

## RESEARCH ARTICLE

# Loss of Control Over Eating in Overweight Youngsters: The Role of Anxiety, Depression and Emotional Eating

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### Abstract

The current study investigated loss of control (LC) over eating and the role of anxiety, depression and emotional eating in a sample of both treatment seeking ( $N = 115$ ) and non-treatment seeking ( $N = 73$ ) overweight youngsters (aged 8–18) using a semi-structured clinical interview and self-report questionnaires. It was found that treatment seekers reported twice as much LC (40%) compared to non-treatment seekers (21%). Cross-sectional prediction models indicated that increased anxiety was associated with emotional eating and LC. Emotional eating tended to mediate the relationship between anxiety and LC. Increased depression was associated with emotional eating but not with LC. Especially overweight treatment seekers turn out to be at risk for LC. Because LC may develop as a result of inadequate coping with negative emotions like anxiety, obesity treatment should focus on teaching more effective coping strategies. Longitudinal research is recommended to further elaborate affect regulation and LC. Copyright © 2008 John Wiley & Sons, Ltd and Eating Disorders Association.

### Keywords

overweight; children and adolescents; loss of control over eating; affect regulation

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## Introduction

Loss of control (LC) over eating appears to be prevalent among a substantial sample of overweight children and adolescents (Glasofer et al., 2007; Goossens, Braet, & Decaluwe, 2007; Tanofsky-Kraff, Yanovski, Wilfley, Marmarosh, Morgan, & Yanovski, 2004). Which underlying mechanisms are responsible for youngsters to lose control over their eating behaviour remains however unclear. It is the purpose of the current study to fill this gap by examining the role of affect regulation in the experience of LC.

Recent studies have demonstrated a relationship between negative emotions and LC and found that the experience of LC is significantly related to symptoms of

anxiety and depression in obese treatment seeking children and adolescents (Eddy, Tanofsky-Kraff, Thompson-Brenner, Herzog, Brown, & Ludwig, 2007; Glasofer et al., 2007; Goossens et al., 2007). These findings can be situated in the predictions of the Affect Regulation Model which proposes that individuals who lose control over their eating and start to binge believe that eating provides distraction and comfort from painful negative emotions (Burton, Stice, Bearman, & Rohde, 2007; Grilo & Shiffman, 1994; Leon, Fulkerson, Perry, & Earlyzald, 1995).

The Affect Regulation Model has introduced the concept 'emotional eating' and looks upon emotional eating as a coping mechanism to regulate and reduce negative emotions. Although the model is developed

based on observations in adults, researchers have already found that overweight youngsters who suffer from LC were significantly more characterised by an emotional eating style compared to those youngsters who do not suffer from LC (Eddy et al., 2007; Goossens et al., 2007; Tanofsky-Kraff et al., 2007). These studies look promising but several features of the assumed mechanism remain unexplored, for example the link between some specific negative emotional states (like anxiety and depression) and emotional eating. Evidence has come from one study that found significant associations between emotional eating and elevated symptoms of anxiety and depression in a sample of treatment seeking overweight youngsters (Eddy et al., 2007).

Gaining a clear and thorough understanding on how common negative emotions (like anxiety and depression) and inadequate coping (like emotional eating) may play a role in the development of LC is necessary. Although longitudinal studies will be crucial to reveal the precise pathway, it is the aim of the present study to test the assumed mechanism in a cross-sectional model, thereby exploring whether and how negative affect contributes to LC. Furthermore, we will explore if the negative states operate, at least partially, via emotional eating. In anxious youngsters, emotional eating might be a way of dealing with the hyper arousal they experience, whereas in the case of depression, emotional eating might provide someone with more positive emotions. Based on preliminary research (Eddy et al., 2007), we expect significant associations between negative emotions (like anxiety and depression) and emotional eating. Also, we will explore whether the relationship between negative emotions and LC is mediated by the presence of an emotional eating style.

