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#### Emotion regulation and loss of control eating

Loss of control eating in adolescents: Associations with adaptive and maladaptive emotion

regulation strategies

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#### Abstract

Objective: To examine differences in the use of emotion regulation strategies in adolescents with and without loss of control over eating (LOC). Method: a community-based sample of 524 adolescents from 12 to 18 years old (70.6% girls;  $M_{age} = 15.08$ ; SD = 1.59) reported on LOC and the use of several maladaptive and adaptive emotion regulation strategies. Results: Adolescents who experience LOC (28%) report more use of maladaptive strategies. With regard to adaptive strategies a significant group X gender interaction effect was found with girls who report LOC using less adaptive strategies. More specifically, based on the FEEL-KJ less problem-oriented action, distraction, humor enhancement, acceptance and cognitive problem solving were observed in girls who report LOC compared to those who do not report LOC. Boys with LOC report more use of adaptive strategies compared to those who do not report LOC. Discussion: LOC in adolescents is associated with increased use of maladaptive emotion regulation strategies as well as a decreased use of adaptive strategies although the latter is only specific for girls. These results may inform prevention and treatment of emotion regulation problems in adolescents with LOC.

Keywords: loss of control eating; adolescent; emotion regulation

#### 1. Introduction

Binge eating is characterized by the consumption of an objectively large amount of food accompanied by the experience of loss of control over eating (LOC) (APA, 2013). Binge eating, even at a subthreshold frequency, appears to be common among adolescents with prevalence estimates ranging from approximately 2-20% in community samples up to 40% in overweight youth (Glasofer et al., 2007; Goossens, Soenens, & Braet, 2009; Sonneville et al., 2013). Also common are reports of eating episodes during which adolescents experience LOC without consuming an unambiguously large amount of food. Studies demonstrate that youth who report LOC are characterized by elevated levels of psychopathology and maladjustment irrespective of whether or not a large amount of food is eaten. For example, LOC appears to be associated with greater eating-related emotional distress, anxiety, and depressive symptomatology and poorer self-esteem (Decaluwe & Braet, 2003; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005). Moreover, longitudinal studies indicate that LOC eating is predictive of exacerbated general and eating disorder psychopathology (Hilbert, Hartmann, Czaja, & Schoebi, 2013; Tanofsky-Kraff et al., 2011), excessive weight and fat gain (Tanofsky-Kraff et al., 2009) and metabolic dysfunction (Tanofsky-Kraff et al., 2012) and may be a precursor of binge eating disorder (Tanofsky-Kraff et al., 2011). Therefore, investigating which factors are implicated in LOC eating is still important to inform both developmental risk models of eating and weight pathology as well as to refine prevention, screening and early intervention strategies for eating and weight disorders in youth (Goldschmidt, Wall, Loth, Bucchianeri, & Neumark-Sztainer, 2014).

When examining the development and maintenance of psychopathology, emotion regulation (ER) appears to be an important transdiagnostic process (Berking & Wupperman, 2012; Gross & Thompson, 2007). ER can be conceptualized as the process by which individuals modify their emotions or the situations eliciting the emotions (Gross, 1998).

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According to Aldao & Nolen-Hoeksema (2012) ER strategies can be classified as ineffective (maladaptive) versus effective (adaptive) based on both their immediate and long-term effects on affect, behavior and cognition. In their meta-analysis, Aldao, Nolen-Hoeksema & Schweizer (2010) found that maladaptive ER strategies such as rumination, avoidance and suppression are more strongly related to psychopathology (i.e. depression, anxiety, substance abuse and eating disorders) than adaptive strategies like acceptance, problem-solving and reappraisal. However, most of the studies that were included in this meta-analysis were conducted in adult samples. From a developmental view, the ability to regulate emotions already starts at very young ages and further increases through childhood and adolescence (Zeman, Cassano, Perry-Parrish, & Stegall, 2006). Research shows that a more frequent use of maladaptive ER strategies is already in youngsters characterized by a worse psychological outcome in terms of more rejection by peers (Kim & Cicchetti, 2010), more depressive and anxiety symptoms (e.g. Carthy, Horesh, Apter, & Gross, 2010; Silk, Steinberg, & Morris, 2003). With regard to the use of adaptive strategies, research shows that a higher presence of adaptive strategies in children is related to better coping with stress whereas more emotional and behavioral problems such as symptoms of anxiety, depression, conduct and oppositional problems are reported in community-based samples when children and adolescents have less adaptive strategies at their disposal (Braet et al., 2014). Unfortunately this latter study did not examine associations with eating pathology.

