Association Between Rumination Factors and Eating Disorder Behaviours in Young Females

Laura Dondzilo\textsuperscript{a}, Elizabeth Rieger\textsuperscript{b}, Romina Palermo\textsuperscript{a}, Susan Byrne\textsuperscript{c} and Jason Bell\textsuperscript{a,b}

\textsuperscript{a}ARC Centre of Excellence in Cognition and its Disorders, School of Psychology, University of Western Australia, Perth, WA, Australia.

\textsuperscript{b}Research School of Psychology, Australian National University, Canberra, ACT, Australia.

\textsuperscript{c}School of Psychology, University of Western Australia, Perth, WA, Australia.

Correspondence concerning this article should be addressed to Laura Dondzilo, School of Psychology, University of Western Australia (M304), 35 Stirling Highway, Crawley WA 6009, Australia. Phone: +61 408 637 524. Email: laura.dondzilo@research.uwa.edu.au

Email addresses of other authors: elizabeth.rieger@anu.edu.au

romina.palermo@uwa.edu.au

sue.byrne@uwa.edu.au

jason.bell@uwa.edu.au
Association Between Rumination Factors and Eating Disorder Behaviours in Young Females

Abstract

Previous research suggests a role for rumination on eating, shape and weight in the maintenance of eating disorder symptoms. The Ruminative Response Scale for Eating Disorders (RRS-ED) measures this type of rumination. To date, no research has verified the two-factor structure of the RRS-ED. Nor has research investigated the association between rumination on eating, shape and weight and the eating disorder behaviours of binge eating and dietary restriction in young adult females. To test these hypotheses, a sample of 119 females (aged 17-24) completed a battery of self-report measures. A confirmatory factor analysis confirmed that the RRS-ED consists of two dimensions, namely reflection and brooding. Furthermore, brooding was found to be uniquely associated with general eating disorder symptoms, over and above mood and BMI. Finally, results provided novel evidence for the association between brooding and clinically significant levels of binge eating and dietary restriction, whilst controlling for mood and BMI. The current study highlights the association between ruminative brooding and eating disorder symptoms in a sample of young adult females. The findings may have implications for prevention and treatment strategies given that binge eating and dietary restraint are primary risk factors for, and also serve to maintain, eating disorders.

Keywords: Eating Disorders, Rumination, Brooding, Reflection, Factor structure
Association Between Rumination Factors and Eating Disorder Behaviours in Young Females

Rumination is a maladaptive emotion-regulation strategy characterised by habitual, abstract and negative thinking that has been implicated in the maintenance of depression, anxiety disorders, eating disorders and substance use disorders (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Startup et al., 2013). A meta-analysis of emotion-regulation strategies across different types of psychopathology revealed that rumination was associated with more disorder-specific symptoms across psychopathologies (e.g., medium effect sizes for eating disorders) compared to other maladaptive emotion-regulation strategies, such as avoidance or suppression (Aldao et al., 2010). There is promising evidence of cognitive-behavioural interventions successfully targeting rumination in individuals with medication-refractory residual depression, generalized anxiety disorder and persistent persecutory delusions (Covin, Ouimet, Seeds, & Dozois, 2008; Foster, Startup, Potts, & Freeman, 2010; Watkins et al., 2007). Thus, identifying individuals across psychopathologies for whom rumination is a significant issue and specifically targeting rumination in treatment, may improve outcomes (Startup et al., 2013).

Rumination in eating disorders has received little attention (Cowdrey & Park, 2011). However, the research that does exist suggests the relevance of rumination in this context. For example, studies have demonstrated that rumination is elevated in individuals with eating disorders relative to healthy controls (Cowdrey & Park, 2011; Rawal, Park, & Williams, 2010; Startup et al., 2013). Additionally, rumination was found to be a strong predictor of eating disorder symptoms, relative to anxiety and depression, in a sample of individuals with anorexia nervosa (Cowdrey & Park, 2011; Startup et al., 2013). Similarly, Nolen-Hoeksema, Stice, Wade, and Bohon (2007) found that female adolescents (11-15 years) with elevated rumination reported
greater bulimic symptoms and binge eating behaviour. These findings suggest a role for rumination in potentially maintaining and/or exacerbating eating disorder symptoms. Greater understanding of the cognitive processes that underpin eating disorders is essential in the development of strategies to augment existing treatments (Cowdrey & Park, 2012), which is particularly crucial for patients with anorexia nervosa since this remains one of the most treatment-resistant disorders (Schmidt et al., 2013).

Preoccupation with eating and body weight control characterizes the type of ruminative thoughts experienced by individuals with eating disorder symptoms (Fairburn, Cooper, & Shafran, 2003; Park, Dunn & Barnard, 2011). The transdiagnostic cognitive behavioural theory of eating disorders postulates that all eating disorders share common core psychopathological processes (Fairburn et al., 2003). According to this theory, over-evaluation of eating, shape and weight as a basis for self-evaluation represents the core dysfunctional cognitive process that serves to maintain eating disorder behaviours such as strict dieting, binge eating and compensatory behaviours. Over-evaluation of eating, weight and shape and their control may be conceptualised as including eating disorder-specific rumination (Cowdrey & Park, 2011; Park et al., 2011).

