An investigation into the role of selective attention and rumination in eating disorder symptomatology

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Bachelor of Science (Honours)

This thesis is presented for the degree of Doctor of Philosophy of The University of Western Australia
School of Psychological Science
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ABSTRACT

Selective attention and rumination have been implicated as key vulnerability factors for eating disorder symptomatology. However, to date no research has investigated the role of both these factors in eating disorder symptomatology. The principal aim of the four studies in this thesis was to evaluate a recently proposed model which outlines one way in which selective attention, specifically attentional bias towards thin-ideal female bodies, and rumination, particularly eating disorder-specific rumination, may serve to trigger eating disorder symptomatology in young women. Specifically, this model hypothesises that ruminating on eating, shape, and weight concerns mediates the effect of attentional bias towards thin-ideal bodies, on both body dissatisfaction and dietary restraint. In order to evaluate the feasibility and validity of the proposed mediation model, four studies were conducted. A widely used measure of attentional bias, the dot probe task, was used for the assessment and modification of attentional bias for body images. Trait and state self-report questionnaires were employed for the assessment of eating disorder-specific rumination and eating disorder symptomatology.

In the first series of studies, and in line with the predictions of the model, eating disorder-specific rumination (Study 1) and attentional bias towards thin-ideal bodies (Study 2) were positively associated with both dietary restraint and body dissatisfaction. Study 2 also showed that eating disorder-specific rumination mediates the relationship between attentional bias towards thin-ideal bodies and both body dissatisfaction and dietary restraint. In the second series of studies, the causality of these relationships was examined. Specifically, Study 3 aimed to determine whether attentional bias causally influences rumination and Study 4 aimed to determine whether rumination, in turn, causally contributes to eating disorder symptomatology. Although results did not support these hypothesised causal relationships, these studies revealed important
findings. Namely, in Study 3 it was shown that individuals trained to attend to thin-ideal bodies experienced greater increases in negative mood, in response to a body image-related stressor, relative to individuals trained to avoid thin-ideal bodies. In other words, attentional bias towards thin-ideal bodies causally influenced negative emotional vulnerability. Furthermore, Study 4 demonstrated that induced eating disorder-specific rumination, but not induced distraction, led to changes in selective attentional processing of thin-ideal bodies. More specifically, rumination served to extinguish the potentially adaptive bias of avoiding thin-ideal bodies.

Collectively, the findings from this thesis highlight the maladaptive roles of both attentional bias towards thin-ideal bodies and eating disorder-specific rumination in psychopathology. An important implication is that attentional bias towards thin-ideal bodies may serve as a risk factor for mood reactivity that may in turn predispose to eating disorders, given evidence linking negative affect and the emergence of eating disorder symptoms. Additionally, since eating disorder-specific rumination was shown to influence attentional bias, this suggests that cognitively-focused strategies which target rumination and/or attention may help build emotional resilience, which in turn may protect against the development of an eating disorder.
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**AUTHORSHIP DECLARATION: CO-AUTHORED PUBLICATIONS**

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A NOTE ABOUT THE FORMAT OF THIS THESIS

This thesis is in agreement with The University of Western Australia Doctor of Philosophy Rules for the content and format of a thesis (39-45) and is presented as a series of papers. The thesis begins with an introductory chapter that sets out the context of the thesis and provides an overview of the key aims of the thesis. These aims are then addressed in the following four chapters, each of which is a self-contained research article that was either published, or submitted for publication, during the candidature. The thesis then concludes with a broader discussion that draws together the main findings of the thesis and establishes the significance of the work. Finally, to maintain consistency between the published and thesis versions of each study, the studies presented in the thesis are entirely unchanged save for formatting changes and a single consolidated reference list.
CHAPTER ONE: GENERAL INTRODUCTION

Body dissatisfaction and disordered eating are recognized as serious public health problems amongst Australian women (Griffiths et al., 2016; Mitchison, Hay, Slewa-Younan, & Mond, 2012; Mitchison, Morin, Mond, Slewa-Younan, & Hay, 2015; Mond et al., 2013; Wade, Wilksch, & Lee, 2012). Body dissatisfaction refers to a subjective discontent with some aspect of one’s physical appearance, such as one’s body shape or weight (Thompson, Heinberg, Altabe, & Tautleff-Dunn, 1999). Disordered eating refers to eating behaviours that are detrimental to physical and/or mental health but are not of a severity to warrant a clinical eating diagnosis (Cruwys, Platow, Rieger, Byrne, & Haslam, 2016). These behaviours include binge eating, dietary restriction, and purging (e.g., self-induced vomiting, and laxative misuse).

In the general Australian population, disordered eating and body dissatisfaction are common. In fact, evidence has emerged that the prevalence of binge eating and extreme dieting in Australian adults has increased over two-fold between 1998 and 2008 (Mitchison et al., 2012). A large longitudinal survey of young Australian women revealed that 23% had experienced disordered eating, including binge eating, purging, and/or dietary restriction (Wade et al., 2012). Body dissatisfaction is more common, with 86.9% of Australian women reporting some level of dissatisfaction and 39.4% reporting moderate to severe dissatisfaction with their bodies (Mond et al., 2013).

Beyond the simple numbers, research suggests that body dissatisfaction and disordered eating are associated with marked impairment in quality of life and psychological distress. For example, subclinical levels of disordered eating were found to have a long term negative impact on quality of life related to mental wellbeing in a sample of young Australian women (Wade et al., 2012). In line with these findings, a recent longitudinal study showed that general eating disorder symptomatology predicted decreases in health-related quality of life over time, as well as increased levels of
psychological distress, in a community sample of Australian women (Mitchison et al., 2015). In addition, results from this study revealed a bidirectional relationship between quality of life and general eating disorder symptomatology. Body dissatisfaction has also been linked to reduced mental and physical health-related quality of life (Griffiths et al., 2016; Mond et al., 2013) and greater psychological distress (Griffiths et al., 2016).

A key vulnerability factor for body dissatisfaction and disordered eating is the sociocultural pressure to attain the culturally-promoted thin-ideal body shape (Stice & Shaw, 2002; Thompson & Stice, 2001). Specifically, sociocultural theory posits that the pressure to be thin leads to internalization of the thin-ideal and appearance-related social comparisons, which in turn contribute to body dissatisfaction (Thompson et al., 1999). The thin-ideal figure is extremely difficult, if not impossible, for most women to attain. As such, women who aspire to the thin-ideal (i.e., thin-ideal internalization) and/or evaluate their appearance against women who they perceive to be thinner (i.e., upward social comparisons; Festinger, 1954), will in turn experience negative feelings about their bodies. In support of this notion, a meta-analysis found that the sociocultural factors of thin-ideal internalization and perceived pressures to be thin have medium-to-large associations with body dissatisfaction (Cafri, Yamamiya, Brannick, & Thompson, 2006). There is also meta-analytic evidence indicating that when women compare themselves to other thinner women, they tend to experience greater body dissatisfaction (Groesz, Levine, & Murnen, 2002; Myers & Crowther, 2009). Furthermore, sociocultural theory suggests that body dissatisfaction arising from these sociocultural factors can in turn lead to dietary restriction in an attempt to attain this thin-ideal (Thompson et al., 1999). Consistent with this view, longitudinal evidence has revealed that initial pressure to be thin and thin-ideal internalization predict increases in body dissatisfaction and initial body dissatisfaction predicts increases in dietary restriction.
and negative affect (Stice, 2001). Increasingly, researchers have been motivated by the hypothesis that cognitive-affective phenomena regarding the thin-ideal also play a role in the onset and/or maintenance of body dissatisfaction and dietary restriction (Jiang & Vartanian, 2016; Rodgers & DuBois, 2016).

As well as being common in the general population, dietary restriction and body image disturbance are key risk factors for, and amongst the core features of, eating disorders (Stice, Gau, Rohde, & Shaw, 2017; Stice, Marti, & Durant, 2011; Stice & Shaw, 2002). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association [APA], 2013) specifies four main types of eating disorders: anorexia nervosa (AN), bulimia nervosa (BN), binge-eating disorder (BED), and other specified feeding and eating disorder (OSFED). AN is characterized by extreme dietary restriction, significantly low body weight (in context of what is expected minimally expected for age, sex, etc.), and an intense fear of gaining weight. Clinical features of BN include recurrent binge eating and compensatory behaviours (e.g., self-induced vomiting). BED, on the other hand, involves recurrent binge eating which is not associated with recurrent compensatory behaviours. Finally, individuals with OSFED present with feeding or eating behaviours which do not meet the full criteria of any other DSM-5 eating disorder but are associated with significant distress and functional impairment (APA, 2013).

Approximately 10% of young female Australians (Fairweather-Schmidt & Wade, 2014), and a comparable 13% of young female Americans (Stice, Marti, & Rohde, 2013), meet criteria for a proposed DSM-5 eating disorder in their lifetime. At age 20, the one-month prevalence of DSM-5 eating disorders in a large sample of Australian women was 15.2% and mostly consisted of BN and BED diagnoses (Allen, Byrne, Oddy, & Crosby, 2013).
Eating disorders are characterized by chronicity, emotional distress, relapse, functional impairment, elevated mortality, and risk for future health and mental health problems (Byrne, Fursland, Allen, & Watson, 2011; Crow et al., 2009; Hay, 2013). The outcome is particularly poor for adults with AN, with no specific treatment modality receiving consistent empirical support as the treatment of choice (Raykos, Watson, Fursland, Byrne, & Nathan, 2013; Wilson, Grilo, & Vitousek, 2007). In addition, the knowledge of which treatment approaches are best suited to a particular individual is still lacking (Vall & Wade, 2015).

Given the negative consequences of eating disorder symptomatology in young women, it is imperative to identify risk factors and to explore how they interact to predict the onset and maintenance of eating disorder symptomatology. One way of approaching this issue is to investigate the role of transdiagnostic risk factors in eating disorder symptomatology. According to the transdiagnostic cognitive behavioural theory of eating disorders, all eating disorders share common core maintenance mechanisms (Fairburn, Cooper, & Shafran, 2003). Therefore, targeting transdiagnostic risk factors in prevention and treatment strategies may simultaneously facilitate improvements across the various eating disorder presentations. In the past decade, theoretical accounts and empirical research implicate attentional bias and ruminative thinking as transdiagnostic risk factors for eating disorder symptomatology. The transdiagnostic cognitive behavioural theory of eating disorders proposes that an over-evaluation of eating, shape, and weight and their control serves as a basis for evaluating self-worth and is central to the maintenance of most eating disorders (Fairburn et al., 2003). This process of over-evaluation may result in preoccupation with eating, body shape, and/or weight which can manifest in the form of ruminative thinking and/or attentional bias. In turn, ruminative thinking and attentional bias may serve to develop
and/or maintain body dissatisfaction and dietary restriction. The relevance of rumination and attentional biases in the eating disorder context will be reviewed in turn.

The Role of Rumination in Body Image Disturbance and Eating Disorder Symptomatology

Rumination has been primarily studied in the context of depression. Increasingly, research has indicated the relevance of depressive rumination in eating disorder symptomatology (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Naumann, Tuschen-Caffier, Voderholzer, Caffier, & Svaldi, 2015; Naumann, Tuschen-Caffier, Voderholzer, Schäfer, & Svaldi, 2016). In turn, this ignited a relatively recent interest in eating disorder-specific rumination. As such, the relevant theoretical accounts and empirical evidence pertaining to depressive rumination will be reviewed first, followed by an appraisal of eating disorder-specific rumination.

Depressive rumination. The conceptualisation of depressive rumination is best understood in the context of negative affect. Thus, prior to outlining its role in eating disorder symptomatology, it is important to understand its association with negative affect. Depressive rumination is a maladaptive emotion regulation strategy which has been defined as the tendency to repetitively focus on symptoms of distress and the possible causes and consequences of these symptoms (Nolen-Hoeksema, 1991, 2000). Ruminative responses may include worrying about possible consequences of one’s distress (e.g., “I won’t be able to concentrate if I keep feeling this way”) and isolating oneself to think about how sad or alone one feels (e.g., “go someplace alone to think about your feelings”) (Nolen-Hoeksema, 1991; Nolen-Hoeksema & Morrow, 1991). According to the response styles theory (RST; Nolen-Hoeksema, 1991), rumination serves to negatively bias thinking and interfere with effective problem solving and instrumental behaviour, which in turn exacerbates and prolongs distress. The RST also contends that the effects of rumination are only evident in the context of a negative
mood. In support of this notion, experimental evidence has shown that compared with
distraction, rumination serves to increase: negative affect, impaired problem-solving,
negative thinking, negative memory recall, and maladaptive attentional biases, but only
for participants who were in a negative mood prior to the rumination induction
(Donaldson & Lam, 2004; Lavender & Watkins, 2004; Lyubomirsky, Caldwell, &
Nolen-Hoeksema, 1998; Lyubomirsky & Nolen-Hoeksema, 1995; Morrison &
O’Connor, 2008; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Additionally, a
reciprocal relationship between momentary rumination and momentary negative affect
has been demonstrated in studies using ecological momentary assessment (Moberly &
Watkins, 2008; Selby, Kranzler, Panza, & Fehling, 2016). Thus, a key criterion of
experimental studies testing the effects of rumination is to include a negative mood
induction prior to the rumination manipulation.

Although predominately studied in the field of depression, there is a growing
theoretical and empirical focus on the relevance of rumination in the occurrence of
eating disorder symptomatology. In a meta-analysis of emotion regulation strategies
across various psychopathologies, eating disorder symptoms were shown to be
positively associated with depressive rumination and negatively associated with
adaptive emotion regulation strategies, such as emotional acceptance (Aldao et al.,
2010). Similarly, in a study by Naumann, Tuschen-Caffier, Voderholzer, and Svaldi
(2016), women with AN and BN reported greater rumination and suppression (i.e., the
attempt to hide one’s current emotional state) and less emotional acceptance, relative to
healthy controls, in response to a negative mood induction. These findings suggest that
individuals with eating disorders tend to use maladaptive emotion regulation strategies,
such as rumination, more so than adaptive counterparts, such as emotional acceptance.
Moreover, there is evidence demonstrating the efficacy of acceptance, relative to
rumination, in both improving body satisfaction in young female undergraduates (Wade,
George, & Atkinson, 2009) and in reducing body-related distress in overweight women (Svaldi, Naumann, Trentowska, Lackner, & Tuschen-Caffier, 2013). Combined, the aforementioned studies suggest that individuals with elevated body dissatisfaction and eating disorder symptomatology adopt a ruminative response style, in response to distress, which may serve to maintain body-related distress and dissatisfaction.

Depressive rumination has also been implicated as a key causal factor for specific eating disorder symptoms. In the latest extension of the RST, Nolen-Hoeksema, Wisco, and Lyubomirsky (2008) postulate that heightened depressive rumination leads to bulimic symptoms (e.g., binge eating or purging) as engaging in such behaviours may serve to temporarily suppress ruminative thoughts. Empirical evidence for a bidirectional relationship between depressive rumination and bulimic symptoms has been demonstrated in samples of adolescent females (Holm-Denoma & Hankin, 2010; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). Moreover, Naumann et al. (2016) found that ruminative thinking, as opposed to emotional acceptance, served to exacerbate body dissatisfaction in females with AN and BN following thin-ideal media exposure. Experimentally induced rumination has also been shown to increase the desire to engage in binge eating in females with BN and also the desire to abstain from eating in females with AN (Naumann et al., 2015). Although the rumination induction did not influence dietary restraint and binge eating in females without an eating disorder (Naumann et al., 2015), it could be that depressive rumination is only influential in individuals with elevated levels of dietary restraint and/or binge eating. Overall, while depressive rumination has shown to play a role in the onset and/or maintenance of eating disorder symptomatology, it may be postulated that eating disorder-specific rumination is a more relevant risk factor for eating disorder symptomatology, especially in young women.
**Eating disorder-specific rumination.** The Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011) is the only existing measure of eating disorder-specific rumination, which has been conceptualised as preoccupation with eating, shape, and weight concerns (Park, Dunn, & Barnard, 2011). It captures two aspects of rumination: brooding and reflection (Cowdrey & Park, 2011). Brooding is characterised by a passive comparison of one’s current situation with an ideal standard (e.g., “Think about a recent meal time wishing it had gone better”), whereas reflective rumination represents a purposeful turning inward to gain insight into eating disorder symptoms (e.g., “Write down what you think about your eating, weight and/or shape and analyse it”) (Cowdrey & Park, 2011; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Previous research has revealed that brooding, but not reflection, predicts depressive symptoms prospectively (Burwell & Shirk, 2007; Schoofs, Hermans, & Raes, 2010). These findings suggest that brooding is the more maladaptive form of depressive rumination, relative to reflection. However, other research suggests that both eating disorder-specific ruminative factors may be maladaptive, with each factor variously predicting eating disorder symptoms in clinical versus non-clinical individuals. Specifically, in a community sample of healthy females, eating disorder-specific brooding, but not reflection, was uniquely associated with eating disorder symptoms, above and beyond anxiety and depression (Cowdrey & Park, 2012). However, in women with a history of AN, eating disorder-specific reflection but not brooding, was uniquely associated with eating disorder symptoms (Cowdrey & Park, 2012). These findings suggest that brooding may play a role in the potential onset and/or maintenance of eating disorder symptoms in individuals vulnerable to the disorder, but reflection may be a more relevant risk factor for eating disorder symptoms in individuals who have experienced AN.
Theoretical accounts also implicate eating disorder-specific rumination in eating disorder symptomatology (Fairburn et al., 2003; Park et al., 2011; Park, Dunn, & Barnard, 2012). As previously mentioned, this ruminative tendency has been conceptualised as a preoccupation with eating, shape, and weight concerns (Park et al., 2011). This preoccupation is proposed to maintain the dysfunctional system for self-evaluation shared by most eating disorders, which centres on the over-evaluation of eating, shape, and weight and their control (Fairburn et al., 2003). A different theoretical account, specific to AN (Park et al., 2011, 2012), hypothesises that eating disorder-specific rumination serves to distract individuals with AN from the subjective experience of hunger and negative affect, thus driving dietary restriction. In support of this proposition, qualitative evidence revealed that, during meal times, some females with AN interpreted a rumination exercise positively because it prevented them from processing negative emotions elicited by the meal (Cowdrey, Stewart, Roberts, & Park, 2013).

To date, only one study has investigated the causal role of eating disorder-specific rumination on eating disorder symptoms (Etu & Gray, 2010). This study showed that young women, who were induced to ruminate on eating, shape, and weight concerns reported greater dissatisfaction and anxiety about their own bodies, relative to participants who were distracted. In summary, there is preliminary evidence to support the notion that eating disorder-specific rumination may play a role in the onset and/or maintenance of body dissatisfaction and broader eating disorder symptomatology.

While rumination has been investigated in isolation, it is also important to examine its association with other risk factors, such as attentional bias, to predict eating disorder symptomatology. One reason to propose this is the substantial evidence of an association between attentional bias towards negative information and depressive rumination in the depression literature (e.g., Donaldson, Lam, & Mathews, 2007;
The Role of Attentional Bias in Body Image Disturbance and Eating Disorder Symptomatology

Attentional bias, or the tendency to preferentially attend to specific information in the environment that is disorder salient, is a robust phenomenon across various psychopathologies (Yiend, 2010). For instance, anxious individuals, in general, selectively attend towards negative information (e.g., words of a negative emotional valence) (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007), whereas individuals with addictive behaviours (e.g., excessive alcohol consumption) tend to show attentional biases for substance-related stimuli (e.g., alcohol-related images) (Field & Cox, 2008).

Moreover, it is well established that individuals with elevated eating disorder symptomatology have attentional biases regarding food and/or body shape/weight-related information. Meta-analytic and systematic reviews have provided support for this finding using different methods for evaluating attentional bias including the modified Stroop task (Aspen, Darcy, & Lock, 2013; Dobson & Dozois, 2004; Johansson, Ghaderi, & Andersson, 2005), the dot probe task (Aspen et al., 2013; Rodgers & DuBois, 2016), and eye tracking tasks (Rodgers & DuBois, 2016).

Cognitive-behavioural theories of eating disorders propose that attentional biases favouring food and/or body shape/weight-related information may contribute to the development and/or maintenance of eating disorder symptoms (Fairburn et al., 2003; Vitousek & Hollon, 1990; Williamson, Muller, Reas, & Thaw, 1999; Williamson, White, York-Crowe, & Stewart, 2004). Specifically, it is hypothesised that the dysfunctional scheme for self-evaluation underlying all eating disorders (i.e., an over-evaluation of eating, shape and weight) leads to cognitive biases, such as attentional
bias, which in turn influences disturbed behaviour patterns (e.g., dietary restraint and body checking) (Fairburn et al., 2003; Vitousek & Hollon, 1990; Williamson et al., 1999; Williamson et al., 2004).

In particular, there is an increasing research focus on the effects of selective attention for thin-ideal female bodies, due to the ubiquity of thin-ideal media in western society. Meta-analytic evidence suggests that exposure to thin-ideal media has a negative impact on women’s body image (Grabe, Ward, & Hyde, 2008; Groesz et al., 2002). Therefore, women who selectively attend towards thin-ideal media may be especially vulnerable to developing and/or exacerbating eating disorder symptomatology.

Attentional biases can be measured through a variety of experimental methods, each offering strengths and weaknesses. One common method employed by researchers to assess attentional bias for body images is eye tracking. In paradigms using eye tracking technology, participants are typically presented with image(s) of their own body or the bodies of others, and specific gaze attributes (e.g., gaze duration, fixation frequency, orientation bias, or the time taken to orient to the stimulus following its onset) are measured (Jiang & Vartanian, 2017). A benefit of eye-tracking is that it can reveal which specific body parts individuals are attending and the changes in the direction of attention over time. Alternatively, a common behavioural measure of selective attentional processing of body images is the dot probe task. In this task, participants are briefly exposed (e.g., 500ms) to emotional and neutral stimuli (images are displayed either top/bottom or left/right of a central fixation point). A probe (e.g., single letter ‘p’ or ‘q’) subsequently replaces the location previously occupied by the emotional or neutral stimuli, at which point participants are required to identify the probe as quickly and accurately as possible (i.e., by pressing the corresponding key on a keyboard). A faster response to a probe that replaced emotional stimuli, compared to
neutral stimuli, is considered evidence for an attentional bias towards emotional stimuli, whereas a slower response to that probe would suggest attention was directed away from emotional stimuli.