Early detection of LC and its emotional precedents can be of importance for the prevention and treatment of overweight and eating pathology. Longitudinal evidence has shown that elevated depressive symptoms and emotional eating, but not anxiety, predicted the onset of binge eating in adolescent girls (Stice, Killen, Hayward, & Taylor, 1998; Stice, Presnell, & Spangler, 2002). Furthermore, sub clinical eating disorder (ED) pathology is associated with the development of full syndrome EDs (Calam & Waller, 1998; Kotler, Cohen, Davies, Pine, & Walsh, 2001). ED pathology has also been associated with a worse obesity treatment outcome (Braet, 2006) and binge eating itself has been associated with excessive weight gain (Stice,

Cameron, Killen, Hayward, & Taylor, 1999; Stice et al., 2002; Tanofsky-Kraff et al., 2006). Finally, increased negative affect has been related with a poorer obesity treatment outcome in some adult studies (Teixeira, Going, Sardinha, & Lohman, 2005) but this has not yet been found in paediatric samples (Braet, 2006).

Although most studies have until now been conducted in treatment seeking samples, we assumed that the same mechanisms can be observed in all overweight youngsters. Remarkably, in a study in a non-treatment seeking sample, no significant difference was found between overweight children with and without LC on measures of depressive symptoms, anxiety and internalising psychopathology (Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005; Tanofsky-Kraff et al., 2004). More research is indicated integrating non-treatment seekers too.

Therefore, the purpose of the current study was to examine the unique contribution of two emotional states (anxiety and depression) to emotional eating on the one hand and LC on the other hand, and this in a sample of both treatment seeking and non-treatment seeking overweight youngsters. We hypothesised that: (1) anxiety will contribute to understanding emotional eating and LC. (2) Depression will also contribute to understanding emotional eating and LC. (3) If results confirmed previous hypotheses, it would allow us to test whether the presence of an emotional eating style can be considered to act as a mediator. Studying a mediator can help us identifying the mechanisms associated with LC.

## Method

### Participants

The sample of this study were 188 overweight children and adolescents (115 of whom seeking treatment and 73 non-treatment seekers); 75 boys (39.9%) and 113 girls (60.1%); ages ranged between 8 and 18 ( $M = 13.76$ ,  $SD = 2.33$ ). Of these youngsters, 26.1% ( $n = 49$ ) were below 13 years of age, 52.1% ( $n = 98$ ) were from 13 to 15 years old, and 21.8% ( $n = 41$ ) were older than 15.

### Measures

#### Eating Disorder Examination child version (ChEDE)

The Eating Disorder Examination (Fairburn & Cooper, 1993) is a standard investigator-based interview measuring the severity of the core psychopathology of eating

disorders and generating eating disorder diagnoses. The child version of the EDE is based on the adult EDE and is modified by experts in the field of eating disorders in children in collaboration with the authors of the original EDE (Bryant-Waugh, Cooper, Taylor, & Lask, 1996). A translation of the ChEDE was designed for use in populations of Dutch children (Decaluwé & Braet, 1999). The ChEDE can be administered from children as young as 8 years old. The ChEDE contains four subscales designed to provide a profile of individuals in terms of four major areas of eating disorder psychopathology: restraint, eating concern, shape concern and weight concern. In addition, the ChEDE measures three forms of overeating: objective bulimic episodes (OBE), subjective bulimic episodes (SBE) and objective overeating episodes. The ChEDE also measures four methods of weight control: self-induced vomiting, laxative misuse, diuretic misuse and intense exercising. The interrater reliability of the ChEDE is very good ( $r = .91$  to  $r = .99$ ). The test-retest reliability is also good ( $r = .61$  to  $r = .83$ ) (Decaluwe & Braet, 2004). Recently, Watkins, Frampton, Lask, & Bryant-Waugh (2005) investigated the reliability and validity of the ChEDE in eating disordered subjects. Interrater reliability was found to be high as well ( $r = .91$  to  $r = 1.00$ ). The  $\alpha$  coefficients for the subscales varied between .80 and .91. These researchers also made a comparison between children with Anorexia Nervosa, children with other clinical eating disturbances and two age-matched control groups. Results confirm the validity. In the current study,  $\alpha$  coefficient for the subscales varies between .56 and .81.

According to the research criteria as proposed by Marcus and Kalarchian (2003), children and adolescents in this study were categorised as having experienced LC over eating when they mentioned at least one episode of objective (OBE; a large amount of food that other people would also qualify as large) or subjective (SBE; a large amount of food according to the child, but that other people would not qualify as large) binge eating over the last three months. Subjects who did not mention OBE or SBE over the last three months were ranked as part of the no loss of control-group (NoLC).

