use dietary restriction to regulate negative affect, the relationship between emotion regulation and emotional eating may be reversed in this group: using more dysfunctional (and less functional) emotion regulation strategies may relate to eating less in response to negative affect. Therefore, we hypothesized that the relationships between emotion regulation and emotional eating would be moderated by group. For example, using more dysfunctional (and less functional) emotion regulation strategies may relate to eating more in response to negative emotions and to eating less in response to positive emotions in the BN group, but may relate to eating less in response to negative emotions and to eating more in response to positive emotions in the AN group.

Methods

Participants

Women with restrictive AN ($n = 54$) and BN ($n = 47$) were recruited before and during inpatient treatment at the Schoen Clinic Roseneck in Prien am Chiemsee, Germany. Women without eating disorders ($n = 68$) were recruited as control group at the University of Salzburg, Austria. All participants were tested with a structured clinical interview (First, Williams, Karg, & Spitzer, 2016). Individuals in the AN and BN group met the respective DSM-5 criteria. The most common current comorbidities in the AN group were major depression ($n = 31$), obsessive-compulsive disorder ($n = 10$), post-traumatic stress disorder ($n = 8$), social phobia ($n = 8$), specific phobias ($n = 8$), and generalized anxiety disorder ($n = 5$). The most common current comorbidities in the BN group were major depression ($n = 25$), borderline personality disorder ($n = 17$), panic disorder/agoraphobia ($n = 13$), social phobia ($n = 13$), obsessive-compulsive disorder ($n = 10$), specific phobias ($n = 8$), and generalized anxiety disorder ($n = 5$). Participants in the control group did not have any current or lifetime eating disorder, no current mental disorders, and no chronic physical diseases.

Participants were 24.0 years old on average ($SD = 7.77$) and age did not differ between groups ($F_{(2,166)} = 1.21, p = .302, \eta_p^2 = .014$). Groups differed in body mass index ($F_{(2,165)} = 97.1, p < .001, \eta_p^2 = .541$) such that the AN group had lower body mass index ($M = 16.0 \text{ kg/m}^2, SD = 1.95$) than the BN group ($M = 22.6 \text{ kg/m}^2, SD = 4.12, t_{(98)} = 10.4, p < .001$) and the control group ($M = 23.0 \text{ kg/m}^2, SD = 2.68, t_{(120)} = 16.1, p < .001$); the BN group and control group did not differ from each other ($t_{(112)} = 0.70, p = .486$).

Questionnaires

Eating Disorder Examination–Questionnaire–8 (EDE–Q–8)

The EDE–Q–8 (Kliem et al., 2016) measures eating disorder symptomatology in the past 28 days with eight items, which are scored from 0 (*no days/never/not at all*) to 6 (*every day/every time/very much*). Higher mean scores indicate higher eating disorder symptomatology. In the validation study, internal reliability was high, factorial validity was supported by a unidimensional, measurement invariant structure across sexes, and convergent validity was supported by a strong correlation with the Eating Attitudes Test (Kliem et al., 2016). Internal reliability in the current study was excellent (Table 1).

Center for Epidemiologic Studies–Depression Scale (CES–D)

A 15-item short version of the CES–D (Hautzinger, Bailer, Hofmeister, & Keller, 2012; Radloff, 1977) was used for measuring depressive symptomatology in the past week. Items are scored from 0 (*rarely*) to 3 (*most of the time*). Higher mean scores indicate higher depressive symptomatology. In the validation study, internal reliability was good, retest-reliability was acceptable, factorial validity was supported by a unidimensional structure, and convergent validity was supported by a strong correlation with the Beck Depression Inventory (Hautzinger, 1988). Internal reliability in the current study was excellent (Table 1).