Theoretically it has already been suggested that LOC eating occurs in response to negative emotional states (Heatherton & Baumeister, 1991; Leon, Fulkerson, Perry, & Early-Zald, 1995) and some adult models of eating disorders (Fairburn, Cooper, & Shafran, 2003; Schmidt & Treasure, 2006) suggest that individuals with poorly regulated emotions often turn to food to escape from or down-regulate their emotions thereby increasing the risk for the development of an eating disorder. Empirically, negative affect has found to be a robust risk

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factor and causal risk factor for LOC in adults (Stice, 2002). Over the past years there have been studies in children and adolescents as well that found evidence for the cross-sectional and longitudinal association between negative affect and LOC eating (Goldschmidt et al., 2014; Hilbert et al., 2013; Ranzenhofer et al., 2014; Tanofsky-Kraff et al., 2007) However, most evidence comes from studies questioning about youngsters' levels of negative affect (mainly using scales that assess symptoms of depression and anxiety) or emotional eating but less evidence is available on which specific ER strategies are associated with LOC in adolescents.

In female adolescents, researchers (Fryer, Waller, & Kroese, 1997) found a role of emotion-focused coping, but not problem-focused coping, for explaining a general measure of disturbed eating attitudes. In another female adolescent population, researchers (Norwood et al., 2011) found that those girls with eating pathology, in terms of restrained and emotional eating, reported more use of expression and suppression strategies. Although these few results support the assumption that disordered eating is associated with more maladaptive emotion regulation, no conclusions can be drawn concerning the specific association with LOC, neither is it possible to conclude whether these associations between ER and disordered eating are also present in adolescent boys. To our knowledge, Czaja, Rief & Hilbert (2009) were the first to investigate the association between a broad range of ER strategies and LOC in a sample of 8 to 13-year old children (of both genders) and concluded that children with LOC used significantly more maladaptive ER strategies (especially giving up and rumination) compared to children without LOC. Interestingly, both groups did not differ in their use of adaptive ER strategies. Furthermore, past evidence has shown that the use of ER strategies varies by age (Zeman et al., 2006), and more specifically that with increasing maturation children may learn to make more use of adaptive ER strategies and less use of maladaptive ER strategies (Gullone, Hughes, King, & Tonge, 2010; John & Gross, 2004). Therefore, it

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remains to be investigated whether the conclusions that were drawn by Czaja and colleagues (2009) can be generalized to an adolescent population.

It was the aim of the present study to examine differences in the use of adaptive and maladaptive emotion regulation strategies in adolescents with and without LOC. In line with previous studies in children (Czaja et al., 2009), it was hypothesized that adolescents who report LOC use more maladaptive ER strategies in general, as well as more of several specific maladaptive ER strategies (giving up, aggressive action, withdrawal, self-devaluation, and rumination). Although in the study of Czaja et al (2009) no differences were found with regard of the use of adaptive ER strategies, based on transdiagnostic research (Braet et al., 2014), we hypothesized that adolescents who report LOC will also use less adaptive strategies, again both on general level as well as with regard to some specific adaptive ER strategies (i.e. acceptance, problem-oriented action, cognitive problem solving, distraction, neglect, revaluation, and put into good humor).

#### 2. Materials and Methods

#### 2.1. Participants and Procedure

Participants were recruited from the community through information letters which were passed around in nine high schools (grades 7-12) and via the University's psychology students as part of a practical course. Every participant received the same information letter explaining that this study was part of a larger project on behavior and emotions of adolescents from 12 to 18 years old. Participants either completed the questionnaires in the class room (paper version) or at home (paper or online version). Completion of the entire set of questionnaires took approximately 45 minutes. In the sample who filled out the questionnaires in the class room, school principals and adolescents gave their active consent while parents gave their passive consent. In the sample who filled out the questionnaires at home, both adolescents and parents gave their active consent. Every adolescent got a unique code to

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maintain anonymity and confidentiality. Ethics approval was obtained from the University's Ethics Committee.

#### 2.2. Measures

**2.2.1. Loss of Control over eating (LOC).** To assess LOC, we used the Children's Eating Disorder Examination Questionnaire (ChEDE-Q) (Decaluwé & Braet, 1999), which is a Dutch adaptation of Fairburn and Beglin's EDE-Q (1994). The ChEDE-Q was designed for use in youngsters from 8 to 18 years old (see Decaluwé and Braet (2004) for more information regarding this modification). Concordant with the EDE-Q, the ChEDE-Q is the only self-report questionnaire available that differentiates between the various forms of binge eating and provides the determination of binge eating as defined in DSM-IV-TR (APA, 2000) and DSM-5 (APA, 2013). It measures objective bulimic episodes (OBE; a sense of loss of control accompanied by eating a large amount of food that other people would also qualify as large) and subjective bulimic episodes (SBE; a sense of loss of control accompanied by eating a large amount of food according to the subject, but that other people would not qualify as unambiguously large). Both OBE and SBE fall under the coordinating term of LOC (Marcus & Kalarchian, 2003). In the present study youngsters were categorized as experiencing LOC when they reported at least one episode of OBE or SBE during the last month (LOC+ group). Youngsters who did not report SBE or OBE were categorized in the NoLOC (LOC-) group (see also Tanofsky-Kraff et al. (2004) for this procedure). Research demonstrated the reliability and validity of the ChEDE-Q for examining eating pathology in youngsters from the general population (Goossens & Braet, 2010; Van Durme, Craeynest, Braet, & Goossens, 2015) and in clinical samples of treatment seeking obese youngsters (Decaluwe & Braet, 2003; Decaluwe, Braet, & Fairburn, 2003).