### **Dutch Eating Behaviour Questionnaire (DEBQ) child version**

The Dutch Eating Behaviour Questionnaire (Vanstrien, Frijters, Bergers, & Defares, 1986) is a

questionnaire to assess eating behavior in children. The DEBQ contains 33 items divided over three subscales. These subscales assess the presence of three types of disturbed eating behaviour: restrained eating (10 items), external eating (eating in response to external cues; 10 items) and emotional eating (eating in response to negative emotions; 13 items). Items are formulated as specific eating behaviours to be rated at their frequency of occurrence on a five-point Likert scale ('1 = never', '2 = seldom', '3 = sometimes', '4 = often', '5 = very often'). In addition, for some items, there is a 'not relevant' category. In adult populations, it was demonstrated that the DEBQ is a reliable and valid instrument (Schlundt, 1995). Studies equally indicate the usefulness of the DEBQ in children and adolescents between the age of 7 and 17 years (Braet, Tanghe, De Bode, Franckx, & Van Winckel, 2003; Braet, Tanghe, Decaluwe, Moens, & Rosseel, 2004; Edlund, Halvarsson, & Sjoden, 1996; Halvarsson & Sjoden, 1998; Lluch, Herbeth, Mejean, & Siest, 2000). Recent research revealed a stable factor structure, satisfying internal consistency (Cronbach  $\alpha$  for the subscales ranged between .77 and .91), good test-retest reliability ( $r$  ranged between .87 and .90 for the different subscales) (Braet, Claus, Goossens, Moens, Soetens, & Van Vlierberghe, 2008) and external validity for the DEBQ in children (Ricciardelli & McCabe, 2001). In the current study, the subscale for emotional eating was used and the coefficient  $\alpha$  for this subscale was .90.

### **Children's Depression Inventory (CDI)**

The Children's Depression Inventory (Kovacs, 1992), translated in Dutch by Timbremont and Braet (2002), assesses cognitive, affective and behavioural symptoms of depression in youth (between the age of 8 and 17 years). The questionnaire has relatively high levels of internal consistency, test-retest reliability and predictive, convergent, discriminant and construct validity (Craighead, Smucker, Craighead, & Ilardi, 1998; Timbremont & Braet, 2002; Timbremont, Braet, & Dreesen, 2004). In the present study, the coefficient  $\alpha$  for the CDI total score was .86.

### **Spence Children's Anxiety Scale (SCAS)**

The Spence Children's Anxiety Scale (Spence, 1998) is a self-report questionnaire measuring specific symptoms of six DSM-IV anxiety disorders, namely generalised anxiety disorder, separation anxiety disorder, social

phobia, panic disorder and agoraphobia, obsessive-compulsive disorder and physical injury fears. The SCAS is useful in children as young as 8 years old. In psychometric studies on the Dutch version in large samples of school children, the SCAS has shown to be reliable and valid (Muris, Schmidt, & Merckelbach, 2000). In the current study, the coefficient  $\alpha$  for the SCAS total score was .91.

### Socioeconomic status

The Hollingshead index was used to assess socioeconomic status. This is a widely used measure of social and economic level based on career and education status (Hollingshead, 1975). Higher scores on the Hollingshead index (SES index) reflect a lower socioeconomic status.

### Physical measurements

Weight and height were measured using calibrated instruments. The BMI (weight/height<sup>2</sup>) was determined for each child. In order to make BMI comparisons between overweight children of different ages, this study uses the adjusted BMI [(actual BMI/Percentile 50 of BMI for age and gender)  $\times$  100]. The 50th percentiles of the BMI for age and gender are based on normative data in a Dutch sample (Fredriks, van Buuren, Wit, & Verloove-Vanhorick, 2000). An adjusted BMI score equal to or greater than 120% is considered as overweight (Van Winckel & Van Mil, 2001). Furthermore, the percentage of participants classified above the 85th, 90th and 97th percentile of BMI for age and gender according to the 2004 Flemish Growth Charts was determined (Roelants & Hauspie, 2005). Finally, to standardise BMI across (international) samples, BMI standard deviation (BMI-z) scores were calculated according to the United States' Centers for Disease Control and Prevention 2000 standards: [(actual BMI - mean BMI) / standard deviation of BMI]. In this calculation, the mean BMI and standard deviation of BMI are based on normative data among a US sample (Ogden et al., 2002).

