

# Self-Regulation in Eating Disorders and Obesity – Implications for Treatment

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## Keywords

Self-regulation · Emotion regulation · Impulse regulation · Eating disorders · Anorexia nervosa · Bulimia nervosa · Binge eating disorder

## Summary

Research has shown that the treatment of certain eating disorders, such as anorexia nervosa and inappropriate eating behavior in obesity, is of limited efficacy and that an elevated psychopathology persists after treatment. This necessitates the identification of other etiological and maintaining factors that, when changed, could improve the efficacy of the treatment. Based on current findings, the present narrative review aims to illustrate the role of the ability to regulate emotions and impulses in the development and maintenance of disordered eating. There is some evidence that the eating disorders anorexia nervosa, bulimia nervosa, binge eating disorder and obesity are associated with a reduced ability of emotion and impulse regulation in childhood, adolescence, and adulthood. Furthermore, a reduced ability of self-regulation in childhood predicts later obesity. Up to now, there are no controlled studies about the efficacy of the inclusion of such components in the treatment of eating disorders. However, there are promising results regarding the efficacy of unspecific prevention approaches for the improvement of self-regulation.

## Schlüsselwörter

Selbstregulation · Emotionsregulation · Impulsregulation · Essstörungen · Anorexia nervosa · Bulimia nervosa · Binge-Eating-Störung

## Zusammenfassung

Die Forschung hat gezeigt, dass die Behandlung einzelner Essstörungen wie z.B. der Anorexia nervosa und ungünstigen Essverhaltens bei Adipositas nur begrenzt effektiv ist bzw. dass auch nach Behandlung der Essstörungssymptomatik eine erhöhte Psychopathologie bestehen kann. Daraus ergibt sich die Notwendigkeit, weitere ätiologische und aufrechterhaltende Faktoren zu identifizieren, deren Veränderung die Wirksamkeit der Behandlung optimieren könnte. Ziel des vorliegenden narrativen Reviews ist es, anhand aktueller Befunde darzustellen, welche Rolle die Fähigkeit, Emotionen und Impulse zu regulieren, in der Entwicklung und Aufrechterhaltung von gestörtem Essverhalten spielt. Es ergeben sich Hinweise darauf, dass die Essstörungen Anorexia nervosa, Bulimia nervosa, Binge-Eating-Störung und Adipositas sowohl im Kindes- und Jugend- als auch im Erwachsenenalter mit einer verminderten Fähigkeit zur Emotions- und Impulsregulation einhergehen, und dass mangelnde Selbstregulationsfähigkeit im Kindesalter späteres Übergewicht vorhersagt. Bisher liegen keine kontrollierten Studien vor, die über die Wirksamkeit des Einbezugs solcher Komponenten in die Psychotherapie der Essstörungen berichten, es gibt jedoch vielversprechende Hinweise über die Wirksamkeit unspezifischer präventiver Ansätze zur Verbesserung der Selbstregulation.

## Introduction

Eating disorders are characterized by dysfunctional dietary restriction or uncontrolled food intake and are associated with persistent concerns and ruminations about weight, shape, or food intake. The prevalences are lower than with affective disorders, but it can be assumed that in the risk group of 16-year-olds, about 18% of women are affected by sub-clinical eating disorders and a total of 20% report persistent concerns about shape and weight [Touchette et al., 2011]. In addition to disorder-specific factors, such as rigidly restrictive or inhibited eating behavior, the various forms of disordered eating behavior are characterized by severe deficits in emotion and impulse regulation (self-regulation). The increased inclusion of these non-disorder-specific deficits could contribute to improving the efficacy of preventive measures and to treatment optimization.

