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Marieke A. Adriaanse^a; Denise T. D. de Ridder^a; Catharine Evers^a

^a Utrecht University, Clinical and Health Psychology, Utrecht, The Netherlands

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Emotional eating: Eating when emotional or emotional about eating?

Marieke A. Adriaanse*, Denise T.D. de Ridder and Catharine Evers

Utrecht University, Clinical and Health Psychology, Utrecht, The Netherlands

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This article examines the extent to which self-reported emotional eating is a predictor of unhealthy snack consumption or, alternatively, an expression of beliefs about the relation between emotions and eating derived from concerns about eating behaviour. Three studies were conducted. Study 1 ($N=151$) and Study 2 ($N=184$) investigated the predictive validity of emotional eating compared to habit strength in snack consumption, employing 7-day snack diaries. Both studies demonstrated that snack consumption was not predicted by emotional eating but depended on the habit of unhealthy snacking and on restraint eating. As emotional eating was not a significant predictor of snack intake, Study 3 addressed the alternative hypothesis of emotional eating being an expression of concerns about eating behaviour. Results from this cross-sectional survey ($N=134$) showed that emotional eating was significantly associated with several concerns. Together, these studies show that snack intake is better predicted by habit strength and restraint eating than by emotional eating. Additionally, the results suggest that in normal-weight women the concept of emotional eating may not capture the tendency to eat under emotional conditions, but rather reflects beliefs about the relation between emotions and eating.

Keywords: emotional eating; snack intake; eating concerns; habits

Worldwide more than 1 billion people are overweight and by the year 2015 this number will have increased to 1.5 billion (WHO, 2005). The ‘toxic food environment’ (Wadden, Brownell, & Foster, 2002) with tempting palatable foods available everywhere is often blamed for the sharp increase in the number of overweight people (van den Bos & de Ridder, 2006). Despite environmental features being important, personal factors also play an important role as they determine how individuals respond to this environment (Faith, Fontaine, Baskin, & Allison, 2007; Snoek, van Strien, Janssens, & Engels, 2007).

A personal characteristic that has often been associated with overeating is ‘emotional eating’, which can be defined as ‘the tendency to overeat in response to negative emotions such as anxiety or irritability’ (van Strien et al., 2007, p. 106). The concept of emotional eating is derived from psychosomatic theory (Bruch, 1964), stating that emotional eaters are unable to differentiate hunger from the

*Corresponding author. Email: m.a.adriaanse@uu.nl

physiological state accompanying negative emotions. As a result, emotional eaters respond by eating when experiencing negative emotions, whereas normally this would result in loss of appetite since emotions induce physiological changes similar to that of satiety (see Greeno & Wing, 1994 for an overview).

Whether someone qualifies as an emotional eater is assessed by emotional eating scales, measuring the self-reported tendency to eat when being emotional, such as the *Emotional Eating Scale* (Arnow, Kenardy, & Agras, 1995), the *Emotional Overeating Questionnaire* (Masheb & Grilo, 2006) and the *Emotional Eating* subscale of the *Dutch Eating Behaviour Questionnaire* (van Strien, 2005). Individuals with high scores on these scales are claimed to have an increased risk of overweight (van Strien, 2005). This claim rests on the assumption that high self-reported emotional eaters *not only* eat in response to hunger, but *additionally* when being emotional. In this article, this claim is investigated by assessing whether the self-reported tendency to eat when experiencing negative emotions, as assessed by emotional eater scales, indeed predicts overall food intake, or, alternatively, whether emotional eating may reflect a troubled attitude towards one's eating behaviour. The assessment of food intake will be tailored to snack consumption specifically.

Although the idea that high scores on emotional eating scales are related to (over)eating is often cited in the literature (Snoek et al., 2007; van Strien & Ouwens, 2007), evidence supporting this line of reasoning is mixed. Positive associations of emotional eating were found with snack intake in normal weight women (Newman, O'Connor, & Conner, 2007) and with energy intake for female (but not male) type 2 diabetes patients (van Strien et al., 2007). In contrast, other studies revealed no association between emotional eating and food intake in adolescents (Wardle et al., 1992), or in a large sample of male and female adults and children (Lluch, Herbeth, Méjean, & Siest, 2000).