### Procedure

The present study was approved by the research ethics committee of Ghent University. Questionnaires and interviews were administered randomised on different days. All participants were diagnosed as being primary

overweight (BMI > 85th percentile for age and gender). Exclusion criteria were mental retardation, autism and the presence of developmental syndromes like Prader-Willi. Informed consent was obtained from both the youngsters and their parents.

Treatment seeking participants were seen at the start of a 10-month obesity treatment program (for a full description of the program: see Braet (2006)). All eligible ( $n = 119$ ) youngsters who entered the clinic between January 2005 and July 2006 were invited. Of these youngsters, 6.7% ( $n = 8$ ) were not included in the study because they did not meet inclusion criteria or did not give their agreement. Participants who were included in the study ( $n = 111$ ) completed all assessments during the first two weeks at the clinic.

Non-treatment seekers were recruited through advertisements in healthcare magazines and via school mailings. The research was described as a study into the psychological well being of youngsters 'with a bigger size'. This recruitment resulted in a sample of 77 overweight youngsters who were willing to participate. These youngsters, all meeting the general inclusion criteria, were eligible when at the time the study took place, they did not seek or follow any kind of inpatient or outpatient treatment for their overweight (defined as a treatment in order to lose weight with at least the help of a dietician). Of these 77 youngsters, 5.2% ( $n = 4$ ) did follow overweight treatment at the moment of the study so they were included in the treatment seeking sample instead of the non-treatment seeking sample. All participants in the non-treatment seeking sample were aware that they would not receive any kind of treatment as part of the study protocol and they were seen at the Department of Developmental, Personality and Social Psychology of Ghent University where they completed all assessments.

### Statistical analysis

The results were expressed as a mean (SD) or percentage of the sample. Categorical data (gender, clinical status, presence of LC) were analysed using  $\chi^2$  statistics. Continuous data (age, adjusted BMI, BMI z-scores, SES index, CDI total score, SCAS total score, DEBQ subscale) were analysed using univariate analyses of variance (ANOVA). Hierarchical regression analyses were used to evaluate the association between anxiety, depression and emotional eating. Binary logistic regression analyses were used to evaluate the

association between anxiety, depression and LC and between emotional eating and LC.

A mediation model was tested following the recommendations of Baron and Kenny (1986; Holmbeck, 1997). According to Baron and Kenny, mediation is present when the following conditions are met: first of all, the independent variable (anxiety) significantly predicts the proposed mediator (emotional eating). Second, the independent variable (anxiety) significantly predicts the dependent variable (LC). Third, the proposed mediator (emotional eating) significantly predicts the dependent variable (LC). Fourth, the relationship between the independent variable (anxiety) and the dependent variable (LC) should be significantly reduced after controlling for the proposed mediator (emotional eating). The significance of this fourth (and indirect) effect was tested using the Sobel test (Sobel, 1982). Data were analysed using the SPSS version 12.0. *p*-values less than 0.05 were considered statistically significant. All tests were two-tailed.

### Missing values

In this study 7.98% of the DEBQ data, 1.60% of the CDI data and 9.04% of the SCAS data were incomplete. On the ChEDE, no data were missing. Comparison of means and covariances of all questionnaire variables using Little (1988) MCAR test revealed that data were missing completely at random,  $\chi^2(9) = 13.70$ ,  $p = .13$ . Therefore, it was decided to estimate missing values using maximum likelihood estimation and the expect-

tation maximisation algorithm available in SPSS (Schafer, 1997).

## Results

### Characteristics of the study sample

The participants ( $N = 188$ ) had a mean adjusted BMI of 167.18% (SD = 28.00) with a range of 120.53–256.04%, a mean BMI of 31.32 (SD = 5.97) with a range of 20.04–50.70 and a mean BMI *z*-score of 2.04 (SD = 0.42) with a range of 0.89 – 2.99. On the basis of the 2004 Flemish Growth Charts, 3.2% ( $n = 6$ ) of the youngsters could be classified between the 85th and 90th percentile of BMI for weight and gender, 18.6% ( $n = 35$ ) could be classified between the 90th and 97th percentile, and 78.2% ( $n = 147$ ) could be classified equal to or above the 97th percentile. The mean socioeconomic status of the sample was 44.28 (SD = 9.85) with a range of 14.5–77.0.