A novel process account of anorexia nervosa (Park et al., 2011; Park, Dunn & Barnard, 2012) suggests one mechanism by which eating disorder-specific rumination may serve to maintain eating disorder symptoms. Specifically, it is postulated that individuals with anorexia nervosa engage in rumination on eating, shape and weight to avoid bodily experiences (e.g., starvation-related cues) and processing distressing emotions. In other words, rumination may serve to distract individuals with anorexia nervosa from the subjective experience of hunger and negative feelings, thus driving dietary restriction. In support of this notion, qualitative evidence
from a recent study revealed that rumination was considered beneficial by some individuals with anorexia nervosa because the analytical self-focus served as a distraction from difficult emotions and cognitions elicited by an upcoming meal (Cowdrey, Stewart, Roberts, & Park, 2013). Moreover, there is certainly abundant evidence that individuals with anorexia nervosa and bulimia nervosa present with emotional vulnerability and difficulty regulating emotions (Anestis, Selby, Fink & Joiner, 2007; Haynos & Fruzzetti, 2011). There is also research suggesting that the avoidance of bodily sensations (i.e., experiential avoidance) is associated with eating disorder symptomatology (Fulton et al., 2012; Rawal et al., 2010).

Cowdrey and Park (2011) devised the Ruminative Response Scale for Eating Disorders (RRS-ED) to assess rumination pertaining to the control of eating, shape and weight. This questionnaire was adapted from the most commonly employed measure of rumination, the Ruminative Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991), which has been predominantly used to assess rumination in depression. Treynor, Gonzalez, and Nolen-Hoeksema (2003) identified that this measure indexes two distinct subcomponents of rumination in depression, which were termed reflection and brooding. A two-factor solution was also found in the eating disorder context. Specifically, in a principal components analysis, Cowdrey and Park (2011) found support for a two-dimensional model, consisting of reflection and brooding, of eating disorder-specific rumination. Reflection is defined as actively engaging in problem solving to alleviate one’s problems (e.g., “Write down what you think about your eating, weight and/or shape and analyse it”), while brooding refers to passively and critically comparing one’s current situation with some ideal standard (e.g., “Think about a recent meal time wishing it had gone better”) (Cowdrey & Park, 2011; Treynor, Gonzalez, & Nolen-Hoeksema, 2003).
Previous studies examining rumination in depression have shown that brooding is more maladaptive than reflection as it tends to be a better predictor of depressive symptoms (Burwell & Shirk, 2007; Joorman, Dkane, & Gotlib, 2006; Treynor et al., 2003). Similar to the aforementioned account of anorexia nervosa (Park et al., 2011; Park, Dunn & Barnard, 2012), Borkovec (1994) postulated that ruminative brooding may function as an emotional avoidance strategy, which is consistent with research indicating an association between brooding and avoidance strategies (Burwell & Shirk, 2007; Cowdrey & Park, 2012), as well as the conceptualisation of rumination as a cognitive avoidance strategy in the Behavioural Activation model for depression (Beck, Rush, Shaw, & Emery, 1979). In contrast, there is research showing associations between reflection and adaptive coping strategies (e.g., problem solving and cognitive restructuring) in a community sample of adolescents (Burwell & Shirk, 2007).

Nonetheless, caution should be exercised in assuming reflection is an adaptive emotional regulation strategy in eating disorders. In the case of eating disorder symptoms, some preliminary findings suggest that both brooding and reflection may be predictive of symptom severity. That is, Cowdrey and Park (2012) found that ruminative brooding uniquely predicted eating disorder symptoms when controlling for depression and anxiety in a healthy female sample, while ruminative reflection uniquely predicted eating disorder symptoms above and beyond depression and anxiety in participants with a history of anorexia nervosa. However, the study did not control for body mass index (BMI = kg/m²), which shares a significant amount of variance with eating disorder symptoms (Rø, Reas, & Rosenvinge, 2012).

Furthermore, the study only examined the ability of rumination to predict a global measure of eating disorder pathology rather than specific eating disorder behaviours. Binge eating and dietary restraint are two specific behaviours which are primary risk and maintenance
factors for eating disorders (Stice, 2002). Moreover, recent evidence suggests rumination may
play a role in the maintenance of binge eating and dietary restraint. Specifically, following a
rumination induction (preceded by a sadness induction) individuals with bulimia nervosa
reported a greater desire to binge eat, whereas individuals with anorexia nervosa reported a
greater desire to abstain from eating (Naumann, Tuschen-Caffier, Voderholzer, Caffier & Svaldi,
2015). Thus investigating the relationship between rumination and specific eating disorder
behaviours would provide further support for the postulation that overconcern of eating, shape
and weight is the core cognitive dysfunction maintaining eating disordered behaviours (Fairburn
et al., 2003) while also potentially informing preventative and treatment interventions for
individuals with eating disorders.