## Self-Regulation

The concept of self-regulation encompasses control of emotions, impulses, and attention, which makes it possible to respond appropriately to the demands of the environment [Murraven and Baumeister, 2000]. The ability to regulate emotions develops at an early age and includes processes that allow short-term regulation of affects and longer-term regulation of emotions. Impulse regulation includes all processes that facilitate the inhibition of undesirable behavior or the delay of short-term gratification [Mischel et al., 2011]. Adequate self-regulation is associated with higher academic and professional achievements, as well as with better mental health and social integration [John and Gross, 2004; Mischel et al., 2011]. The neural foundations of the corresponding regulatory processes seem to be mainly localized in the prefrontal cortex [Heather-ton, 2011]. Subcortical structures are also involved, such as the amygdala for the perception and experience of emotion, and the nucleus accumbens (reward center) for the experience of impulses. In summary, it can be assumed that self-regulation is more difficult when an imbalance of regulatory skills occurs due to a high emotional intensity or strong impulses [Heather-ton and Wagner, 2011]. The role of environmental factors is clear: Factors that activate the amygdala or reward center (e.g., stress or constantly being confronted with readily available food) impede self-regulation or situationally adaptive behavior, especially where there is vulnerability of a subject (e.g., extreme sensitivity to food-related rewards).