Table 1 presents the general characteristics of the treatment seekers and non-treatment seekers separately. No significant gender,  $\chi^2(1) = .12$ ,  $p = .73$ , or age,  $F(1,186) = .01$ ,  $p = .92$ ,  $\eta^2 = .00$ , differences were found between treatment seekers and non-treatment seekers. Both samples did differ in BMI *z*-score,  $F(1,186) = 147.41$ ,  $p = .00$ ,  $\eta^2 = .44$ , and SES index,  $F(1,183) = 10.74$ ,  $p = .00$ ,  $\eta^2 = .06$ . The treatment seeking subjects had significantly higher BMI *z*-scores and significantly higher SES index score (which indicates lower SES) compared to the non-treatment seekers. Both groups did not differ significantly in emotional eating style

**Table 1** General characteristics of the treatment seeking and non-treatment seeking overweight youngsters

	Treatment seekers $n = 115$		Non-treatment seekers $n = 73$		$F/\chi^2$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age (years)	13.77	2.19	13.74	2.54	.01
Sex ratio (M/FM)	47/68		28/45		.12
BMI <i>z</i> -score	2.26	.29	1.69	.34	147.41***
SES index	46.15	9.43	41.42	9.84	10.74***
LC/NoLC	46/69		15/58		7.71**
CDI total	12.82	6.64	10.63	6.15	5.09*
SCAS total	24.14	14.08	25.66	15.07	.49
DEBQ Emotional Eating	2.24	.86	2.15	.81	.44

Note: M, male; FM, female; SES index, Hollingshead index; LC, Loss of control over eating; NoLC, No loss of control over eating; CDI, Children's Depression Inventory; DEBQ, Dutch Eating Behaviour Questionnaire; SCAS, Spence Children's Anxiety Scale. Higher scores on the CDI reflect more depression, higher scores on the SCAS reflect more anxiety, higher scores on the DEBQ reflect higher symptomatology.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

(DEBQ Emotional Eating subscale score),  $F(1,186) = .44$ ,  $p = .51$ ,  $\eta^2 = .00$ , and anxiety symptomatology (SCAS total score),  $F(1,186) = .49$ ,  $p = .48$ ,  $\eta^2 = .00$ . However, treatment seekers experienced significantly more depressive symptoms compared to non-treatment seekers (CDI total score),  $F(1,185) = 5.09$ ,  $p = .03$ ,  $\eta^2 = .03$ .

Of the 188 participants, 61 (32.4%) reported LC over their eating, with a mean of 7.39 episodes (range 1–37 episodes) over the past 3 months. The presence of LC was significantly higher in the treatment seeking sample compared to the non-treatment seeking sample,  $\chi^2(1) = 7.71$ ,  $p = .01$ . In the non-treatment seeking sample 20.55% reported LC, whereas the prevalence of LC amongst the treatment seekers was 40%.

According to the ChEDE interviews, six participants (3.2%) met criteria for an eating disorder: two youngsters (treatment seekers) met criteria for Bulimia Nervosa and four youngsters (three treatment seekers and one non-treatment seeker) met criteria for Binge Eating Disorder (APA, 2000).

Furthermore, comparison with appropriate norm groups revealed that 27 (13.3%) participants had clinical CDI total scores, 21 (11.17%) participants had clinical DEBQ Emotional Eating scores and finally, 15 (7.98%) participants had clinical SCAS total scores (Braet et al., 2008; Spence, 1998; Timbremont & Braet, 2002).

### Is anxiety associated with emotional eating and LC?

To test whether it is possible to explain part of the variance of emotional eating (outcome variable) by anxiety (predictor), a hierarchical linear regression analysis was used. Group status (treatment seekers = 0, non-treatment seekers = 1), gender (male = 0, female = 1), age, BMI z-score and SES index score were considered as control variables and entered in block 1. SCAS total score was entered in block 2. Overall, the control variables explained 18% of the variance of DEBQ Emotional Eating score, whereas SCAS total score accounted for an extra 5% of the variance of DEBQ Emotional Eating score. SCAS total score significantly predicted DEBQ Emotional Eating score,  $t = 3.54$ ,  $p = .00$ .