Emotion Regulation Questionnaire (ERQ)

The ERQ (Abler & Kessler, 2009; Gross & John, 2003) measures individual differences in the use of emotion regulation strategies with 10 items, which are scored from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale differentiates two emotion regulation strategies: *reappraisal* (six items) and *suppression* (four items). Higher mean scores indicate a stronger tendency to reappraise negative emotions and to suppress negative emotions, respectively. In the validation study, internal reliabilities were acceptable, factorial validity was supported by a two-factorial structure, and construct validity was supported by positive correlations of the suppression subscale with measures on ambivalence over emotions and depression and no correlations of the

Table 1. Means and standard deviations of questionnaire measures as a function of group.

	N	Anorexia nervosa			Bulimia nervosa			Control group			F	p	η_p^2
		n	M (SD)	α	n	M (SD)	n	M (SD)	n	M (SD)			
Eating Disorder Examination–Questionnaire–8	169	54	3.55 (1.43) ^a	.904	47	4.40 (1.21) ^b		68	1.93 (1.33) ^c	51.8	<.001	.384	
Center for Epidemiologic Studies–Depression Scale	165	53	1.59 (0.62) ^a	.933	45	1.69 (0.68) ^a		67	0.67 (0.42) ^b	59.0	<.001	.421	
Emotion Regulation Questionnaire													
Reappraisal	165	53	3.56 (1.11) ^a	.853	45	3.25 (1.20) ^a		67	4.61 (0.96) ^b	25.3	<.001	.238	
Suppression	165	53	4.25 (1.33) ^a	.803	45	4.06 (1.29) ^a		67	3.17 (1.18) ^b	12.6	<.001	.134	
Cognitive Emotion Regulation Questionnaire													
Functional	165	53	2.58 (0.63) ^a	.820	45	2.65 (0.68) ^a		67	3.29 (0.60) ^b	23.6	<.001	.226	
Dysfunctional	165	53	2.68 (0.67) ^a	.684	45	3.06 (0.56) ^b		67	2.58 (0.57) ^a	9.03	<.001	.100	
Salzburg Emotional Eating Scale													
Happiness	169	54	3.20 (0.59) ^a	.934	47	2.68 (0.87) ^b		68	2.92 (0.59) ^c	7.38	.001	.082	
Sadness	169	54	2.17 (0.80) ^a	.908	47	4.14 (0.75) ^b		68	3.38 (0.65) ^c	95.0	<.001	.534	
Anger	169	54	2.06 (0.66) ^a	.926	47	3.58 (1.06) ^b		68	2.73 (0.67) ^c	45.9	<.001	.356	
Anxiety	169	54	2.06 (0.70) ^a	.867	47	3.53 (0.97) ^b		68	2.49 (0.62) ^c	49.5	<.001	.373	
Salzburg Stress Eating Scale	169	54	1.99 (0.77) ^a	.946	47	3.93 (0.88) ^b		68	2.89 (0.69) ^c	79.2	<.001	.488	

Means with different superscripts are significantly different from each other.

reappraisal subscale with these measures (Abler & Kessler, 2009). Internal reliabilities in the current study were good (Table 1).

Cognitive Emotion Regulation Questionnaire (CERQ)

An 18-item short version of the CERQ (Garnefski & Kraaij, 2006; Loch, Hiller, & Witthöft, 2011) was used for measuring individual differences in the use of functional and dysfunctional emotion regulation strategies. Items are scored from 1 (*[almost] never*) to 5 (*[almost] always*). Functional emotion regulation strategies include the subscales *putting into perspective*, *positive refocusing*, *positive reappraisal*, *acceptance*, and *planning*. Dysfunctional emotion regulation strategies include the subscales *self-blame*, *blaming others*, *ruminating*, and *catastrophizing*. Higher mean scores indicate a stronger tendency to use functional and to use dysfunctional emotion regulation strategies, respectively. In the validation study, internal and retest-reliabilities were acceptable, but factor structure differed from the original version by Garnefski and Kraaij (2006). However, construct validity of the function and dysfunctional scales was supported in that the dysfunctional emotion regulation strategies positively correlated with measures of anxiety sensitivity and depression, while functional emotion regulation strategies negatively correlated with these measures (Loch et al., 2011). Internal reliability in the current study was acceptable for the dysfunctional subscale and good for the functional subscale (Table 1).