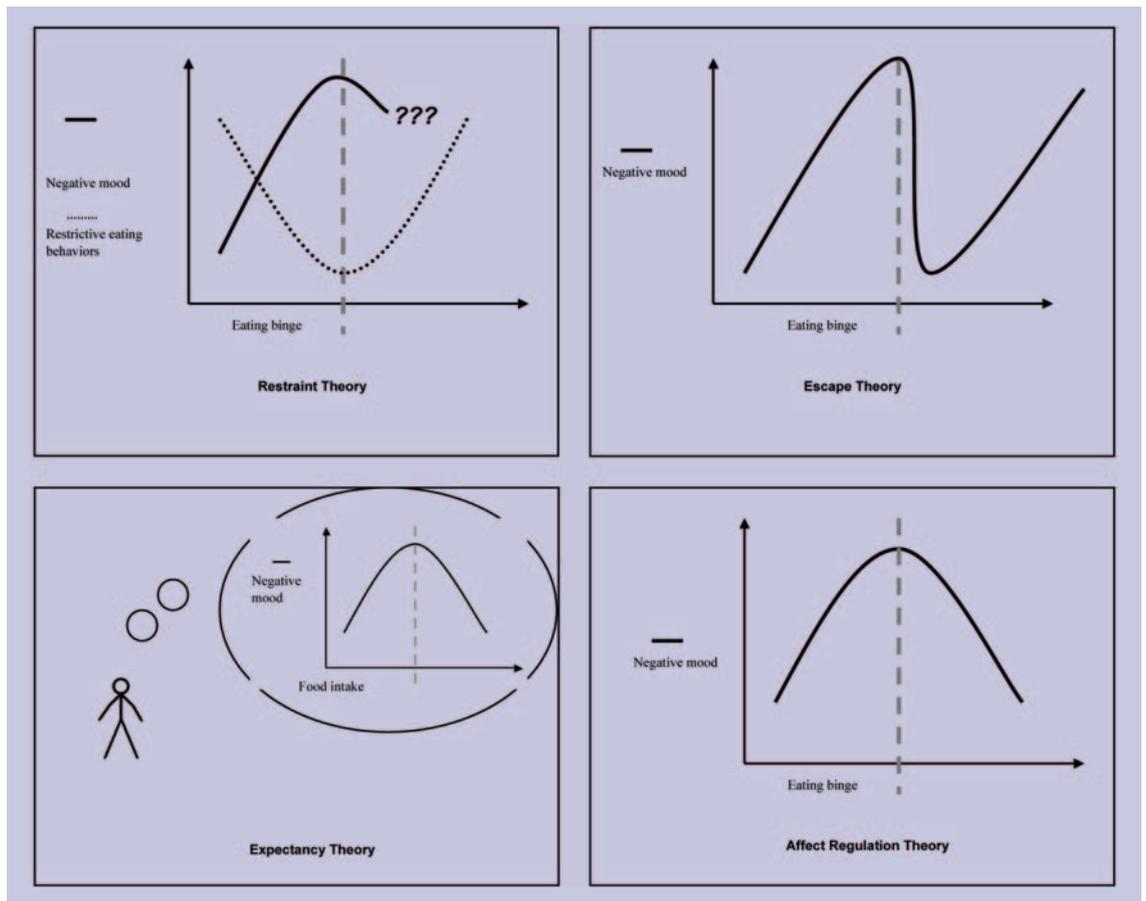
## Self-Regulation and Mental State

The ability to regulate emotions and impulses develops in infancy, as the baby increasingly learns to adapt to new situations independently, to calm himself, and to focus his attention. Inadequate self-regulation is already manifest in 20% of

infants in the form of regulatory disorders characterized by excessive crying, sleep problems, feeding problems, or attentional disorders. These difficulties are usually temporary. In a minority of 8%, which is often characterized by problems in more than one area, these regulatory disorders persist until preschool age [Schmid et al., 2010]. In cross-sectional studies of adults, a lack of self-regulatory skills, in the sense of maladaptive strategies of emotion regulation, was found especially with anxiety and affective disorders [Aldao et al., 2010]. Impulse-control disorders and disorders of attention and hyperactivity are also based upon deficient self-regulation [American Psychiatric Association, APA, 2000]. Food intake is subject to a basal regulatory mechanism for hunger and satiety that is essential for survival, and in which self-regulation plays a central role. Disturbance of this homeostatic regulation by psychosocial or biological vulnerability factors has a lasting impact not only on food intake, but also on the development of eating behavior and body weight, and subsequent psychological development. It has been shown that in the etiology and maintenance of eating disorders (as in substance use disorders), the interaction between the regulatory functions of the prefrontal cortex and action-initiating subcortical structures, such as the reward center, plays an important role. When food intake per se takes on a reinforcement function, as with overeating and binge eating disorders, it makes it more difficult to regulate the impulse to eat [Epstein et al., 2010].

## Self-Regulation and Anorexia Nervosa

Anorexia nervosa (AN) is characterized by persistent refusal to achieve or maintain age-appropriate body weight, and is associated with marked anxiety about weight gain and body image disorders [APA, 2000]. Lifetime prevalence is 0.6% and 12-month prevalence in the high-risk group of 13- to 18-year-old adolescents is 0.2% [Hudson et al., 2007; Swanson et al., 2011]. AN may be associated with serious medical late sequelae and has high comorbidity rates, as well as the highest mortality rate of all mental disorders [Steinhausen, 2009]. The conceptual model of Epstein et al. [2010], that food has a regulatory function, cannot be applied to AN, where the main symptom is food restriction. However, integrative models of AN postulate that avoidance of food intake achieves emotion regulation, insofar as the state of hunger decreases sensitivity to emotional stimuli over the short term [Hatch et al., 2010]. It was shown in an experimental trial that women with AN aged between 16 and 25, compared to the healthy control group, reported more difficulties in emotion regulation, which was predicted by depressive mood and poor emotion recognition [Harrison et al., 2010b]. Interestingly, it appears that deficient emotion regulation in AN is manifest especially in the case of anger [Harrison et al., 2010a]. First indications show that deficits in emotion regulation in AN are a reversible correlative factor. Thus, no differences were found between remitted pa-



**Fig. 1.** Schematic representation of theories of emotion regulation and binge eating.

tients and healthy control subjects with respect to emotion regulation [Harrison et al., 2010c]. Future research could clarify whether the correlative deficits are a result of malnutrition or of preexisting, predisposing factors.