Studies investigating the effects of emotional eating on eating behaviour *in response to negative emotions* have also reported mixed findings. Oliver, Wardle, and Gibson (2000), and, more recently, O'Connor, Jones, Conner, McMillan, and Ferguson (2008) found that stressed emotional eaters had a higher caloric intake than unstressed and non-emotional eaters, but other studies found no support for this moderating role of emotional eating (Conner, Flitter, & Fetcher, 1999; Evers, de Ridder, & Adriaanse, in press; O'Connor & O'Connor, 2004). However, these findings do not concern the claim to be tested in this article, that is, whether individuals high on self-reported emotional eating consume more (snack) food *overall*.

This mixed evidence regarding the association between self-reported emotional eating and food consumption might be explained by the fact that emotional eating scales 'potentially involve a triple recall bias: They require individuals to recall their negative emotions, their eating behaviour, and the association between both' (Evers et al., in press). Although such a 'triple recall bias' could arguably influence all scales assessing associations between two phenomena (e.g. external eating), emotional eating may be particularly subject to such bias. Previous research has indicated that retrospective emotional ratings are highly sensitive for recall bias (Barrett, 1997; Ready, Weinberger, & Jones, 2007). Moreover, it has been shown that when people are in 'cold' (i.e. not emotional) states, they underestimate the impact of emotions on their behaviour (Nordgren, van der Pligt, & van Harreveld, 2007).

As a result of these biases, emotional eating scales may tell us more about the *perceived* association between negative emotions and eating than about individuals' actual eating behaviour when being emotional. Indeed, several studies have

suggested that self-reports of emotional eating may be an expression of *beliefs* about the frequency of eating when being emotional (Lluch et al., 2000), about the relation between emotions and eating (Bekker, van de Meerendonk, & Mollerus, 2004), and about the comforting role of eating in the case of negative emotions (Spoor, Bekker, van Strien, & van Heck, 2007).

Some studies suggest that this perceived association between emotions and eating may be the result of concerns about one's eating behaviour. Wardle et al. (1992) showed that adolescents with high scores on emotional eating felt fatter and more often reported feeling upset about eating even though there was no association between their emotional eating scores and BMI. Moreover, the finding that emotional eating is associated with a range of emotional problems, such as low self-esteem, social anxiety and feelings of inadequacy (van Strien, Schippers, & Cox, 1995), suggests that individuals scoring high on emotional eating may experience more emotional distress but do not necessarily respond to distress by (over)eating.

Considering the above presented findings, we suggest that self-reported emotional eating may be an expression of perceived associations between negative emotions and eating, derived from concerns about one's eating behaviour rather than an accurate description of actual past eating behaviour in response to negative emotions that predicts eating behaviour. The present studies were therefore designed to reassess the conceptual status of the emotional eating construct by (a) comparing its role in predicting snack intake with the role of habit strength and (b) investigating its relation to concerns about one's eating behaviour.

Eating habits have proven to be an important predictor of eating behaviour (Brug, de Vet, de Nooijer, & Verplanken, 2006; Honkanen, Olsen, & Verplanken, 2005; Verplanken, 2006; Verplanken, Herabadi, Perry, & Silvera, 2005) but have not been examined specifically for snacking in relation to eating styles, such as emotional eating. It is widely acknowledged that habits, including eating habits, are not simply reflections of the frequency of past behaviour but mental constructs with automaticity (unintentionality, uncontrollability, lack of awareness and efficiency) as their most defining characteristic (e.g. Aarts & Dijksterhuis, 2000; Verplanken, 2006). If snacking behaviour is of habitual nature, and hence occurs without awareness, individuals may be unable to accurately report on their tendency to eat when being emotional, giving credit to the alternative explanation that emotional eating is an expression of beliefs about the relation between emotions and eating behaviour.

Before presenting the overview of the studies that were conducted, it is important to note that there are several lines of research supporting the association between negative emotions and food intake (Conner et al., 1999; Macht, Haupt, & Ellgring, 2005; Newman et al., 2007; O'Connor & O'Connor, 2004; O'Connor et al., 2008). The question of interest in this article, hence, does not concern the relation between emotions and eating, but rather the validity of trait-like measures indicating the self-reported tendency to eat when experiencing negative emotions in predicting food intake.

Research overview

Three studies were conducted. In all studies, snack consumption was used as a measure of eating behaviour for the following reasons. First, as 'snacks' refer to any type of food that is consumed between meals (De Graaf, 2006), snack consumption

is probably more sensitive to the impact of emotions than meals that are consumed at regular times and places. Second, a focus on snacks is relevant because previous studies have demonstrated that snack intake is an important contributor to overweight (Zizza, Siega-Riz, & Popkin, 2001).