Salzburg Emotional Eating Scale (SEES)

The SEES (Meule et al., 2018a) measures changes in food intake amount in response to emotional experiences with 20 items, which are scored from 1 (*I eat much less than usual*) to 5 (*I eat much more than usual*). The scale differentiates between four emotional states: *happiness*, *sadness*, *anger*, and *anxiety*. Higher mean scores indicate a stronger tendency to eat more than usual when being happy, sad, angry, and anxious, respectively, and lower mean scores indicate a stronger tendency to eat less than usual when experiencing these emotions. Medium scores (mean total scores around 3) indicate that these emotions do not alter how much one eats. In the validation studies, internal reliabilities were acceptable or good, factorial validity was supported by a four-factorial, measurement invariant structure across sexes, and construct validity was supported by positive correlations of the sadness, anger, and anxiety subscales with other measures of stress and emotional eating and negative correlations of the happiness subscale with these measures (Meule et al., 2018a). Internal reliabilities in the current study were good or excellent (Table 1).

Salzburg Stress Eating Scale (SSES)

The SSES (Meule, Reichenberger, & Blechert, 2018b) measures changes in food intake amount in response to stress with 10 items, which are scored from 1 (*I eat much less than usual*) to 5 (*I eat much more than usual*). Exemplary items are “When I am overwhelmed with things I have to do, ...” or “When I am under pressure, ...”. Higher mean scores indicate a stronger tendency to eat more than usual when being stressed and lower mean scores indicate a stronger tendency to eat less than usual when being stressed. Medium scores (mean total scores around 3) indicate that stress does not alter how much one eats. In the validation studies, internal reliability was high, factorial validity was supported by a unidimensional, measurement invariant structure across sexes, convergent validity was supported by a positive correlation with a measure of emotional eating, and discriminant validity was supported by the absence of a relationship with perceived stress (Meule et al., 2018b). Internal reliability in the current study was excellent (Table 1).

Data analyses

Groups were compared regarding eating disorder symptomatology (EDE-Q-8), depressive symptomatology (CES-D), emotion regulation strategies (ERQ, CERQ), and emotional and stress eating (SEES, SSES) with analyses of variance. Significant group differences were followed up with independent *t*-tests. To explore associations between emotion regulation strategies and stress/emotional eating as a function of group, moderation analyses were conducted using PROCESS (Hayes, 2018). Specifically, linear regression analyses were calculated using emotion regulation strategies as independent variables, stress and emotional eating as dependent variables, and group (0 = control group, 1 = AN group, 2 = BN group) as multicategorical moderator variable. Indicator coding was used for the three groups (Hayes & Montoya, 2017). Separate models were run for each subscale/questionnaire; that is, as there were four emotion regulation subscales and five emotional/stress eating subscales, 20 moderation models were tested in total. The alpha level was set at $p < .05$ and *p*-values between .05 and .10 are denoted as marginally significant.

Results

Group comparisons

EDE-Q-8

Groups significantly differed in EDE-Q-8 scores with a large effect size (Table 1). The BN group had higher EDE-Q-8 scores than the AN group,