**2.2.2. Emotion regulation.** The Questionnaire to Assess Children's and Adolescents' Emotion Regulation strategies (FEEL-KJ; Cracco, Van Durme, & Braet, 2015; Grob &

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Smolenski, 2005) is a 90-item self-report questionnaire measuring 15 emotion regulation strategies in response to three emotions, i.e. anger, anxiety and sadness in children and adolescents between the age of 10 and 20. Each ER strategy is assessed by two items for each of the three emotions, and items are rated on a five-point scale from 1 = almost never to 5 =almost always. The FEEL-KJ encompasses 15 primary emotion regulation strategies and two secondary emotion regulation scales conformed through factor analyses, i.e. an adaptive emotion regulation scale and a maladaptive emotion regulation scale (Cracco et al., 2015). The Adaptive ER scale consists of seven primary strategies (acceptance, problem-oriented action, cognitive problem solving, distraction, neglect, revaluation and put into good humor) and the Maladaptive ER scale consists of five primary strategies (giving up, aggressive action, withdrawal, self-devaluation and rumination). Three additional scales are not part of the secondary strategy scales: social support, expression and control over emotion. These three latter scales were not considered in the present study. In previous research in older adolescents, the internal consistency of the primary emotion regulation strategies lies between .69 and .91, with a mean of .77 which indicates good reliability of the FEEL-KJ (Grob & Smolenski, 2005) and also a recent study using several validating measures confirms that the FEEL-KJ is a valid and reliable measure of ER strategies in children and adolescents (Cracco et al., 2015). In the present study, Cronbach's alpha ranged from .61 to .88 for the seven primary adaptive ER scales and from .69 to .82 for the primary maladaptive ER scales. For the secondary scales, alphas were .94 for the adaptive ER scale and .90 for the maladaptive ER scale.

**2.2.3. Adjusted Body Mass Index (Adjusted BMI).** The Body Mass Index (BMI; weight/height<sup>2</sup>) was determined for each adolescent. In order to make BMI comparisons between youngsters of different ages and sex, we calculated the adjusted BMI [(actual BMI/ Percentile 50 of BMI for age and sex) x 100]. The 50<sup>th</sup> percentiles of the BMI for age and sex

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are based on normative data in a Flemish sample (Roelants & Hauspie, 2004). Data on the validity of self-reported weight and height suggest that adolescents provide information on their weight and height that is as valid as the information provided by adults (with correlations between self-reported and objectively measured data up to r = .98 for weight and r = .73 for height) (Field et al., 1999).

#### 2.3. Statistical analysis

Analyses were conducted using SPSS for Windows 22.0. To compare youngsters who report LOC (LOC+) with those who do not report LOC (LOC-) on sociodemographic variables a chi-square analyses (for gender) and ANOVA (for age, adjusted BMI) was used. Next, three MANOVAs were conducted with group (LOC+ versus LOC-) and gender (girls versus boys) entered as fixed factors. In the first MANOVA, the two secondary ER strategies (total adaptive ER and total maladaptive ER) were entered as dependents. In the second MANOVA, the seven primary adaptive ER strategies were entered as dependent variables and finally in the third MANOVA the five primary maladaptive ER strategies were entered as dependent variables. Since the use of ER strategies may vary by age (e.g. John & Gross, 2004), in each MANOVA age was included as a covariate. Measures of effect size are expressed as  $\eta_{p}^2$ .