Studies 1 and 2 examined the role of emotional eating in predicting consumption of unhealthy snacks and employed snack diaries as dependent measures in prospective designs. This is an improvement to previous studies often using aggregate eating measures in cross-sectional designs. Study 2 also accounted for the experience of negative emotions during the daily snack consumption registration. Study 3 examined whether emotional eating is associated with personal concerns about eating, arguing that such an association would support the idea that emotional eating reflects beliefs about the role of emotions in eating.

For the assessment of emotional eating, we chose the Emotional Eating subscale of the Dutch Eating Behaviour Questionnaire (EE-DEBQ; van Strien, 2005). The EE-DEBQ is very similar to the Emotional Eating Scale (EES; Arnow et al., 1995) as both scales ask for the desire to eat in response to several distinct emotions. The EE-DEBQ requires self-reports on desire in terms of frequency (e.g. 'Do you have a desire to eat when you are anxious?') using scales ranging from 'never' to 'very often', whereas the EES requires self-report on desire strength, employing scales ranging from 'no desire to eat' to 'an overwhelming urge to eat'. Although both measures might be good indicators of emotional eating, we argue that past behavioural frequency is more relevant when trying to predict eating behaviour. The third available emotion eating scale, the Emotional Overeating Questionnaire (EOQ; Masheb & Grilo, 2006) was not considered because during data collection, this scale had only been used in binge eating disorder patients.

Study 1

This study examined the predictive validity of emotional eating and unhealthy snack habit strength with regard to the amount of unhealthy snacks consumed over a period of 7 days, as registered by a snack diary, controlling for external and restraint eating.

Method

Sample and procedure

One hundred fifty-four female undergraduates with an interest in healthy eating were recruited to participate in a study on snacking behaviour. Participants filled out a questionnaire and then received a 7-day snack diary. After 1 week, participants returned the diary and were reimbursed with €10. Of the recruited participants, 151 participants returned their diaries. The final sample consisted of 151 predominantly normal weight females with an average age of 20.53 years ($SD = 2.06$) and an average BMI of 21.48 ($SD = 2.34$).

Questionnaire

The questionnaire included questions about age, weight and length. Next, the Emotional Eating (13 items: $\alpha = 0.82$), External Eating (10 items: $\alpha = 0.73$) and

Restraint Eating (10 items: $\alpha = 0.93$) scales from the DEBQ (van Strien, 2005) and an adapted version of the Self-Report Habit Index (SRHI; Verplanken & Orbell, 2003) were administered. The SRHI consists of 12 items ($\alpha = 0.94$) measuring habit strength in terms of repetition and automaticity. For the purpose of this study, the SHRI was adapted in such a way that it referred to the habit of eating unhealthy snacks (e.g. 'Eating unhealthy snacks is something I do without thinking about it'). Participants indicated their response on 7-point scales.

Snack diary

The snack diaries consisted of one column with healthy snacks and one column with unhealthy snacks. A snack was defined as any food item that was consumed in between meals. Categories of healthy (mainly fruits and vegetables) and unhealthy snacks (e.g. crisps and cookies) were derived from a previous snack diary study (Adriaanse, de Ridder, & de Wit, 2009). For both snack categories, an option 'other' was also provided. Participants were asked to indicate how much of the snacks they had consumed during the day, measured in appropriate units (e.g. 'pieces' for fruits, and 'hand full' for crisps). They were instructed to fill out the diary in the evening when they did not expect to eat anymore. The amount of kilocalories (kcal) consumed on unhealthy snacks during 7 days was calculated by multiplying each snack by the average amount of kcal it contains. These averages were derived from the Dutch Nutrition Centre and validated by a professional dietician.

Results

Mean scores, standard deviations and intercorrelations are presented in Table 1. Caloric intake from unhealthy snacks and healthy snack consumption were log-transformed to obtain a normal distribution, but for ease of interpretation, Table 1 presents means and standard deviations for the non-transformed variables. Participants consumed an average of 343.23 kcal on unhealthy snacks ($SD = 206.51$) and 1.12 on healthy snacks (fruit and vegetables: $SD = 1.10$) per day. The mean scores for emotional eating, external eating and restraint eating were all above average according to norms for female students (van Strien, 2005).

Table 1. Study 1: Means, SD and correlations.