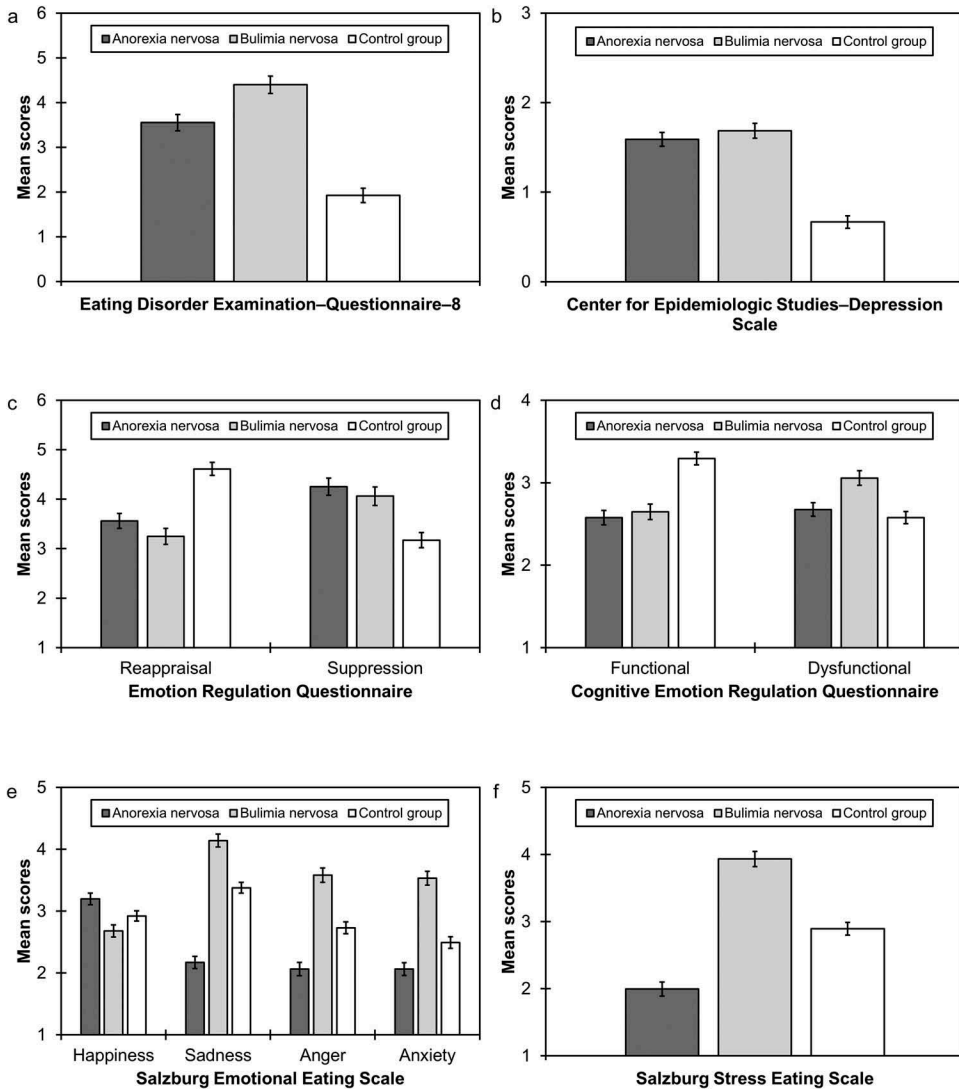


Figure 1. Mean questionnaire scores as a function of group. Error bars indicate standard errors of the mean.

which in turn had higher scores than the control group (all t s > 3.18, all p s < .003; Table 1; Figure 1(a)).

CES-D

Groups significantly differed in CES-D scores with a large effect size (Table 1). The control group had lower CES-D scores than the AN and BN group (both t s > 9.76, both p s < .001); the AN and BN group did not differ from each other ($t_{(96)} = 0.72, p = .471$; Table 1; Figure 1(b)).

ERQ

Groups significantly differed in ERQ scores with large effect sizes (Table 1). The control group had higher reappraisal scores than the AN and BN group (both $t_s > 5.54$, both $p_s < .001$); the AN and BN group did not differ from each other ($t_{(96)} = 1.33$, $p = .186$; Table 1; Figure 1(c)). The control group had lower suppression scores than the AN and BN group (both $t_s > 3.75$, both $p_s < .001$); the AN and BN group did not differ from each other ($t_{(96)} = 0.71$, $p = .479$; Table 1; Figure 1(c)).

CERQ

Groups significantly differed in CERQ functional scores with a large effect size and in CERQ dysfunctional scores with a medium effect size (Table 1). The control group had higher functional scores than the AN and BN group (both $t_s > 5.31$, both $p_s < .001$); the AN and BN group did not differ from each other ($t_{(96)} = 0.53$, $p = .600$; Table 1; Figure 1(d)). The BN group had higher dysfunctional scores than the AN and control group (both $t_s > 3.02$, both $p_s < .004$); the AN and control group did not differ from each other ($t_{(118)} = 0.87$, $p = .386$; Table 1; Figure 1(d)).