To test whether scores on anxiety can predict LC, a binary logistic regression analysis was used. Group status, gender, age, BMI z-score and SES index score

**Table 2** Summary of hierarchical linear regression analysis and binary logistic regression analysis of anxiety on emotional eating and LC, respectively ( $N = 188$ )

Variable	Emotional eating			LC		
	B	SE	t	B	SE	Wald
Group	-.43	.15	-2.82**	.41	.47	.76
Gender	.49	.12	4.19***	-.22	.36	.38
Age	.07	.02	3.05**	-.06	.07	.67
BMI z-score	-.55	.18	-3.09**	1.16	.57	4.07*
SES index	.00	.01	.30	-.01	.02	.08
SCAS total	.01	.00	3.54***	.03	.01	4.29*

Note: B, Unstandardised Coefficient; SE, Standard Error; SES index, Hollingshead index; SCAS, Spence Children's Anxiety Scale; LC, Loss of control over eating.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

were considered as control variables and entered in block 1. SCAS total score was entered in block 2. Results show that adding the control variables significantly contributed to the predictive value of the model,  $\chi^2(5) = 14.59$ ,  $p = .01$ ,  $R^2 = .11$ . Adding SCAS total score to the model also significantly contributed to the predictive value of the model,  $\chi^2(1) = 4.38$ ,  $p = .04$ ,  $R^2 = .14$ . Table 2 represents a summary of the hierarchical linear regression analysis and binary logistic regression analysis of anxiety on emotional eating and LC, respectively.

### Emotional eating as a mediator between anxiety and LC?

Since significant relations were found between anxiety and emotional eating on one hand, and between anxiety and LC on the other hand, we can test the hypothesis that emotional eating might serve as a mediator between anxiety and LC. Following the recommendations of Fritz and MacKinnon (2007) and MacKinnon, Lockwood, Hoffman, West, and Sheets (2002), it was found that the sample size ( $N = 188$ ) was large enough to achieve adequate power (i.e. .8 power) when testing for mediation.

Table 3 presents a summary of the regression results for this set of analyses. As the results above show, the first and second conditions are fulfilled; anxiety significantly predicts both emotional eating and LC. To test the third and fourth condition, a binary logistic regression analysis was used. Group status, gender, age,

**Table 3** Binary logistic regression analysis of anxiety on LC after controlling for emotional eating

Variable	<i>B</i>	SE	Wald	Exp( <i>B</i> )
Block 1				
Group status	.18	.49	.14	1.20
Gender	.06	.39	.02	1.06
Age	-.10	.08	1.81	.90
BMI z-score	1.51	.61	6.16	4.53*
SES index	-.01	.02	.10	.99
Block 2				
DEBQ Emotional Eating	.53	.24	5.01	1.69*
Block 3				
SCAS total	.02	.01	2.18	1.20

Note: CDI, Children's Depression Inventory; DEBQ, Dutch Eating Behaviour Questionnaire; SCAS, Spence Child Anxiety Scale.

\* $p < .05$ .

BMI z-score and SES index score were considered as control variables and entered in block 1. DEBQ Emotional Eating score was entered in block two and SCAS total score was entered in block 3. Results revealed that DEBQ Emotional Eating significantly predicted LC,  $\chi^2(1) = 7.40$ ,  $p < .01$ , thereby confirming the third condition. Moreover, results showed that after controlling for DEBQ Emotional Eating score, SCAS total score did not significantly predict LC anymore,  $\chi^2(1) = 2.17$ ,  $p = .14$ . DEBQ Emotional Eating score, however remained significantly associated with LC,  $Wald(1) = 5.01$ ,  $p = .03$ . Thus, the impact of SCAS total score on LC was less after controlling for DEBQ Emotional Eating. Following the suggestions of Baron and Kenny (1986), the significance of the indirect effect was tested using the Sobel test (Sobel, 1982). The reduction was trend significant,  $t = 1.88$ ,  $p = .06$ .