**Attentional bias for thin versus non-thin body stimuli.** Experimental findings regarding the presence, magnitude and direction of attentional biases for thin versus non-thin body-related stimuli are somewhat inconsistent. Factors that might contribute to these conflicting findings are the participant sample (e.g., high versus low levels of eating disorder symptomatology) and the nature of the stimuli (e.g., relevant to the self or depicting the bodies of others). In general, studies show that women with elevated eating disorder symptomatology selectively attend towards body-shape related stimuli connoting a large physique if they can be interpreted as *self-relevant* and body-shape related stimuli connoting a thin physique if they can be perceived as a reflection of the environment (i.e., *other* females). Both of these patterns would have implications for driving eating disorder symptoms such as body dissatisfaction.

Beginning with research using images depicting other females, findings from eye-tracking studies have revealed longer and more frequent attention towards images of other female bodies or body regions which are indicative of the thin-ideal in females with BN (Blechert, Nickert, Caffier, & Tuschen-Caffier, 2009) and AN (Pinhas et al., 2014), and also in females with elevated body dissatisfaction (Cho & Lee, 2013; Purvis, Jones, Bailey, Bailenson, & Taylor, 2015). In line with this general tendency, females with elevated body dissatisfaction have also demonstrated attentional avoidance of non-thin body regions (Lykins, Ferris, & Graham, 2014) and body regions identified as problematic, such as thighs and stomach (Janelle, Hausenblas, Fallon, & Gardner, 2003) of other women. Other eye-tracking studies have shown that females with elevated general eating disorder symptomatology (Jansen, Nederkoorn, & Mulkens, 2005), body dissatisfaction (Roefs et al., 2008), and also overweight women (Warschburger,
Calvano, Richter, & Engbert, 2015) have a tendency to selectively attend to the attractive body parts of other females. These findings have some relevance for the processing of thin body stimuli given cultural norms serve to conflate “attractive” and the “thin-ideal”. In support of this notion, Cho and Lee (2013) showed that women with elevated body dissatisfaction rated thin bodies as more attractive relative to women with low body dissatisfaction. Furthermore, behavioural research using the dot probe task found that females with elevated body dissatisfaction demonstrated an attentional bias to thin images of other women relative to non-thin body images (Joseph et al., 2016; Moussally, Brosch, & Van der Linden, 2016).

However, as an indication of the conflicting findings, one study found that even healthy women show a bias towards thin-ideal bodies (Glauert, Rhodes, Fink, & Grammer, 2010). Specifically, this study revealed that healthy females automatically attended towards thin, as opposed to non-thin, female bodies as assessed by the dot probe task. Research on women with eating disorders reveals further contradictory findings to those showing a link between attentional bias to thin-ideal bodies and eating disorder symptomatology. These studies revealed that women with an eating disorder selectively attended towards non-thin bodies of other women as assessed by the dot probe task (Shafran, Lee, Cooper, Palmer, & Fairburn, 2007) and eye-tracking (Svaldi, Caffier, & Tuschen-Caffier, 2011).

When viewing stimuli relevant to their own body, such as images of themselves, women with elevated body dissatisfaction (Jansen et al., 2005; Roefs et al., 2008) and also women with AN and BN (Tuschen-Caffier et al., 2015) have been found to selectively attend towards their own body regions with which they are dissatisfied. In a study using the dot probe task, females with AN and BN were faster to attend to probes replacing non-thin relative to neutral words, and slower to those replacing thin relative to control words (Rieger et al., 1998), with words presumably interpreted as self-
relevant. These studies on self-relevant stimuli are therefore each consistent with a
tendency for women with elevated eating disorder symptomatology to focus on self-
relevant non-thin stimuli.

Yet as a final illustration of the conflicting findings, research has revealed an
attentional bias towards both thin and non-thin bodies of other women in those with
elevated body dissatisfaction (Gao et al., 2013, 2014) and dietary restraint (Jiang and
Vartanian, 2012). In addition, the study by Jiang and Vartanian (2012) found no
difference in selective attentional processing of thin and non-thin body images between
restrained and unrestrained eaters. Further research is clearly necessary to determine the
difference between attentional processing of thin versus non-thin images, and to
establish which attentional mechanism (bias towards thin bodies versus bias away from
non-thin bodies) is more strongly related to eating disorders symptomatology.

The evidence outlined so far is based on cross-sectional data, which does not
permit any causal conclusions regarding the relationship between attentional bias
regarding thin-ideal body images and eating disorder symptomatology. Although there
is no causal evidence, to date, for this particular relationship, there is research showing
the causal influence of selective attention for non-thin, self-relevant stimuli on body
dissatisfaction (Smeets, Jansen, & Roefs, 2011; Smith & Rieger, 2006, 2009). Studies
by Smith and Rieger (2006, 2009) used a well-established attentional bias modification
(ABM) paradigm (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002), based
on the dot probe task, to induce selective attention for specific stimuli. Depending on
participants’ training condition, probes were always displayed in the location
corresponding to one of: shape/weight words connoting a non-thin physique (e.g.,
“fat”), emotional words matched for valence (e.g., “worthless”), or neutral words (e.g.,
“clock”). Women who were induced to attend towards shape/weight words connoting a
non-thin physique reported greater body dissatisfaction compared to women who were trained to attend to either emotional or neutral words (Smith & Rieger, 2006, 2009).

In summary, there is some research suggesting that when viewing other female bodies, women with elevated eating disorder symptomatology tend to selectively attend towards thin body regions. This selective attentional pattern could be considered to represent an upward social comparison (Festinger, 1954), whereby the individual compares their own body to other female bodies that are perceived as thinner and more attractive. In turn, this may serve to perpetuate body dissatisfaction and drive dietary restriction in an attempt to achieve this ‘ideal’. The notion that appearance comparisons with other females contributes to body image concerns is in line with the sociocultural theory (Thompson et al., 1999). Further, the finding in at least some research that women with elevated eating disorder symptomatology also tend to selectively focus on non-thin regions when viewing their own body would likely also contribute to ongoing body dissatisfaction and dietary restriction. It is important to note that the mechanism underlying the relationship between attentional bias for thin-ideal images and eating disorder symptomatology remains unclear. As previously propositioned in this review, it is plausible that attentional bias may contribute to ruminative thinking, which in turn predicts eating disorder symptomatology, as has been demonstrated in the context of depression.

**The Relationship Between Rumination and Selective Attention**

Researchers have proposed that attentional bias and rumination work together to increase vulnerability for depression (De Raedt & Koster, 2010; Koster et al., 2011). More specifically, the impaired disengagement hypothesis posits that difficulties in disengaging attention from negative information lead to a heightened ruminative disposition, which in turn intensifies negative mood (Koster et al., 2011).
Consistent with this theoretical account, there is substantial evidence of an association between attentional bias for negative information and depressive rumination. This association has been demonstrated in studies utilising the dot probe task (Donaldson et al., 2007; Joormann et al., 2006) and also eye-tracking paradigms (Duque, Sanchez, & Vazquez, 2014; Owens & Gibb, 2016). More specifically, studies have found that this relationship exists for ruminative brooding, but not ruminative reflection (Joormann et al., 2006; Owens & Gibb, 2016). In addition, the relationship between rumination and selective attention has been found to remain significant even after controlling for depressive symptoms (Donaldson et al., 2007; Duque et al., 2014; Joormann et al., 2006; Owens & Gibb, 2016).

Furthermore, studies have shown that the association between depressive rumination and attentional bias reflects impaired attentional disengagement from negative information, as opposed to enhanced engagement with such information (Grafton et al., 2016; Southworth, Grafton, MacLeod, & Watkins, 2017). Moreover, one study revealed that difficulties in disengaging attention from negative information were associated with heightened ruminative brooding, but not heightened reflection, further highlighting the maladaptive nature of ruminative brooding (Southworth et al., 2017). However, the cross-sectional design of the aforementioned studies does not permit conclusions to be drawn regarding the causal relationship between attentional bias and rumination.

To date, only two studies provide evidence for a causal relationship between attentional bias for negative information and depressive rumination. Yang, Ding, Dai, Peng, and Zhang (2015) showed that induced attentional bias away from depressive-relevant words led to significantly reduced rumination and depressive symptoms, relative to placebo training and no-training, in a sample of undergraduate students with elevated depressive symptoms. Results from this study also revealed that the reduction
in rumination served to mediate the relationship between change in attentional bias and the reduction of depressive symptoms. These findings are consistent with the possibility that attentional bias plays a causal role in rumination and also, with the theory put forward by Koster et al., (2011), according to which depressive rumination mediates the relation between attentional bias and depressive symptoms. Moreover, findings by Morrison and O’Connor (2008) demonstrate that depressive rumination may causally influence this attentional bias, in a reciprocal manner. Specifically, young adult participants who were induced to ruminate about depressive themes showed a reduced attentional bias towards positive words, whilst those who were distracted showed an increased attentional bias towards positive words. However, rumination did not lead to greater attentional bias towards negative words. This result is in line with the RST (Nolen-Hoeksema, 1991), which envisages rumination as the process of repetitively and passively thinking about one’s feelings and problems, which in turn diminishes the ability to focus on distracting (positive) activities.

In summary, research supports an association between attentional bias for negative information and depressive rumination, two important cognitive vulnerabilities for depression. Additionally, there is preliminary evidence to suggest that selectively attending to negative information causally impacts rumination, a relationship which is potentially reciprocal, which in turn influences depressive symptoms. Thus, it is plausible to assume that attentional bias specific to body shape and/or weight information may influence eating disorder-specific rumination, which in turn further increases attentional bias, and also serves to intensify eating disorder symptomatology. The current research program was developed on the basis of this proposition.

**Overview of the Current Research Program**

As illustrated in this review, there is considerable theoretical and empirical evidence to implicate attentional bias and rumination as vulnerability factors for eating
disorder symptomatology. The overall goal of the current research program was to develop a novel model which describes how selective attention for thin-ideal images and eating disorder-specific rumination interact to predict body dissatisfaction and dietary restraint in young women.

Given that the studies that comprise the current research program manipulated attentional bias and rumination, in order to understand their causal impact in eating disorder symptomatology, samples of female undergraduate students were utilised. This was to avoid the ethical issue of exposing highly vulnerable individuals to increasing rumination and attentional biases and also to avoid a potential ceiling effect in these factors that may occur in a clinical sample (Jansen, 2016; Rieger, Dolan, Thomas, & Bell, 2017). The rationale for investigating the aetiology of the specific eating disorder symptoms of dietary restraint and body dissatisfaction is due to their high prevalence amongst young undergraduate females (Eisenberg, Nicklett, Roeder, & Kirz, 2011; Luce, Crowther, & Pole, 2008; Neighbors & Sobal, 2007; White, Reynolds-Malear, & Cordero, 2011) and evidence showing an association between these symptoms and reduced quality of life (Mond et al., 2013; Wade et al., 2012). Additionally, body dissatisfaction and dietary restraint are considered important risk factors for eating disorders (Stice et al., 2017, 2011; Stice & Shaw, 2002).

Guided by the impaired disengagement model of depressive rumination (Koster et al., 2011) and substantial empirical evidence demonstrating a rumination-linked attentional bias (e.g., Donaldson et al., 2007; Grafton et al., 2016; Joormann et al., 2006; Morrison & O’Connor, 2008; Owens & Gibb, 2016; Yang et al., 2015), it is proposed that attentional bias towards thin-ideal images affects both body dissatisfaction and dietary restraint, via the mediating role of eating disorder-specific rumination (see Figure 1.1). In order to assess the feasibility and validity of the proposed mediation model, four studies were conducted.
**Figure 1.1.** The mediation model predicting that eating disorder-specific rumination mediates the relationship attentional bias towards thin-ideal bodies and the specific eating disorder symptoms of body dissatisfaction ($Y_1$) and dietary restraint ($Y_2$).

The dot probe task was employed for the assessment and modification of attentional bias for body images. The primary reason for choosing this task is because it allows for the assessment and modification of attentional biases towards, and avoidance of, female bodies. The present studies were designed to build upon related research using the dot probe task (Glauert et al., 2010; Joseph et al., 2016; Moussally et al., 2016) whilst incorporating several important design advantages over that research: 1) increasing ecological validity by using real body images as opposed to computer generated images; 2) utilising body stimuli that have been rated and subsequently matched on emotional valence and arousal, and finally, 3) pairing body images with neutral images. The importance of ensuring stimuli have an equal affective valence is due to evidence and theory suggesting that rumination is associated with valence-specific attentional biases (Koster et al., 2011). Further, the benefit of the pairing of body images with neutral images, relative to the pairing of thin bodies with non-thin bodies seen in some previous studies (Glauert et al., 2010; Joseph et al., 2016), is that it allows for the magnitude of attentional bias towards or away from each body type to be quantified. In the current research program neutral images consisted of abstract art. Finally, trait and state self-report questionnaires were utilised for the assessment of eating disorder-specific rumination and eating disorder symptomatology. This was to
permit the use of verified stable measures whilst also measuring changes across time in studies designed to manipulate attentional biases and rumination.

The purpose of each study will now be reviewed in turn.

**Study 1: Association between rumination factors and eating disorder behaviours in young women.** Compared with depressive rumination, the pathological function of eating disorder-specific rumination is less understood. The Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011) is the only existing self-report measure of trait eating disorder-specific rumination, rendering it a pertinent measure for the purposes of the present research program. The RRS-ED has demonstrated adequate reliability and good levels of convergent and discriminant validity in both clinical and non-clinical samples (Cowdrey & Park, 2011, 2012). However, to the best of our knowledge, there is no existing evidence of its utility in young women (i.e., the demographic of interest). In order to justify its use, it was necessary to firstly provide evidence for its validity by, 1) verifying its two-factor structure (i.e., brooding and reflection) and, 2) examining its ability to predict eating disorder symptomatology in young women. It was hypothesised that a two dimensional model of eating disorder-specific rumination would be supported. Additionally, it was hypothesised that rumination factors would be correlated with overall eating disorder symptoms.

Furthermore, a key justification for the proposed mediation model is that eating disorder-specific rumination is a risk factor for specific eating disorder symptoms. To date, there is relatively little research exploring the association between eating disorder-specific rumination and specific eating disorder behaviours. Therefore, Study 1 aimed to determine whether eating disorder-specific rumination factors are associated with self-reported binge eating and dietary restraint. It was hypothesised that greater levels of
eating disorder-specific rumination would be associated with greater levels of eating disorder behaviours.

**Study 2: The mediating role of rumination in the relation between attentional bias towards thin female bodies and eating disorder symptomatology.**

Having validated the use of the RRS-ED, the second study in the series set out to investigate the relationships between attentional bias, rumination, and eating disorder symptoms. The proposed mediation model (see Figure 1.1) is based on the argument that selective attention for thin-ideal images is an important vulnerability factor for body dissatisfaction and dietary restraint in young women. However, empirical evidence suggests attentional processing of both thin and non-thin body images is relevant in eating disorder symptomatology (Blechert et al., 2009; Cho & Lee, 2013; Gao et al., 2013, 2014; Janelle et al., 2003). Therefore, the primary aim of Study 2 was to examine the associations between selective attentional processing of both thin-ideal and non-thin body images and specific eating disorder symptoms. A secondary aim was to establish which attentional mechanism (i.e., bias towards thin bodies versus bias away from non-thin bodies) is more strongly associated with the specific eating disorder symptoms. It was hypothesised that the association between heightened attentional bias and greater levels of both body dissatisfaction and dietary restraint would be greater for bias towards thin-ideal bodies relative to bias away from non-thin bodies.

The third and final aim was to determine whether eating disorder-specific rumination serves to mediate the relationship between attentional bias towards thin-ideal images and specific eating disorder symptoms. This was based on the theoretical account by Koster et al. (2011) and substantial empirical evidence (e.g., Donaldson et al., 2007; Grafton et al., 2016; Joormann et al., 2006; Morrison & O’Connor, 2008; Owens & Gibb, 2016; Yang et al., 2015) indicating a relationship between attentional bias towards negative information and depressive rumination. It was hypothesised that
eating disorder-specific rumination mediates the relationship between attentional bias towards thin bodies and both body dissatisfaction and dietary restraint.

**Study 3: The causal role of selective attention for thin-ideal images on negative affect and rumination.** The primary purpose of the third study was to extend the correlational design of Study 2 to establish causality for the relationship between attentional bias and rumination. Given the aforementioned literature, according to which depressive rumination also requires the presence of negative mood (Donaldson & Lam, 2004; Lavender & Watkins, 2004; Lyubomirsky et al., 1998; Lyubomirsky & Nolen-Hoeksema, 1995; Morrison & O’Connor, 2008; Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008) and preliminary evidence suggesting that momentary eating disorder-specific rumination is associated with momentary negative affect (Seidel et al., 2016), this meant that negative mood needed to be induced prior to rumination measurement.

That aside, Study 3 specifically assessed whether inducing an attentional bias for thin-ideal images increases vulnerability to experience heightened rumination on eating, shape, and weight concerns, in response to a body image-related stressor. The nature of the paradigm means that Study 3 also tested the effect of attentional bias on negative affect. An attentional bias modification (ABM) procedure was used to train participants to either attend to or avoid thin-ideal bodies. Primarily, it was hypothesised that the ABM task will be successful in producing the predicted changes in attentional bias. Secondly, it was anticipated that participants trained to attend to thin-ideal bodies would experience greater eating disorder-specific rumination and negative affect, in response to a body image-related stressor, relative to the distraction group.

**Study 4: The effect of induced rumination on attentional bias towards thin-ideal female bodies and eating disorder symptomatology.** Study 3 sought to examine whether attentional bias causally influences rumination. In turn, Study 4 aimed to test
the causal role of eating disorder-specific rumination in body dissatisfaction and dietary restraint. Combined, these two studies investigated the causal relationships in the proposed mediation model (see Figure 1.1). Given preliminary evidence for a causal relationship between eating disorder-specific rumination and body dissatisfaction in young women (Etu & Gray, 2010), and previous evidence suggesting depressive rumination serves to exacerbate body dissatisfaction, dietary restraint, and binge eating in individuals with eating disorders (Naumann et al., 2015; Naumann et al., 2016), it was hypothesised that induced rumination would lead to significantly greater increases in self-reported body dissatisfaction and dietary restraint compared with induced distraction. Furthermore, the proposed mediation model specifies a unidirectional relationship between attentional bias and rumination. However, there is evidence in the depression literature suggesting this relationship is bidirectional (Morrison & O’Connor, 2008). Thus, the second aim of the final study was to determine whether heightened eating disorder-specific rumination leads to changes in attentional bias towards thin-ideal bodies. It was hypothesised that induced rumination on eating, shape, and weight concerns, as compared to distraction, would lead to a greater positive change in attentional bias towards thin-ideal bodies (i.e., either greater attentional bias towards thin-ideal bodies or reduced avoidance of thin-ideal bodies).
CHAPTER TWO: ASSOCIATION BETWEEN RUMINATION FACTORS AND EATING DISORDER BEHAVIOURS IN YOUNG FEMALES

Laura Dondzilo, Elizabeth Rieger, Romina Palermo, Susan Byrne, and Jason Bell

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.
Introduction

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 et al., 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 et al., (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 (Abbate-Daga, Amianto, Delsedime, De-Bacco, & Fassino, 2013).

Preoccupation with eating and body weight control characterises the type of ruminative thoughts experienced by individuals with eating disorder symptoms (Fairburn et al., 2003; Park et al., 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, 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 et al., 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 et al. (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 et al., 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; Joormann et al., 2006; Treynor et al., 2003). Similar to the aforementioned account of anorexia nervosa (Park et al., 2011, 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, this 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) and therefore is a potential confounding variable in the relationship between rumination and eating disorder symptomatology.

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 et al., 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 et al., 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 $\alpha = .90$, $\alpha = .81$ and $\alpha = .86$, 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 $\alpha = .93$ and $\alpha = .85$, 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 (Schmitz, 2012), 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 .40, 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 $\chi^2$, 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 $\chi^2$ is the only inferential statistic which permits conclusions regarding hypothesis testing (Iacobucci, 2010). However, the $\chi^2$ 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 $\chi^2$ adjusted by its degrees of freedom, does not exceed 3.0 (Kline, 2004): $\chi^2 / df \leq 3$. Other fit indices reflecting absolute fit of a model, in addition to $\chi^2$, 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 $\chi^2$ 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 2.1), 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 2.1). Ultimately, the two-factor structure provided a significantly better fit to the sample data ($\chi^2_{\text{diff}} = 26.12, df = 1, p < .0001$).

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.
Table 2.1

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

* $p < .01$, ** $p < .0001$
**Rumination and Global Eating Disorder Symptomatology**

Prior to conducting the subsequent analyses, the data were 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 2.2. 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 2.2, global EDE-Q scores were significantly and positively correlated with the RRS-ED brooding and reflection scores and also with the total RRS-ED 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.
Table 2.2

Means, standard deviations and correlations among measures of eating disorder symptoms, rumination, BMI and mood

<table>
<thead>
<tr>
<th></th>
<th>Global EDE-Q</th>
<th>RRS-ED brood.</th>
<th>RRS-ED refl.</th>
<th>BMI</th>
<th>DASS dep.</th>
<th>DASS anx.</th>
<th>DASS str.</th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

\[ M \]

\[ 2.19 \]

\[ SD \]

\[ 1.64 \]

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.