	1	2	3	4	5	6	7	8
BMI (1)	–							
Age (2)	0.17*	–						
Emotional eating (3)	0.07	–0.12	–					
External eating (4)	–0.06	–0.07	0.33**	–				
Restraint eating (5)	0.29**	0.03	0.16	–0.19*	–			
Habit strength (6)	–0.10	–0.08	0.31**	0.47**	–0.21*	–		
Unhealthy snack intake (kcal) (7)	–0.14	–0.06	0.05	0.28**	–0.35**	0.43**	–	
Healthy snack intake (8)	0.04	0.08	0.07	–0.19*	0.19*	–0.12	–0.00	–
<i>M</i>	21.48	20.53	2.79	3.24	2.79	3.84	343.23	1.12
<i>SD</i>	2.34	2.06	0.69	0.46	0.81	1.26	206.51	1.10

Note: * $p < 0.05$; ** $p < 0.01$.

A hierarchical multiple regression analysis with caloric intake as the dependent variable was performed in order to examine the predictive validity of emotional eating. BMI was entered as a control variable in step 1 of the model. In step 2, emotional, external and restraint eating were entered. In step 3, habit strength was added to the equation. Table 2 shows that steps 2 and 3 contributed significantly to the prediction of caloric intake. In step 2, restraint and external eating were significant predictors, and in step 3, restraint eating and habit strength were significant predictors: Participants who scored low on restraint eating and who reported strong unhealthy snacking habits were more inclined to eat unhealthy snacks. The final model explained 23.6% of the variance in unhealthy snack consumption (adj. R^2).

As it could be the case that participants high in emotional eating consumed more *healthy* snacks, a similar hierarchical regression analysis was performed for healthy snack intake. Results showed that only step 2 was significant, with participants low on external eating consuming more healthy snacks (Table 2). This model explained 3.8% of the variance in healthy snack intake (adj. R^2).

Discussion

The results of Study 1 indicate that unhealthy snack consumption is to a relatively large extent explained by habit strength and restraint eating, but not by self-reported emotional eating. As it seems likely that during the 7-day diary several negative emotional episodes occurred, the finding that emotional eater status is not associated with overall snack intake may indicate that people identifying themselves as emotional eaters actually do not consume more food when being emotional.

However, in order to investigate this assumption, inclusion of emotional episodes in the diary seems necessary. Firstly, such inclusion is required in order to confirm that negative emotional episodes were included during the timeframe of 7 days. Previous research, however, seems to indicate so: Newman et al. (2007) showed that people experience 0–5 ‘hassles’ a day, and other studies revealed that people experience on average one hassle a day (Conner et al., 1999; O’Connor et al., 2008). Secondly, including a measure of emotional state in the diary is required to assess the

Table 2. Hierarchical multiple regression analysis for unhealthy and healthy snack consumption.

	Unhealthy snack intake					Healthy snack intake				
	β_1	β_2	β_{final}	ΔF	ΔR^2	β_1	β_2	β_{final}	ΔF	ΔR^2
Step 1				3.07	0.02				0.23	0.00
BMI	-0.14	-0.05	-0.03			0.04	-0.02	-0.02		
Step 2				8.54**	0.15				3.35*	0.07
Emotional eating		0.03	-0.05			0.13	0.14			
External eating		0.21*	0.08			-0.21*	-0.19			
Restraint eating		-0.30**	-0.24**			0.13	0.12			
Step 3				18.14**	0.09				0.27	0.00
Habit strength			0.36**					-0.05		

Note: * $p < 0.05$; ** $p < 0.01$.

alternative explanation that self-reported emotional eaters do in fact consume more when experiencing negative emotions, but compensate for this increased intake during non-emotional episodes, resulting in an overall snack intake similar to non-emotional eaters.

Study 2

Study 2 again incorporated a 7-day snacking diary to examine the effects of emotional eating and snacking habits on snack consumption. However, this time we asked participants to register their unhealthy snack intake for each unhealthy snacking *episode*. Moreover, we added a measure of emotional state in the snack diary: Participants registered for each snacking episode which emotion had preceded it (if any). These improvements allowed for (a) checking if during a 7-day timeframe snacking was indeed preceded by any negative emotional episodes, and (b) investigating if self-reported emotional eaters reveal more snacking episodes preceded by negative emotions (cf Wardle et al., 1992).

Method

Sample and procedure

The procedure was similar to Study 1. Two hundred and thirty-five female students with an interest in eating healthily were recruited, of whom 184 completed the study. The women in the final sample had a predominantly normal weight (BMI: $M = 21.37$, $SD = 2.24$) and had a mean age of 21.11 years ($SD = 2.54$).

Questionnaire and snack diary

Questionnaire

The questionnaire was similar to Study 1. The emotional, external and restraint eating scales, and SRHI again showed good reliability (α 's = 0.89, 0.80, 0.91, and 0.90, respectively).