In summary, preliminary findings suggest that the two distinct subcomponents of
rumination (i.e., reflection and brooding) differentially predict eating disorder symptoms (e.g.,
Cowdrey & Park, 2012). However, empirical evidence from confirmatory factor analysis (CFA)
for the hypothesised two-factor structure of the RRS-ED is non-existent. Therefore, the initial
aim of the present study is to examine the RRS-ED using CFA in a young adult female sample.
In line with the exploratory factor analytical results of Cowdrey and Park (2011), it is anticipated
that the present study’s data will provide an acceptable fit to the hypothesised two dimensional
model of eating disorder-specific rumination.

The second aim of the present study is to investigate the association between two eating
disorder-specific rumination factors (i.e., brooding and reflection) and eating disorder symptoms
in a young adult female sample, especially given conflicting findings as to whether or not
reflection is predictive of pathology. No previous research has investigated these associations in
a young adult female sample, despite this age group being the peak period of onset for eating
disorders (Stice, Marti, & Rhode, 2013). It is hypothesised that the rumination factors will be correlated with overall eating disorder symptoms, as well as differentiating between individuals who do not engage in the specific eating disorder behaviours of binge eating and dietary restraint, versus individuals who engage in recurrent binge eating and extreme dietary restraint.

Method

Participants

One hundred and nineteen females with a mean age of 19 (SD = 1.77, range = 17-24) took part in the study. The mean BMI was 21.61 (SD = 3.02, range = 15.55-31.01). Participants were first year psychology students attending the University of Western Australia who took part in the study in exchange for course credit. Ethics approval for this study was granted in accordance with the requirements of the National Statement on Ethical Conduct in Human Research and the policies and procedures of the University of Western Australia.

Self-Report Questionnaires

Depression Anxiety Stress Scale 21 (DASS-21; Lovibond & Lovibond, 1995).

The DASS-21 consists of 21 items assessing symptoms of depression, anxiety and stress experienced over the past week. There are seven items pertaining to each negative emotional state, which are measured on a four-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). Higher subscale scores indicate greater levels of depression, anxiety and stress. The reliability and validity of these scales has been extensively supported (Henry & Crawford, 2005). The Cronbach’s alpha for the depression, anxiety and stress subscales in the present study was α = .90, α = .81 and α = .86, respectively.

Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011).
The RRS-ED evaluates ruminative themes of eating, weight and shape, with two subscales: brooding and reflection. There are six items relating to brooding (e.g., “Think about a recent meal time wishing it had gone better”) and three items relating to reflection (e.g., “Write down what you think about your eating, weight and/or shape and analyse it”). Each of the nine items is assessed on a four-point Likert scale ranging from 1 (almost never) to 4 (almost always). Thus, a higher score indicates greater rumination. The RRS-ED demonstrates good convergent and discriminant validity and test-retest reliability (Cowdrey & Park, 2011). Reliability and validity of the RRS-ED has been demonstrated in both a healthy and an anorexia nervosa sample (Cowdrey & Park, 2011, 2012). The Cronbach’s alpha for the brooding and reflection subscales in the present study was α = .93 and α = .85, respectively.

*Eating Disorder Examination – Questionnaire (EDE-Q; Fairburn & Beglin, 1994).*

The EDE-Q assesses the presence and severity of eating disorder psychopathology within the previous 28 days. Subscale scores relating to dietary restraint, eating concerns, weight concerns and shape concerns are derived from 22 items using a seven point Likert scale. These scores are summed to yield a total score, with higher scores indicating greater levels of overall eating disorder symptoms. Additionally, frequencies of behavioural features (i.e., binge eating and compensatory behaviours) are assessed in terms of both the number of days on which these occurred and the number of episodes. The occurrence of an objective binge eating episode (OBE) requires endorsement of the consumption of an objectively large amount of food accompanied by a loss of control over eating. To determine recurrent binge eating, with as close as possible adherence to the *DSM-5* criteria (American Psychiatric Association [APA], 2013), OBEs were required to occur, on average, at least once a week in the present study. The *DSM-5* criteria additionally state that OBEs should occur for at least three months, however, due to the
structure of the EDE-Q, assessment of recurrent OBEs was restricted to the preceding month. Extreme dietary restraint was defined as “going without food for a period of eight or more waking hours…” (food avoidance item) on average three or more times per week, a criterion used by Mond, Hay, Rodgers, and Owen (2006). The EDE-Q has shown acceptable reliability and validity in both community and clinical samples (Fairburn & Beglin, 2008; Mond, Hay, Rodgers, Owen, & Beumont, 2004). The Cronbach’s alpha for the EDE-Q total scale in the present study was $\alpha = .97$.

**Procedure**

To commence, each participant read an information sheet detailing the study and was required to provide their informed consent in order to proceed. Participants’ height and weight were then measured for the purposes of calculating BMI. Finally, participants completed the self-report measures in the following order: DASS-21, RRS-ED and EDE-Q. The questionnaires were presented online via Version 1.92+ of LimeSurvey (2010), an advanced online survey system that was hosted on the University of Western Australia servers.