* \( p < .05 \); ** \( p < .01 \) (adjusted \( p \)-values based on multiple comparisons corrections).
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). Importantly, all predictors were associated with variance inflation factor and tolerance values \(<4\) and \(>25\), respectively, indicating an absence of multicollinearity (Pan & Jackson, 2008).

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 2.3). 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.
### Table 2.3

*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>( R^2 )</th>
<th>( R^2 ) change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>.22</td>
<td>.04</td>
<td>.40*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.17</td>
<td>.04</td>
<td>.45*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>.05</td>
<td>.04</td>
<td>.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>-.02</td>
<td>.05</td>
<td>-.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>.05</td>
<td>.03</td>
<td>.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.04</td>
<td>.03</td>
<td>.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>.02</td>
<td>.02</td>
<td>.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>.01</td>
<td>.03</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brooding</td>
<td>.21</td>
<td>.03</td>
<td>.70*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td>.05</td>
<td>.05</td>
<td>.07</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.*

*\( p < .001 \)*

### Rumination and Eating Disorder Behaviours

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 2.4. 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 2.4

Descriptive Statistics for Frequency of Objective Binge Eating Episodes and Dietary Restraint

<table>
<thead>
<tr>
<th></th>
<th>Brooding</th>
<th>Reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Frequency (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBEs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>53.45</td>
<td>10.23</td>
</tr>
<tr>
<td>Occasional Episodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recurrent(^1)</td>
<td>25.00</td>
<td>18.17</td>
</tr>
<tr>
<td>Diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>66.38</td>
<td>11.01</td>
</tr>
<tr>
<td>Occasional Episodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extreme(^2)</td>
<td>7.76</td>
<td>19.00</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.

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 2.5 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 2.6 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 2.5

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</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>1.00</td>
<td>.84 – 1.19</td>
</tr>
<tr>
<td>Stress</td>
<td>-.00 (.09)</td>
<td>.00</td>
<td>1</td>
<td>.00</td>
<td>.88 – 1.30</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</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>1.02</td>
<td>.76 – 1.14</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 2.6

*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</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet</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></td>
<td></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</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Diet</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Intercept</td>
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<td>1.13</td>
<td>1</td>
<td></td>
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</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>
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<td>.04</td>
<td>1</td>
<td>.97</td>
<td>.72 – 1.31</td>
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<tr>
<td>BMI</td>
<td>-.19 (.17)</td>
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<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.
* $p < .05$; ** $p < .01$; *** $p < .001$
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
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 et al., 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.
Chapter Three

CHAPTER THREE: THE MEDIATING ROLE OF RUMINATION FACTORS IN THE RELATION BETWEEN ATTENTIONAL BIAS TOWARDS THIN FEMALE BODIES AND EATING DISORDER SYMPTOMATOLOGY

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Abstract

The present study sought to investigate the association between selective attentional processing of body images, rumination, and eating disorder symptoms in young women. Seventy-three undergraduate female students (ages 17-24) completed a modified dot-probe task to assess whether young women showed a differential attentional bias pattern towards thin and non-thin female bodies. Participants also completed self-report measures of eating disorder pathology. It was found that increased reports of dietary restraint and body dissatisfaction were associated with both greater attentional bias towards thin bodies and avoidance of non-thin bodies (as compared to neutral images), although the former relationship was stronger than the latter. The results suggest attentional vigilance to thin-ideal images plays a greater role in the potential development and/or maintenance of eating disorder symptoms, at least in a university sample of young women. Results also revealed that eating disorder-specific rumination mediated the relationship between attentional bias to thin ideal images and eating disorder symptoms. These findings build on existing research and theories, for example the impaired disengagement model of rumination, and have potential clinical applications such as specifically targeting ruminative and/or attentional processes in the prevention and/or treatment of eating disorder symptoms.
Introduction

Exposure to advertisements glorifying the thin-ideal female body shape is pervasive. A meta-analysis of experimental and correlational studies revealed that media exposure to the thin-ideal is related to women’s vulnerability to body image disturbances and disordered eating behaviour (Grabe et al., 2008). More specifically, research has shown that women dissatisfied with their own bodies are particularly susceptible to negative affect and disordered eating after viewing thin-ideal stimuli (Johansson, Lundh, & Andersson, 2005; Posavac, Posavac, & Posavac, 1998; Stice, Spangler, & Agras, 2001). Those with an attentional bias towards thin-ideal imagery may be especially vulnerable in an environment where such stimuli are ubiquitous.

Theoretical and empirical evidence suggests that attentional biases towards body shape-related information, such as via thin-ideal media, may play an important role in the development and/or maintenance of eating disorder symptoms. In accordance with the transdiagnostic cognitive behavioural theory of eating disorders (Fairburn et al., 2003), these biases are hypothesised to arise from a dysfunctional scheme for self-evaluation that centres on the over-evaluation of eating, shape and weight and their control.

Empirical data show an association between attentional biases in the processing of female body images and eating disorder symptoms (Blechert et al., 2009; Cho & Lee, 2013; Janelle et al., 2003; Jansen et al., 2005; Joseph et al., 2016; Moussally et al., 2016; Pinhas et al., 2014). When viewing body-related information of other females (including both whole bodies and body regions), it generally appears that women with elevated levels of eating disorder symptomatology selectively attend towards body stimuli connoting a thin physique and avoid non-thin body stimuli. For example, avoidance of body regions identified as causing dissatisfaction has been found in women with a high level of drive for thinness and body dissatisfaction (Janelle et al., 2003). Similarly, women high on eating disorder symptoms spent more time looking at
attractive compared to unattractive body parts of other women (Jansen et al., 2005). These eye-tracking results have been replicated in a sample of overweight men and women viewing images of other men and women, respectively (Warschburger et al., 2015) and also in young women who were both dissatisfied with their own bodies and had a higher body mass index (BMI) (Roefs et al., 2008). Moreover, women with bulimia nervosa showed significantly longer fixations, relative to controls, when presented with images of female bodies that were thinner in comparison to the self (Blechert et al., 2009).

Other studies have used a dot-probe methodology, in which participants are briefly presented with stimulus pairs (e.g., thin body image and a neutral image) and are required to discriminate a probe (e.g., single letter ‘p’ or ‘q’) that subsequently appears in the location of one of these two stimuli. Attentional bias is present when an individual is quicker to identify probes that replaced one stimulus type (e.g., thin body images) relative to other stimuli (e.g., neutral images). Glauert et al. (2010) found an automatic attentional bias to thin female bodies, compared to non-thin female bodies, in a non-clinical female sample. Further studies found that a greater attentional bias to thin bodies, relative to non-thin bodies, was associated with elevated levels of body dissatisfaction (Joseph et al., 2016; Moussally et al., 2016).

Although there is currently no research investigating whether attentional biases towards thin body images are causally involved in developing and/or exacerbating eating disorder symptoms, studies do show that attentional biases towards self-relevant body-related information may serve to trigger body dissatisfaction (Smeets et al., 2011; Smith & Rieger, 2006, 2009). For example, an experimentally induced attentional bias towards young women’s own and self-defined unattractive body parts led to increased body dissatisfaction (Smeets et al., 2011). Similarly, studies by Smith and Rieger (Smith & Rieger, 2006, 2009) showed that training young women to attend to
shape/weight words connoting a large physique, with these words potentially processed as self-relevant, resulted in increased body dissatisfaction. However, induced body dissatisfaction did not lead to greater attentional biases (Smith & Rieger, 2010). In summary, individuals with eating disorder symptoms seem to attend to thin bodies/body regions of others (as compared to non-thin) and for themselves, focus on the non-thin regions. This attentional pattern would serve to exacerbate dissatisfaction with one’s own body. In considering these findings, it may be postulated that attentional biases in the processing of body shape imagery is a risk factor for developing eating disorder symptoms, such as body dissatisfaction.

The specific mechanism by which attentional bias triggers eating disorder symptoms remains unknown. One possibility is that a cognitive-affective process, such as eating disorder-specific rumination, serves to mediate the relationship between attentional bias and eating disorder symptoms. Several studies have found an association between eating disorder-specific rumination in the potential development and/or maintenance of general eating disorder symptoms (Cowdrey & Park, 2011, 2012; Cowdrey et al., 2013; Dondzilo, Rieger, Palermo, Byrne, & Bell, 2016), clinically significant levels of dietary restraint (Dondzilo et al., 2016), and body dissatisfaction and anxiety (Etu & Gray, 2010). Eating disorder-specific rumination is characterised by preoccupation with eating, shape and weight and their control (Park et al., 2011, 2012) and has two distinct subcomponents: brooding and reflection (Cowdrey & Park, 2011; Dondzilo et al., 2016). Reflection is interpreted as active 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 reflects a passive comparison of one’s current situation with some ideal standard (e.g., “Why can’t I handle my eating better?”) (Cowdrey & Park, 2011; Treynor et al., 2003). Research has shown that these two ruminative components differentially predict eating disorder symptoms. For example, in
Rumination as Mediator Between Attention and Eating Disorder Symptoms

samples of non-clinical females, only eating disorder-specific brooding was shown to associate with general eating disorder symptoms (Cowdrey & Park, 2012; Dondzilo et al., 2016) and clinical levels of both dietary restriction and binge eating (Dondzilo et al., 2016). However, in a sample of females with a history of anorexia nervosa, only reflection on eating, shape and weight concerns showed an association with eating disorder symptoms (Cowdrey & Park, 2012). These findings suggest that both ruminative brooding and reflection are relevant for the development and/or maintenance of eating disorder symptoms.

To the best of our knowledge, no research to date has investigated the relationship between attentional biases towards body shape-related information and eating disorder-specific rumination. However, it is plausible to hypothesise that such a relationship exists considering the existence of a relationship between attentional bias for negative information and depressive rumination (Donaldson et al., 2007; Joormann et al., 2006; Morrison & O’Connor, 2008). Associations between attentional bias and depressive rumination remain evident even after statistically controlling for concurrent levels of depression (Donaldson et al., 2007; Joormann et al., 2006). Additionally, Joorman et al. (2006) found that an attentional bias for images of sad faces was only significantly related to ruminative brooding, and not ruminative reflection. To account for such findings, Koster et al., (2011) proposed the impaired disengagement hypothesis, which basically states that heightened rumination is due to difficulties in disengaging attention away from negative self-referent information. Recent empirical findings provide support for this theory by showing that greater rumination about depressive themes was associated with greater impairments in attentional disengagement from negative information, and not enhanced engagement with such information (Grafton et al., 2016). The theoretical and experimental evidence for an association between depressive rumination and attentional bias for depressogenic
information suggests a potential relationship between an attentional bias towards body images and eating disorder-specific rumination. In turn, eating disorder-related rumination may serve to trigger eating disorder symptoms. Therefore, it is possible that eating-disorder-specific rumination may function as a mediator between attentional bias to body images and eating disorder symptoms.

The overall goal of the present study was to investigate the relationship between attentional biases to body images, eating disorder-specific rumination, and eating disorder symptoms in a university sample of young women. A female-only sample was recruited to maximize comparability with the findings from previous studies investigating selective attention for body images that have used predominantly female-only samples. In addition, gender differences have been found in attentional processing of body images. Specifically, research has shown that men with elevated levels of eating disorder symptomatology selectively attend towards images of muscular male bodies, as opposed to thin-ideal bodies (Cho & Lee, 2013). The first aim was to investigate whether young women show a differential attentional pattern towards thin, and away from non-thin, female bodies, as compared to neutral images, using a modified dot probe task. It was predicted that young women would show an attentional bias towards thin bodies and attentional avoidance of non-thin bodies given that this is the general pattern of findings for studies using images of other women and non-clinical samples.

To date, no research has investigated which attentional mechanism (i.e., bias towards thin bodies versus bias away from non-thin bodies) plays a greater role in the potential maintenance and/or development of eating disorder symptomatology. As such, the second objective of the present study was to determine whether attentional bias towards thin body images is more strongly associated with the specific eating disorder symptoms of body dissatisfaction and dietary restraint, relative to attentional avoidance of non-thin body images. It was predicted that a greater attentional bias towards thin
bodies and greater avoidance of non-thin bodies would be associated with greater reports of body dissatisfaction and dietary restraint. In addition, it was predicted that the relationships between attentional bias and both dietary restraint and body dissatisfaction would be stronger for bias towards thin versus non-thin bodies.

Finally, the current research aimed to examine whether eating disorder-specific rumination mediates the relationship between attentional bias to body images and both body dissatisfaction and dietary restraint. Based on theoretical and empirical research suggesting a relationship between valence-specific attentional bias and depressive rumination, together with emerging research suggesting an association between eating disorder-specific rumination and eating disorder symptoms, it was hypothesised that eating-disorder-specific rumination would mediate the relationship between attentional bias to female body shapes and the specific eating disorder symptoms of body dissatisfaction and dietary restraint.

Method

Participants

The present study was advertised to females-only on an online experiment system used by first-year undergraduate psychology students at the University of Western Australia. Seventy-three female undergraduate students agreed to participate in the study in exchange for course credit. Participants were between the ages of 17 and 24 (\(M = 18.59, SD = 1.28\)). The mean BMI was 21.84 (\(SD = 3.52\), range = 15.92 to 34.13). Ethics approval to conduct this study was provided by the University of Western Australia Human Research Ethics Committee, and all participants provided written informed consent. Although some of the participants were 17 years old, they were deemed mature enough as university students to participate in this study.

1 The present sample size \((N = 73)\) was deemed adequate to carry out the analyses reported in this study. Specifically, to achieve power of .80 for an indirect effect the empirical estimates of sample sizes range between 53 and 118.
Self-Report Questionnaires

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). A higher score indicates greater rumination. The RRS-ED demonstrates good internal consistency, test-retest reliability, and convergent and discriminant validity (Cowdrey & Park, 2011, 2012; Dondzilo et al., 2016). The Cronbach’s alpha for the Brooding and Reflection subscales in the present study was $\alpha = .91$ and $\alpha = .84$, respectively.

Dutch Eating Behavior Questionnaire (DEBQ; van Strien, Frijters, Bergers, & Defares, 1986). The current study utilised the 10-item Dietary Restraint subscale of the DEBQ, which assess the tendency to restrict food intake. Specifically, respondents rate on a five-point Likert scale, ranging from 1 (never) to 5 (very often), how often they engage in restrictive eating behaviours (e.g., ‘Do you try to eat less at mealtimes than you would like to eat?’). A higher score is indicative of more frequent dietary restraint. The DEBQ’s Restraint scale has demonstrated strong reliability and a supported factor structure (Allison, Kalinsky, & Gorman, 1992). The Cronbach’s alpha for the Dietary Restraint subscale in this sample was $\alpha = .96$.

Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987). The BSQ consists of 34 items assessing dissatisfaction regarding shape and weight. Participants rate how often they have experienced body shape/weight-related concerns (e.g., ‘Have you felt excessively large and rounded?’) over the past month according to a six-point Likert scale, ranging from 1 (never) to 4 (always). A
higher BSQ score indicates greater body dissatisfaction. This questionnaire demonstrates high internal consistency among females, concurrent validity with other measures of body dissatisfaction, and the ability to discriminate between clinical and non-clinical individuals (Cooper et al., 1987; Rosen, Jones, Ramirez, & Waxman, 1996). The Cronbach’s alpha for the total BSQ in the present study was $\alpha = .98$.

**Stimuli**

In the present study, 40 image pairs each comprising a body image of a positive (thin body) or negative (non-thin body) emotional valence and an image of a neutral emotional valence (abstract art) were required. An initial pool of 68 images of thin ($n = 34$) and non-thin ($n = 34$) female bodies were sourced from the internet. The bodies depicted in these images reflected relatively healthy representations of thin and non-thin bodies. For each body type there was an estimated small range of BMIs, with thin bodies approximated to be bordering on underweight, which is consistent with the ideal, and non-thin bodies likely to be at the upper end of the healthy to the lower end of the overweight BMI range. These images were cropped to focus on specific body regions, such as the abdominal region and thighs as they have been shown to cause high dissatisfaction in women (Freeman et al., 1991; Janelle et al., 2003; Jansen et al., 2005).

Next, images were rated by a separate sample to prevent the participants taking part in the current study from having previous exposure to the body images. This pilot sample was comprised of 57 female first-year psychology undergraduates (aged 17-24) from the University of Western Australia. Specifically, participants assessed the valence and arousal of these images using the Self-Assessment Manakin (SAM) affective rating system (Lang, 1980), which is the same scale used by the International Affective Pictures System (Lang, Bradley, & Cuthbert, 2008). The SAM scale ranges from 0 (‘unpleasant’ for valence and ‘calm’ for arousal) to 9 (‘pleasant’ for valence and ‘excited’ for arousal). On the basis of these ratings, a final pool of 20 positively
valenced thin body images ($M = 6.19$, $SD = .70$) and 20 negatively valenced non-thin body images ($M = 3.84$, $SD = .72$) were obtained. Thin and non-thin body images were matched for arousal, $t(19) = 1.65$, $p = .12$, $d = .57$, 95% CI [-.06, .48], but differed significantly on valence, $t(19) = 10.36$, $p < .001$, $d = 3.31$, 95% CI [1.87, 2.82]. Stimuli also included cropped sections of abstract art, which were of a neutral valence ($M = 4.77$, $SD = 0.23$).

The images were colour JPEG computer files and approximately 11cm high and 7.3cm wide on the screen. The stimuli were presented on 1024 x 768 Dell CRT monitor running at 85Hz, driven by a Dell PC and using Matlab (2012b) to control stimulus presentations.

**Modified Dot Probe Task**

Participants were seated with their eyes approximately 125 cm from the monitor. Each trial commenced with participants attending to a fixation cross presented in the middle of a desktop computer screen. The purpose of the central fixation cross was to minimize the likelihood that participants were attending to either probe location at the start of each trial. The cross appeared for 1,000 ms and was then replaced by an image pair comprising one body image (i.e., either a thin or non-thin body) and one abstract image. One of the images was centred three degrees above the fixation cross, and the other image was centred three degrees below the fixation cross. After a fixed period of 500 ms the image pair was removed from the screen and the position occupied by one of the images was replaced by one of two probes, a letter “p” or “q”. Participants were instructed to identify the letter, by pressing the appropriate key on a keyboard, as quickly and accurately as possible. After a response was made, the next trial commenced.

The letter shown and the location of the probe was randomised with equal probability. The fact participants had to discriminate between two alternative probes
was to ensure that attention was allocated to the probe location. In other words, these letters would be easily confusable in the instance that attention was not allocated to the probe location. Additionally, two stimuli pairing conditions were run: (1) thin bodies and abstract art and; (2) non-thin bodies and abstract art. The stimuli of interest (i.e., thin or non-thin bodies) were paired with abstract art images as they do not hold any body shape and/or weight-related properties. This pairing allows us to quantify the magnitude of attentional bias towards or away from each body type. The conditions were blocked with a random order and random individual trial order for each observer. There were 160 trials for each stimuli pairing combination, making a total of 320 trials. Additionally, there were nine practice trials preceding each stimuli pairing combination block.

**Procedure**

To commence, participants completed the modified dot probe task. Subsequently, participants completed the self-report measures (i.e., RRS-ED, DEBQ, and BSQ). The questionnaires were presented online via Version 1.92+ of LimeSurvey (Schmitz, 2012), an advanced online survey system that was hosted on the University of Western Australia servers. Finally, participants’ height and weight was measured to allow the calculation of BMI.

**Statistical Analyses**

Data analyses were performed using SPSS. The criterion for statistical significance across all analyses was $p < .05$. In considering that probe discrimination reaction times (RTs) are indicative of attention to the task at hand *only* when probes are discriminated correctly, the data analysis for the modified dot probe task was based on RTs for correct trials only. One participant was removed from further analysis as more than 25% of their responses were incorrect. The remaining participants displayed very high accuracy on the modified dot probe task, averaging 95.07% overall. To correct for
the potential effects of outlier reaction times (RTs), response latencies of <200 ms were excluded, which is in line with criteria used in previous studies (Bradley, Mogg, White, Groom, & Bono, 1999; Shafran et al., 2007). To further eliminate outliers, RTs more than 2.5 standard deviations above each individual’s mean RT were also removed (Carters, Rieger, & Bell, 2015). Mean probe RTs were used to calculate an attentional bias difference score for each of the stimulus pairing combinations (thin and non-thin) using the formula of MacLeod and Matthews (MacLeod & Mathews, 1988), computed as \([\frac{(upper\ probe/lower\ target - upper\ probe/upper\ target) + (lower\ probe/upper\ target - lower\ probe/lower\ target)}{2}]\). These scores provided an index of the degree to which probe detection was facilitated or inhibited by images of thin and non-thin bodies.

Positive values for the stimulus pairing combinations of body images and abstract art images reflect an attentional bias towards the body image.

For the main analyses, one sample t-tests were performed on the two attentional bias difference scores (thin and non-thin) to determine whether there were attentional biases towards or away from probes which replaced thin/non-thin body images, relative to neutral images. Next, bivariate correlations between the attentional bias difference scores and eating disorder-related correlates were tested using Pearson correlation analysis. Partial correlations, controlling for BMI, were also conducted.

In regards to the second aim, Lee and Preacher’s (Lee & Preacher, 2013) test for differences between dependent correlations was performed to determine whether attentional bias towards thin bodies was more strongly correlated with the eating disorder-related symptomology, compared to attentional bias away from non-thin bodies.

In regards to the third aim, the indirect effect of attentional bias towards thin bodies on body dissatisfaction/dietary restraint through eating disorder-specific rumination was assessed using the bootstrapping procedure described by Preacher and
Rumination as Mediator Between Attention and Eating Disorder Symptoms
Hayes (Preacher & Hayes, 2008). The covariate of BMI was included in the models simultaneously with all other predictor variables. Bootstrapping generates an empirical approximation of the sampling distribution of the indirect effect, quantified as the product of the ordinary least-squares (OLS) regression coefficient estimating eating disorder-specific rumination from attentional bias (path $a$ in Fig 3.1) and the OLS regression coefficient estimating body dissatisfaction/dietary restraint from eating disorder-specific rumination controlling for attentional bias (path $b$ in Fig 3.1). In accordance with this procedure, 5000 bootstrap samples were drawn with replacement from the original sample to calculate bias-corrected and accelerated 95% confidence intervals for the indirect effect. Mediation was considered statistically significant ($p < .05$) if the 95% confidence intervals (CI) for the indirect effect did not include zero.