### Is depression associated with emotional eating and LC?

To test whether it is possible to explain part of the variance of emotional eating (outcome variable) by depression (predictor), a hierarchical linear regression analysis was used. Group status (treatment seekers = 0, non-treatment seekers = 1), gender (male = 0, female = 1), age, BMI z-score and SES index score were considered as control variables and entered in block 1. CDI total score was entered in block 2. Overall, the control variables explained 18% of the variance of DEBQ Emotional Eating score, whereas CDI total score accounted for an extra 4% of the variance of DEBQ Emotional Eating score. CDI total score

**Table 4** Summary of hierarchical linear regression analysis and binary logistic regression analysis of depression on emotional eating and LC, respectively ( $N = 188$ )

Variable	Emotional eating			LC		
	<i>B</i>	SE	<i>t</i>	<i>B</i>	SE	Wald
Group	-.34	.15	-2.22*	.33	.47	.51
Gender	.57	.12	4.97***	-.46	.35	1.69
Age	.07	.02	3.00**	-.06	.07	.60
BMI z-score	-.50	.18	-2.80**	1.23	.57	4.70*
SES index	.00	.01	.15	-.00	.02	.02
CDI total	.03	.01	3.03***	.02	.03	.45

Note: *B*, Unstandardised Coefficient; SE, Standard Error; SES index, Hollingshead index; CDI, Children's Depression Inventory; LC, Loss of Control over Eating.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

significantly predicted DEBQ Emotional Eating score,  $t = 3.03$ ,  $p = .00$ .

To test whether scores on depression can predict LC, a binary logistic regression analysis was used. Group status, gender, age, BMI z-score and SES index score were considered as control variables and entered in block 1. CDI total score was entered in block 2. Results show that adding the control variables significantly contributed to the predictive value of the model,  $\chi^2(5) = 15.72$ ,  $p = .01$ ,  $R^2 = .12$ . However, adding CDI total score to the model did not significantly contributed to the predictive value of the model,  $\chi^2(1) = .45$ ,  $p = .50$ ,  $R^2 = .12$ . Therefore, it was redundant to further test the possible mediating effect of emotional eating between depression (CDI total score) and LC. Table 4 represents a summary of the hierarchical linear regression analysis and binary logistic regression analysis of depression on emotional eating and LC, respectively ( $N = 188$ ).

## Discussion

In this study, we have examined whether and how negative emotions such as anxiety and depression, emotional eating and LC over eating are interrelated in a large sample of treatment seeking and non-treatment seeking overweight youngsters.

The first comparison between both sub samples showed that although LC can be detected in overweight youngsters who are not seeking weight loss treatment (21%), it seems that the treatment seekers are even more characterised by this type of disturbed eating behaviour (40%). This finding supports prior research

that higher prevalence rates of LC can be found in treatment seeking overweight samples (Eddy et al., 2007; Glasofer et al., 2007; Goossens et al., 2007; Levine, Ringham, Kalarchian, Wisniewski, & Marcus, 2006) compared to non-treatment seeking overweight samples (Tanofsky-Kraff et al., 2005; Tanofsky-Kraff et al., 2004).

Moreover, treatment seekers also report higher depression scores compared to the non-treatment seekers. Although the effect size in this investigation was rather small, other studies have already confirmed that among overweight adults (Fitzgibbon, Stolley, & Kirschenbaum, 1993) and youngsters (Braet, Merielde, & Vandereycken, 1997; Britz et al., 2000), those who seek treatment are a more 'pathological' group.

Furthermore, we have explored the relationship between LC and emotional states like anxiety and depression. Corroborating our expectations and consistent with previous research findings, we have found that LC was significantly associated with higher degrees of anxiety symptoms (Glasofer et al., 2007). These findings fit well within the Affect Regulation Model, which proposes that individuals may lose control over their eating behaviour and start to binge eat because they believe it provides distraction and comfort from painful negative emotions (Burton et al., 2007; Grilo & Shiffman, 1994; Leon et al., 1995).

However, in contrast to prior research findings (Glasofer et al., 2007; Goossens et al., 2007; Morgan et al., 2002) but consistent with others (Tanofsky-Kraff et al., 2005; Tanofsky-Kraff et al., 2004) no significant association was found between LC and depression. Apparently, losing control over eating was only exerted by anxious youngsters to secure distraction from their negative emotion. The lack of an association between symptoms of depression and LC indicates that overweight youngsters with symptoms of depression did not differ dependent on whether or not LC was present.

Also, the concept of emotional eating has been investigated. After controlling group status, gender, age, BMI z-score and SES, significant positive associations between anxiety symptoms and emotional eating on the one hand and between depressive symptoms and emotional eating on the other hand have been detected and provide support to our assumptions. This finding is consistent with previous studies that also found positive associations between emotional eating and negative emotions in both normal weight and overweight children (Braet & VanStrien, 1997; Eddy et al., 2007).