**Results**

*Confirmatory Factor Analysis of the Ruminative Response Scale for Eating Disorders*

A confirmatory factor analysis (CFA) was performed to test the assumed two-factor (i.e., reflection and brooding) structure of the RRS-ED, according to Cowdrey and Park (2011). The factor structure was investigated using AMOS 4.0 (Arbuckle, 2006). The mean scores on each of the subscales for the RRS-ED ($n = 119$) were as follows: Reflection = 5.29 ($SD = 2.46$) and Brooding = 12.98 ($SD = 5.45$). Items were allowed to load on a single latent factor only (i.e., reflection contains three items and brooding contains six items), errors were uncorrelated and covariance between the factors were allowed. In this two-factor model, the standardized factor
loadings ranged from .69 to .93 for reflection and from .76 to .88 for brooding, all p’s < .001. As all standardized factor loadings were above .04, this implies that items were representative of their corresponding factor (Bowen & Guo, 2011). The standardized model revealed a correlation of .90 between the two factors.

Five close-fit indices, frequently used in the CFA literature, were examined to determine whether the two-factor model was acceptable. These were: the χ², the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993), the standardized root mean residual (SRMR; Bentler, 1995), the comparative fit index (CFI; Bentler, 1990) and the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973). The χ² is the only inferential statistic which permits conclusions regarding hypothesis testing (Iacobucci, 2010). However, the χ² lacks power in small sample sizes, such as the current study (Kenny & McCoach, 2003). Although absolute standards do not exist, there is some agreement in the psychometric literature that a model demonstrates reasonable fit if χ² adjusted by its degrees of freedom, does not exceed 3.0 (Kline, 2004): χ² / df ≤ 3. Other fit indices reflecting absolute fit of a model, in addition to χ², include the RMSEA and SRMR. RMSEA values approximating less than .05 are indicative of a good fit, while values between .08 and .10 are indicative of a moderate fit (Byrne, 1998). Simulation studies, however, have shown that RMSEA over-rejects true models for “small” sample sizes (i.e., N < 250; Kenny & McCoach, 2003; Hu & Bentler, 1999) and that SRMR is preferred in this case as it is less sensitive to small sample size (Iacobucci, 2010). SRMR values approximating .08 to .06 or less are indicative of an acceptable fit (Hu & Bentler, 1999). Finally, the incremental close-fit indexes (i.e., CFI and TLI) are indicative of a good-fitting model with values approximating .95 or larger (Hu & Bentler, 1999). In particular, CFI has demonstrated power and robustness (Hu & Bentler, 1998). Therefore, due to the “small” sample size of the present study (i.e., N < 250), the
χ² and RMSEA should be interpreted with caution. Alternatively, the SRMR and CFI are better indicators of the absolute and incremental fit of the model, respectively.

According to the close-fit indices (see Table 1), the model provided an acceptable fit to the data. A second CFA was performed to evaluate whether a one-factor model would provide a better fit to the data. Adequacy of fit was not achieved as RMSEA was > .10. Furthermore, all close-fit indices pertaining to the two-factor structure were indicative of a progressively better fitting model, compared to those concerning the one-factor structure (see Table 1). Ultimately, the two-factor structure provided a significantly better fit to the sample data (χ²diff = 26.12, df = 1, p < .0001). This supports the two-factor structure of the RRS-ED, in favour of a single factor model, which verifies that eating disorder-specific rumination consists of the two subcomponents of reflection and brooding.

[Rumination and Global Eating Disorder Symptomatology]

Prior to conducting the subsequent analyses, the data was evaluated and three outliers (defined as 3 standard deviations from the mean) were removed rendering the final sample size, n = 116. The variables of interest were deemed to be acceptably normally distributed (i.e., skew and kurtosis were less than |2.0|) (West, Finch, & Curran, 1995).

Means, standard deviations and correlations between eating disorder symptoms (global EDE-Q scores), rumination on eating, shape and weight concerns (RRS-ED subscale scores: brooding and reflection), mood (depression, anxiety and stress subscales of the DASS) and BMI can be seen in Table 2. Significance levels were corrected for multiple comparisons in order to reduce Type 1 errors. Namely, each of the p values were multiplied by the number of correlation coefficients tested for significance (n = 21).
As can be seen in Table 2, global EDE-Q scores were significantly and positively correlated with the RRS-ED brooding and reflection scores, \( r(114) = .87, p < .001 \). Mood and BMI significantly and positively correlated with global EDE-Q scores and were thus included as covariates in subsequent regression analyses.

To determine the independent contributions of rumination factors on overall eating disorder symptoms, a hierarchical regression analysis was conducted. The EDE-Q global scores were entered as the outcome variable and the RRS-ED brooding and RRS-ED reflection subscale scores were entered as the predictor variables. Mood and BMI were controlled for in the analysis. Conducting a multiple regression analysis with six predictors and a sample size of \( n = 116 \) may be justified by Green’s (1991) rules (i.e., \( N = 50 + 8p \) for overall multiple regressions and \( N = 104 + p \) for partial correlations).