#### 3. Results

#### 3.1. Participants

The sample consisted of 528 participants (70.6% girls) from 12 to 18 years old ( $M_{age} = 15.08$ ; SD = 1.59). The Adjusted BMI of the entire sample ranged between 69.47 and 149.98 (M = 102.49; SD = 13.30). In our sample, 7.2% could be classified as underweight (Adjusted BMI  $\leq$  85); 83.1% as normal weight (85 < Adjusted BMI < 120), 8.5% as overweight (120  $\leq$  Adjusted BMI < 140) and 1.2% as obese (Adjusted BMI  $\geq$  140). Of the total sample, 4 participants did not report on whether or not they experienced LOC and were thus not

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included in the final analyses. Of the other 524 participants, 28.4% (N = 149) reported they experienced at least one episode of LOC over the past month. More specifically, 15.6% reported at least one OBE episode (range 1-28), 19.9% reported at least one SBE episode (range 1-28). Of the LOC-sample, 7.1% reported both OBE and SBE episodes. Table 1 presents an overview of the sample characteristics of participants who report LOC versus those who do not. No significant differences were found between the LOC+ and LOC- group with regard to age and Adjusted BMI. Since results indicate gender differences between LOC+ and LOC- adolescents, gender was included as control variable in subsequent analyses and gender X group interaction effects were calculated.

#### [insert Table 1]

#### 3.2. Association between LOC and secondary ER strategies

Results of the multivariate tests show a significant main effect of both gender,  $F(2,513) = 20.43, p < .001, \eta_p^2 = .07$  and group,  $F(2,513) = 8.81, p < .001, \eta_p^2 = .03$  as well as a significant gender X group interaction effect,  $F(2,513) = 4.79, p < .01, \eta_p^2 = .02$ . No significant main effect of the covariate age was found,  $F(2,513) = 2.87, p > .05, \eta_p^2 = .01$ .

Table 2 presents the univariate results of the analyses comparing the LOC+ and LOCgroup with regard to the total adaptive ER scale and total maladaptive ER scale, and their interaction with gender. Univariate analyses show that with regard to the total maladaptive ER scale a significant main effect of gender, F(1, 514) = 34.04, p < .001,  $\eta^2_p = .06$ , and a significant main effect of group, F(1, 514) = 12.66, p < .001,  $\eta^2_p = .02$ , could be detected. More specifically regarding the main effect of gender the descriptives show that girls report significantly more use of maladaptive strategies compared to boys (M = 78.93, SD = 17.87 for girls versus M = 65.93, SD = 16.39 for boys; data not shown in Table 2). Regarding the main effect of group the descriptives show that adolescents of the LOC+ group report significantly more use of maladaptive strategies compared to adolescents of the LOC+ sample. No significant gender X group interaction effect was found with regard to the total maladaptive ER scale, F(1, 514) = .54, p = .46,  $\eta^2_{p} = .00$ . Also univariate analyses show a marginally significant effect of the covariate age, F(1,514) = 3.83, p = .05,  $\eta^2_{p} = .01$ .

With regard to the total adaptive ER scale univariate analyses show a significant main effect of gender, F(1, 514) = 11.69, p < .01,  $\eta^2_p = .02$ , but no significant main effect of group, F(1, 514) = 2.93, p = .09,  $\eta^2_p = .01$ . Results did show a significant interaction effect, F(1, 514) = 9.51, p < .01,  $\eta^2_p = .02$ . No significant effect of the covariate age was found, F(2,514) = 1.22, p = .27,  $\eta^2_p = .00$ . As demonstrated in Figure 1, girls who report LOC use less adaptive strategies compared to those who do not report LOC, whereas in boys, those who report LOC seem to use more adaptive strategies compared to those who do not report LOC.

#### [insert Table 2]

[insert Figure 1]

#### 3.3. Association between LOC and primary ER strategies

Results of the multivariate tests comparing the LOC+ and LOC- groups with regard to the seven primary adaptive ER strategies show a significant main effect of gender, F(7,512) = 6.03, p < .001,  $\eta^2_p = .08$ , and a significant effect of group, F(7,512) = 2.18, p < .05,  $\eta^2_p = .03$ , as well as a significant gender X group interaction effect, F(7,512) = 2.91, p < .01,  $\eta^2_p = .04$ . Also a significant main effect of the covariate age was found, F(7,512) = 5.09, p < .001,  $\eta^2_p = .07$ .

Table 3 presents the univariate results of the analyses comparing the LOC+ and LOCgroups with regard to the seven primary adaptive ER strategies and their interaction with gender. Univariate analyses show significant gender X group interaction effects on five adaptive strategies: problem-oriented action, F(1,518) = 7.37, p <.01,  $\eta^2_p = .01$ , distraction, F(1,518) = 9.47, p <.01,  $\eta^2_p = .02$ , put into good humor, F(1,518) = 4.97, p <.05,  $\eta^2_p = .01$ , acceptance, F(1,518) = 5.65, p <.05,  $\eta^2_p = .01$ , and cognitive problem solving, F(1,518) = 14.02, p <.001,  $\eta_p^2 = .03$ . Only with regard to this latter strategy of cognitive problem solving, the covariate age made a significant contribution, F(1,518) = 15.83, p <.001,  $\eta_p^2 = .03$ . As presented in Figure 2, results show that girls of the LOC+ group report less of these five strategies compared to girls of the LOC- group, whereas in boys the reversed is shown with boys of the LOC+ group reporting more of these five adaptive strategies compared with boys of the LOC- group. With regard to neglect, a significant main effect of group was found, F(1,518) = 4.42, p <.05,  $\eta_p^2 = .01$ , with adolescents of the LOC+ group reporting slightly more use of this strategy compared to the LOC- group). Finally, with regard to revaluation a significant main effect of gender was detected, F(1,518) = 6.74, p <.01,  $\eta_p^2 = .01$ , with boys reporting more use of this strategy compared with girls (M = 17.71, SD = 5.78, for boys versus M = 16.68, SD = 4.50 for girls; data not shown in table 3).