### Self-Regulation and Bulimic Eating Disorders

Bulimic disorders include bulimia nervosa (BN) and binge eating disorder (BED), which are characterized by repeated episodes of binge eating (eating an objectively large amount of food in a short period of time), with a strongly experienced feeling of loss of control. In contrast to BN, BED involves no regular compensatory measures such as self-induced vomiting, excessive sport activity, or laxative abuse. Adult lifetime prevalence rates of 1% were reported for BN, with most patients suffering from additional comorbid mental disorders [Hudson et al., 2007]. BED, with a reported adult lifetime prevalence of 6.6%, is the most common eating disorder and is accompanied by reduced quality of life, increased general psychopathology, and comorbid affective anxiety and impulse-control disorders [Gruzca et al., 2007; Hudson et al., 2007]. Recent studies have further shown that BED appears even in childhood, among 6- to 13-year-olds [Tanofsky-Kraff et al., 2011].

The associations between binge eating and emotion regulation have been specifically examined in bulimic eating disor-

ders. The findings form the basis of theoretical models on the trigger for binge eating (see schematic overview in fig. 1). ‘Restraint Theory’ postulates that restrictive eating behavior and the associated cognitive control are interrupted by negative affect, triggering binge eating [Herman and Polivy, 1984]. ‘Escape Theory’ proceeds from the standpoint that eating binges represent a strategy to interrupt aversive emotional states [Heatherton and Baumeister, 1991]. In contrast to Restraint Theory, it assumes that the negative affect is reduced during the eating binge, because attention is diverted from aversive emotions, but that after binge eating negative affect increases again. ‘Expectancy Theory’ explains the maintenance of bulimic eating behavior by the anticipated reward of food intake [Hohlstein et al., 1998]. The most research attention has been given, however, to ‘Affect Regulation Theory,’ i.e., the assumption that food intake reduces the increase in negative emotions or stress [Polivy and Herman, 1993].

A recent meta-analysis reviewed the significance of emotion regulation theories in relation to maintenance of bulimic behaviors in adolescents and adults (especially Affect Regulation Theory), based on 36 studies that used ambulatory electronic diaries (Ecological Momentary Assessment (EMA)) [Haedt-Matt and Keel, 2011]. EMA makes it possible to monitor behavior, emotions, and thoughts in a timely manner in the natural setting, thus reducing distortions introduced by retrospective reports [Shiffman et al., 2008]. The results indicate an

increase of negative affect before binge eating compared to average emotion throughout the day and compared to affect before normal food intake; this applies particularly to BED. The rise in negative affect after the binge eating, however, contradicts Affect Regulation Theory's postulated emotion-regulating effect of binge eating. Interestingly, these findings with EMA contradict other studies that have shown that patients retrospectively report a decline in negative affect [Haedt-Matt and Keel, 2011]. Similarly, the meta-analysis data do not provide confirmation for Escape Theory, particularly since negative affect does not decline during binge eating; here the possibility of reactivity should be considered, since the EMA survey is conducted shortly after binge eating, which might in fact draw the patients' attention to their aversive emotions. If a significantly longer period of 4 h after binge eating is considered, however, there is gradual improvement in the negative mood of adult patients with BED [Munsch et al., 2011b]. Moreover, there are indications that it is not so much an accumulation of negative affect, but rather the experience of immediate negative affect that triggers the eating binges; mood then improves slowly, although it is unclear whether this can be attributed to binge eating itself [Munsch et al., 2011b]. With respect to the compensatory behavior of BN, the meta-analytical data suggest that such behavior can regulate the rise of negative affect after the binge eating, but there is no improvement in the affective condition overall [Haedt-Matt and Keel, 2011].

In summary, looking at the theories of emotion regulation in bulimic disorders, there is evidence of a rise in negative affect prior to binge eating. Concerning the development of negative affect during and after binge eating in BED, the data suggest more pronounced negative affectivity on days when there are binges, compared to binge-free days. However, on the days with binges, it seems more likely that there is a short-term increase of negative mood, but that the mood subsequently improves over the long term. In BN, the situation appears quite a bit more complex, because there is conflicting evidence regarding short-term improvement of mood; data are lacking on longer-term development, and subsequent compensatory measures after binge eating result in only a slight reduction of negative affect to the baseline level.