Snack diary

The snack diary was similar to Study 1, except that participants were requested to only record their *unhealthy* snack intake and to fill out one entry for each unhealthy snacking episode (defined as a 30-minute period) rather than to aggregate their unhealthy snack consumption over 1 day. The diary consisted of six entries per day for each day of the week. Each entry consisted of several columns of which two were of particular importance for this study: one column with 12 types of unhealthy snacks including an option 'other', and another column for registering positive and negative emotions (PANAS; Watson, Clark, & Tellegen, 1988). The other columns were added as control variables and included options for places, times and activities during the consumption of snacks.

For each snacking episode, participants were asked to indicate (a) which snack(s) they consumed and how much of this/these snack(s) they consumed, (b) how they felt when *starting* to eat the snack and (c) where/when/with whom they were when starting to consume the snack (control questions). With regard to their feelings, they were asked to choose *one* option that best described their affect when they were going

Table 3. Study 2: Means, SD and correlations.

	1	2	3	4	5	6	7	8
BMI (1)	–							
Age (2)	0.01	–						
Emotional eating (3)	0.15	–0.01	–					
External eating (4)	0.03	–0.11	0.35**	–				
Restraint eating (5)	0.35**	0.08	0.21**	–0.04	–			
Habit strength (6)	0.11	–0.04	0.36**	0.36**	–0.11	–		
Unhealthy snack intake (kcal) (7)	–0.05	–0.14	–0.07	0.08	–0.27**	0.29**	–	
Unhealthy snacking in response to negative emotions (freq) (8)	–0.09	–0.12	0.15	0.16	–0.07	0.17*	0.40**	–
<i>M</i>	21.37	21.11	2.69	3.26	2.72	3.84	405.62	0.44
<i>SD</i>	2.24	2.54	0.69	0.53	0.74	1.20	246.79	0.42

Note: * $p < 0.05$; ** $p < 0.01$.

to eat the snack. In this manner, the caloric intake from unhealthy snacks in general as well as the frequency of unhealthy snacking preceded by negative emotions could be determined.

Results

Table 3 shows the means, standard deviations and intercorrelations of the variables under study. Caloric intake from unhealthy snacks and frequency of snacking preceded by negative emotions were log-transformed in order to obtain normal distributions. For ease of interpretation, means and standard deviations are presented for the non-transformed variables. The mean amount of kilocalories consumed from unhealthy snacks was 405.62 kcal ($SD = 246.79$) a day. In order to calculate the number of snacking episodes preceded by negative emotions, the entries in which a negative emotion was specified were summed per participant. On average, consumption of snacks preceded by negative emotions occurred 0.44 times a day ($SD = 0.42$). The average scores for emotional, external and restraint eating were above average according to norms for female students (van Strien, 2005).

A hierarchical multiple regression analysis with unhealthy snack consumption as dependent variable with steps similar to Study 1 was conducted (Table 4). Step 1 (BMI) was not significant. Step 2 was significant, with restraint eating as significant predictor. In the final step, habit strength and restraint eating were significant predictors; participants with strong unhealthy snacking habits and low on restraint eating consumed more unhealthy snacks. The final model explained 14.3% of the variance in caloric intake (adj. R^2). The same regression analysis with frequency of unhealthy snacking in response to negative emotions as the dependent variable did not yield any significant effects.

Discussion

The results of Study 2, like in Study 1 did not reveal a significant effect of emotional eating on caloric intake but did demonstrate a strong significant effect of unhealthy

Table 4. Hierarchical multiple regression analysis for unhealthy snack consumption.

	β_1	β_2	β_{final}	ΔF	ΔR^2
Step 1				0.52	0.00
BMI	-0.05	0.05	0.01		
Step 2				5.28**	0.08
Emotional eating		-0.05	-0.15		
External eating		0.09	0.02		
Restraint eating		-0.28**	-0.22**		
Step 3				17.09**	0.08
Habit strength			0.32**		

Note: * $p < 0.05$; ** $p < 0.01$.

snacking habit strength and restraint eating. Results thus again provide support for the assumption that self-reported emotional eating does not predict overall snack intake. Considering only snacking episodes that were preceded by negative affect did not affect these results. Together, these findings indicate that self-reported emotional eating may not be an accurate description of participants' actual tendency to eat in response to negative emotions. This idea is corroborated by a recent study (Evers et al., in press) that more stringently tested this assumption by inducing emotions and measuring food intake in a controlled environment.