# [insert Table 3]

### [insert Figure 2]

Results of the multivariate tests comparing the LOC+ and LOC- groups with regard to the five primary maladaptive ER strategies show a significant main effect of both gender,  $F(5,514) = 9.11, p < .001, \eta^2_p = .08$ , and group,  $F(5,514) = 2.72, p < .05, \eta^2_p = .03$ , but no significant gender X group interaction effect,  $F(5,514) = 2.09, p = .07, \eta^2_p = .02$ . Also a significant main effect of the covariate age was found,  $F(5,514) = 3.36, p < .01, \eta^2_p = .03$ .

Univariate analyses show significant gender effects for all five strategies, more specifically girls report significantly more use of giving up, F(1,518) = 38.32, p < .001,  $\eta_p^2 = .07$ , aggressive action, F(1,518) = 11.17, p < .001,  $\eta_p^2 = .02$ , withdrawal, F(1,518) = 24.41, p < .001,  $\eta_p^2 = .05$ , self-devaluation, F(1,518) = 3.84, p < .05,  $\eta_p^2 = .01$ , and rumination, F(1,518) = 10.24, p < .001,  $\eta_p^2 = .02$ , compared to boys. Next, significant group effects are found for self-devaluation, F(1,518) = 9.62, p < .01,  $\eta_p^2 = .02$ , and rumination, F(1,518) = 7.86, p < .01,

 $\eta_p^2 = .02$ , and a trend significant effect for withdrawal, F(1,518) = 3.60, p = .06,  $\eta_p^2 = .01$ , with LOC+ youngsters reporting more use of these three maladaptive strategies compared with LOC- youngsters. Only with regard to the strategy of aggressive action the covariate age made a significant contribution, F(1,518) = 12.18, p < .01,  $\eta_p^2 = .02$ . Table 4 presents the univariate results of the analyses comparing the LOC+ and LOC- groups with regard to the five primary maladaptive ER strategies and their interaction with gender.

### [insert Table 4]

#### 4. Discussion

It was the aim of the present study to examine differences in the use of adaptive and maladaptive emotion regulation (ER) strategies in adolescents with and without loss of control over eating (LOC). With regard to the use of maladaptive ER strategies in general, results showed a main effect of group status with adolescents who experience LOC reporting more frequent use of maladaptive ER strategies compared with those who do not experience LOC. This is in line with the results of the study by Czaja and colleagues (Czaja et al., 2009) who also used the FEEL-KJ to assess the different ER strategies and who concluded that children of 8 to 13 years old with LOC make more use of dysfunctional ER strategies. When considering the specific (primary) maladaptive ER strategies, adolescents with and without LOC in the present study especially differ with regard to the use of self-devaluation and rumination. The elevated use of self-devaluation in the LOC group was not found in the study by Czaja and colleagues (2009), which may be explained by the age differences between the study samples. Where younger children with LOC rather report increased use of a maladaptive strategy such as giving up, as they grow older and mature they may increasingly deploy maladaptive strategies that require more cognitive capacities such as blaming their negative emotions to them self (i.e. self-devaluation). Importantly, the fact that in our study adolescents who experience LOC tend to ruminate more about negative emotions was in line

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with the findings by Czaja and colleagues (2009) in younger children indicating that the role of rumination in LOC eating is rather robust and may be less subjective to maturational changes.

Although these cross-sectional results can only tell us something about the association between LOC and ER strategies at one moment in time, it remains to be investigated which role rumination and self-devaluation play in the development and/or maintenance of LOC. For example, it could be hypothesized that when experiencing negative emotions, adolescents' maladaptive ER strategy of ruminating about the event or devaluating themselves proves to be ineffective in reducing the negative emotion, so instead they may use uncontrolled eating as a more 'behavioral' strategy that requires less effort of the mind. In that way, this finding is in line with assumptions of the Escape Theory (Heatherton & Baumeister, 1991) where LOC can be seen as an attempt to escape from the aversive self-awareness that is maintained by ER strategies like rumination and self-devaluation. Since adolescence is already characterized by heightened levels of self-awareness (Chen, Mechanic, & Hansell, 1998), the 'escape mechanism' may especially be valuable to explain LOC eating in this developmental phase as it enables youth to escape from dysfunctional thinking and to narrow cognitive attention at least temporarily to the more immediate (food) environment (Heatherton & Baumeister, 1991). However, it is plausible that when adolescents experience LOC, the maladaptive 'behavioral' strategy proves to be ineffective in downregulating the negative emotions as well, and may even result in more (or other) negative emotions such as guilt and shame that are often reported after a binge (Tanofsky-Kraff et al., 2007).