SEES

Groups significantly differed in SEES sadness, anger, and anxiety scores with large effect sizes and in SEES happiness scores with a medium effect size (Table 1). The AN group had higher happiness scores than the control group, which in turn had higher scores than the BN group (all $t_s > 1.78$, all $p_s < .078$; Table 1; Figure 1(e)). The BN group had higher sadness, anger, and anxiety scores than the control group, which in turn had higher scores than the AN group (all $t_s > 3.57$, all $p_s < .002$; Table 1; Figure 1(e)).

SSES

Groups significantly differed in SSES scores with a large effect size (Table 1). The BN group had higher SSES scores than the control group, which in turn had higher scores than the AN group (all $t_s > 6.79$, all $p_s < .001$; Table 1; Figure 1(f)).

Moderation analyses

The group \times ERQ suppression interaction was significant when predicting SSES scores (R^2 change = 0.03, $F_{(2,159)} = 4.56$, $p = .012$). Higher ERQ suppression scores related to lower SSES scores in the AN group, while there were no associations in the BN group and control group (Figure 2(a)).

The group \times CERQ functional interaction was marginally significant when predicting SEES happiness scores (R^2 change = 0.03, $F_{(2,159)} = 2.58$, $p = .079$).

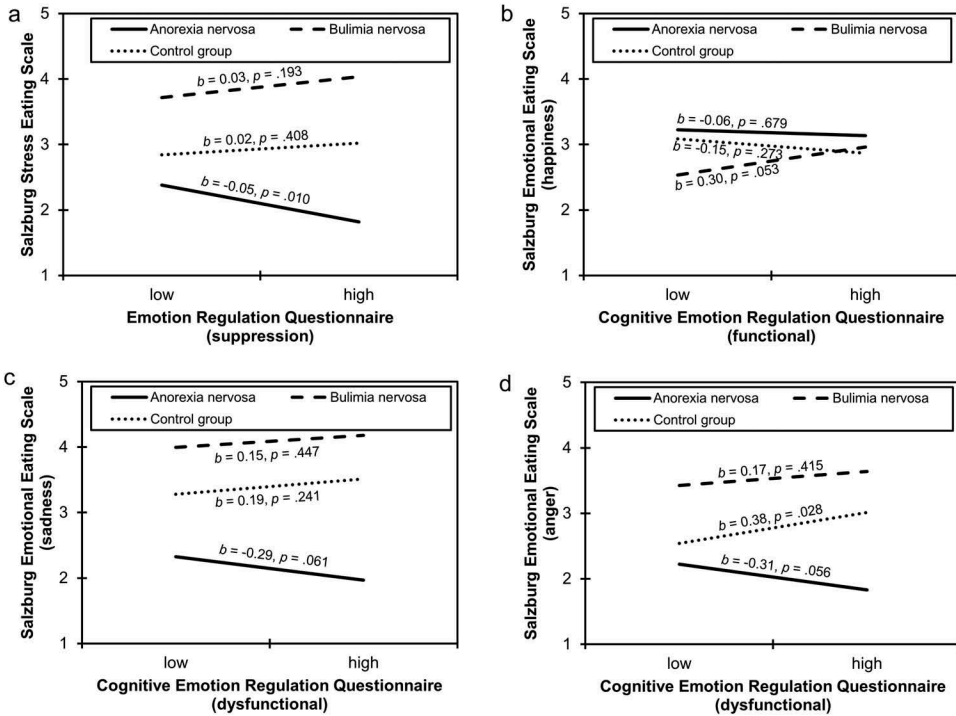


Figure 2. Simple slopes for probing the interactions between emotion regulation strategies and group when predicting emotional and stress eating scores. Specifically, unstandardized coefficients and p -values are provided to illustrate the direction and significance of the relationships between the independent variables on the x -axis (emotion regulation strategies) and the dependent variables on the y -axis (stress and emotional eating) in each of the three groups. Low and high values represent one standard deviation below and above the sample's mean.