In our investigation, anxiety (5%) and depressive symptoms (4%) were both able to explain a small but unique part of the variance of emotional eating. Along with the assumption of the tripartite model (Clark & Watson, 1991) we can hypothesise that in anxious youngsters emotional eating is a mean of coping with hyper arousal, whereas in depressive youngsters it might be a way of gaining more positive emotions. Thus, the current study shows that anxiety and depression should be considered as two distinct emotional states with each their separate contribution towards (over)eating.

The control variables accounted for a substantial part (18%) of the variance of emotional eating. With regard to the control variables it is noteworthy that consistent with studies in adults (Tanofsky, Wilfley, Spurrell, Welch, & Brownell, 1997) as well as in children and adolescents (Braet et al., 2008; Tanofsky-Kraff et al., 2007), girls seem to be even more prone to developing an emotional eating style. However, this latter finding is in contrast with other studies where no gender differences in emotional eating could be detected in adults (Masheb & Grilo, 2006) or in younger age groups, as reported by both the children themselves (Shapiro, Woolson, Hamer, Kalarchian, Marcus, & Bulik, 2007) and the parents (Braet & VanStrien, 1997).

Again in support of our assumptions and some previous studies (Eddy et al., 2007; Goossens et al., 2007; Tanofsky-Kraff et al., 2007), emotional eating was significantly associated with LC and even tended to mediate the relationship between anxiety and LC. Thus, it was assumed that the emotional eating style is a way of coping with anxiety and hyper arousal, often related to an experience of totally losing control over their eating. Since only a trend significant mediation effect was found, more research in larger samples is needed to replicate this latter finding.

Thus, the current study shows that overweight youngsters who are characterised by symptoms of anxiety or depression use eating as a coping mechanism to handle their negative emotions, but it appears that especially the anxious overweight youngsters are vulnerable for losing control over their eating behaviour.

Clinically, current findings imply that when overweight youngsters present themselves for treatment, it is important to screen them for the presence of negative emotions, emotional eating and LC so that their treatment can be adapted with teaching them more



adequate strategies. In that way, the treatment outcome may be improved and the development of full blown eating disorders may be averted.

The strength of the current study is the use of the interview methodology to assess LC. Also, to our knowledge, this study is the first to assess LC in both treatment seeking and non-treatment seeking overweight youngsters and also the first to examine the relationship between LC, anxiety, depression and an emotional eating style in one and the same sample.

This study has some limitations. Because of the cross-sectional design of this study, we were only able to pronounce upon associations between variables. This design does not make it possible to draw causal relationships between LC, emotional eating, anxiety and depression. Previous research on risk factors of overweight and eating disorders has already shown that there is a complex (multidirectional) relationship between negative emotions and the development of overweight and pathological eating behaviour such as LC (Stice, 2002; Stice et al., 1998; Stice et al., 2002). In future, longitudinal research is needed to examine the development of LC, emotional eating and negative emotions and this both in treatment seeking and non-treatment seeking youngsters. Through longitudinal research it might be elucidated whether these cross-sectional variables (like anxiety and emotional eating) indeed constitute risk factors for LC, rather than being just correlates or even effects of LC. Also, longitudinal (prospective) research is needed to examine the assumed negative effect of LC, emotional eating style and negative emotions on treatment outcome of overweight youngsters following weight loss treatment. Finally, future research should further elaborate the unique contribution of different affective states on the development of (pathological) eating styles.

To sum up, the current study has made an attempt to comprehend the underlying mechanisms of LC over eating by examining the contribution of anxiety, depression and emotional eating in a sample of both treatment seeking and non-treatment seeking overweight children and adolescents. First of all, results show that the presence of negative emotions such as anxiety and depression are significantly associated with an emotional eating style. Moreover, anxiety was also associated with LC whereby emotional eating tended to mediate the relationship between anxiety and LC. Increased depression was associated with emotional eating but not with LC. Finally, it turns out that

especially overweight treatment seekers seem to be prone to LC. Therefore, this particular subgroup might benefit more from a treatment that not only focuses on weight loss but also addresses its emotional precedents.

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