Results

Modified Dot Probe Task

To determine whether the attentional bias difference scores for the thin and abstract image pairing ($M = 2.35, SD = 20.94$) and the non-thin and abstract image pairing ($M = -6.27, SD = 22.84$) were significantly different to zero, these scores were analysed by one sample $t$-tests. More specifically, since the attentional bias difference scores reflect the degree to which attention selectively moved to the location of thin/non-thin body images, compared to abstract art images, a value which differs significantly from zero is therefore indicative of a meaningful attentional bias.

Results showed that participants were significantly slower at detecting probes which replaced non-thin body images, compared to those replacing abstract art images, $t(71) = -2.33; p = .02$, indicating an attentional bias away from non-thin body images. On the other hand, the time taken for participants to detect probes which replaced thin body images, was not significantly different from the time to detect probes replacing abstract art images, $t(71) = .95, p = .35$, indicating no attentional bias towards or away
from thin body images. Nonetheless, a paired samples $t$-test revealed that the two attentional bias scores (thin vs. non-thin) did not differ significantly from each other, $t(71) = 1.97, p = .052$, indicating there was no difference in the absolute magnitude of these biases.

**Attentional Bias and Eating Disorder-Related Correlates**

Correlational analyses were performed to test the associations between thin and non-thin attentional bias difference scores and ruminative brooding and ruminative reflection on eating, shape and weight concerns, body dissatisfaction and dietary restraint. Prior to conducting the subsequent analyses, two outliers (defined as three standard deviations from the mean) were identified and removed, rendering the final sample size, $n = 70$.

Descriptive statistics and correlations between attentional bias difference scores and the self-report questionnaires are shown in Table 3.1. It can be seen that the degree of attentional bias to thin body images was significantly, positively, and moderately (Cohen, 1988) associated with all eating disorder-related correlates. On the other hand, attentional bias to non-thin female bodies was significantly, negatively and moderately (Cohen, 1988) associated with only dietary restraint and body dissatisfaction. All correlations remained significant after statistically controlling for participants’ BMI. Finally, results revealed that the relationships between attentional bias and specific eating disorder symptoms (i.e., dietary restraint and body dissatisfaction) was stronger for bias towards thin versus non-thin bodies (all $p < .01$).
Table 3.1

*Bivariate correlations between AB difference scores for thin and non-thin bodies (ms) with eating disorder-related correlates (n = 70)*

<table>
<thead>
<tr>
<th>Reflection</th>
<th>Brooding</th>
<th>Rest.</th>
<th>Body Diss.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>4.77 (2.03)</td>
<td>12.64 (4.91)</td>
<td>26.86 (11.26)</td>
</tr>
<tr>
<td>Thin</td>
<td>.35**</td>
<td>.29*</td>
<td>.33*</td>
</tr>
<tr>
<td>Non-thin</td>
<td>-.20</td>
<td>-.18</td>
<td>-.30*</td>
</tr>
</tbody>
</table>

Reflection, Ruminative Response Scale for Eating Disorders reflection subscale; Brooding, Ruminative Response Scale for Eating Disorders brooding subscale; Rest., Dutch Eating Behaviour Questionnaire dietary restraint subscale; Body Diss., Body Satisfaction Questionnaire;

*p < .05; **p < .01

Mediation Analyses

To determine whether rumination on eating, shape, and weight concerns (i.e., the RRS-ED total score was used as both factors, brooding and reflection, equally mediated these relationships) functioned as a mediator between attentional biases to thin bodies and specific eating disorder symptoms (i.e., body dissatisfaction and dietary restraint), while statistically controlling for participants’ BMI, two mediation analyses were carried out using the bootstrapping procedure described by Preacher and Hayes (2008).

Mediation analyses, which controlled for BMI, showed that rumination on eating, shape, and weight concerns did in fact mediate the relationship between attentional bias towards thin bodies and each of the following (see Fig 1): body dissatisfaction ($B = .65$, SE = .24, $p = .007$, 95% CI = .20, 1.15), and dietary restraint ($B = .17$, SE = .06, $p = .005$, 95% CI = .05, .30). As can be seen in Fig 1, the direct effect of attentional bias on body dissatisfaction was significant, suggesting partial mediation.
However, the direct effect of attentional bias on dietary restraint was non-significant suggesting full mediation.

![Diagram](image)

*Figure 3.1.* Mediation models representing the mediating effect of eating disorder-specific rumination on attentional bias to thin female bodies and body dissatisfaction (top) and dietary restraint (bottom). Paths $a$ and $b$ represent direct effects. All numbers are standardized OLS regression coefficients. BMI was included as a covariate. $^*p < .05; ^{**}p < .01$. ¥ – The 95% confidence intervals of the bias-corrected and accelerated estimate indicate a significant indirect effect.

**Discussion**

The current study was the first to show that eating disorder-specific rumination mediated the relationship between attentional bias to thin-ideal imagery and the specific eating disorder symptoms of body dissatisfaction and dietary restraint in a university sample of young women. These findings extend the literature demonstrating an association between depressive rumination and valence-specific attentional bias (Donaldson et al., 2007; Grafton et al., 2016; Morrison & O’Connor, 2008) to different types of rumination, namely, eating disorder-specific rumination. Also, while correlational in nature, the results are consistent with the suggestion that eating disorder-specific rumination contributes towards body dissatisfaction (Etu & Gray,
Rumination as Mediator Between Attention and Eating Disorder Symptoms (2010) and dietary restraint (Dondzilo et al., 2016). The mediational model accommodates various theories including the cognitive science perspective of impaired attentional disengagement leading to heightened rumination (Koster et al., 2011) and the novel process account of anorexia nervosa, which suggests that eating disorder-specific rumination may be associated with negative emotions and starvation-related body cues becoming less salient, thus driving dietary restriction (Park et al., 2011, 2012).

Although the current findings cannot establish causal relationships, due to the cross-sectional design, it is possible that the relationship between rumination and attentional bias is bidirectional. For instance, it is possible that attentional biases arise from a schema centering on the overconcern with body shape and weight (Vitousek & Hollon, 1990; Williamson et al., 1999), which may be conceptualised as including eating disorder-specific rumination. This is an important question as it informs the development of novel treatment strategies for eating disorder patients. The incorporation of procedures designed to target ruminative and/or attentional processes is supported by preliminary evidence showing the effectiveness of body exposure in improving body satisfaction in females high in body dissatisfaction (Jansen et al., 2016) and successful results for rumination focused interventions in individuals with medication-refractory residual depression, generalised anxiety disorder, and persistent persecutory delusions (Covin et al., 2008; Foster et al., 2010; Watkins et al., 2007).

Results also showed that heightened attention to thin bodies, and enhanced attentional avoidance of non-thin bodies, were associated with greater reports of body dissatisfaction and dietary restraint, even after controlling for participants’ BMI. Ruminative reflection and ruminative brooding on eating and body shape concerns positively and significantly correlated with bias to thin bodies only. Further analyses revealed that dietary restraint, body dissatisfaction, and eating disorder-specific rumination correlated significantly more strongly with bias to thin bodies than with the
avoidance of non-thin bodies. This may imply that attentional bias towards thin-ideal body shapes plays a more important role in the potential development of eating disorder symptoms. In turn, this identifies attentional bias towards thin-ideal bodies as more maladaptive and a greater risk factor for developing an eating disorder, as opposed to the avoidance of non-thin bodies. These findings corroborate previous empirical research showing an association between bias to thin-ideal body shapes and eating disorder pathology (Blechert et al., 2009; Jansen et al., 2005; Roefs et al., 2008). The selective attentional pattern may represent maladaptive social comparison strategies (Festinger, 1954) in the sense that young women with elevated eating disorder pathology engage in upward social comparison by comparing their body to those perceived as more attractive (i.e., attentional bias to thin bodies) and avoid those perceived as less attractive (i.e., attentional avoidance of non-thin bodies). This attentional pattern would serve to maintain dissatisfaction with one’s own body as it sustains unrealistic body ideals.

Finally, the current study revealed that overall, young women showed attentional avoidance of non-thin bodies, however, no attentional bias towards thin bodies. The absence of attentional bias towards thin bodies is somewhat contrary to the results of Glauert et al. (2010) who found an attentional bias to thin female bodies in a non-clinical female sample. Several methodological differences between the two studies may account for these discrepant results. Firstly, the current study utilised photographs of real and clothed female bodies that were more ecologically valid compared to the computer-generated bodies used by Glauert et al. (2010). Furthermore, the current study measured attentional bias by pairing body images with neutral images, while Glauert et al. (2010) paired thin and non-thin bodies, with the former pairing arguably more representative of a naturalistic setting.
Rumination as Mediator Between Attention and Eating Disorder Symptoms

Although the current study is unique in that it advanced on the theoretical and empirical research encompassing rumination-linked attentional biases in the domain of eating disorder symptoms, it has some limitations. Firstly, the cross-sectional data does not allow any definite conclusions to be reached about the relationship between attentional bias and eating disorder symptoms. Experimental studies, which manipulate attentional bias and/or rumination, are necessary to obtain evidence of causality. Moreover, to aid differentiation between the two attentional components (i.e., attentional orientation versus attentional disengagement) and to register biases in the later stages of attentional processing, future research could incorporate eye-tracking technology. A further direction for future research is to determine whether men also exhibit an association between attentional bias towards idealized male bodies (i.e., muscular and lean), eating disorder-specific rumination and eating disorder symptoms. Finally, it would be valuable to extend the current methodology to young women with a clinically diagnosed eating disorder as it cannot be assumed that findings on a community sample extend to clinical samples.

In summary, the current findings suggest that while young women generally avoid non-thin body shapes, those with a heightened attentional bias to thin-ideal imagery experience greater body dissatisfaction, dietary restraint, and eating disorder-specific rumination. Attentional vigilance towards thin-ideal bodies is therefore a potential risk factor for developing an eating disorder. Furthermore, the current study was the first to show that eating disorder-specific rumination functions as a mediator between selective attentional processing of thin-ideal imagery and eating disorder symptoms. This supports the relevance of eating disorder-specific rumination in linking shape-related attentional processes and eating disorder pathology. The current study therefore builds on existing theories relating to the role of attention and rumination in eating disorder pathology and may have clinical applications such as the potential
integration of rumination or attentional-focused strategies for the prevention and treatment of eating disorders.
Rumination as Mediator Between Attention and Eating Disorder Symptoms
CHAPTER FOUR: THE CAUSAL ROLE OF SELECTIVE ATTENTION FOR
THIN-IDEAL IMAGES ON NEGATIVE AFFECT AND RUMINATION

Laura Dondzilo, Elizabeth Rieger, Romina Palermo, and Jason Bell

This chapter has been submitted for publication. Dondzilo, L., Rieger, E., Palermo, R., & Bell, J. (submitted for publication). The causal role of selective attention for thin-ideal images on negative affect and rumination.
Abstract

Attentional bias towards thin-ideal body images has been implicated as a vulnerability factor for eating disorder symptomatology. However, the nature and causal basis of its relationship with other eating disorder-related vulnerability factors, namely, eating disorder-specific rumination and negative mood, remains unclear. Accordingly, the current study investigated the causal influence of attentional bias towards thin-ideal images on emotional and ruminative vulnerability, in response to a body image-related stressor. An established attentional bias modification (ABM) procedure, the modified dot probe task, was used for the assessment and manipulation of attentional bias. Female undergraduate students \((N = 110)\) aged between 17 and 24 years were randomly assigned to either ‘attend’ towards or ‘avoid’ thin-ideal images. Pre- and post-attentional training, participants completed the dot probe task, as well as state measures of rumination and negative mood. Results showed that participants trained to attend to thin bodies reported heightened negative mood, in response to the stressor, compared with participants trained to avoid thin bodies. On the other hand, groups did not demonstrate a differential increase in eating disorder-specific rumination in response to the stressor. These results provide the first causal evidence for the role of attentional bias towards thin-ideal images in negative emotional vulnerability. Importantly, these results suggest attentional bias may serve as a risk factor for mood reactivity and a potential target for strategies designed to enhance emotional resilience.
Introduction

Empirical evidence suggests selective attentional processing of thin-ideal bodies is a key vulnerability factor for eating disorder symptomatology in females. For example, studies using eye-tracking technology have shown attentional biases towards images of thin-ideal female bodies in a non-clinical sample of women with high levels of body dissatisfaction (Cho & Lee, 2013) as well as in those diagnosed with bulimia nervosa (Blechert et al., 2009) or anorexia nervosa (Pinhas et al., 2014). Moreover, recent research has found an association between selective attention for thin female bodies/body parts and body dissatisfaction in non-clinical samples of women using a behavioural assessment of selection attention (i.e., the widely-used dot probe task) (Dondzilo, Rieger, Palermo, Byrne, & Bell, 2017; Joseph et al., 2016; Moussally et al., 2016). In the dot probe task used by Dondzilo et al. (2017), a pair of stimuli (i.e., a thin body image and a neutral stimulus) were briefly presented on a computer screen, which was followed by a probe (i.e., a letter ‘p’ or ‘q’ to which the participant responded) replacing one of the stimuli. Faster responding to probes that replaced thin body stimuli, relative to neutral stimuli, indicated an attentional bias to thin bodies. Collectively, these studies implicate the maladaptive role of attentional bias towards thin-ideal bodies on body image.

Despite significant progress in the understanding of the pathological consequences of attentional bias towards thin-ideal bodies, there is less clarity regarding its relationship with other eating disorder-related vulnerabilities. One such vulnerability is eating disorder-specific rumination, which has been conceptualized as preoccupation with eating, shape, and weight concerns (Park et al., 2011). Some researchers have argued, on theoretical grounds, that attentional bias and depressive rumination work together to influence vulnerability to depression (De Raedt & Koster, 2010; Koster et al., 2011). In support of this notion, there is substantial research showing an association
between depressive rumination and an attentional bias for negative information (Donaldson et al., 2007; Grafton et al., 2016; Joormann et al., 2006; Owens & Gibb, 2016; Southworth et al., 2016) and preliminary evidence to suggest that attentional bias plays a causal role in depressive symptoms, via the mediating role of depressive rumination (Yang et al., 2015).

Extending on this work, Dondzilo et al. (2017) showed that eating disorder-specific rumination mediated the relationship between attentional bias towards images of thin female bodies and the specific eating disorder symptoms of body dissatisfaction and dietary restraint in young women. These findings suggest that an attentional bias towards thin-ideal images may lead to further elaborative processing, by ruminating about eating, body shape, and/or weight concerns. In turn, this may serve to develop and/or exacerbate dietary restraint and body dissatisfaction. However, the correlational nature of the data does not permit firm conclusions to be drawn about the causal relationship between attentional bias to thin bodies and eating disorder-specific rumination.

In addition to eating disorder-specific rumination, negative affect comprises a risk factor for eating disorder symptomatology (Leehr et al., 2015; Stice, 2001, 2002, Stice et al., 2017, 2011). It is possible that selective attention for thin-ideal bodies serves to trigger negative affect, in addition to eating disorder-specific rumination. This is based on a compelling body of evidence indicating that attentional bias causally influences emotional vulnerability or reactivity to subsequent induced or real life stress (Beevers & Carver, 2003; Dandeneau & Baldwin, 2004; Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007; Fox, Cahill, & Zougkou, 2010; MacLeod et al., 2002; See, MacLeod, & Bridle, 2009). For example, an induced attentional bias towards threat words led to greater increases in negative mood, in response to a stress-inducing task, compared with a induced attentional bias towards neutral words (MacLeod et al.,
In another study, undergraduate students trained to avoid rejection-related information reported less exam-related stress and anxiety after having experienced their exam (Dandeneau et al., 2007). Thus, in considering the aforementioned evidence it is plausible that selectively attending to thin bodies may increase susceptibility to both heightened negative mood and rumination on eating, shape, and weight concerns.

Accordingly, the aim of the current study was to determine whether attentional bias towards thin female images causally contributes to emotional and ruminative vulnerability in young women. It was hypothesised that individuals trained to attend to thin bodies would demonstrate increased negative mood and eating disorder-specific rumination, in response to a body image-related stressor, compared with individuals trained to avoid thin bodies.

Method

Participants

Female undergraduate students ($N = 110$) participated in the study in exchange for course credit. Sample size was determined beforehand based on previous studies reporting effects using the current methodology (Kemps, Tiggemann, & Hollitt, 2016; Kemps, Tiggemann, Orr, & Grear, 2014; MacLeod et al., 2002; Smith & Rieger, 2006). A sample of female undergraduate students, rather than clinical participants, was utilised to avoid the ethical issue of inducing potentially maladaptive attentional biases in highly vulnerable individuals. Participants were between the ages of 17 and 24 ($M = 19.08, SD = 1.43$) with a mean BMI of $22.06$ ($SD = 3.64$, range $= 16.41$ to $39.13$).

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.
Measures

**Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995).** The DASS-21 is a 21-item self-report questionnaire that assesses three components of negative affect: depression, anxiety, and stress. These subscale scores are summed to yield a total score of negative affect, with higher scores indicative of greater disturbance. The range of possible scores is 0 to 63. Items refer to the past week; and scores range from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). Support for the psychometric properties of the DASS-21 includes high internal consistency and adequate construct validity (Henry & Crawford, 2005). The Cronbach’s alpha for the total score in the present study was $\alpha = .94$.

**Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011).** The nine-item RRS-ED assesses ruminative thinking about eating, body shape, and/or weight. Participants rate their tendency to experience ruminative symptoms on a four-point Likert scale ranging from 1 (*almost never*) to 4 (*almost always*). Scores on the RRS-ED range from 9 to 36 and are obtained by summing the responses for each item with higher scores reflecting higher levels of eating disorder-specific rumination. The RRS-ED has demonstrated both strong internal consistency and validity (Cowdrey & Park, 2011, 2012). Researchers have also distinguished two RRS-ED subscales: brooding and reflection (Cowdrey & Park, 2011; Dondzilo et al., 2016). For the purposes of the present investigation, only the composite score of the RRS-ED was relevant. Cronbach’s alpha for the composite score in the current sample was $\alpha = .91$.

**Subjective state ratings.** Subjective state ratings of negative mood and eating disorder-specific rumination at the moment were assessed using the following 100-point visual analogue scales (VAS) ranging from “not at all” to “very much”, respectively: At the moment 1) I am feeling sad, 2) I am thinking about my feelings concerning my
eating and body shape and/or weight. These items were informed by previous research investigating the effect of induced rumination on eating disorder symptoms (Naumann et al., 2015). Support for the construct validity of these state rumination and negative mood items was evident in terms of their associations with validated measures of trait eating disorder-specific rumination and negative affect. Specifically, the state rumination item correlated with the RRS-ED at $r = .62, p < .001$ and the state negative mood item correlated with the DASS at $r = .49, p < .001$.

**Materials**

In line with previous research assessing attentional bias towards images of female bodies (Dondzilo et al., 2017), thin body shape images of a positive emotional valence were paired with abstract art images of a neutral emotional valence for the purpose of modification and assessment of attentional bias. Thin body images comprised of 20 previously rated thin images (Dondzilo et al., 2017) and 20 additional images which were sourced from the internet and cropped as per the original 20, to focus on specific weight-relevant body regions (e.g., abdomen and thighs). The 20 new thin body images were selected from an initial pool of 70 thin body images, which were rated by 19 independent judges using the 10-point Self-Assessment Manikin affective rating system (Lang, 1980), from 0 (unpleasant) to 9 (pleasant). On the basis of these ratings, 20 thin body images rated to be strongest in positive valence ($M = 5.87, SD = .35$) were chosen. These images were found to be statistically equivalent to the valence of the 20 previously rated thin images ($M = 6.19, SD = .70$) based on a non-significant unpaired $t$-test [$t(74) = 1.91, p = .06$]. Stimuli also consisted of cropped segments of abstract art, which were of a neutral valence ($M = 4.77, SD = 0.23$). In total, there were 40 stimulus pairs, which always included a thin body image and an abstract art image. A subset of 24 stimulus pairs was used at training. The remaining 16 stimulus pairs were used at pre- and post-training. The independence of test and training pairs was done to
ensure that training effects were related to the selective attention for thin bodies and not the specific stimuli themselves.

The images were approximately 11cm high and 7.3cm wide on the screen. The stimuli were displayed on a 1024 x 768 Dell CRT monitor running at 85Hz, driven by a Dell PC and using Matlab (2012b) and the Psychophysics Toolbox (Brainard, 1997) to control stimulus presentations. The monitor was positioned at a distance of approximately 125 cm from the participant.

**Modified dot probe task.** A modified dot probe task, adapted from MacLeod et al., (2002), was used to assess and manipulate attentional bias towards thin female bodies. Each trial commenced with the presentation of a fixation cross in the centre of the screen for 1,000 ms. This was followed by the presentation of two images, which were centred three degrees above or below the fixation cross, for 500 ms. Subsequently, a probe stimulus (i.e., the letter “p” or “q”) appeared in the position previously occupied by one of the images. Participants were instructed to identify the letter as quickly and accurately as possible, by pressing the appropriate key on a keyboard. After a response was made, the next trial commenced. In total, 489 trials were presented across the modified dot probe task. Assessment of pre-training attentional bias commenced with nine practice trials, followed by 96 experimental trials. There were 288 attentional training trials and a further 96 post-training trials. Participants were provided with three scheduled breaks across the duration of the dot probe task trials (i.e., one break at midpoint for the assessment trials and two breaks over the course of the training trials). The distinction between assessment and training trials is described below.