An alternative explanation for our findings could be that emotional eating was not a big issue in the present sample of young females (Snoek et al., 2007). Although this explanation does not seem very plausible considering that 56.8% of the participants scored at least average on the emotional eating scale, we re-ran our analyses, excluding 31 participants who scored 'very low' to 'low' on emotional eating. This analysis again did not demonstrate significant effects of emotional eating on either the number of kilocalories consumed on unhealthy snacks or the number of snacking episodes preceded by negative emotions.

Lastly, it could be argued that there is in reality only a small effect of emotional eating on caloric intake from snacks and that Studies 1 and 2 lack the power to reveal a small effect. In order to rule out this possibility the data for emotional eating and caloric intake from Studies 1 and 2 were merged to calculate the correlation for these two studies combined. This analysis including 335 participants revealed a non-significant correlation of emotional eating with caloric intake, $r = -0.03$, $p = 0.65$. As a sample size of $N = 335$ gives a power of 0.80 to detect a small effect of $r = 0.13$, lack of power seems an unlikely explanation for our findings.

Study 3

In Study 3, we address the alternative hypothesis that self-reported emotional eating is an expression of personal beliefs about the association between emotions and eating resulting from concerns about one's eating behaviour. The existence of such concerns has been reported in the literature (Rozin, Bauer, & Catanese, 2003), as well as their association with disturbed eating patterns (Rozin, Bauer, et al., 2003; Rozin, 2005; Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999). Previous studies showed that an association exists between feelings of guilt and the amount of food

eaten (Rozin, Kabnick, Pete, Fischler, & Shields, 2003). Concerns about one's eating behaviour have also been examined in relation to emotional eating. Wardle et al. (1992), for example, demonstrated that feeling upset about one's eating behaviour was more prevalent amongst emotional eaters and adolescents with high scores on emotional eating felt fatter even though there was no association between their emotional eating scores and BMI.

Four types of concerns were examined: worries about eating behaviour (Rozin et al., 1999, Rozin, Bauer, et al., 2003), monitoring eating behaviour (Rozin et al., 1999, Rozin, Bauer, et al., 2003), perceived control over eating behaviour (Wardle et al., 1992) and extrinsic motivation for healthy eating behaviour (i.e. eating healthily for reasons of complying with other people's expectations; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004). As concerns about eating may be related to the extent that individuals feel capable of regulating their food intake, we also examined the role of self-regulatory skills. In addition, past snacking behaviour was assessed as a history of high snack consumption might influence concerns about this behaviour.

Method

Sample and procedure

Female students ($N=134$) with an interest in healthy eating were recruited to participate in a survey study that was presented as examining the role of lifestyle factors in healthy eating behaviour. They received course credit for participation. The sample consisted of 134 predominantly normal weight participants with an average age of 19.7 years ($SD=1.61$) and an average BMI of 21.31 ($SD=2.36$).

Dependent variables

Worries about eating behaviour were assessed by two items, $\alpha=0.61$ ('Are you worried about: '... the quantity of foods you consume?' and '... the quality of foods you consume?'; Rozin et al., 1999, 2003). *Monitoring one's eating behaviour* was assessed by two items, $\alpha=0.80$ ('Are you paying attention to/monitoring what you eat?'; Rozin et al., 1999, 2003). *Perceived control over one's eating behaviour* was assessed by a single item ('Do you feel able to control your food intake?', Wardle et al., 1992). *Motivation for healthy eating behaviour* was measured by the Regulation of Eating Behaviour scale (Pelletier et al., 2004) which distinguishes between six types of motivation, varying in the level of self-determination. In this study, we used the 'introjected regulation' scale (four items, e.g. 'Other people close to me insist that I eat healthy') to assess extrinsic motivation for healthy eating behaviour ($\alpha=0.76$). All items were measured on 7-point scales ranging from 1 = 'absolutely not' to 7 = 'definitely'.

Predictors

Emotional, external and restraint eating were measured similar to Studies 1 and 2. All scales showed good reliability (Cronbach's $\alpha=0.91$, 0.75 and 0.92, respectively).

Control variables

Self-regulatory skills were measured by the Decision-related subscale of the Action Control Scale (D-ACS; Kuhl, 1994). Previous research demonstrated that individuals scoring low on this scale have more difficulties in regulating their eating behaviour (Fuhrmann & Kuhl, 1998; Palfai, 2002). The D-ACS subscale consists of 12 forced-choice items with one response reflecting low action orientation and the other reflecting high action orientation. For example, in response to the item 'When I am facing a big project that has to be done' participants could choose the state orientation option ('I often spend too long thinking about where I should begin') or the action orientation alternative ('I don't have any problems getting started'). Responses to the 12 items were summed ($\alpha = 0.75$) with higher scores indicating higher action orientation (i.e. higher self-regulatory skills).