Higher CERQ functional scores tended to relate to higher SEES happiness scores in the BN group, while there were no associations in the AN group and control group (Figure 2(b)).

The group \times CERQ dysfunctional interaction was marginally significant when predicting SEES sadness scores (R^2 change = 0.02, $F_{(2,159)} = 2.75$, $p = .067$). Higher CERQ dysfunctional scores tended to relate to lower SEES sadness scores in the AN group, while there were no associations in the BN group and control group (Figure 2(c)).

The group \times CERQ dysfunctional interaction was significant when predicting SEES anger scores (R^2 change = 0.03, $F_{(2,159)} = 4.51$, $p = .013$). Higher CERQ dysfunctional scores related to higher SEES anger scores in the control group and tended to relate to lower SEES anger scores in the AN group (Figure 2(d)). In all other moderation models, the interaction effect was not significant (all $ps > .108$).

Discussion

The current study aimed to investigate emotion regulation and emotional eating in women with restrictive AN, women with BN, and women without eating disorders. Similar to previous findings (Brockmeyer et al., 2014), it was found that both eating disorder groups reported higher negative affect and use of dysfunctional emotion regulation strategies. This is in line with the suggestion that emotion regulation difficulties seem not to be linked to a specific diagnostic entity, but rather represent a transdiagnostic factor contributing to the development or maintenance of mental disorders (Svaldi et al., 2012).

Despite these similarities between individuals with AN and BN, however, groups showed opposite patterns of emotional eating: While the BN group reported eating more than usual when being sad, angry, anxious, and stressed and eating less than usual when being happy, the AN group reported eating more than usual when being happy and less than usual when being sad, angry, anxious, and stressed. When examining relationships between emotion regulation strategies and emotional eating, however, results were less clear. Although differential associations across groups were only found for a subset of emotions and regulation strategies, the overall pattern is in line with the main analyses such that emotion regulation strategies manifest in opposite eating behaviors in AN and BN. That is, using less functional emotion regulation strategies tended to relate to eating less when happy in the BN group only while using more dysfunctional emotion regulation strategies tended to relate to eating less when experiencing negative affect in the AN group only.

We speculate that the lack of finding associations between dysfunctional emotion regulation strategies and eating more in response to negative emotions in individuals with BN may have been due to ceiling effects, as the BN group already reported largely elevated levels of both dysfunctional emotion regulation strategies and eating more in response to negative emotions. Yet, inconsistent associations between emotion regulation deficits and emotional eating in the current study may also hint toward contributions of other mechanisms. Alternative accounts of emotional eating such as escape from self-awareness (Blackburn, Johnston, Blampied, Popp, & Kallen, 2006), depletion of self-regulatory resources through negative affect (Loth et al., 2016), or disinhibition of restrained eating (Evers, Dingemans, Junghans, & Boevé, 2018) might explain group differences and call for a combined investigation of the different accounts in the same study and population.

The association between negative affect and binge eating in individuals with BN has been well established and current treatments that foster adaptive emotion regulation skills help to normalize eating behavior (Safer et al., 2001). In addition to these findings, however, our results show that the

dysfunctional eating patterns displayed by individuals with BN not only include negative affect-induced overeating but also positive affect-induced undereating. This underscores the importance of maintaining a regular eating schedule as a major target as BN patients may tend to eat too little when their mood improves during treatment. Yet, more research is necessary about the role of positive affect in the eating behavior of individuals with BN. While eating less than usual when happy may reflect an aspect of dysfunctional eating behavior (as it significantly differed from individuals without eating disorders in the current study), it may also be that positive affect can mitigate the occurrence of binge eating. Moreover, as the SEES only refers to the amount of food, the types of food involved in emotional eating may also play a crucial role. For example, it has previously been found that positive affect increases food pleasantness and consumption of healthy foods (Macht, 2008).