**Attentional assessment trials.** In the attentional assessment trials (pre- and post-training), the probes replaced previously presented thin body or neutral images with equal probability. Additionally, the letter shown (p, q) and the location of the probe
(top, bottom) was randomized. Within each block (pre or post) of attentional assessment trials, each stimulus pair was presented six times.

**Attentional training trials.** In the attentional training trials, the position of the probe stimulus was contingent on the allocated condition. For participants in the “attend thin bodies” condition, probes consistently (100% probability) replaced the previously presented thin body image. Conversely for the “avoid thin bodies” condition, probes consistently (100%) replaced the previously presented neutral (abstract art) image. Each stimulus pairs was presented 12 times.

**Body image-related stressor.** The stressor consisted of an adaptation of the body image-related scenario used by Etu and Gray (2010) to elicit body dissatisfaction and negative mood. Participants were instructed to imagine how they would feel and what they would think and do if a specific scenario was actually happening to them. For example, part of the scenario stated that, “You wake up…pause at the mirror and sigh. You feel unattractive and fat…You start to cry…You had promised yourself you would lose weight within the last month but haven’t been able to do it.” The complete scenario is included in Appendix B.

**Procedure**

After providing informed consent, all participants completed the dot probe task to assess pre-training attentional bias. Following this, participants completed state (i.e., VAS ratings) and trait measures (i.e., DASS-21 and RRS-ED) of eating disorder-specific rumination and negative mood. These materials were presented online via Qualtrics (Qualtrics, 2016), an advanced online survey system that was hosted on the University of Western Australia servers.

Next, participants were randomly allocated to either the ‘attend’ or ‘avoid’ training condition. The attentional training trials were immediately followed by post-training assessment trials. Subsequently, the body image-related stressor was
administered. Immediately following the stressor, participants completed state measures of eating disorder-specific rumination and negative mood. Finally, participants’ height and weight were measured for the calculation of body mass index (BMI = kg/m²). All participants were then fully debriefed and the experimenter monitored all participants for residual distress.

**Results**

**Sample Characteristics**

Means and standard deviations for BMI and trait levels of eating disorder-related rumination and negative affect are displayed in Table 4.1. The descriptive statistics associated with state levels of negative mood and eating disorder-specific rumination are displayed in Figures 4.2 and 4.3, respectively. There were no pre-existing differences between the two training conditions on state or trait levels of eating disorder-specific rumination, negative affect, and BMI (all ps > .05).

<table>
<thead>
<tr>
<th></th>
<th>Attend (N = 55)</th>
<th>Avoid (N = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>22.56 (4.27)</td>
<td>21.56 (2.84)</td>
</tr>
<tr>
<td>RRS-ED</td>
<td>16.33 (5.76)</td>
<td>15.65 (6.52)</td>
</tr>
<tr>
<td>DASS</td>
<td>17.60 (12.01)</td>
<td>17.00 (10.84)</td>
</tr>
</tbody>
</table>

*Note.* BMI, Body Mass Index (kg/m²); RRS-ED, Ruminative Response Scale for Eating Disorders; DASS, Depression Anxiety Stress Scales.

**Attentional Bias Modification**

To assess the efficacy of the ABM, the probe discrimination reaction times (RTs) on the pre-training trials were compared with those at post-training. The data
analysis was based on correct trials only. Following previous studies (Carters et al., 2015; Dondzilo et al., 2017), probe discrimination RTs less than 200 ms or more than 2.5 standard deviations above each individual’s mean were eliminated as outliers. Mean probe discrimination RTs were used to compute an attentional bias difference score, for each of the pre-training and post-training assessment phases. In order to calculate these scores, the appropriate RTs were substituted into the following formula of MacLeod and Mathews (1988): 

\[
\frac{\text{[(upper probe/lower target – upper probe/upper target) + (lower probe/upper target – lower probe/lower target)]}}{2}
\]  

Specifically, upper probe/lower target corresponds to RTs when the probe appears in the upper area but the body image appears in the lower area, and so on. Thus, the calculation provides a single index of the speed difference when detecting probes in the same area as thin bodies versus when detecting probes in a different location to the bodies. In other words, the attentional bias difference score suggests the degree to which probe discrimination was facilitated or inhibited by images of thin bodies, such that positive values reflect an attentional bias towards thin body images.

An independent t-test indicated that the baseline attentional bias scores did not significantly differ by condition, \( t(101.02) = -1.04, p = .30, d = .20, 95\% \text{ CI} [-10.66, 3.33] \). To determine whether the training successfully modified attentional bias, a 2 (training condition: attend, avoid) × 2 (time: pre-training, post-training) mixed model ANOVA was performed. As expected, the interaction between training condition and time was significant, \( F(1,108) = 9.56, p = .003, \eta^2 = .08 \). As can be seen in Figure 1, simple main effect analyses showed a significant increase in attentional bias to thin body images, from pre- to post-training, in the attend thin group, \( t(54) = -2.57, p = .01, d = .49, 95\% \text{ CI} [1.87, 14.43] \). Although participants in the avoid group showed an increase in avoidance of thin bodies, this change was non-significant, \( t(54) = 1.80, p = .08, d = -.34, 95\% \text{ CI} [-.58, 11.97] \). The change in attentional bias was small in the avoid
group and moderate in the attend group. Nevertheless, there was no significant
difference in attentional bias between the two experimental groups at post-training,
t(108) = 2.84, p = .005, d = .54, 95% CI [3.07, 17.26]. Additionally, there was no main
effect of time, F(1,108) = .30, p = .59, η² = .003, or of condition, F(1,108) = 1.38, p =
.24, η² = .01. These results indicate that the attentional training successfully induced
differential changes in attentional bias towards thin bodies in the expected directions.

Figure 4.1. Mean attentional bias difference scores for attend and avoid conditions at
pre- and post-training. Standard errors are represented by the error bars. A positive
attentional bias score represents an attentional bias towards thin bodies whereas a
negative attentional bias score represents avoidance of thin bodies.

Affective Reactions to the Body Image-related Stressor

A 2 (training condition: attend, avoid) × 2 (time: pre-stressor, post-stressor)
mixed model ANOVA was performed to evaluate the effect of the body image-related
stressor on state negative mood (measured by the subjective state ratings). To reiterate,
each group of participants underwent the exact same stressor. A significant main effect
of time was obtained, F(1,108) = 44.15, p < .001, η² = .29, indicating the stressor was
effective in inducing negative mood, whereas the main effect of training condition was not significant, $F(1,108) = 1.57, p = .21, \eta^2 = .01$.

As predicted, the interaction between training condition and time was also significant, $F(1,108) = 8.34, p = .005, \eta^2 = .07$. To explore the interaction further, simple main effect analyses showed that negative mood significantly increased from pre- to post-stressor induction in both the attend group, $t(54) = 6.74, p < .001, d = 1.29$, 95% CI [18.05, 33.08], and the avoid group, $t(54) = 2.66, p = .009, d = .51, 95\% \text{ CI } [2.56, 17.59]$. Both experimental groups showed a large increase in negative mood, based on effect size. However, as can be seen in Figure 2, post stressor, negative mood was increased significantly more in the attend group relative to the avoid group, $t(104.67) = 2.23, p = .03, d = .43, 95\% \text{ CI } [1.57, 26.36]$. This difference in negative mood, post stressor, was relatively moderate. Therefore, it can be concluded that participants who were trained to attend to thin bodies were significantly more susceptible to the body image-related stressor.

![Figure 4.2](image-url). Mean analogue negative mood scale score for the attend and avoid conditions at pre- and post-stressor. Standard errors are represented by the error bars.
Causal Role of Attentional Bias on Negative Affect and Rumination

Ruminative Reactions to the Body Image-related Stressor

A 2 (training condition) × 2 (time) mixed model ANOVA\(^1\) was conducted to determine the effects of the negative body image-related stressor on state eating disorder-specific rumination (measured by the subjective state ratings). The predicted interaction between training condition and time was not significant, \(F(1,108) = .20, p = .66, \eta^2 = .002\). Additionally, the main effect of training condition was not significant, \(F(1,108) = .78, p = .38, \eta^2 = .01\).

There was, however, a significant main effect of time, \(F(1,108) = 18.76, p < .001, \eta^2 = .15\). As can be seen in Figure 3, simple main effect analyses showed that rumination significantly increased from pre- to post-stressor induction in both the attend group, \(t(54) = 3.38, p = .001, d = .64, 95\% \text{ CI} [5.37, 20.63]\), and the avoid group, \(t(54) = 2.75, p = .007, d = .52, 95\% \text{ CI} [2.94, 18.19]\). Both experimental groups demonstrated a moderate increase in rumination. Thus, both groups experienced greater levels of rumination on eating, shape, and weight concerns in response to a body image-related stressor but, unlike the findings for state negative mood, the change in rumination was not influenced by attentional training condition.

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\(^1\)It should be acknowledged that moderation analyses were also conducted and revealed that change in attentional bias and its relationships with change in negative affect/rumination were not moderated by trait eating disorder-specific rumination.
Figure 4.3. Mean analogue eating disorder-specific rumination scale score for the attend and avoid conditions at pre- and post-stressor. Standard errors are represented by the error bars.

Discussion

The current study represents a first attempt to understand the causal role of selective attention for images of thin women on emotional and ruminative vulnerability, in response to a body image-related stressor. Findings revealed that the ABM was effective in manipulating participants’ attentional bias towards or away from thin-ideal images. Furthermore, participants trained to attend to thin bodies subsequently reported a larger increased negative mood, in response to the body image-related stressor, relative to participants trained to avoid thin bodies. In other words, it was shown that selective attention for thin bodies causes vulnerability for heightened negative mood. Conversely, induced attentional bias towards thin bodies did not differentially influence rumination on eating, shape, and weight concerns in response to the stressor.

The current finding of a causal relationship between attentional bias and emotional vulnerability is consistent with previous findings (Beevers & Carver, 2003; Dandeneau & Baldwin, 2004; Dandeneau et al., 2007; Fox et al., 2010; MacLeod et al.,
Causal Role of Attentional Bias on Negative Affect and Rumination

2002) and theoretical accounts which implicate attentional biases in increasing vulnerability for depression (Beck, 1976, 2008; De Raedt & Koster, 2010). In addition, this causal relationship contributes to work showing exposure to thin-ideal images serves to exacerbate negative mood in females (Harper & Tiggemann, 2008; Hawkins, Richards, Granley, & Stein, 2004; Stice & Shaw, 1994; Tiggemann & McGill, 2004). One potential mechanism, by which attending to thin-ideal bodies may elicit negative mood is upward social comparisons, whereby women compare themselves with other thin and attractive women. In support of this notion, numerous studies have shown that engaging in social comparisons, in response to thin-ideal images, is an important contributor to negative affect (Tiggemann & McGill, 2004; Tiggemann, Polivy, & Hargreaves, 2009).

An important implication of the current finding is that attentional bias for thin-ideal bodies may serve as a risk factor for mood reactivity. In turn, this mood reactivity may predispose to eating disorders, given evidence linking negative affect and the emergence of eating disorder symptoms (Polivy & Herman, 2002; Stice, 2001, 2002, Stice et al., 2017, 2011). Thus, attentional bias towards thin-ideal images might be an appropriate target for strategies designed to promote emotional resilience in young women. As a result, increased emotional resilience may serve to protect against the development of body image and eating disturbances.

On the other hand, the findings did not support the hypothesis that attentional bias causally influences ruminative vulnerability. Instead, both experimental groups showed near identical and moderate increases in state rumination following the attentional training and immediately subsequent to the stressor. One potential reason for this similarity is that both groups were given equal exposure to thin-ideal body images and thus simple exposure may have exacerbated state rumination. Whilst the avoid group were being trained away from thin-ideal images, both groups were exposed to
thin-ideal images on every trial. Another possible explanation is that the body-related stressor (which both groups were exposed to) had a fixed influence on state rumination, despite the opposite, preceding attentional training conditions. Ultimately, our finding for a difference in state mood but not state rumination following ABM warrants further investigation.

Further, this result contrasts with previous evidence indicating an association between attentional bias towards thin bodies and eating disorder-specific rumination (Dondzilo et al., 2017). There are several reasons which could account for this discrepancy. Firstly, it could be that attentional bias directly influences rumination, but only for individuals who consistently attend to thin bodies. For example, in the study by Yang et al. (2015), a direct causal effect of attentional bias on depressive rumination was only seen after two weeks of repetitive ABM training. Alternatively, it could be that the single VAS item used to measure state eating disorder-specific rumination did not adequately capture this multifaceted construct. More specifically, eating disorder-specific rumination consists of a reflective and brooding component (Cowdrey & Park, 2011; Dondzilo et al., 2016), which have both shown associations with attentional bias to thin-ideal images (Dondzilo et al., 2017). Therefore, future studies should ensure that the assessment of state eating disorder-specific rumination consists of multiple items that represent both reflective and brooding rumination.

Despite the promising theoretical and practical implications of the current research, a number of methodological issues must be considered in interpreting the findings. Firstly, assessment of state negative mood and rumination occurred immediately prior to the ABM and directly after the stressor. Thus, it is unknown whether attentional bias had a direct effect on state mood and rumination. To more precisely assess the emotional and ruminative changes triggered by attentional bias, future studies should assess state mood and rumination prior to and directly after the
ABM. Secondly, the current findings are based on a non-clinical sample. Therefore, it would be valuable to test whether the results generalize to individuals with a clinically diagnosed eating disorder. Furthermore, given the assessment of state rumination and negative mood were measured by single items only, the current results should be interpreted with caution. However, it should be noted that these one-item measures demonstrated excellent construct validity via strong correlations with their counterpart trait measures. Nonetheless, to further improve the assessment of state levels of specific constructs, future studies should use multi-item self-report measures.

Overall, this study provides the first demonstration that attentional bias towards thin-ideal images plays a causal role in negative emotional vulnerability. This result contributes to the growing body of literature and cognitive theories of depression which implicate attentional bias as an important cognitive vulnerability for depression. Importantly, the findings hold therapeutic potential for the development of novel cognitive procedures designed to modify attentional biases, which could in turn promote emotional resilience in young women.
CHAPTER FIVE: THE EFFECT OF INDUCED RUMINATION ON ATTENTIONAL BIAS TOWARDS THIN-IDEAL FEMALE BODIES AND EATING DISORDER SYMPTOMATOLOGY

Laura Dondzilo, Elizabeth Rieger, Petrina Wong, Romina Palermo, and Jason Bell

This chapter has been submitted for publication. Dondzilo, L., Rieger, E., Wong, P., Palermo, R., & Bell, J. (submitted for publication). The effect of induced rumination on attentional bias towards thin-ideal female bodies and eating disorder symptomatology.
Abstract

Rumination on eating, shape, and weight concerns has been implicated in the potential onset and/or maintenance of eating disorder symptoms and attentional bias towards thin-ideal bodies. However, the causal nature of these relationships remains unclear. Thus, the current study aimed to determine whether induced eating disorder-specific rumination contributes to changes in body dissatisfaction, dietary restraint, and selective attention for thin-ideal bodies. Female undergraduate students ($n = 110$) were randomly allocated to an eating disorder-specific rumination or a distraction condition, in which they were induced to ruminate on eating, shape, and weight concerns or focus on non-emotional content, respectively. Prior to and following the induction task, participants completed a modified dot probe task, assessing their attentional bias towards thin-ideal images, and state measures of eating disorder symptoms. Results showed that the rumination condition alone showed a significant change in attentional bias. More specifically, induced rumination served to extinguish the initial and potentially adaptive bias of avoiding thin bodies. On the other hand, induced rumination did not lead to changes in dietary restraint and body dissatisfaction. The current study highlights the maladaptive role of eating disorder-specific rumination in the augmentation of selective attentional processing of thin-ideal bodies.
Introduction

In recent years there has been increasing interest in the relevance of eating disorder-specific rumination in the potential onset and/or maintenance of eating disorder symptomatology. This ruminative tendency has been conceptualised as a preoccupation with eating, shape, and weight concerns (Park et al., 2011). Several studies have shown an association between eating disorder-specific rumination and eating disorder symptoms (Cowdrey & Park, 2011, 2012; Dondzilo et al., 2016; Etu & Gray, 2010; Seidel et al., 2016). More specifically, research has shown that females with anorexia nervosa have a greater tendency to ruminate on eating, shape, and weight concerns than healthy controls (Cowdrey & Park, 2011; Seidel et al., 2016). Additionally, eating disorder-specific rumination is uniquely associated with global eating disorder symptoms, above and beyond negative affect, in both community samples of women (Cowdrey & Park, 2012; Dondzilo et al., 2016) and in women with a history of anorexia nervosa (Cowdrey & Park, 2012). Further, there is research showing an association between eating disorder-specific rumination and clinically relevant levels of dietary restraint and binge eating in a community sample of women (Dondzilo et al., 2016). Such findings raise the possibility that eating disorder-specific rumination plays a role in the development and/or maintenance of eating disorder symptoms (Park et al., 2011).

To date, there is only one study exploring the causal role of eating disorder-specific rumination in eating disorder symptomatology. In this study, Etu and Gray (2010) revealed that young women who were encouraged to ruminate about an imagined, negative body image event reported greater dissatisfaction and anxiety about their own bodies, relative to female participants who were asked to distract themselves from the same negative event. However, a limitation of this study was that assessment of state body dissatisfaction only occurred after the rumination/distraction induction. Therefore, it is uncertain whether the rumination group actually increased in body
dissatisfaction from pre- to post-rumination induction. While there is minimal research on eating disorder-specific rumination, there is evidence suggesting that depressive rumination causally influences dietary restraint and binge eating in women with anorexia nervosa and bulimia nervosa, respectively (Naumann et al., 2015). Additionally depressive rumination has been shown to exacerbate body dissatisfaction in women with anorexia nervosa and bulimia nervosa (Naumann et al., 2016). Taken together, these findings suggest that eating disorder-specific rumination may play a role in triggering or exacerbating body image disturbance and disordered eating behaviours, although this awaits investigation.

Moreover, there is little understanding of the relationship between eating disorder-specific rumination and other eating disorder-related cognitive vulnerabilities, such as attentional bias. This is surprising given that several studies support an association between depressive rumination and attentional bias for negative information (Donaldson et al., 2007; Duque et al., 2014; Grafton et al., 2016; Joormann et al., 2006; Morrison & O’Connor, 2008; Owens & Gibb, 2016; Southworth et al., 2016). Such findings are consistent with the impaired disengagement hypothesis (Koster et al., 2011). This hypothesis asserts that attentional bias for negative information contributes to depressive rumination and in turn this serves to maintain and/or develop depressive symptoms. Indeed, there is preliminary causal evidence indicating that attentional bias for negative information influences depressive symptoms via the mediating role of depressive rumination (Yang et al., 2015).

Beyond depressive rumination, recent evidence revealed that eating disorder-specific rumination mediated the relationship between attentional bias for thin-ideal images and both body dissatisfaction and dietary restraint (Dondzilo et al., 2017). This suggests that selectively attending to images of thin bodies triggers ruminative thinking about eating, shape, and/or weight concerns which in turn, perpetuates eating disorder
symptoms. However, since this study was correlational, the nature of the causal relationship between eating disorder-specific rumination and attentional bias for thin-ideal bodies remains untested. One possibility is that attentional bias and rumination influence each other. This would lead one to predict that selective attentional processing of disorder-related content leads to heightened disorder-related rumination, and vice versa. In support of the latter, Morrison and O’Connor (2008) found that induced depressive rumination led to a reduced attentional bias for positively valenced words in healthy adults.

In light of the above, the current study sought to determine the causal role of eating disorder-specific rumination in body dissatisfaction and dietary restraint. Additionally, the current study aimed to establish whether heightened eating disorder-specific rumination leads to changes in attentional bias for thin-ideal bodies. It was hypothesised that young women induced to ruminate about eating, shape, and weight concerns would show an increased attentional bias for thin bodies (i.e., either increased attentional bias for thin bodies or reduced attentional avoidance of thin bodies). On the other hand, it was hypothesised that participants given the distraction task would not show a significant change in attentional bias. Furthermore, it was hypothesised that induced rumination would lead to greater reports of body dissatisfaction and dietary restraint, compared with induced distraction.

Method

Participants

Participants were female undergraduate students \((n = 110)\) who voluntarily participated in return for partial course credit. Sample size was determined beforehand based on previous studies reporting effects in rumination induction paradigms (Etu & Gray, 2010; Naumann et al., 2015; Naumann et al., 2016). Participants were aged between 17 and 24 years \((M = 19.05, SD = 1.64)\) with a mean BMI of 21.81 \((SD = 3.58)\).
Effect of Rumination on Attention and Eating Disorder Symptoms

range = 15.87 to 35.73). 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.

**Measures**

**Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995).** The DASS-21 consists of 21 items which assess the severity of depression, anxiety, and stress-related symptoms experienced over the past week. Each item is measured on a 4-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*). Scores on each item are summed to yield a total score of negative affect (total score range: 0-62), with higher scores indicating greater negative affect. Additionally, this questionnaire has demonstrated acceptable reliability and adequate construct validity (Henry & Crawford, 2005). The Cronbach’s alpha for the total score in the present study was $\alpha = .91$.

**Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011).** The nine-item RRS-ED assesses the tendency to experience ruminative symptoms regarding eating, body shape, and/or weight. Items are answered on a four-point Likert scale ranging from 1 (*almost never*) to 4 (*almost always*). Scores are summed to provide a total score (range: 9 – 36) with higher scores reflecting a greater tendency to ruminate on eating disorder-related themes. Support for the psychometric properties of the RRS-ED includes strong internal consistency and validity (Cowdrey & Park, 2011, 2012). The Cronbach’s alpha for the total score in the present study was $\alpha = .90$.