Past snacking behaviour was assessed by measuring the frequency of snacking for three specific occasions (i.e. morning, afternoon, evening) on 5-point scales ranging from 1 (less than once a week) to 5 (daily). Items were summed to compute a scale with high scores reflecting more frequent snacking (the minimum score was 3, the maximum score was 15).

Results

Table 5 shows the means, standard deviations and intercorrelations of the variables under study. The mean scores for emotional, external and restraint eating were above average according to the norms for female students.

Four hierarchical multiple regression analyses were performed to examine the effects of emotional eating on the four types of eating concerns. First, BMI, past snacking behaviour, and self-regulatory skills were entered as control variables (step 1), followed by emotional, external and restraint eating (step 2). Table 6 presents the results of these analyses, showing that the emotional eating scale is a significant predictor of increased worrying about one's eating behaviour, a higher level of monitoring one's eating behaviour, lower perceived control over one's eating behaviour and a stronger extrinsic motivation for healthy eating behaviour after controlling for BMI, self-regulatory skills and past snacking behaviour. Restraint eating was also an important predictor of eating concerns, except for perceived control over eating.

Discussion

The results of Study 3 show that emotional eating is an important predictor of eating concerns. Restraint eating was also a significant predictor, which corresponds with the previous literature on restraint eating expressing a problematic attitude towards food intake (Polivy, 1998). However, results must be interpreted with care as this study was cross-sectional and thus does not allow for drawing firm conclusions regarding the direction of these effects.

General discussion

Results from Studies 1 and 2 show that the impact of emotional eating on snack consumption is negligible when compared to the impact of snacking habits and

Table 5. Study 3: Means, SD and correlations.

	1	2	3	4	5	6	7	8	9	10
BMI (1)	–									
Self-regulatory skills (2)	–0.08	–								
Past snacking behaviour (3)	0.11	0.03	–							
Emotional eating (4)	0.16	–0.19*	–0.25**	–						
External eating (5)	–0.09	–0.26**	–0.35**	0.35**	–					
Restraint eating (6)	0.35**	–0.08	0.35**	0.17	–0.14	–				
Worries (7)	0.18*	–0.30**	0.03	0.35**	0.23**	0.48**	–			
Monitoring (8)	0.11	0.06	0.28**	0.18*	–0.15	0.59**	0.31**	–		
Perceived control (9)	–0.19*	0.21*	0.31**	–0.33**	–0.32**	0.11	–0.23**	0.26**	–	
Extrinsic motivation (10)	0.18*	–0.10	0.05	0.18*	0.04	0.52**	0.42**	0.38**	–0.02	–
<i>M</i>	21.31	19.22	10.24	2.78	3.22	3.48	4.02	5.71	4.72	4.59
<i>SD</i>	2.36	2.76	3.72	0.69	0.46	0.71	1.33	1.01	1.47	1.38

Note: * $p < 0.05$; ** $p < 0.01$.

Table 6. Results of hierarchical multiple regression analyses for concerns (worries, monitoring, perceived control and extrinsic motivation) ($N = 134$).

	Worries			Monitoring			Perceived control			Extrinsic motivation		
	β	ΔF	ΔR^2	β	ΔF	ΔR^2	β	ΔF	ΔR^2	β	ΔF	ΔR^2
Step 1		5.53	12% ^{**}	4.16	9% ^{**}		9.292	18% [*]		5.32	11% ^{**}	
BMI	-0.01			-0.13			-0.23 ^{**}			0.07		
Self-regulatory skills	-0.19 [*]			0.11			0.17			-0.02		
Past snacking behaviour	-0.02			0.11			0.12			-0.09		
Step 2		17.55	38% ^{**}	21.84	40% ^{**}		4.66	26% ^{**}		19.08	39% ^{**}	
Emotional eating	0.17 [*]			0.16 [*]			-0.21 [*]			0.21 [*]		
External eating	0.18 [*]			-0.07			-0.16			-0.01		
Restraint eating	0.46 ^{**}			0.57 ^{**}			0.16			0.51 ^{**}		

Note: Final β 's are presented.
^{*} $p < 0.05$; ^{**} $p < 0.01$.