In addition, with regard to the use of maladaptive ER strategies a main effect of gender was found with female adolescents reporting more maladaptive ER strategies compared to males. Until now, research found inconsistent results with regard to gender-specific use of ER strategies (Nolen-Hoeksema & Aldao, 2011). For example in line with our results, Braet and

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colleagues (2014) also found a gender effect of maladaptive transdiagnostic ER strategies with 8 to 18-year old girls reporting more maladaptive strategies than boys. However another study in a large cohort from 11 to 50-year old participants found that some specific maladaptive strategies such as rumination are more reported in females whereas others such as avoidance and suppression are more frequently reported in males (Zimmermann & Iwanski, 2014). Future research should further explore the exact nature of these gender differences in ER.

Although previous research has linked eating pathology to maladaptive ER rather than the non-use of adaptive ER strategies (e.g. Aldao et al., 2010; Czaja et al., 2009; Sim & Zeman, 2005), results of the present study demonstrate that in a community sample, adolescents with LOC tend to report less use of adaptive ER strategies compared with adolescents who do not experience LOC. Importantly however, this effect was only visible in girls. When considering the primary adaptive strategies, this significant interaction effect between gender and LOC status was visible for five of the seven strategies that are included in the FEEL-KJ that is problem-oriented action, distraction, put into good humor, acceptance and cognitive problem solving. Girls who report LOC seem to use less of these strategies compared to girls who do not report LOC. These results extend those recently published by Braet and colleagues (2014) who concluded that internalizing and externalizing psychopathology in children and adolescents is associated with a lack of adaptive ER strategies. The fact that the present study is also able to link eating pathology, and more specifically LOC, to a lack of adaptive ER strategies in particular in girls may be interesting for different reasons: first of all, it demonstrates that in adolescent girls pathological eating behavior may not only be explained by an increased use of ineffective ER strategies, but also by a lack of (or decreased use of) some effective strategies. In other words, when experiencing a negative emotion these girls' repertoire of strategies to regulate this negative

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emotion may predominantly consist of ineffective strategies. Findings from previous research that in general girls experience more interpersonal conflicts and social stressors than boys (Hankin, Mermelstein, & Roesch, 2007), and also appear to be more emotionally reactive to stressors than boys (Charbonneau, Mezulis, & Hyde, 2009), in combination with our findings that girls who experience LOC seem to lack adaptive ER strategies to deal with stressors, may help to explain why especially adolescent girls are at an increased risk of developing an eating disorder as they might end up in a vicious circle of intense emotions, ineffective ER strategies and LOC (Klein & Walsh, 2004).

Remarkably, boys who experience LOC reported more use of adaptive strategies (and more specifically distraction and cognitive problem solving) compared to those who do not experience LOC. This finding first of all indicates that the association between LOC and adaptive ER is gender-specific and that in boys, LOC seems predominantly related to more use of maladaptive ER strategies than to a non-use of adaptive ER strategies. In fact, it might be possible that the increased use of adaptive strategies protects these boys from developing worse eating disorder pathology.

Interestingly, with regard to cognitive problem solving results also showed a significant influence of age. The fact that within our sample the use of this adaptive strategy increased with age can be explained by developmental changes. More specifically, adolescence is a developmental phase characterized by fundamental changes in the cognitive domain (Steinberg, 2005) and in fact, research on normative changes in ER has often focused on the idea that youngsters gradually learn to use more adaptive ER strategies, such as cognitive problem solving, as they mature and gain the cognitive skills that are necessary to successfully regulate emotional experiences (Zimmermann & Iwanski, 2014; John & Gross, 2004). However, the gender-specific associations between cognitive problem solving and LOC that were found in the present study seem to indicate that despite increased cognitive

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maturation, adolescent girls with LOC seem to decrease their use of cognitive problem solving and rather seem to turn to maladaptive strategies that require cognitive skills (such as self-blaming) whereas adolescent boys with LOC seem to profit more from their increased cognitive skills.