**Dutch Eating Behavior Questionnaire (DR-DEBQ; Van Strien, Frijters, Bergers, & Defares, 1986).** The 10-item Dietary Restraint subscale of the DEBQ assesses the tendency to engage in restrictive eating behaviours. Response categories range from 1 (*never*) to 5 (*very often*). Scores are summed to provide a total score
(range: 10 – 50), with a higher total DR-DEBQ score indicating more frequent dietary restraint. The DEBQ’s Restraint scale has demonstrated sound psychometric properties (Allison et al., 1992). In the current sample, the Cronbach’s alpha for the Dietary Restraint subscale was $\alpha = .93$.

**Body Shape Questionnaires (BSQ; Cooper, Taylor, Cooper & Fairburn, 1987).** The BSQ is a 34-item self-report measure which assesses levels of body shape/weight-related dissatisfaction experienced over the past month. Each item is measured on a six-point Likert scale, ranging from 1 (*never*) to 4 (*always*). Scores are summed to produce a total score (range: 34 – 204) with higher scores indicating greater body dissatisfaction. This measure has demonstrated good concurrent and discriminant validity (Rosen et al., 1996; Varnado-Sullivan, Horton, & Savoy, 2006). Cronbach’s alpha for the current sample was $\alpha = .97$.

**Subjective state ratings.** State negative mood (“At the moment I am feeling sad”), eating disorder-specific rumination (“At the moment I am thinking about my feelings concerning my eating and body shape and/or weight”), body dissatisfaction (“I feel extremely dissatisfied with my body size and shape”), and dietary restraint (“I would refuse food or drink offered to me because I am concerned about my weight”) were assessed using 100-point visual analogue scales (VAS) ranging from 0 (*not at all*) to 100 (*very much*). The wording of these items was informed by previous research examining the relationship between induced rumination and eating disorder symptomatology (Etu & Gray, 2010; Naumann et al., 2015). Support for the construct validity of these state items was evident in terms of their associations with corresponding validated trait measures. Specifically, the state rumination item correlated with the RRS-ED at $r = .61$, $p < .001$, the state negative mood item correlated with the DASS at $r = .61$, $p < .001$, the state body dissatisfaction item correlated with
the BSQ at $r = .73, p < .001$, and the state dietary restraint item correlated with the DR-DEBQ at $r = .64, p < .001$.

**Materials**

**Images.** The images for the modified dot probe task included 20 thin-ideal female body images paired with 20 abstract art images as used by Dondzilo et al. (2017). Body images were previously rated by independent judges (Dondzilo et al., 2017) using a 10-point scale on emotional valence from 0 (*unpleasant*) to 9 (*pleasant*) such that thin body images were positive ($M = 6.19$, $SD = .70$) and abstract art (control) images were neutral ($M = 4.77$, $SD = 0.23$). Thin-ideal images focused on specific regions that highlighted body size, such as thighs and the abdominal region.

**Modified dot probe task.** Participants’ attentional bias for thin-ideal images was measured using a modified dot probe task (based on MacLeod et al., 1986). Stimuli were displayed on a Dell CRT monitor with a screen resolution of 1024 x 768 and a frame rate of 85Hz. Presentation of stimuli was controlled by Matlab (2012b) and the Psychophysics Toolbox (Brainard, 1997). The monitor was positioned at a distance of approximately 125 cm from the participant.

Each trial commenced with the display of a fixation cross in the centre of the screen for 1,000 ms, which was followed by the presentation of two images (thin-ideal and control image) for 500 ms. The images were approximately 7.3 cm in width and 11 cm in height, and were centred three degrees above or below the fixation cross. Immediately after the images disappeared, a probe stimulus (i.e., the letter “p” or “q”) was then displayed in the position previously occupied by one of the images. Participants were instructed to indicate the letter as quickly and accurately as possible, by pressing the corresponding key on a keyboard. After a response was made, the next trial commenced.
The 20 image pairs (thin body-abstract art) were presented in a different random order for each participant. The location of the probe and images (i.e., top versus bottom) was randomised with equal probability. Additionally, the probes replaced the images in each pair with equal frequency. There were 160 trials pre- and post-modified response task (i.e., the rumination or distraction induction), making a total of 320 trials across the full experimental session. Additionally, the task commenced with nine practice trials.

**Body image-related negative mood induction.** A negative mood induction is a necessary precursor to any rumination induction. This is based on theory (Nolen-Hoeksema, 1991) and previous rumination induction studies which suggest that the effects of rumination are only seen in the context of a negative mood (Etu & Gray, 2010; Morrison & O’Connor, 2008; Naumann et al., 2015). To elicit a body-relevant negative mood, participants were asked to read a negative body image-related scenario devised by Etu and Gray (2010) and imagine it was actually happening to them. An excerpt from the scenario stated, “You stare at the mirror and can’t help but feel disgusted with yourself...You had promised yourself you would lose weight.”

**Rumination or distraction induction: Modified response task.** A modified version of the well-established response task (Nolen-Hoeksema & Morrow, 1993) was used to induce rumination or distraction. Within this task, participants were asked to focus their mind on a series of thoughts and ideas for eight minutes – a duration consistent with previous rumination induction studies (e.g., Etu & Gray, 2010; Naumann et al., 2015; Nolen-Hoeksema & Morrow, 1993). There were a total of eight items, with each item presented for one minute before automatically proceeding to the next item. Participants were asked to write down any thoughts that came to mind for each item and to not worry about spelling and grammar. In the rumination condition, the items were self-focused and encouraged rumination about the symptoms, causes, and consequences of current feelings related to body shape, weight, and eating in a repeated...
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The phrases did not contain any explicit focus on negative feelings but were instead based on items commonly included in rumination measures (i.e., RRS-ED: Cowdrey & Park, 2011; PANE: Mezulis, Abramson, & Hyde, 2002; RSS: Nolen-Hoeksema & Morrow, 1991) and the response task by Nolen-Hoeksema and Morrow (1993). In contrast, in the distraction condition, the items were based on external and non-emotional content (e.g., “Think about and describe in as much detail as you can the layout of the room you are in currently”). Distraction items were influenced by those used in previous rumination induction studies (Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005; Nolen-Hoeksema & Morrow, 1993; Rusting & Nolen-Hoeksema, 1998). All rumination/distraction items are included in Appendix C.

Procedure

Participants were told that the purpose of the experiment was to investigate cognitive processes associated with imagined scenarios. Focusing on imagination as a cover story is consistent with previous rumination induction studies (Bushman et al., 2005; Etu & Gray, 2010; Nolen-Hoeksema & Morrow, 1993). After providing informed consent, participants were given the modified dot probe task to assess their baseline attentional bias for thin-ideal images. All other materials were presented via Qualtrics (Qualtrics, 2016), an advanced online survey system that was hosted on the University of Western Australia servers. After the initial assessment of attentional bias, participants completed the subjective state ratings and self-report questionnaires. Subsequently, the body image-related scenario was administered to induce negative mood, which was immediately followed by the mood manipulation check item. Next, participants were randomly assigned to one of two groups: rumination or distraction. Based on their experimental group, participants completed the appropriate modified response task (rumination or distraction). Following this, the modified dot probe task was again
undertaken, to measure the effects of induced rumination and distraction on attentional bias. Then, participants again completed the subjective state ratings on rumination as a manipulation check, and body dissatisfaction and dietary restraint as dependent variables. Finally, participants’ height and weight were measured for the calculation of body mass index (BMI = kg/m$^2$). All participants were fully debriefed and the experimenter monitored all participants for any residual distress.

**Results**

**Sample Characteristics**

Means and standard deviations for state and trait levels of the study variables are displayed in Tables 5.1 and 5.2, respectively. There were no baseline (pre-induction) differences between the two experimental groups on BMI and state or trait levels of eating disorder-specific rumination, body dissatisfaction, or dietary restraint (all $ps > .05$). Despite not differing on trait negative affect, the distraction group unexpectedly reported significantly higher levels of state sadness at baseline relative to the rumination group ($p = .03$).
Effect of Rumination on Attention and Eating Disorder Symptoms

Table 5.1

*Means (SDs) for State Sadness, Rumination, Body Dissatisfaction, and Dietary Restraint*

<table>
<thead>
<tr>
<th></th>
<th>Rumination (N = 55)</th>
<th>Distraction (N = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>State measures</td>
<td>Baseline</td>
<td>Post-induction</td>
</tr>
<tr>
<td>Sadness</td>
<td>10.18 (17.67)</td>
<td>62.98 (25.43)</td>
</tr>
<tr>
<td>ED-rumination</td>
<td>27.05 (27.53)</td>
<td>43.67 (35.15)</td>
</tr>
<tr>
<td>Body dissatisfaction</td>
<td>34.29 (27.99)</td>
<td>37.38 (30.30)</td>
</tr>
<tr>
<td>Dietary restraint</td>
<td>17.75 (22.88)</td>
<td>21.38 (24.47)</td>
</tr>
</tbody>
</table>

*Note.* State measures were assessed via the VAS. For sadness, post-induction refers to after the negative mood induction, but prior to the modified response task. For the remaining state measures, post-induction refers to after the modified response task.

Table 5.2

*Means (SDs) for BMI and Self-Report Trait Questionnaires*

<table>
<thead>
<tr>
<th></th>
<th>Rumination (N = 55)</th>
<th>Distraction (N = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>21.69 (3.97)</td>
<td>21.93 (3.18)</td>
</tr>
<tr>
<td>RRS-ED</td>
<td>16.40 (5.96)</td>
<td>15.38 (5.31)</td>
</tr>
<tr>
<td>DASS</td>
<td>16.60 (9.33)</td>
<td>16.89 (9.74)</td>
</tr>
<tr>
<td>BSQ</td>
<td>97.62 (34.57)</td>
<td>92.40 (36.75)</td>
</tr>
<tr>
<td>DEBQ-DR</td>
<td>27.36 (9.00)</td>
<td>24.85 (8.54)</td>
</tr>
</tbody>
</table>

*Note.* BMI = Body Mass Index (kg/m²); RRS-ED = Ruminative Response Scale for Eating Disorders; DASS = Depression Anxiety Stress Scales; BSQ, Body Satisfaction Questionnaire; DEBQ-DR, Dutch Eating Behaviour Questionnaire Dietary Restraint subscale.
Negative Mood Induction Manipulation Check

To assess whether the body image-related scenario elicited negative mood (measured by the subjective state ratings), a 2 (condition: rumination, distraction) × 2 (time: pre-mood induction, post-mood induction) mixed model ANOVA was conducted. The interaction between condition and time was significant, $F(1,108) = 11.93, p = .001, \eta^2 = .10$ as was the main effect of time, $F(1,108) = 235.61, p < .001, \eta^2 = .69$. There was no main effect of condition, $F(1,108) = .08, p = .78, \eta^2 = .001$.

Simple main effect analyses revealed a significant increase in sadness from pre- to post-mood induction in both the rumination group, $t(54) = 13.30, p < .001, d = 2.54, 95\% \text{ CI } [44.93, 60.67]$, and the distraction group, $t(54) = 8.41, p < .001, d = 1.60, 95\% \text{ CI } [25.53, 41.27]$, suggesting that the negative mood induction was successful and effective for both conditions. Further simple main effect analyses revealed the unexpected finding that the rumination group reported significantly higher levels of sadness than the distraction group following the mood induction, $t(104.17) = 2.00, p = .049, d = .38, 95\% \text{ CI } [.07, 21.46]$.

Modified Response Task Manipulation Check

A 2 (condition: rumination, distraction) × 2 (time: pre-response task, post-response task) mixed model ANOVA was performed to determine whether rumination (measured by the state subjective ratings) was induced in the rumination group alone. As expected, the interaction between condition and time was significant, $F(1,108) = 8.18, p = .005, \eta^2 = .07$, as was the main effect of time, $F(1,108) = 14.57, p < .001, \eta^2 = .12$. There was no main effect of condition, $F(1,108) = .22, p = .64, \eta^2 = .002$.

Simple main effect analyses showed a significant increase in eating disorder-specific rumination, from pre- to post-response task, in the rumination group, $t(54) = 4.72, p < .001, d = .90, 95\% \text{ CI } [9.64, 23.59]$, but not in the distraction group, $t(54) =
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.68, \( p = .50, d = .13, 95\% \text{ CI} [\text{-}4.59, 9.36] \). Therefore, rumination was successfully induced in the rumination group only.

**Calculating Attentional Bias**

To assess the effect of induced rumination on attentional bias, the probe discrimination reaction times (RTs) at baseline were compared with those at post-response task. Only data of correct trials were analysed (<5% of trials were excluded due to incorrect trials). In line with previous studies (e.g., Carters, Rieger, & Bell, 2015; Dondzilo et al., 2017), RTs less than 200 ms or more than 2.5 standard deviations above each participant’s mean RT were eliminated as outliers. Mean probe discrimination RTs were used to calculate an attentional bias difference score for each assessment phase, using the formula of MacLeod and Mathews (1988), computed as \( [(\text{upper probe}/\text{lower target} – \text{upper probe}/\text{upper target}) + (\text{lower probe}/\text{upper target} – \text{lower probe}/\text{lower target})/2] \). This score provides an index of attentional bias to thin-ideal relative to control images such that a *positive* score indicates an attentional bias towards thin body images, whereas a *negative* score indicates attentional avoidance of thin body images. Attentional bias difference scores for the experimental groups at each assessment phase are illustrated in Figure 5.1.

**Attentional bias at baseline.** First it was examined whether participants began the experiment with an attentional bias towards or away from the thin-ideal. The negative values in the white bars of Figure 5.1 indicate that prior to the modified response task, participants in both conditions showed attentional avoidance of thin-ideal images. A pair of one-sample \( t \)-tests showed that the attentional bias scores at baseline were significantly less than zero for both the rumination group, \( t(54) = -4.06, p < .001, d = -0.55, 95\% \text{ CI} [-12.15, -4.12] \), and the distraction group, \( t(54) = -4.23, p < .001, d = -0.57, 95\% \text{ CI} [-12.58, -4.49] \), while an independent \( t \)-test indicated that the attentional bias scores did not differ by group, \( t(108) = .14, p = .89, d = 0.03, 95\% \text{ CI} [-5.24, 6.03] \).
Attentional bias change from pre- to post-modified response task. Next it was determined whether induced rumination via the modified response task led to changes in attentional bias in the rumination group, but not in the distraction group. To address this question directly, two planned paired samples t-tests were conducted (comparing attentional bias scores at pre- to post-modified response task). These comparisons revealed a significantly increased attentional bias score, from pre- to post-response task, in the rumination group, $t(54) = 2.06, p = .045, d = .30, 95\%$ CI [.12, 9.89], but no significant change in the distraction group, $t(54) = 1.09, p = .28, d = .20, 95\%$ CI [-2.43, 8.26]. In short, inducing rumination led to an increase in attention towards thin-ideal relative to control images in the form of a decrease in attentional avoidance.

Attentional bias post-modified response task. Finally, it was determined whether induced rumination abolished the previously seen attentional avoidance of thin-ideal images. The hatched bars in Figure 5.1 show that both groups continued to show negative attentional bias indices after the modified response task, indicating continued attentional avoidance of thin-ideal relative to neutral images. However, a pair of one-sample $t$-tests on the post-modified response task data revealed that only the distraction group maintained significant attentional avoidance of thin bodies, $t(54) = -2.99, p = .004, d = -.40, 95\%$ CI [-9.38, -1.85]. The rumination group no longer exhibited a significant attentional bias away from thin-ideal bodies, $t(54) = -1.30, p = .20, d = -.18, 95\%$ CI [-7.94, 1.69]. Thus, induced rumination produced a significant change in attentional bias, with this change constituting a nulling of the significant attentional avoidance of thin-ideal images.

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1An alternative way to examine this hypothesis is via a $2 \times 2$ (condition: rumination, distraction) $\times$ 2 (time: pre-response task, post-response task) mixed model ANOVA. The mixed model ANOVA on attentional bias revealed a main effect of time, $F(1,108) = 4.82, p = .03, \eta^2 = .04$, but no main effect of condition nor a significant interaction. However, given that our hypothesis was justified on the basis of previous findings showing that induced rumination led to a change in attentional bias (Morrison & O’Connor, 2008), the planned comparisons provide relatively greater statistical power and should be performed no matter the outcome of the ANOVA (Ruxton & Beauchamp, 2008).
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Figure 5.1. Mean attentional bias difference scores for the rumination and distraction conditions at pre- and post-response task. Standard errors are represented by the error bars.

Body Dissatisfaction

To determine the effect of eating disorder-specific rumination on state body dissatisfaction (measured by the subjective state ratings), a 2 (condition: rumination, distraction) × 2 (time: pre-response task, post-response task) mixed model ANOVA was performed\(^2\). The interaction between condition and time was significant, \(F(1,108) = 4.21, p = .04, \eta^2 = .04\). There were no significant main effects of condition, \(F(1,108) = 1.03, p = .31, \eta^2 = .01\), or time, \(F(1,108) = .23, p = .63, \eta^2 = .002\).

Simple main effect analyses showed a non-significant decrease in body dissatisfaction, from pre- to post-response task, in the distraction group, \(t(54) = -1.79, p = .08, d = -.17, 95\% \text{ CI} [-10.50, .53]\). In contrast, there was a non-significant increase in

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\(^2\)It should be acknowledged that moderation analyses were also conducted and revealed that change in eating disorder-specific rumination and its relationships with change in attentional bias/body dissatisfaction/dietary restraint was not moderated by trait eating disorder-specific rumination/dietary restraint/body dissatisfaction.
body dissatisfaction in the rumination group, \( t(54) = 1.11, p = .27, d = .11, 95\% \text{ CI } [-2.42, 8.61] \).

**Dietary Restraint**

To determine the effect of eating disorder-specific rumination on state dietary restraint (measured by the subjective state ratings), a 2 (condition: rumination, distraction) \( \times \) 2 (time: pre-response task, post-response task) mixed model ANOVA was performed. There was no significant interaction between condition and time, \( F(1,108) = .17, p = .68, \eta^2 = .002 \), or significant main effect of condition, \( F(1,108) = .07, p = .80, \eta^2 = .001 \). There was, however, a main effect of time, \( F(1,108) = 4.33, p = .04, \eta^2 = .04 \), indicating that both groups reported increased dietary restraint from pre- to post-response task.

**Discussion**

The present study sought to investigate whether rumination on shape and weight concerns serves to influence eating disorder symptomatology (i.e., dietary restraint and body dissatisfaction) and selective attentional processing of thin-ideal images in young women. Findings revealed that participants who were induced to ruminate, but not participants who were induced to be distracted, demonstrated a significant change in selective attention for thin-ideal images. More specifically, induced rumination served to extinguish the initial and potentially adaptive bias of avoiding thin bodies. Conversely, induced rumination was not shown to play a causal role in both body dissatisfaction and dietary restraint.

The current finding of rumination influencing attentional bias builds on the growing body of evidence showing an association between depressive rumination and attentional bias for negative information (Donaldson et al., 2007; Duque et al., 2014; Grafton et al., 2016; Joormann et al., 2006; Owen & Gibb, 2016; Southworth et al., 2016). Furthermore, this finding extends on the mediation model found by Dondzilo et
al. (2017) by suggesting a potential causal relationship between attentional bias for thin-ideal bodies and eating disorder-specific rumination. Although the mediation model suggested that attentional bias predicts rumination, which in turn predicts eating disorder symptoms, a reciprocal relationship between these two cognitive factors would have important implications for prevention and/or treatment avenues for eating disorder symptomatology. Namely, both attentional bias and ruminative thinking would ideally be targeted, via cognitively-focused experimental procedures, in order to optimally reduce eating disorder symptoms such as body dissatisfaction and dietary restraint. Thus, while the present study provides support for rumination inducing change in attentional bias, future studies are needed to test whether, conversely, attentional bias triggers rumination as suggested in the mediation model by Dondzilo et al. (2017).

Another noteworthy finding in the current study is the initial attentional avoidance of thin-ideal images in both the rumination and distraction groups. This result seemingly contradicts earlier findings, in which community samples of women have been reported to attend to thin bodies (Glauert et al., 2010), or show no bias either towards or away from thin bodies (Dondzilo et al., 2017). One potential reason for the discrepancy with the findings of Glauert et al. (2010) is their use of computer generated/synthetic thin female body images, whereas the current study used images of real bodies that are more ecologically valid. It seems plausible that participants found the synthetic stimuli in Glauert et al.’s study more novel, and thus more attention-grabbing. In support of the notion that synthetic stimuli are processed differently by human observers, Crookes et al. (2015) showed both reduced recognition memory accuracy and perceptual discrimination accuracy for computer generated faces relative to real faces. With regards to the contradictory findings of Dondzilo et al. (2017), a key difference is that this previous study also included non-thin body images. Attentional avoidance of non-thin bodies was found and it seems plausible that the inclusion of a
non-thin body type may have altered attention to thin bodies. Finally, the discrepancy in the direction and strength of the attentional bias across these studies may also be due to differences in moderating variables across the various samples. For example, Rieger et al. (2017) found that women with higher levels of shape/weight concerns reduced their avoidance of thin-ideal images after they had experienced interpersonal rejection, while women with lower levels of shape/weight concerns showed the reverse pattern. Thus attentional patterns regarding thin-ideal images can alter in response to individual difference and situational factors.

The avoidance of thin-ideal bodies seen in the present study could reflect a self-serving cognitive bias which promotes a healthy body image for self since it minimises the negative effects of engaging in upward social comparisons (Bessenoff, 2006; Festinger, 1954; Tiggemann & McGill, 2004) in the form of comparing oneself to the thin-ideal. As such, a reduced self-serving bias (i.e., reduced attentional avoidance of thin-ideal images) or a heightened maladaptive bias (i.e., attending towards thin-ideal images), may contribute to negative effects, including eating disorder symptomatology. Consistent with this, Jansen et al. (2005) found a self-serving attentional bias in healthy individuals but a maladaptive bias in those with elevated eating disorder symptoms. Specifically, healthy females attended to the unattractive body regions of other women, that is, an adaptive self-serving strategy. However, this attentional pattern was reversed for females with elevated levels of eating disorder symptomatology, whereby they attended to the attractive body regions of other women. Related to this, our findings demonstrated that induced rumination extinguished the initial adaptive attentional bias of avoiding thin-ideal bodies. This implies that in healthy individuals, eating disorder-specific rumination may serve to reduce positive cognitive biases. This accords with research indicating that depressive rumination leads to a reduced positive attentional bias (Morrison & O’Connor, 2008) and the response styles theory (Nolen-Hoeksema,
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According to which depressive rumination diminishes the ability to engage in positive activities.