Controlling for the covariates, the addition of rumination and brooding in step two accounted for an additional 33% of the variance in eating disorder symptoms (see Table 3). Brooding was the only variable uniquely associated with eating disorder symptoms in the final step of the model. The corresponding semi-partial correlation was estimated at \( r = .37 (p < .001) \). Thus, 14.7% of the variance in eating disorder symptoms was accounted for by brooding, independently of the effects of mood, BMI and reflection.

Next we tested the independent contributions of rumination factors on the frequency of eating disorder behaviour. The descriptive statistics associated with the frequency of eating disorder behaviours (i.e., objective binge eating episodes and dietary restraint) over the previous
28 days are reported in Table 4. Stepwise multinomial logistic regression analyses were carried out. No binge eating or dietary restriction was used as the reference category. These procedures controlled for mood and BMI, whilst reflection and brooding were entered as stepwise terms. Both analyses did not include reflection in the model, in accordance with the stepwise method.

[Table 4 near here]

An initial multinomial logistic regression testing the independent contributions of the rumination factors on frequency of objective binge eating episodes, controlling for mood and BMI, was found to be statistically significant (see Table 5 for results). As shown, after adjusting for the covariates, participants who were binge eating recurrently were found to brood on eating, shape and weight concerns more often than participants who did not binge eat at all in the previous 28 days. For every single-point increase in brooding, participants were 1.28 times more likely to binge eat recurrently than none at all, whilst controlling for mood and BMI. However, in the comparison between no binge eating and occasional binge eating, only BMI was a significant predictor.

A second multinomial logistic regression investigating the independent contributions of the rumination factors on frequency of dietary restriction, controlling for mood and BMI, was found to be statistically significant (see Table 6 for results). The results indicated that participants who engaged in either occasional or extreme dietary restriction were found to brood on eating, shape and weight concerns more often than participants who did not restrict their diet at all in the previous 28 days. For every single-point increase in brooding, participants were 1.40 times more likely to engage in extreme dietary restriction than no dietary restriction at all, whilst controlling for mood and BMI.

[Table 5 near here]
[Table 6 near here]

**Discussion**

The current study is the first to offer confirmatory factor analytical support for the hypothesized two-factor model of the Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011). Furthermore, the two-factor model showed a superior fit as compared to a one-factor model. This finding provides validity for the use of the RRS-ED to assess two aspects of disorder-specific rumination, namely brooding and reflection. Additionally, this finding contributes to the literature by suggesting that reflection and brooding are not only two different subcomponents of depressive rumination (Treynor et al., 2003) but also of eating disorder-specific rumination.

Secondly, the independent contributions of these two disorder-specific rumination factors on general eating disorder symptoms and eating disorder behaviours (i.e., binge eating and dietary restriction) in a young adult female sample was examined. It was found that ruminative brooding on eating, shape and weight was uniquely associated with global eating disorder symptoms, above and beyond depression, anxiety, stress and BMI. This result is consistent with previous findings (Cowdrey & Park, 2011, 2012), importantly, even after additionally controlling for BMI in the present study. Additionally, results provided novel evidence for the independent contribution of ruminative brooding on binge eating and dietary restriction, whilst controlling for mood and BMI. Specifically, participants who engaged in recurrent binge eating and/or extreme dietary restriction, were found to brood on eating, shape and weight concerns more often compared to participants who did not binge eat and/or restrict their diet in the previous 28 days.

Previous findings on rumination and psychopathology in the general population suggest that ruminative brooding (as opposed to reflection) is specifically associated with emotional
avoidance (Burwell & Shirk, 2007; Cowdrey & Park, 2012; Treynor et al., 2003). Theoretical and empirical findings, including those of the present study, suggest that brooding, rather than reflection, is a more relevant construct for women susceptible to eating disorders, perhaps because it allows individuals to escape distressing emotions associated with eating, shape and weight. For example, Cowdrey and Park (2012) found a positive association between brooding (but not reflection) on eating, shape and weight concerns and experiential avoidance in both a healthy and clinical sample of women with anorexia nervosa. The way in which brooding may function to limit the emotional impact of concerns about eating and body weight is by increasing the focus on the content of these concerns as opposed to focusing on the distressing feelings (Park et al., 2011). Furthermore, in considering that binge eating and dietary restraint are often prompted and/or followed by distressing emotions (Anestis et al., 2007; Wolff, Crosby, Roberts & Wittrock, 2000), it may be that ruminative brooding is a means of escaping general negative emotions in addition to negative emotions specifically regarding eating, shape and weight. The present study did not incorporate a measure of experiential avoidance, which limits the ability to make conclusions regarding the theorised emotion regulation function of brooding. Future research is required to explore this aspect of brooding, as well as identifying the mechanisms that might link brooding and eating disorder symptoms. For instance, brooding might maintain the individual’s focus on negative aspects of the self (such as body dissatisfaction), which in turn trigger dieting and/or binge eating. These behaviours may in turn exacerbate brooding.