This study has several strengths. First of all, to the best of our knowledge, the current study is the first to investigate a broad range of both adaptive and maladaptive ER strategies in adolescents who report LOC. By doing so, the present study adds to the knowledge concerning emotion regulation difficulties in individuals reporting LOC and extends the findings described by Czaja et al (2009) in children. Moreover, in the present study gender-specific differential associations between ER strategies and LOC were examined. Another strength is the use of a developmentally appropriate self-report instrument to assess the use of ER strategies in youth. The FEEL-KJ covers seven adaptive and five maladaptive ER strategies and was found to be reliable and valid for use in young samples (Cracco et al., 2015).

This study has also some limitations. First of all, since the sample was recruited from the community future research should examine whether these associations between ER strategies and eating disorder symptoms can also be detected in clinical eating disorders. Secondly, both the assessment of LOC and ER relied on self-report measures and although both the ChEDE-Q and FEEL-KJ have proven to be reliable and valid instruments in adolescents, research using more objective methodologies may further unravel the association between ER and LOC. Also, since girls in the present study were overrepresented replication of the results including a larger sample of boys is warranted. Next, because of the crosssectional design, we can only conclude about differences in use of ER strategies between youngsters who report LOC and those who don't, but we cannot make causal inferences. In other words, the present results provide no information on whether LOC is caused by

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difficulties in ER or whether these difficulties are rather a consequence of this eating disorder symptom. Also, we cannot conclude about the role of ER in the maintenance of LOC in youth so more longitudinal as well as experimental studies in this area are needed in order to elucidate the association between ER and LOC eating in youth.

Clinically, identification of which ER strategies have stronger relationships with psychopathology may inform the improvement of existing treatments and provide avenues for new interventions (Berking, Orth, Wupperman, Meier, & Caspar, 2008). Specifically in youngsters who are at risk for eating disorders or who present with LOC in clinical practice, mapping out their ER profile may increase insight into which maladaptive strategies are used, and also whether or not these youngsters still have some adaptive strategies at their disposal. But also in the treatment of LOC in adolescents, both the focus on the role of maladaptive ER strategies next to broadening the repertoire of adaptive strategies may deserve a more prominent role in order to not only tackle the eating disorder symptom but also in helping to cope with their problems thereby preventing the development of worse eating and other psychiatric disorders.

To conclude, results of the present study demonstrate that LOC in adolescents is associated with increased use of maladaptive ER strategies as well as a decreased use of adaptive strategies, although the latter seems only specific for girls. Future research should further disentangle the association between LOC and emotion regulation difficulties in youth.

Author disclosure statements

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### Contributors

Lien Goossens and Kim Van Durme designed the study and wrote the protocol. Eva Van Malderen searched and included relevant literature. Lien Goossens conducted statistical analyses and wrote the first draft of the manuscript. Eva Van Malderen, Kim Van Durme and Caroline Braet commented on the different sections of the manuscript. All authors contributed to and have approved the final manuscript.

### **Conflicts of Interest**

All authors declare that they have no conflicts of interest.

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Figure 1.

Gender X group interaction effect on the use of adaptive ER strategies in adolescents



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### Figure 2.

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,00

LOC

1,00

Gender X group interaction effects on the use of five primary adaptive ER strategies:

problem-oriented action, distraction, put into good humor, acceptance and cognitive problem

solving in adolescents



Emotion regulation and loss of control eating

### Table 1.

Sample characteristics of participants who report LOC (LOC+) and those who do not (LOC-)

	LOC+	LOC-	$F/\chi^2$
	<i>N</i> = 149	N = 375	
Sex ratio (M/F)	24/125	129/246	17.26***
Age (years)	14.87 (1.49)	15.16 (1.62)	3.44 (n.s.)
AdjBMI	103.60 (14.19)	102.04 (12.79)	1.46 (n.s.)

Note. LOC = Loss of Control over Eating; M = Male; F = Female; AdjBMI = Adjusted Body Mass Index; n.s. = non significant; \*\*\*p<.001

*p*<.00

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Table 2.

Differences between adolescents who report LOC (LOC+) and those who do not (LOC-) on secondary ER strategies

		LOC+			LOC-		FLOC	Fgender	F <sub>LOCxGen</sub>
						S			der
	Boys	Girls	Total	Boys	Girls	Total			
	M(SD	M(SD	M(SD	M(SD	M(SD	M(SD			
	)	)	)		)	)			
Total	153.7	132.5	135.9	138.1	137.2	137.5	2.93	11.69**	9.51**
Adaptive	2	1	8	7	7	8			
ER Scale	(25.9	(26.6	(27.5	(30.6	(23.2	(25.9			
	6)	0)	6)	1)	5)	8)			
Total	70.94	84.75	82.49	64.99	76.00	72.21	12.66**	34.04**	0.54
Maladapti	(14.7	(19.3	(19.2	(16.5	(16.3	(17.2	*	*	
ve ER	0)	0)	8)	7)	8)	4)			
Scale	5								