restraint eating. The finding that unhealthy snack consumption is predicted by restraint eating is in correspondence with previous studies showing a negative association between restraint eating and food intake (Lluch et al., 2000; Wardle et al., 1992). The association between unhealthy snacking and habit strength may explain why emotional eating was not related to snack consumption. Habitual behaviours are typically performed without conscious awareness (Aarts & Dijksterhuis, 2000). This implies that individuals with the habitual tendency to eat when being emotional may not necessarily be aware of the unconscious link between negative emotions and the corresponding behavioural response (i.e. eating). Making accurate report of whether or not it is typically an emotional cue that triggers their snacking behaviour seems not very plausible in this case. In addition, it could very well be the case that emotional eating is inferred from having a strong habit to snack, as scores on emotional eating scales may include several sources for bias (Evers et al., in press).

The findings from Studies 1 and 2 demonstrating that unhealthy snack consumption is not predicted by self-reported emotional eating give credence to the alternative hypothesis that emotional eating may not be an accurate description of eating in response to negative emotions but instead reflects increased concerns about eating. Indeed, Study 3 showed that emotional eating was a significant predictor of increased concerns about eating behaviour.

There are several explanations for the relation between personal concerns about eating and emotional eating scores. For example, the finding that emotional eaters reported more eating concerns could be an indication that they generally experience more negative affect (van Strien, 2005). A study by Bekker et al. (2004) showed that inducing negative affect (by providing achievement-related failure feedback) resulted in significantly higher levels of self-reported emotional eating, suggesting that higher scores on emotional eating scales might reflect a general tendency to experience negative feelings or an over-interpretation of these feelings, but not necessarily a specific tendency to eat when experiencing negative emotions.

Conversely, the association between emotional eating and eating concerns could also point to a general preoccupation with eating and food in emotional eaters which, in turn, might result in an inflated notion of the frequency of eating (or the desire to eat) in response to negative emotions. The higher report of eating concerns by emotional eaters in Study 3 suggests that high scores on emotional eating reflects a certain fixation on the potentially negative aspects of eating, such as eating for the 'wrong' reasons (i.e. negative emotions), although there are no *actual* differences in eating in response to negative emotions. High scores on emotional eating might thus reflect a biased perception of the frequency of the desire to eat when feeling bad: If someone fills out to 'often' have the desire to eat when feeling emotional, this does not necessarily mean that this desire is actually experienced more frequently than someone scoring 'rarely', as this response reflects a *subjective* interpretation of frequency. The idea that emotional eating scores reflect a preoccupation with eating is in line with the finding that emotional eaters often feel upset about eating unhealthy foods (Wardle et al., 1992).

Several limitations have to be noted. The first limitation is that we only employed the EE-DEBQ scale (van Strien, 2005). Future research should also investigate the predictive validity of other emotional eating scales, such as the EES (Arnold et al., 1995) and the EOQ (Masheb & Grilo, 2006), taking into account the recommendation by Masheb and Grilo (2006) that the predictive validity of emotional eating

scales could benefit from measuring the frequency of eating in response to emotions (as measured by the EOQ) rather than the desire to eat in response to emotions (as measured by the EE-DEBQ and the EES).

The second limitation is that we only measured consumption of snacks. Although snack consumption is probably sensitive to the effects of emotional eating because it occurs by definition at irregular times and places (thus having a higher chance of capturing episodes of experiencing negative emotions), future research should include other types of foods as well, in order to more stringently assess the effect of emotional eating on overall food intake.

The third limitation concerns the sample of our studies, which consist of only women. We focussed on females as the literature suggests that women are more susceptible to emotional eating than men (van Strien, 2005). However, as effects of emotional eating on snack intake may be different in men, future research could focus on a male sample. Also, the women in our studies mainly had normal BMIs. Although emotional eating scores were above average in our studies and several studies have indicated that emotional eating also affects normal weight individuals (O'Connor et al., 2008), the effects of emotional eating may be more pronounced for overweight individuals, thus warranting research investigating associations of emotional eating and snack intake in a sample of overweight individuals.

Lastly, the present research concerns self-reported eating behaviour and affect and can benefit from a more controlled environment in order to reduce self-representation and recall biases. However, the present design also has important strengths as it allowed for a real-life setting which increases the generalisability and ecological validity of our findings.

Notwithstanding these limitations, our results suggest that people who are concerned about their eating behaviour attribute their (over)eating to the experience of negative emotions, although their eating behaviour may in fact be a reflection of the habit to consume unhealthy snacks. Future research should examine which factors explain why individuals perceive themselves as emotional eaters.

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