Initial studies with children so far provide no evidence of negative affectivity before binge eating [Hilbert et al., 2009]. 'Numbing out', with a concomitant impaired ability to perceive emotions, could provide a possible explanation. Questionnaire studies with 8- to 13-year-old children, however, indicate that the experience of loss of control during the prior 3 months is associated with increased dysfunctional emotion regulation strategies, especially the regulation of anxiety [Czaja et al., 2009].

### Self-Regulation and Obesity

Eating disorders are rare although serious mental disorders, but overweight and obesity are classified by the World Health

Organization (WHO) as among the most serious problems of the 21st century. Worldwide, 23.2% of adults and 10% of children are overweight, and 9.8% and 2.3%, respectively, are obese [Kelly et al., 2008; Lobstein et al., 2004]. Overweight and obesity are associated with serious medical side effects and mental problems and have a high rate of persistence from childhood into adulthood [WHO, 2006, 2009; Lavie et al., 2009]. Moreover, in adult obese population groups, the prevalence of BED is twice that of populations of normal weight [Hudson et al., 2007]. Several studies point to the relationship between hyperfunction of the gustatory and somatosensory cortex and the food intake of overweight and obese people. One can assume that food intake in overweight and obese children and adolescents has a greater reinforcement function than in people of normal weight [Stice et al., 2009]; this limits the capacity for self-regulation, according to the neuropsychological model of Heatherton and Wagner [2011]. In addition to increased food-related reward sensitivity, according to Stice et al. [2009], environmental factors, such as the constant oversupply of unhealthy foods, as well as the personality factor of impulsiveness, contribute significantly to overeating. Reduced dopamine activity in the reward center is probably also one of the common neural bases of frequent comorbid disorders of overweight/obesity and Attention Deficit Hyperactivity Disorder (ADHD) in childhood and adulthood [Agranat-Meged et al., 2005; Altfas, 2002]. Several studies have also shown that both adults and children who suffer from ADHD have a higher risk of being overweight or obese, or having higher body mass index (BMI) values than the reference population [Pagoto et al., 2009; Lapane and Waring, 2008]. Pagoto et al. [2009] point out, furthermore, that the increased rate of overweight and obese adults in a population with ADHD is partly mediated by the presence of BED during the previous 12 months. In laboratory studies of children, relationships have been shown between self-regulation, in the sense of directing one's attention, and the amount of food intake: Thus, for 8- to 12-year-old overweight children, the amount of food eaten is predicted by attentional difficulties [Munsch et al., 2011a]. Findings of another laboratory study with overweight children point to an association between impulse regulation and BMI in childhood, as measured by go/no-go tasks. However, this association was no longer present in adolescence. By contrast, inattention remains correlated with BMI at both stages of life: the more inattentive and distractible the children/adolescents were in the behavioral observation, the higher was their BMI [Pauli-Pott et al., 2010]. However, the effects of the overall findings have to be described as low. Furthermore, important variables such as media consumption and intelligence, which could also influence BMI, were not fully monitored. In addition to cross-sectional studies, prospective longitudinal studies were also able to prove the association between overweight/obesity and self-regulation: Thus, an emotional temperament (e.g., excessive expression of anger and frustration) and tantrums in infancy and about food are predictive of overweight at age 9

[Agras et al., 2004]. This effect was also demonstrated in standardized behavioral observations: Children between the ages of 3 and 5 with weaker ability for self-regulation, in the sense of reward postponement, had a significantly higher risk of gaining weight and being overweight up to age 12 [Francis and Susman, 2009; Seeyave et al., 2009]. This association persists into adolescence: 9-year-old children with weaker self-regulatory skills tend to be overweight at the age of 15 [Duckworth et al., 2010; Tsukayama et al., 2010]. Interesting gender differences appear with respect to the predictive function of correlates of self-regulation, such as shorter attention span in infancy: This seems to predict obesity at age 5–6, but only for boys and only if the variable was reported by the parents, whereas no predictive value was found when behavioral observations were made by the experimenter in mixed-gender samples [Faith and Hittner, 2010; Graziano et al., 2010]. Other findings from population-based prospective longitudinal studies confirm the cumulative effects of ADHD symptoms with respect to the likelihood of overweight and obesity in adulthood [Fuemmeler et al., 2011; Mamun et al., 2009].