The current findings suggest that ruminative brooding on eating and body shape concerns may be a risk factor for eating disordered behaviours in young adult women. After controlling for mood and BMI, brooding distinguished between participants who engaged in recurrent binge eating versus those who engaged in no binge eating but not those who engaged in occasional
binge eating. Since occasional binge eating is relatively common among young adults (Schotte & Stunkard, 1987), brooding appears to be specifically associated with clinically significant levels of binge eating. Similarly, brooding may be specifically associated with levels of dieting that are clinically relevant. In the present study, brooding differentiated both extreme and occasional dieters from those who did not diet at all. Research has found that even moderate dieters are at increased risk for developing an eating disorder over the subsequent six months compared to non-dieters (Patton, Selzer, Coffey, Carlin, & Wolfe, 1999), indicating that occasional dieting is clinically relevant. Hence its association with the pathological construct of brooding in the present study is not surprising. In short, the presence of brooding appears to differentiate clinical from non-clinical levels of binge eating and dietary restriction.

In contrast, ruminative reflection was not found to be uniquely associated with either general eating disorder symptoms or specific eating disorder behaviours, after controlling for mood and BMI in this young adult sample, which is consistent with previous research indicating that reflection is not associated with psychopathology (e.g., Burwell & Shirk, 2007). However, these findings are inconsistent with Cowdrey and Park’s (2012) data which indicated that, reflection on eating, shape and weight was elevated in individuals with a history of anorexia nervosa. The reasons underlying this inconsistency are unclear although one speculative suggestion is that, since the reflection items of the RRS-ED describe the tendency to process information at the level of detail, the scale may be indexing the analytical processing style that is common in individuals with anorexia nervosa (Anderluh, Tchanturia, Rabe-Hesketh, & Treasure, 2003; Southgate, Tchanturia, & Treasure, 2008).

There are some limitations in the present study that need to be considered in interpreting the findings. First, the cross-sectional design of the study does not allow for definitive
conclusions to be drawn regarding the predictive effects of rumination on eating disorder symptoms. Given our results, a next step would be experimental and/or longitudinal research to provide stronger evidence for a causal impact of rumination on eating disorder symptoms. Secondly, the study relied on self-report, with previous research suggesting that participants tend to underestimate the frequency of binge eating episodes on the EDE-Q (Mond, Hay, Rodgers, Owen, & Beumont, 2004) in comparison to the interview assessment (the Eating Disorder Examination) from which the EDE-Q is derived. Finally, the present study did not explore the relationships between ruminative factors and eating disorder symptoms in participants diagnosed with a clinically significant eating disorder. Thus, it would be valuable to replicate this study in a group of young women with clinically diagnosed eating disorders.

In conclusion, the current findings contribute towards a growing body of theoretical and empirical work suggesting a role for eating disorder-specific rumination in the maintenance of eating disorder symptoms. Specifically, the current findings offer the first confirmatory factor analytical support for the two-factor (i.e., brooding and reflection) model of the RRS-ED. Also, the results add to the literature suggesting that ruminative brooding is a more maladaptive form of rumination for eating disorder symptoms than reflective rumination. Furthermore, the current study provides the first evidence of an association between ruminative brooding on eating, shape and weight concerns and clinical levels of dietary restriction and recurrent binge eating. Future research should focus on experimental paradigms assessing the causal role of rumination on eating disorder symptoms and the effects of targeting rumination in the treatment of eating disorders.
Acknowledgements

This work was supported by the Australian Research Council Centre of Excellence for Cognition and its Disorders (CE110001021) www.ccd.edu.au.
References


Table 1. Close-fit indices for the RRS-ED models.

<table>
<thead>
<tr>
<th>Model</th>
<th>df</th>
<th>$\chi^2$</th>
<th>$\chi^2$/df</th>
<th>RMSEA</th>
<th>SRMR</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflection-Brooding</td>
<td>26</td>
<td>50.10*</td>
<td>1.93</td>
<td>.09</td>
<td>.03</td>
<td>.97</td>
<td>.96</td>
</tr>
<tr>
<td>Unidimensional</td>
<td>27</td>
<td>76.22**</td>
<td>2.82</td>
<td>.12</td>
<td>.04</td>
<td>.94</td>
<td>.92</td>
</tr>
</tbody>
</table>

RMSEA = Root Mean Square Error Approximation; SRMR = Standardized Root Mean Residual; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index

*p < .01; **p < .0001
Table 2. Means, standard deviations and correlations among measures of eating disorder symptoms, rumination, BMI and mood.