Nonetheless, it is important to acknowledge that the current experimental design does not allow differentiation between avoidance of one or bias towards the other stimulus category (i.e., abstract art vs. thin-ideal body). Thus, the observed avoidance of thin-ideal bodies could theoretically represent an attentional bias towards the abstract art images. A further noteworthy consideration is that the change in attentional bias in the rumination group was very small ($d = .30$). Perhaps this effect could have been increased with a more effective rumination induction. Alternatively, perhaps a larger effect is only seen in vulnerable individuals (e.g., those with a clinical eating disorder).

Further research is required to determine whether a more powerful rumination induction task is capable of producing a large shift in attentional bias or whether a large shift is only possible in vulnerable individuals.

In contrast, the current results did not support the hypothesis that eating disorder-specific rumination casualty contributes to both body dissatisfaction and dietary restraint, which conflicts with previous evidence (Naumann et al., 2015, 2016). Specifically, Naumann et al. (2015) found that induced depressive rumination increased dietary restraint in individuals with anorexia nervosa. There is also evidence suggesting that depressive rumination serves to exacerbate body dissatisfaction in individuals with anorexia nervosa and bulimia nervosa (Naumann et al., 2016). Therefore, it could be the case that eating disorder-specific rumination does in fact causally contribute to eating disorder symptoms, but only in individuals with elevated eating disorder symptomatology and/or a clinical eating disorder diagnosis. Alternatively, perhaps there was a lack of sensitivity in the current state measures for indexing change. Specifically, eating disorder-specific rumination might induce increases in dietary restraint but in more subtle forms that those assessed by our single-item VAS (i.e., “I would refuse
food or drink offered to me because I am concerned about my weight”) such as reducing one’s portion sizes or selecting lower calorie options. Further, the VAS item referred to extremely elevated levels of body dissatisfaction (i.e., “I feel extremely dissatisfied with my body size and shape”), whereas the rumination induction method employed in the current study may only elicit changes in more moderate levels of body dissatisfaction.

There are several limitations associated with this study that need to be acknowledged and considered when interpreting the findings. Perhaps the most concerning limitation is that the re-assessment of dietary restraint and body dissatisfaction was undertaken not only after the rumination/distraction induction, but after the second administration of the modified dot probe task. Thus it is possible that exposure to the thin-ideal images included in this task reduced the distinction between the rumination and distraction conditions (e.g., participants encouraged to use distraction were then shown images of the thin-ideal), which could have in turn minimised group differences on the dependent variables (e.g., the lack of a significant difference between groups on dietary restraint). Another limitation is that the item used to assess state eating disorder-specific rumination (i.e., “at the moment I am thinking about my feelings concerning my eating and body shape and/or weight”) may not have solely captured rumination. Although it is important to note that the current state rumination item correlated strongly ($r = .61$) with a validated trait measure of eating disorder-specific rumination (i.e., the RRS-ED; Cowdrey & Park, 2011), this item could nevertheless have also been measuring acceptance of eating and body-related concerns. In order to improve the assessment of eating disorder-specific rumination, future studies should include items which specifically target both components of this construct (i.e., brooding and reflection). Additionally, participants were not selected on the basis of displaying elevated levels of rumination or a clinical eating disorder diagnosis, which highlights the need to replicate this study in individuals who meet these criteria. Finally,
given the aforementioned limitation of our VAS measures of dietary restraint and body
dissatisfaction, future research on alternative measures of these constructs would be
valuable. For instance, the validity of the bogus taste test as a measure of dietary
restraint has long been established, most recently by Robinson et al. (2017).

Notwithstanding these limitations, the current study was novel in its finding that
heightened eating disorder-specific rumination serves to modify attentional bias towards
thin-ideal images in young females. More precisely, inducing eating disorder-specific
rumination was shown to eliminate the potentially adaptive bias of avoiding thin-ideal
bodies, which supports the theorised maladaptive nature of rumination. This finding
extends on previous empirical evidence by suggesting that disorder-specific rumination
may underlie individual differences in attentional bias for disorder-specific stimuli.
CHAPTER SIX: GENERAL DISCUSSION

Attentional bias regarding thin-ideal female bodies and eating disorder-specific rumination are considered cognitive vulnerabilities for body image disturbance and eating disorder symptomatology. The present research program sought to address a critical gap in the literature by investigating how these two cognitive factors work together in order to influence specific eating disorder symptoms. A mediation model was developed on the basis of theory and empirical evidence in the depression literature indicating the combined role of attentional bias towards negative information and depressive rumination in predicting vulnerability to depression. In this model, attentional bias towards thin-ideal images affects both body dissatisfaction and dietary restraint via the mediating role of eating disorder-specific rumination (see Figure 6.1). Four studies were conducted to test the feasibility and validity of the proposed mediation model. The findings for each of the studies will be reviewed in turn.

Figure 6.1. The mediation model predicting that eating disorder-specific rumination mediates the relationship attentional bias towards thin-ideal bodies and the specific eating disorder symptoms of body dissatisfaction ($Y_1$) and dietary restraint ($Y_2$).

Review of Experimental Findings

Study 1: Association between rumination factors and eating disorder behaviours in young women. The maladaptive role of depressive rumination in psychopathology, in particular depression, is well established (Aldao et al., 2010; Olatunji, Naragon-Gainey, & Wolitzky-Taylor, 2013; Rood, Roelofs, Bögels, Nolen-
Hoeksema, & Schouten, 2009; Wilkinson, Croudace, & Goodyer, 2013). The construct of eating disorder-specific rumination, however, is relatively novel and its pathological function is not fully understood. The Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011) is the only existing measure of eating disorder-specific rumination, but prior to Study 1, it had not been validated in undergraduate samples of young women. Thus, the primary aim of Study 1 was to validate the RRS-ED by confirming its two-factor structure (i.e., brooding and reflection) and by examining its association with general eating disorder symptomatology. The second aim was to determine whether eating disorder-specific rumination is a vulnerability factor for specific eating disorder attitudes and behaviours.

Findings obtained in Study 1 provided the first verification of the two-factor structure of eating disorder-specific rumination via confirmatory factor analysis. Study 1 also revealed that ruminative brooding, but not ruminative reflection, was shown to be a unique contributor to general eating disorder symptoms, above and beyond negative emotional states and BMI (Aim 1). These findings provide justification for the utility of the RRS-ED in young women. Furthermore, findings revealed associations between heightened ruminative brooding and clinically relevant levels of both binge eating and dietary restraint, whilst controlling for negative mood and BMI (Aim 2). These results make a novel contribution to the literature and suggest that eating disorder-specific ruminative brooding may serve as a risk factor for clinical levels of eating disordered attitudes and behaviours in young women. Finally, and crucially, the results supported the feasibility for the proposed mediation model, which predicts a relationship between eating disorder-specific rumination and dietary restraint.
Chapter Six

Study 2: The mediating role of rumination in the relation between attentional bias towards thin female bodies and eating disorder symptomatology.

Given Study 1 served to validate the use of the RRS-ED in young women, the second study aimed to investigate the relationships between rumination, attentional bias, and eating disorder symptomatology. The primary aim of Study 2 was to investigate whether there were differences in attentional processing of thin versus non-thin images, with regards to body dissatisfaction and dietary restraint. This was based on empirical evidence suggesting that attentional processing of both thin and non-thin body images is relevant in eating disorder symptomatology (Blechert et al., 2009; Cho & Lee, 2013; Gao et al., 2013, 2014; Janelle et al., 2003), yet it was unclear whether processing of one body type, over the other, is more maladaptive. The second aim was to determine whether rumination serves to mediate the relationship between attentional bias and the specific eating disorder symptoms.

Results revealed that both heightened attentional bias towards thin bodies and avoidance of non-thin bodies was related with greater reports of body dissatisfaction and dietary restraint. Comparatively, however, the relationship between attentional bias and eating disorder symptoms was stronger for bias towards thin bodies, relative to bias away from non-thin bodies (Aim 1). Importantly, these findings were the first to implicate attentional bias towards thin-ideal bodies as playing a relatively stronger role in the potential maintenance and/or development of eating disorder symptomatology. Furthermore, findings lend support to the proposed mediation model (Figure 6.1) which seeks to examine the mechanism by which selective attention for thin bodies (and not non-thin bodies) influences body dissatisfaction and dietary restraint in young women. Findings obtained in Study 2 also provided preliminary evidence for the mediating role of eating disorder-specific rumination in the relationship between selective attention for
thin bodies and both body dissatisfaction and dietary and restraint, whilst statistically controlling for BMI (Aim 2).

**Study 3: The causal role of selective attention for thin-ideal images on negative affect and rumination.** The primary purpose of Study 3 was to extend on the findings from Study 2 by determining whether attentional bias makes a causal contribution to eating disorder-specific rumination. Specifically, this study tested the effect of attentional bias on ruminative and negative emotional vulnerability in response to a body image-related stressor. The purpose of the negative stressor was to induce negative mood, which has been identified as a prerequisite for rumination to occur (Donaldson & Lam, 2004; Lavender & Watkins, 2004; Lyubomirsky et al., 1998; Lyubomirsky & Nolen-Hoeksema, 1995; Morrison & O’Connor, 2008; Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008). It was hypothesised that selectively attending to thin-ideal bodies would increase ruminative and negative emotional vulnerability in response to a body image-related stressor.

An attentional bias modification (ABM) paradigm was used to affect attentional biases. As predicted, attentional bias for thin-ideal bodies increased in the attend group and decreased in the avoid group. Furthermore, participants trained to attend to thin bodies experienced greater negative mood, in response to a body image-related stressor, relative to participants trained to avoid thin bodies. Thus, attentional bias towards thin-ideal bodies was shown to causally influence negative emotional vulnerability. However, participants trained to attend to thin bodies did not show a differentially greater increase in eating disorder-specific rumination, relative to those trained to avoid thin bodies. Thus, a causal relationship between attentional bias and rumination could not be supported.

**Study 4: The Effect of Induced Rumination on Attentional Bias towards Thin-Ideal Female Bodies and Eating Disorder Symptomatology.** The final study
also sought to extend on the correlational findings in Study 2 and determine whether eating disorder-specific rumination causally influences body dissatisfaction and dietary restraint. Additionally, this study assessed the bi-directionality of the relationship between attentional bias and rumination by determining whether heightened rumination serves to modify attentional bias.

Findings revealed that inducing rumination did not lead to significant increases in body dissatisfaction and dietary restraint. By contrast, inducing distraction led to significantly reduced body dissatisfaction, but no significant changes in dietary restraint. Thus, a causal relationship between rumination and eating disorder symptoms was not confirmed. On the other hand, Study 4 did reveal that inducing rumination led to a significant change in selective attention for thin-ideal images. More specifically, induced eating disorder-specific rumination served to extinguish the initial and potentially adaptive bias of avoiding thin-ideal bodies. This novel finding suggests that eating disorder-specific rumination can serve to reduce protective cognitive biases in healthy individuals.

**Theoretical Implications of the Current Findings**

The current findings serve to extend understandings of attentional bias and rumination, as well as the relation between them, and therefore have important implications for theoretical accounts of eating disorders and depression.

**The causal relationship between attentional bias, rumination, and eating disorder symptoms.** Collectively, evidence from Studies 1 and 2 supports the feasibility of the proposed mediation model by showing that both attentional bias for thin bodies and eating disorder-specific rumination are vulnerability factors for eating disorder symptomatology. Studies 3 and 4, however, did not confirm the causal direction of these predicted relationships. That is, attentional bias did not serve to causally influence rumination (Study 3), and rumination did not make a causal
contribution to body dissatisfaction and dietary restraint (Study 4). Thus, combined, the results in this thesis did not support the proposed mediation model. This also means that the results are discordant with the impaired disengagement model of rumination (Koster et al., 2011), according to which attentional bias for negative information contributes to depressive rumination that, in turn, serves to maintain and/or develop depressive symptoms. In an attempt to explain the current findings, two possible accounts of the causal relationship between attentional bias, rumination, and eating disorder symptoms will be described. First, it is proposed that rumination plays a causal role in eating disorder symptomatology via the mediating role of attentional bias. Second, it is suggested that the proposed mediation model does in fact exist and there is also a bidirectional relationship between attention and rumination.

The first potential explanation for the current findings is that rumination is in fact causally involved in eating disorder symptomatology via the mediating role of attentional bias. A key assumption of this proposal is that rumination causes attentional bias, which is supported by findings obtained in Study 4 and also by Morrison and O’Connor (2008). In addition to this, numerous studies indicate the causal role of depressive rumination in cognitive mechanisms, which includes negative memory biases (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Moulds, Kandris, & Williams, 2007; Park, Goodyer, & Teasdale, 2004) and impaired cognitive control (Philippot & Brutoux, 2008; Whitmer & Gotlib, 2012). A second assumption of this alternative mediation model is that attentional bias, in turn, causally contributes to eating disorder symptoms. In accordance with this notion, results from Study 2, although correlational, indicated the greater importance of attentional bias towards thin bodies, relative to avoidance of non-thin bodies, in both body dissatisfaction and dietary restraint. Additionally, there is some evidence suggesting attentional bias towards non-thin self-relevant body shape and/or weight related information triggers body
dissatisfaction (Smeets et al., 2011; Smith & Rieger, 2006, 2009). Additionally, while the mediation model principally examined in the current research program is well grounded in theory (Koster et al., 2011), it does not account for inter-individual differences in attentional bias, which is an unconscious process. However, differences in ruminative style might be more easily conceptualized, given it is a conscious process, thus explaining differences in vulnerability to thin-ideal images. Importantly, the alternative mediation model would imply that rumination, but not necessarily attentional bias, should be a primary target for cognitive-experimental procedures seeking to reduce eating disorder symptomatology given that rumination triggers the attentional bias eliciting eating disorder symptoms.

On the other hand, it could be that the proposed mediation model does in fact exist but a limitation in the measurement of state changes in the dependent variables (i.e., rumination and specific eating disorder symptoms) in Studies 3 and 4 masked the true effects. More specifically, the mediation effect shown in Study 2 was a function of ruminative disposition in general, as results did not differentially implicate brooding and reflection. Although this result challenges previous evidence suggesting brooding, but not reflection, is related to attentional bias for negative information (Joormann et al., 2006; Owens & Gibb, 2016; Southworth et al., 2016), perhaps selectively attending to thin bodies triggers both reflection (e.g., analysing why you strive to be thin) and brooding (e.g., thinking about a recent meal and wishing you had eaten less). This proposition may explain why Study 3 did not confirm a causal relationship between attentional bias and rumination. Specifically, the one-item measure of eating disorder-specific rumination used in Study 3 may not have adequately represented both ruminative factors. Additionally, it could be that attentional bias directly influences rumination and thus, the effects of the body image-related stressor may have extinguished any differential increases in rumination. In other words, it could be that the
effect of attentional bias on rumination is independent of negative mood. The fact that
the positive association between attentional bias and depressive rumination remains
even after controlling for depressive symptoms (Donaldson et al., 2007; Duque et al.,
2014; Joormann et al., 2006; Owens & Gibb, 2016) lends support for this proposition.
Moreover, given the findings of Study 4, this account would imply that attentional bias
and rumination influence each other in a bidirectional manner. Importantly, a
bidirectional relationship would suggest that both attentional bias and rumination should
be targeted in cognitively-focused experimental procedures, in order to optimally reduce
body dissatisfaction and dietary restraint. Further, even if attentional bias does in fact
influence both ruminative brooding and reflection, brooding is perhaps the more
pertinent ruminative factor in the development and/or maintenance of specific eating
disorder symptoms. This idea is based on the findings obtained in Study 1 and in the
study by Cowdrey and Park (2012), which both revealed that brooding, and not
reflection, was uniquely associated with eating disorder symptoms in community
samples of women. Further, there is evidence indicating that brooding, but not
reflection, predicted depressive symptoms prospectively (Burwell & Shirk, 2007;
Schoofs et al., 2010). Although findings obtained in Study 4 did not support a causal
relationship between induced eating disorder-specific rumination and eating disorder
symptoms, this is potentially due to the fact that the one-item measures lacked
sensitivity to change.

These two contrasting accounts of attentional bias, rumination, and eating
disorder symptoms have distinct implications for the understanding of, and prevention
and/or interventions for, body dissatisfaction and dietary restraint. There is a clear need
for further experimental research investigating the proposed causal mechanisms.
Nonetheless, Study 4 provided evidence for a causal relationship between eating
disorder-specific rumination and attentional bias towards thin-ideal images, which is a
novel contribution to the literature. Specifically, induced eating disorder-specific rumination was shown to reduce the potentially adaptive bias of avoiding thin bodies in young women. This result provides support for the response styles theory (Nolen-Hoeksema, 1991), according to which depressive rumination diminishes the ability to engage in positive activities. More broadly, it can be inferred that eating disorder-specific rumination serves to perpetuate cognitive-affective body image disturbances. On a final note, a causal relation between attentional bias and rumination has now been shown for depression-specific (Morrison & O’Connor, 2008; Yang et al., 2015) and also eating disorder-specific content (Study 4). Thus, it is plausible to assume that this relation (i.e., that rumination about disorder-specific concerns is causally associated with attentional bias for disorder-specific information) also exists in the context of other psychopathology.

**Differential motivation for attentional bias to thin versus non-thin bodies.**

The present research program also helped advance our understanding of the relative importance of attentional mechanisms for thin versus non-thin bodies. That is, selective attending to thin-ideal bodies was shown to be more strongly associated with body dissatisfaction and dietary restraint, relative to avoidance of non-thin bodies (Study 2). The distinction in attentional bias patterns to thin versus non-thin bodies raises the possibility that young women have different underlying motivations for attending to, or avoiding, specific body shapes. It is postulated that the underlying motivation for attending to thin bodies is *thinspiration*, whereas the motivation for avoiding non-thin bodies is *fear of fat*. Specifically, thinspiration represents the desire to attain the thin-ideal body shape, whereas fear of fat represents the desire to avoid acquiring a fat identity (Dalley & Buunk, 2009).

Given the relatively stronger role of selectively attending to thin bodies in its association with eating disorder symptoms, as shown in Study 2, this implies that
thinspiration plays a greater role in the development and/or exacerbation of dietary restraint and body dissatisfaction, relative to fear of fat, in young women from community samples. This interpretation, however, conflicts with previous research suggesting the concept of fear of fat is more strongly associated with dietary restraint (Dalley & Buunk, 2009; Dalley, Toffanin, & Pollet, 2012; Woud, Anschutz, Van Strien, & Becker, 2011) and body dissatisfaction (Woud et al., 2011), relative to the concept of thinspiration.

One potential reason for this discrepancy is due to specific methodological limitations in previous work. For instance, the studies by Dalley and Buunk (2009) and Dalley et al. (2012) used explicit measures (i.e., self-report) to assess motivational concepts, which are prone to socially desirable responding and also incapable of accessing information that is outside of one’s conscious awareness (Gawronski & De Houwer, 2014). This suggests that implicit measures of affect towards body shapes are potentially a better indicator of motivational orientation.

By contrast, while the study by Woud et al. (2011) used an improved implicit measure, there were flaws in the choice of stimuli. Specifically, this study employed an indirect measure, the stimulus response compatibility (Mogg, Bradley, Field, & De Houwer, 2003), which required participants to make symbolic approach and avoidance movements to thin and non-thin bodies by moving a manakin figure towards or away from the stimuli. However, the non-thin images utilized in this study lacked construct validity in that the non-thin images were artificially created by stretching thin-ideal female bodies 20% in the horizontal dimension, to give the bodies a ‘plump’ appearance. This transformation stretched heads and hands as much as hips and thighs, whilst preserving key thin-ideal markers such as the thigh gap and hip-to-waist ratio. Furthermore, since images were not rated on perceived body size, it is not certain whether participants perceived the images as thin, non-thin or simply as odd. Perhaps
not surprisingly then, participants demonstrated an overall ambivalence towards non-thin bodies (i.e., participants were neither faster to make approach or avoidance movements).

A further consideration is that with increased severity of eating disorder symptomatology a shift might occur in the primary motivation from thinspiration to fear of fat. Indeed, there is evidence showing that females with anorexia nervosa have demonstrated greater implicit negative affect towards non-thin bodies relative to control groups (Cserjési et al., 2010; Spring & Bulik, 2014). In both these studies, there were no group differences in implicit affect towards thin bodies. Thus, it is suggested that the primary motivating factor in body image disturbance and eating disorder symptomatology is thinspiration for women in the community and fear of fat for women with a clinically diagnosed eating disorder. The interplay between attentional and motivational processes specific to body shape and/or weight related information is currently a critical gap in the literature which warrants further investigation, especially given that understanding whether an individual is more motivated by a drive for thinness or by a fear of fat has implications for the development of appropriate interventions targeting eating disorder symptomatology (Levitt, 2003).