The current findings are also consistent with the suggestion that self-starvation in individuals with AN serves to regulate negative affect (Brockmeyer et al., 2012). The current study relied on cross-sectional self-report data, which precludes drawing definite conclusions about the causal direction of the relationship between dietary restriction and affect. Yet, a study that used ecological momentary assessment in individuals with AN could demonstrate that higher negative affect on a given day was associated with a greater likelihood of dietary restriction on the following day (while there was no relationship between restriction on a given day and affect on the following day; Engel et al., 2013). Together, these findings suggest that individuals with AN indeed use dietary restriction as an emotion regulation strategy, while it is unlikely that this restriction exacerbates negative affect. Future studies need to examine the mechanisms of this relationship. For example, it has been found that individuals with AN had higher baseline serotonin-related neural activity and reported decreased anxiety during tryptophan depletion, suggesting that restricting dietary intake to modulate dysphoric mood might be mediated by changes in serotonin-related neural activity (Kaye et al., 2003). Yet, more studies are needed to corroborate this hypothesis and to identify other possible mediators that can explain how self-starvation leads to reduced negative affect in individuals with AN.

In the current study, individuals with AN not only reported negative affect-induced undereating but in fact reported eating more than usual in response to positive emotions. This suggests that positive mood gives them access to self-caring and self-restorative activities and goals that they learn to set during treatment. The broaden-and-build theory suggests that learning and memorizing becomes more likely under positive mood (Fredrickson, 2004). Clinically, mood stabilization might, thus, be a means for normalization of eating and weight restoration. This interpretation is also in line with previous findings that showed increased food intake in AN patients after positive mood induction (Cardi, Esposito, Clarke, Schifano, & Treasure, 2015). By contrast, force and

pressure in refeeding—although medically often necessary—might induce negative mood and, therefore, hamper treatment progress.

In contrast to the finding of increased food intake in response to positive affect, however, positive affect actually decreased before loss of control eating in individuals with AN in the study by Engel et al. (2013). Thus, it seems that there are other factors that may moderate the affect–eating relationship in individuals with AN. For example, the study by Engel et al. (2013) investigated individuals with AN that exhibited binge/purge-behaviors, while only individuals with restricting-type AN were examined in the current study. Hence, it might be that the relationship between higher positive affect and increased food intake may only be observed in individuals with restrictive AN, while individuals with binge/purge-type AN may be more similar to individuals with BN, for which higher negative affect is associated with increased food intake.

Interpretation of findings is limited to the current sample's characteristics. As only women were investigated, results may not apply to men. For example, sex differences have been found in the use of emotion regulation strategies and related psychological variables such as personality in men and women in general and in individuals with eating disorders in particular (Nolen-Hoeksema, 2012; Woodside et al., 2004). Moreover, we investigated a treatment-seeking sample of individuals with AN and BN. Although the questionnaire measures for emotional regulation and emotional eating do not specify a certain timeframe (e.g., last week) but refer to the person's behavior in general, we cannot exclude the possibility that scores may have been affected by the anticipation of treatment and, thus, may be different in non-treatment-seeking samples. Finally, self-report measures can potentially be biased. Indeed, it has been suggested previously that self-assessed emotional eating may reflect beliefs about emotional eating rather than one's actual eating behavior when being emotional (Adriaanse, de Ridder, & Evers, 2011; Evers, de Ridder, & Adriaanse, 2009). Thus, the present results warrant replication with other methodologies such as laboratory food intake studies (Sysko, Steinglass, Schebendach, Mayer, & Walsh, 2018) or ambulatory assessment (Reichenberger et al., 2018).

In conclusion, this study indicates that although individuals with restrictive AN and BN have similar levels of negative affect and emotion regulation deficits, they show opposite eating patterns to regulate emotional states. These differences in emotional eating are not restricted to negative affect (when those with BN eat more and those with AN eat less—as indicated by SSES and SEES sadness, anger, and anxiety scores) but are also reflected in positive affect (when those with BN eat less and those with AN eat more—as indicated by SEES happiness scores). These findings highlight the need to differentiate between emotional overeating and undereating as well as between

different affective states when examining the emotion regulatory function of food intake.




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The authors declare that there is no conflict of interest..

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