<table>
<thead>
<tr>
<th></th>
<th>Global</th>
<th>RRS-ED</th>
<th>RRS-ED</th>
<th>BMI</th>
<th>DASS</th>
<th>DASS</th>
<th>DASS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EDE-Q</td>
<td>brood.</td>
<td>refl.</td>
<td></td>
<td>dep.</td>
<td>anx.</td>
<td>str.</td>
</tr>
<tr>
<td>Global EDE-Q</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRS-ED brood.</td>
<td>.88**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRS-ED refl.</td>
<td>.72**</td>
<td>.79**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>.43**</td>
<td>.43**</td>
<td>.34**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DASS dep.</td>
<td>.53**</td>
<td>.49**</td>
<td>.37**</td>
<td>.05</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DASS anx.</td>
<td>.38**</td>
<td>.31*</td>
<td>.34**</td>
<td>.03</td>
<td>.68**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>DASS str.</td>
<td>.43**</td>
<td>.37**</td>
<td>.33**</td>
<td>.08</td>
<td>.63**</td>
<td>.67**</td>
<td>1</td>
</tr>
<tr>
<td>(M)</td>
<td>2.19</td>
<td>12.97</td>
<td>5.27</td>
<td>21.51</td>
<td>4.68</td>
<td>4.36</td>
<td>7.40</td>
</tr>
<tr>
<td>(SD)</td>
<td>1.64</td>
<td>5.46</td>
<td>2.44</td>
<td>2.93</td>
<td>4.24</td>
<td>3.81</td>
<td>4.42</td>
</tr>
</tbody>
</table>

Note: EDE-Q, Eating Disorder Examination Questionnaire; RRS-ED brood., Ruminative Response Scale for Eating Disorders brooding subscale; RRS-ED refl., Ruminative Response Scale for Eating Disorders reflection subscale; BMI, Body Mass Index (kg/m\(^2\)); DASS dep., Depression Anxiety Stress Scale depression subscale; DASS anx., Depression Anxiety Stress Scale anxiety subscale; DASS str., Depression Anxiety Stress Scale stress subscale; \(M\), mean; \(SD\), standard deviation.

\(*p<.05; **p<.01\) (corrected for multiple comparisons)
Table 3. Hierarchical multiple regression analysis predicting eating disorder symptoms.

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>B</th>
<th>R²</th>
<th>R² change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>.46*</td>
<td>.22</td>
<td>.04</td>
<td>.40*</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>.17</td>
<td>.04</td>
<td>.04</td>
<td>.45*</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.05</td>
<td>.04</td>
<td>.04</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>-.02</td>
<td>.05</td>
<td>.05</td>
<td>-.04</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>.79*</td>
<td>.05</td>
<td>.03</td>
<td>.09</td>
<td>.33*</td>
</tr>
<tr>
<td>BMI</td>
<td>.04</td>
<td>.03</td>
<td>.03</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.02</td>
<td>.02</td>
<td>.02</td>
<td>.06</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>.01</td>
<td>.03</td>
<td>.03</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>.21</td>
<td>.03</td>
<td>.03</td>
<td>.70*</td>
<td></td>
</tr>
<tr>
<td>Brooding</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.07</td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: RRS-ED brood., Ruminative Response Scale for Eating Disorders brooding subscale; RRS-ED refl., Ruminative Response Scale for Eating Disorders reflection subscale; BMI, Body Mass Index (kg/m²); DASS dep., Depression Anxiety Stress Scale depression subscale; DASS anx., Depression Anxiety Stress Scale anxiety subscale; DASS str., Depression Anxiety Stress Scale stress subscale. 
*p<.001
Table 4. Descriptive Statistics for Frequency of Objective Binge Eating Episodes and Dietary Restraint.

<table>
<thead>
<tr>
<th>Frequency (%)</th>
<th>$M$</th>
<th>$SD$</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brooding</td>
<td>Reflection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBEs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>53.45</td>
<td>10.23</td>
<td>4.36</td>
<td>4.18</td>
</tr>
<tr>
<td>Occasional Episodes</td>
<td>21.55</td>
<td>13.76</td>
<td>4.26</td>
<td>5.96</td>
</tr>
<tr>
<td>Recurrent$^1$</td>
<td>25.00</td>
<td>18.17</td>
<td>4.52</td>
<td>7.00</td>
</tr>
<tr>
<td>Diet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>66.38</td>
<td>11.01</td>
<td>4.80</td>
<td>4.61</td>
</tr>
<tr>
<td>Occasional Episodes</td>
<td>25.86</td>
<td>16.20</td>
<td>4.89</td>
<td>6.17</td>
</tr>
<tr>
<td>Extreme$^2$</td>
<td>7.76</td>
<td>19.00</td>
<td>2.55</td>
<td>7.89</td>
</tr>
</tbody>
</table>

Note. OBE., Objective Binge Eating Episode; Diet., Dietary Restraint.

$^1$Recurrent OBEs = on average at least once a week. $^2$Extreme Dietary Restraint = on average three times per week.
Table 5. Stepwise multinomial logistic regression analysis predicting objective binge eating episodes.