Note. LOC = Loss of Control over Eating; ER = Emotion Regulation; *F*-values represent the results of the univariate analyses; the effect of Age (covariate) was not significant with regard to Total Adaptive ER Scale (p>.05) and marginally significant with regard to Total Maladaptive ER Scale (p=.05); \*\*p<.01, \*\*\*p<.001

### Table 3.

Differences between adolescent boys and girls who report LOC (LOC+) and those who do not (LOC-) on primary adaptive ER strategies

		LOC+			LOC-		FLOC	Fgender	F <sub>LOCxGend</sub> er
	Boys	Girls	Total	Boys	Girls	Total			
	M(SD	M(SD	M(SD	M(SD	M(SD	M(SD			
	)	)	)	)	)	)			
Acceptanc	21.96	18.25	18.84	20.12	18.87	19.30	1.66	24.37**	5.65*
e	(4.38)	(4.09)	(4.34)	(4.68)	(3.69)	(4.09)		*	
Problem-	21.48	18.73	19.17	19.86	20.22	20.10	.03	4.58*	7.37**
oriented	(5.06)	(4.46)	(4.66)	(4.84)	(4.34)	(4.51)			
action									
Cognitive	22.23	19.08	19.59	18.35	19.90	19.37	7.44*	1.89	14.02***
problem	(4.48)	(4.91)	(4.96)	(5.69)	(4.54)	(4.96)	*		
solving									
Distractio	24.58	19.66	20.45	21.95	21.04	21.35	0.89	19.91**	9.47**
n	(5.16)	(5.13)	(5.42)	(5.79)	(5.05)	(5.33)		*	
Neglect	21.46	19.72	20.00	19.28	19.47	19.40	4.42*	1.80	2.90
	(3.39)	(4.25)	(4.16)	(6.13)	(3.92)	(4.78)			
Revaluatio	19.15	16.88	17.25	17.45	16.58	16.88	2.91	6.74**	1.23
n	(5.62)	(4.49)	(4.74)	(5.79)	(4.52)	(5.00)			
Put into	22.92	20.05	20.52	21.15	21.21	21.19	0.16	4.33*	4.97*
good	(6.00)	(5.64)	(5.77)	(5.80)	(4.95)	(5.25)			
humor									

Note. LOC = Loss of Control over Eating; *F*-values represent the results of the univariate analyses; the effect of Age (covariate) was only significant with regard to Cognitive problem solving (p<.001);\*p<.05, \*\*p<.01, \*\*\*p<.001

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Table 4.

Differences between adolescent boys and girls who report LOC (LOC+) and those who do not (LOC-) on primary maladaptive ER strategies

		LOC+			LOC-	6	F <sub>LOC</sub>	Fgender	FLOCxGend
						G			er
	Boys	Girls	Total	Boys	Girls	Total			
	M(SD	M(SD	M(SD	M(SD	M(SD	M(SD			
	)	)	)	)		)			
Giving up	12.13	16.56	15.85	12.23	14.80	13.92	2.11	38.32**	2.71
	(3.54)	(5.07)	(5.12)	(4.52)	(4.39)	(4.59)		*	
Aggressiv	11.33	14.71	14.16	11.23	12.61	12.14	3.02	11.17**	2.43
e action	(4.43)	(6.05)	(5.94)	(4.99)	(5.96)	(5.68)			
Withdraw	12.38	15.51	15.01	11.38	14.23	13.26	3.60 <sup>\$</sup>	24.41**	.06
al	(5.22)	(5.24)	(5.35)	(4.47)	(4.86)	(4.91)		*	
Self-	16.72	18.29	18.03	15.30	16.08	15.81	9.62*	3.84*	.50
devaluatio	(4.87)	(5.13)	(5.11)	(4.77)	(4.64)	(4.69)	*		
n	V								
Ruminatio	18.46	19.79	19.57	14.85	18.87	17.49	7.86*	10.24**	2.44
n	(4.29)	(4.26)	(4.28)	(4.60)	(8.54)	(7.66)	*		

Note. LOC = Loss of Control over Eating; *F*-values represent the results of the univariate analyses; the effect of Age (covariate) was only significant with regard to Aggressive action (p<.01);  ${}^{\$}p = .06$ ,  ${}^{*}p < .05$ ,  ${}^{**}p < .01$ ,  ${}^{***}p < .001$ 

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#### Highlights

- Youth with and without loss of control eating (LOC) differ in emotion regulation
- Adolescents with LOC use more maladaptive emotion regulation strategies
- Associations between LOC and emotion regulation appear to be gender-specific
- Girls but not boys who report LOC use less adaptive emotion regulation strategies