Evidence is limited, however, of an association between weak self-regulatory skills in childhood and increased body weight in childhood, adolescence, and adulthood; this is because the impact of, e.g., socio-economic status, BMI, or psychological well-being, as well as self-assessed parenting skills, was not controlled in all studies. Gender differences with respect to the predictive value of shorter attention span also remain largely unexplained. Additional investigations with the aim of replicating the above findings could help to ascertain whether deficient self-regulation is a causal risk factor in the development of obesity and whether this can be influenced by targeted interventions [for an overview of risk factors in eating disorders, see Jacobi et al., 2004].

## Implications for Treatment

The validity of findings from current psychotherapy research into the symptoms of AN is particularly limited by high treatment dropout rates and methodological shortcomings. Overall, however, we have to assume a low efficacy at all ages using conventional therapies [Hartmann et al., 2011]. It remains to be determined whether the integration of strategies for promoting emotion regulation in disorder-specific treatment approaches, as called for by Haynos and Fruzzetti [2011], can improve the efficacy of interventions. For the bulimic eating disorders, cognitive-behavioral therapy and interpersonal therapy, as well as guided self-help in adulthood, are quite effective in the majority of cases [Hay et al., 2009; Vocks et al., 2010]. Nevertheless, negative affect before and after treatment, interpersonal problems, and unfavorable emotion-regulating behaviors (eating, smoking, drinking) seem to be associated with less favorable treatment outcome [Dingemans et al., 2007; Hilbert et al., 2007; Masheb and

Grilo, 2008a, 2008b]. Regarding obesity, it has been shown that combined techniques can be used effectively for treatment of childhood obesity, such as change in diet and physical activities, as well as behavioral training. In the future, however, it should be determined whether the long-term effects could be enhanced if psychological factors, such as self-regulation ability, were a focus of treatment efforts [Oude Luttikhuis et al., 2009; Puder and Munsch, 2010].

Despite the importance of self-regulation deficits in the etiology and maintenance of disordered eating behaviors, there have so far been only a few studies on the efficacy of integrating these techniques. A recent study of a small sample of 19 female patients with AN, BN, or an eating disorder not otherwise specified, which looked at techniques for emotion regulation in addition to standard treatment, was merely able to establish improved regulation of negative emotions and a trend toward improvement in restrained eating behavior [Storch et al., 2011].

Parallel to the evaluation of the added effect of strategies for self-regulation, strategies to improve disordered self-control should be used to prevent disordered eating behavior. Muraven and Baumeister [2000] proceed from the standpoint that self-regulation can be trained like a muscle, and that this training has generalized effects. In other words, regular practice of self-regulation in the problem area is not required. It has also been shown that minimal daily training in overall self-regulation (e.g., maintaining good posture, using the non-dominant hand for writing) can lead to improvements in the problem behavior [see overview by Heatherton and Wagner, 2011]. A non-specific training also includes the benefit of lower ‘ironic effects,’ such as the increased focus on the problem behavior and thus the greater likelihood that such behavior will actually occur, because of reduced capacity for self-regulation [Wegner, 2009].

## Conclusion

To examine the precise role of self-regulatory capacities in the specific development of disordered eating behaviors, both prospective longitudinal studies and other intervention studies are necessary, which aim at studying, on the psychological level, the efficacy of training in self-regulation for eating disorders and overweight. In addition, studies that examine the processes of self-regulation (emotion and impulse regulation) of different clinical groups in comparison with control subjects could provide information on the disorder-specificity of the process.

## Disclosure Statement

The authors declare that they have no conflicts of interest regarding this work.

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