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>Wald $\chi^2$</th>
<th>df</th>
<th>Exp (B)</th>
<th>95% CI Exp (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No OBEs vs. Occasional OBEs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-8.55 (2.47)</td>
<td>11.99***</td>
<td>1</td>
<td>1.13</td>
<td>.93 – 1.38</td>
</tr>
<tr>
<td>Depression</td>
<td>-.13 (.10)</td>
<td>1.56</td>
<td>1</td>
<td>1.13</td>
<td>.93 – 1.38</td>
</tr>
<tr>
<td>Stress</td>
<td>-.00 (.09)</td>
<td>.00</td>
<td>1</td>
<td>1.00</td>
<td>.84 – 1.19</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.07 (.10)</td>
<td>.41</td>
<td>1</td>
<td>1.07</td>
<td>.88 – 1.30</td>
</tr>
<tr>
<td>BMI</td>
<td>.28 (.12)</td>
<td>5.96*</td>
<td>1</td>
<td>1.32</td>
<td>1.06 – 1.66</td>
</tr>
<tr>
<td>Brooding</td>
<td>.08 (.06)</td>
<td>1.40</td>
<td>1</td>
<td>1.08</td>
<td>.95 – 1.22</td>
</tr>
<tr>
<td><strong>No OBEs vs. Recurrent OBEs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-12.04 (3.02)</td>
<td>15.92***</td>
<td>1</td>
<td>1.31</td>
<td>1.05 – 1.63</td>
</tr>
<tr>
<td>Depression</td>
<td>.27 (.11)</td>
<td>5.84*</td>
<td>1</td>
<td>1.31</td>
<td>1.05 – 1.63</td>
</tr>
<tr>
<td>Stress</td>
<td>-.07 (.11)</td>
<td>.48</td>
<td>1</td>
<td>.93</td>
<td>.76 – 1.14</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.02 (.11)</td>
<td>.04</td>
<td>1</td>
<td>1.02</td>
<td>.82 – 1.27</td>
</tr>
<tr>
<td>BMI</td>
<td>.31 (.13)</td>
<td>5.85*</td>
<td>1</td>
<td>1.37</td>
<td>1.06 – 1.76</td>
</tr>
<tr>
<td>Brooding</td>
<td>.25 (.07)</td>
<td>12.58***</td>
<td>1</td>
<td>1.28</td>
<td>1.12 – 1.47</td>
</tr>
</tbody>
</table>

*Note: Pseudo $R^2 = .42$ (Cox and Snell). Model $\chi^2(10) = 63.64, p<.001.$

OBE., Objective Binge Eating Episode; Diet., Dietary Restraint. Recurrent OBEs = on average at least once a week. Extreme Dietary Restraint = on average three times per week.

*p<.05; **p<.01; ***p<.001
Table 6. Stepwise multinomial logistic regression analysis predicting dietary restriction.

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>Wald $\chi^2$</th>
<th>df</th>
<th>Exp (B)</th>
<th>95% CI Exp (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No Diet vs. Occasional Diet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.74 (1.98)</td>
<td>1.91</td>
<td>1</td>
<td>.91</td>
<td>.76 – 1.08</td>
</tr>
<tr>
<td>Depression</td>
<td>-.10 (.09)</td>
<td>1.15</td>
<td>1</td>
<td>.91</td>
<td>.76 – 1.08</td>
</tr>
<tr>
<td>Stress</td>
<td>.15 (.08)</td>
<td>3.49</td>
<td>1</td>
<td>1.16</td>
<td>.99 – 1.35</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.12 (.10)</td>
<td>1.62</td>
<td>1</td>
<td>1.13</td>
<td>.94 – 1.36</td>
</tr>
<tr>
<td>BMI</td>
<td>-.12 (.10)</td>
<td>1.27</td>
<td>1</td>
<td>.89</td>
<td>.73 – 1.09</td>
</tr>
<tr>
<td>Brooding</td>
<td>.22 (.07)</td>
<td>11.48***</td>
<td>1</td>
<td>1.25</td>
<td>1.10 – 1.42</td>
</tr>
<tr>
<td><strong>No Diet vs. Extreme Diet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.80 (3.57)</td>
<td>1.13</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.20 (.15)</td>
<td>1.78</td>
<td>1</td>
<td>1.22</td>
<td>.91 – 1.62</td>
</tr>
<tr>
<td>Stress</td>
<td>-.05 (.15)</td>
<td>.10</td>
<td>1</td>
<td>.96</td>
<td>.72 – 1.27</td>
</tr>
<tr>
<td>Anxiety</td>
<td>-.03 (.15)</td>
<td>.04</td>
<td>1</td>
<td>.97</td>
<td>.72 – 1.31</td>
</tr>
<tr>
<td>BMI</td>
<td>-.19 (.17)</td>
<td>1.29</td>
<td>1</td>
<td>.83</td>
<td>.60 – 1.15</td>
</tr>
<tr>
<td>Brooding</td>
<td>.34 (.11)</td>
<td>10.14**</td>
<td>1</td>
<td>1.40</td>
<td>1.14 – 1.72</td>
</tr>
</tbody>
</table>

*Note: Pseudo $R^2 = .36$ (Cox and Snell). Model $\chi^2(10) = 50.79$, $p<.001$.*

OBE., Objective Binge Eating Episode; Diet., Dietary Restraint. Recurrent OBEs = on average at least once a week. Extreme Dietary Restraint = on average three times per week.

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