**Attentional Bias towards thin-ideal bodies: A transdiagnostic mechanism in both depressive and eating disorder symptoms?** The maladaptive nature of selective attentional processing of thin-ideal bodies was further reinforced in Study 3. This study provided the first empirical evidence for the causal role of attentional bias towards thin-ideal images in negative emotional vulnerability, in response to a body image-related stressor. This finding implicates attentional bias for thin-ideal bodies a risk factor for mood reactivity. In turn, this mood reactivity may predispose to eating disorders, given evidence linking negative affect and the emergence of eating disorder symptoms (Polivy & Herman, 2002; Stice, 2001, 2002; Stice, Gau, Rohde, & Shaw, 2017). Given that
sadness-linked cognitive reactivity is also a robust risk factor for depressive symptoms (Figueroa et al., 2015; Kruijt et al., 2013; Scher, Ingram, & Segal, 2005; Segal et al., 2006; van Rijsbergen et al., 2013), this would implicate attentional bias towards thin-ideal bodies as a potential transdiagnostic risk factor for depressive and eating disorder symptoms. In fact, there is a high prevalence of comorbidity of depression and eating disorders (Godart et al., 2015; Hudson, Hiripi, Pope, & Kessler, 2007; Keski-Rahkonen & Mustelin, 2016) suggesting at least some common underlying mechanisms. Emotion regulation deficits may serve as one such mechanism. Indeed, numerous studies support the idea that eating disorders and depression are related to difficulties in regulating emotions (Aldao et al., 2010; Brockmeyer et al., 2012; Svaldi, Griebenstroh, Tuschen-Caffier, & Ehring, 2012). Further, it is proposed that attentional biases towards affective stimuli, such as thin-ideal bodies of a positive affectivity, constitute one form of emotion regulation given such biases have been shown to regulate subsequent emotional responses (Todd, Cunningham, Anderson, & Thompson, 2012). Although speculative at this point, the idea that attention-induced affective disturbance could serve as a transdiagnostic emotion dysregulation strategy has important theoretical and clinical implications and thus deserves further investigation.

Moreover, the relationship between attentional bias and negative affect is potentially bidirectional. This is based on evidence showing that negative mood serves to increase attentional bias towards self-relevant body shape and/or weight-related information (Smith & Rieger, 2010; Svaldi et al., 2016). Given these previous studies suggest a direct relationship between attentional bias and negative mood, it is possible that attentional bias also influences negative mood directly. Unfortunately the current results cannot assess that possibility. A limitation of Study 3 was that assessment of mood and rumination only occurred after the body image-related stressor, meaning that the direct relationship between attentional bias and mood was not assessed. Thus, it is
important for future studies to determine whether attentional bias influences mood itself versus mood reactivity to a stressful event.

Furthermore, the current finding showing a causal relationship between attentional bias towards thin-ideal bodies and negative affect serves to build on the sociocultural theory (Thompson et al., 1999), which asserts that body dissatisfaction and disordered eating stem from the pressure to be thin. Thus, in line with this theory it would be expected that participants engaged in appearance-related social comparisons, by evaluating their own bodies against the thin-ideal stimuli, which in turn led to them experiencing greater negative affect. Moreover, this finding serves to extend on cognitive behavioural theories of eating disorders (Fairburn, Cooper, & Shafran, 2003; Williamson et al., 2004), which suggest a role for negative affect and attentional bias in the onset and/or maintenance of eating disorders, and theoretical accounts of depression (Beck, 1976, 2008; De Raedt & Koster, 2010), which propose that attentional bias is causally involved in increasing vulnerability for depression. Ultimately, this finding implicates attentional bias towards thin-ideal bodies as a potential transdiagnostic emotion dysregulation mechanism underlying both depressive and eating disorder symptoms that has potential implications for prevention and/or treatment interventions.

**Applied Implications of the Findings**

The studies in this research program collectively support the maladaptive roles of attentional bias and rumination in psychopathology. Causal evidence revealed that attentional bias towards thin-ideal images leads to vulnerability for heightened negative mood and that rumination serves to exacerbate this detrimental bias. In turn, negative mood is considered a risk factor for the emergence of depressive and eating disorder symptoms. As such, the current findings have potential implications for targeting attentional selectivity for thin-ideal images and/or eating disorder-specific rumination, in empirically-validated prevention and/or treatment interventions designed to enhance
emotional resilience in young women. ABM-focused interventions are the predominant treatment approach through which the effects of attention on negative affect can potentially be addressed, while rumination-focused cognitive behavioural therapy (RFCBT) is currently the most empirically supported treatment approach for the effects of rumination on depressive symptoms (Watkins, 2015). Furthermore, Watkins (2015) contends that utilizing both RFCBT and cognitive bias modification (CBM) may enhance therapy outcomes for depression. Thus, the clinical implications with regards to ABM and RFCBT and also a combined approach will be discussed.

**Targeting the effects of attentional bias through ABM.** It has been suggested that ABM may provide a “cognitive vaccine” (Holmes, Lang, & Shah, 2009, p. 82) against both depression and eating disorders. Several studies have shown promising results in terms of the efficacy of ABM interventions for depression (Browning, Holmes, Charles, Cowen, & Harmer, 2012; Li et al., 2015; Wells & Beevers, 2010; Yang et al., 2015), although meta-analyses have revealed that its benefits are somewhat inconsistent (Hallion & Ruscio, 2011; Mogoaşê, David, & Koster, 2014). Based on these studies it appears that the beneficial effects of ABM on depressive symptoms tends to be more successful for non-clinical samples (Li et al., 2015; Wells & Beever, 2010; Yang et al., 2015) or previously depressed individuals (Browning et al., 2012). This implies that in the context of depression, ABM might be better suited to prevention rather than treatment. Additionally, a recent study showed that the improvement in depression symptoms following ABM was associated with neural changes indicative of a normalisation of abnormal spontaneous brain activity in neural circuits linked to a vulnerability for depression (Li et al., 2015). Importantly, research has shown that multiple ABM sessions are more effective in yielding long-term effects. For example, in a study investigating the effect of ABM on depressive symptoms, participants trained to
avoid negative information over a two week period showed continuously maintained symptom reduction up until the final follow-up at seven months (Yang et al., 2015).

The proposal that ABM is potentially better suited as a preventative rather than a treatment intervention, together with the maladaptive role of selectively attending to thin bodies consistently demonstrated in the current thesis, suggests that future research should seek to train young women to avoid thin bodies. On the other hand, the focus of the attentional training may also be important. That is, it may be more conducive to train individuals to attend towards the non-thin bodies of other females. Whilst Study 2 showed that patterns of attention to non-thin bodies do have clinical relevance, we did not attempt to retrain attention towards or away from these images. Engaging in downwards appearance comparisons, whereby women evaluate themselves against other females perceived as less attractive, could serve to protect body esteem and potentially improve mood, body dissatisfaction, and disordered eating behaviours. In support of this view, Jansen et al. (2005) showed that women with elevated eating disorder symptomatology tended to allocate greater attention to the attractive body parts of other women (i.e., upwards appearance comparisons) whereas normal controls focused more on the unattractive body parts of other women (i.e., downwards appearance comparisons). Thus, training vulnerable women to selectively attend to other non-thin women may improve their body image via the mechanism of downwards appearance comparisons. Further research is thus necessary to determine the optimal conditions for enhancing psychological resilience via the modification of attentional bias and whether developing ABM tasks involving thin and/or non-thin ideals is a useful exercise.

On a final note, it is acknowledged that the current findings are all laboratory based and thus it may be worth considering the use of mobile technology in order to deliver ABM in more naturalistic settings. For instance, the creation of a gamified
smartphone application could serve as a more accessible, affordable, and potentially more engaging method of integrating attentional re-training into everyday life. Specifically, the integration of game elements into cognitive training paradigms has been shown to enhance motivation to complete training, especially in young adults (Boendermaker, Boffo, & Wiers, 2015; Lumsden, Edwards, Lawrence, Coyle, & Munafò, 2016). Indeed, there is preliminary evidence for the effectiveness of a gamified ABM smartphone application in reducing anxiety and stress reactivity in adults with elevated anxiety symptoms (Dennis & O’Toole, 2014). Importantly, the growth of gamified smartphone applications has far-reaching implications for the development of a universal prevention strategy which aims to reduce appearance-related comparisons with thin-ideal images and ultimately build emotional resilience in young women. Taken together, the preliminary evidence suggests that ABM can offer more than just a laboratory-based intervention and future researchers are encouraged to verify the efficacy of gamified variants of ABM tasks, delivered as a smartphone application, especially in comparison to existing ABM tasks.

Targeting the effect of rumination through RFCBT. The current findings also suggest that targeting eating disorder-specific rumination would be beneficial in terms of reducing its maladaptive effects on cognitive biases. Indeed, there is promising evidence in the depression and anxiety literature indicating that targeting depressive rumination via RFCBT serves to reduce ruminative, depressive, and anxiety symptoms. RFCBT was initially developed by Watkins et al. (2007) as a novel treatment for treatment-resistant residual depression. Although RFCBT is still grounded within the core principles and techniques of CBT for depression, it includes several novel elements which focus on modifying the process of thinking as opposed to the content of thoughts. These elements include the use of functional analysis, experiential/imagery exercises,
and behavioural experiments to facilitate a shift from an unconstructive thinking style to a more constructive thinking style.

A randomised controlled trial (RCT) for adults with medication-refractory residual depression revealed that individualised RFCBT plus treatment as usual (TAU), in this case antidepressant medication, significantly improved residual symptoms (depression and depressive rumination) and remission rates compared to TAU alone (remission rates: TAU 21%; TAU+RFCBT 62%; Watkins et al., 2011). In addition, RFCBT has been shown to reduce rumination and depression in samples of adolescents with a history of major depressive disorder (Jacobs et al., 2016) and adults with residual depression (Teismann et al., 2014). There is also preliminary evidence for the effectiveness of RFCBT as a preventative intervention for anxiety and depression (Topper, Emmelkamp, Watkins, & Ehring, 2017). Specifically, young adults with elevated levels of rumination assigned to either a group or internet-based RFCBT intervention showed significantly reduced worry, rumination, anxiety, and depression at post-intervention and one year follow-up, relative to those in the waiting list control group. Moreover, the treatment groups showed halved one-year rates of major depression and generalized anxiety disorder, relative to the control group (Topper et al., 2017). Taken together, there is converging support for the effectiveness of RFCBT in preventing and treating rumination, depressive, and anxiety symptoms.

**Targeting the effect of rumination and attention through combined ABM and RFCBT.** standalone rumination and attentional-focused interventions show promise in both the prevention and treatment of psychopathology. Theoretically, ABM, or more broadly CBM as it pertains to all types of cognitive biases (e.g., memory and interpretation), is suited for integration in CBT. This is due to the fact cognitive-behavioural models for eating disorders highlight the role of cognitive biases, such as attentional bias, in the maintenance of eating disorders (Vitousek & Hollon, 1990;
Williamson et al., 1999; Williamson et al., 2004). By integrating these two approaches the modification of negative cognitive biases would be achieved both explicitly (i.e., CBT) and implicitly (i.e., CBM). In turn, this may serve to enhance resilience and/or treatment outcomes for psychopathology.

To date, there is no research specifically examining the combined effects of RFCBT and ABM. However, there is preliminary support for the successful integration of CBM (specifically targeting interpretation bias via mental imagery) and CBT for depression (Williams et al., 2015; Williams, Blackwell, Mackenzie, Holmes, & Andrews, 2013). Qualitative feedback from participants involved in an RCT, which included one week of CBM followed by 10 weeks of CBT, suggests that CBM may serve to facilitate cognitive re-appraisal (e.g., eliciting greater awareness of negative thinking) even without the explicit instructions given in CBT (Williams et al., 2015). Thus, there is initial support for targeting both rumination and attentional bias in prevention and/or treatment interventions designed to promote emotional resilience.

Methodological Limitations and Avenues for Future Research

In this section, the key methodological issues of the studies comprising this thesis will be discussed and, in doing so, potential avenues for future research will be considered.

**Assessment of attentional bias towards body images.** The present research used a reaction time based measure of attentional bias, that is, the modified dot probe task. As clearly demonstrated by the present findings, this measure allows for the differentiation between an attentional bias towards, and attentional avoidance of, body images. Additionally, the dot probe task is capable of modifying biases, meaning it can be used to illuminate causal mechanisms of attentional biases. However, one limitation of reaction time based paradigms is that they obtain only a snapshot of attention at the time of response execution (Armstrong & Olatunji, 2012). Eye tracking procedures and
event-related brain potentials (ERPs) are two candidate approaches that could serve to overcome this limitation, by providing a continuous measure of attentional processing and bias.

Eye tracking procedures in the field of body image and eating disorders involve the tracking of, and recording, of individuals’ eye-gaze direction while they are viewing images of their own bodies and the bodies of others (Jiang & Vartanian, 2017). Given the high continuous temporal resolution provided by eye tracking, a number of potentially valuable gaze parameters can be examined including: the proportion of each trial that an individual spends focusing on the stimulus, the time taken to orient to the stimulus following its onset, and the frequency of fixations exhibited when the stimulus is displayed on the screen. Although there are numerous eye-tracking studies providing evidence for these gaze parameters in women with elevated eating disorder symptomatology, including an orientation bias (Gao et al., 2014) and longer and more frequent gaze durations (Blechert et al., 2009; Cho & Lee, 2013) for thin body images, these gaze parameters have not yet been investigated in the context of eating disorder-specific rumination or negative affect. Therefore, a clear avenue for future research involves using eye tracking procedures to provide rich and continuous information that would allow one to determine what the most pertinent aspect of attention is in relation to the thin-ideal body.

An alternative paradigm that could provide a measure of the neuronal activity underlying attentional biases is event-related brain potentials (ERPs). ERPs represent the brain’s response to a particular stimulus, and are measured with electroencephalography, a non-invasive procedure which requires placing electrodes on the scalp. In contrast to behavioural measures, ERPs can reveal the time course and localisation (although the latter is not as precise as with fMRI) of neuronal activation associated with attentional processes (Hillyard & Anllo-Vento, 1998). For example, in
females with elevated body dissatisfaction, amplitudes of the N100 and N170 ERP components (responses approximately 100 ms and 170 ms after stimulus onset, respectively, over occipitotemporal regions) were larger for words connoting a large physique, relative to those connoting a thin physique, which suggests earlier attentional processing of non-thin, relative to thin, self-relevant body shape and/or weight-related information (Gao et al., 2011). Moreover, sustained attentional processing, reflected by larger late positive potential amplitudes in an earlier (450-680 ms) as well as in a later time window (850-1250 ms) over centro-parietal regions, was seen in adolescent females with anorexia nervosa whilst viewing thin body images but typically developing adolescent girls whilst viewing non-thin body images in the earlier time window only (Horndasch, Heinrich, Kratz, & Moll, 2012). Importantly, this finding provides neural evidence of differential attentional processing of female body shapes in clinical versus non-clinical females. In sum, the two aforementioned studies suggest that ERPs can be used to illuminate the biological aspects of attentional selectivity for thin-ideal bodies.

In order establish a more complete picture of sustained attentional processing of thin-ideal bodies in individuals with elevated rumination and negative affect, a wide range of experimental methods should be employed. In particular, it is recommended that future researchers use eye-tracking and/or ERP in conjunction with the dot probe task to assess the deployment of selective attention for thin-ideal body images. ERP studies would serve to advance on the current findings by demonstrating whether attentional biases towards thin-ideal images, as indicated on the dot probe task in the current studies, is consistent with early and/or sustained attentional processing. Eye-tracking could help to reveal whether biases towards thin-ideal images are due to an initial orienting bias and/or shorter fixation duration on non-target stimuli. For example, in the study by Gao et al. (2011), an attentional bias towards non-thin body shape and/or weight-related words in women with elevated body dissatisfaction, as shown on the dot
probe task, was accompanied by initial orienting towards and speeded detection of non-thin words, based on eye-tracking data.

**Assessment of alternative facets of selective attention to thin-ideal bodies.**

As a further consideration regarding the assessment of attentional bias, the present research program did not discriminate between different facets of selective attention towards body images, namely, facilitated attentional engagement and/or impaired attentional disengagement. That is, the dot probe task utilised in Studies 2, 3, and 4 was not capable of dissociating these two forms of attentional selectivity. Determining the attentional characteristics associated with elevated eating disorder-specific rumination and negative affectivity has important theoretical implications, as well as for the development of attentional tasks intended to reduce heightened attentional biases towards thin-ideal bodies. Koster et al. (2011) hypothesised that an elevated ruminative disposition is characterised by impaired attentional disengagement from negative information. In order to determine whether the same applies for the relationships between attentional bias towards thin-ideal bodies and both eating disorder-specific rumination and negative affect, future studies need to utilise a variant of the dot probe task, which enables the independent assessment of engagement bias and disengagement bias (Grafton, Watkins, & MacLeod, 2012). The key requirement of this task is that participants commence each trial either with attention already focused towards or away from a thin-ideal image. A faster response to probes replacing thin-ideal images on trials where the thin-ideal image appears distal to initial attentional focus would indicate enhanced attentional engagement with thin-ideal images. In contrast, reduced attentional disengagement from thin-ideal images would be reflected by faster responses to probes replacing thin-ideal images which appear proximal to initial attentional focus. The validity of this task in assessing attentional engagement with, and attentional disengagement from, negative information has been shown in a number of studies.
Thus, a clear avenue for future research is to determine whether individuals with elevated negative affect and eating disorder-specific rumination are characterised by facilitated engagement and/or impaired disengagement from thin-ideal images.

**Assessment of state negative mood, rumination, body dissatisfaction and dietary restraint.** A potential limitation of Studies 3 and 4 was the use of one-item measures for the assessment of state negative mood, eating disorder-specific rumination, body dissatisfaction, and dietary restraint. In the current data, these measures demonstrated construct validity via their association with corresponding established trait measures. However, one could argue that multifaceted constructs such as negative affect, eating disorder-specific rumination, body dissatisfaction, and dietary restraint would be best assessed by multi-item self-report and/or behavioural measures.

The assessment of body dissatisfaction is particularly challenging due to the multidimensionality of the construct and the abundance of measures which aim to assess one or more of these dimensions (Thompson, 2004). Thus, future research would benefit from using multiple measures of body dissatisfaction. One potential measure is the commonly used figural rating scale (FRS), which is capable of assessing both cognitive and affective components of body image disturbance (Altabe & Thompson, 1992; Thompson & Dolce, 1989; Tiggemann, 1996). The FRS variously consists of a series of frontal images of men and/or women ranging in size from emaciated to obese. Individuals are usually asked to indicate the image that best represents their current and ideal body size, and this discrepancy is taken as a measure of state body dissatisfaction (Gardner & Brown, 2010). Specifically, the Photographic Figure Rating Scale (PFRS; Swami, Salem, Furnham, & Tovée, 2008) is a possible candidate for future research given its high ecological validity (i.e., it utilises photographic images of real women as
opposed to line-drawn silhouettes or computer-generated bodies) and good convergent validity and test-retest reliability (Swami et al., 2012; Swami et al., 2013). Additionally, there is evidence indicating an association between body dissatisfaction (as assessed by the PFRS) and recognition memory of thin-ideal images (Jiang & Vartanian, 2016), which suggests is may be a useful measure for researchers seeking to examine the relation between cognitive biases and state body dissatisfaction.

With regards to state dietary restraint, one potentially important limitation of the self-report measure utilised in Studies 3 and 4 is that it only captures the intent to restrict dietary intake as opposed to the actual behaviour. To measure the latter, studies could use a behavioural measure, such as the bogus taste test. This typically involves providing participants with one or more food items, a series of ratings to complete (e.g., visual attractiveness, taste or smell) in a set time period (e.g., 10 minutes), and informing participants they are free to eat as much of the offered items as they please (Robinson et al., 2017). Consumption or food intake is determined by weighing the food both before and after the bogus taste test. Recent evidence suggests that the bogus taste test is a valid measure of consumption (Robinson et al., 2017). Importantly, it has shown sensitivity to experimental manipulations in previous studies, which includes studies assessing the effect of attentional bias on consumption (Kakoschke, Kemps, & Tiggemann, 2014; Kemps, Tiggemann, & Elford, 2015; Kemps et al., 2014; Nijs, Muris, Euser, & Franken, 2010; Werthmann et al., 2011).

In summary, investigators seeking to extend on the findings obtained in the present studies should consider utilising multiple component measures, such as the PFRS for body dissatisfaction and the bogus taste test for dietary restraint, to enrich the assessment of key study variables.

**Assessment and conceptualisation of the proposed mediation model.** There are several methodological considerations regarding the assessment and
conceptualisation of the proposed mediation model that need to be considered. The first is that the validation of the causality of the proposed mediation model was not based on temporal precedence. Temporal precedence is suggested as the key criterion for a true mediation effect, according to which the independent variable (attentional bias) is assessed at time point 1, the mediator (rumination) is assessed at time point 2, and the dependent variable (body dissatisfaction or dietary restraint) is measured at time point 3. The study by Yang et al. (2015) is the only study, to date, that has demonstrated the causal role of attentional bias in depressive symptoms, via the mediating role of depressive rumination, whilst incorporating temporal precedence. In their study, attentional bias was assessed at baseline, rumination was then assessed four weeks after baseline and, finally, depressive symptoms were assessed eight weeks after baseline. This research suggests that in order for rumination to exert an effect on psychopathology, individuals need some time to become engaged in this process. This lack of time to engage, in the current Study 4 design, may explain why the findings revealed that induced rumination had no influence on eating disorder symptoms. However, to address this issue, future studies should assess the causality of the proposed mediation effect by incorporating temporal precedence.

The studies described in this thesis evaluated the proposed mediation model for body dissatisfaction and dietary restraint only. It is plausible, however, that the proposed mediation model extends to other eating disorder-specific facets. Specifically, given that Study 1 revealed an association between eating disorder-specific rumination and binge eating, and acknowledging previous evidence indicating attentional biases towards body images in women with binge eating disorder (BED) (Svaldi, Caffier, & Tuschen-Caffier, 2011, 2012), it is possible that the proposed mediation model may find more support in the context of binge eating. The importance of investigating the mechanisms underlying binge eating is highlighted by longitudinal evidence showing
that even minor levels of binge eating can lead to reduced quality of life in women (Wade et al., 2012). Moreover, binge eating can lead to the development of bulimia nervosa and BED, which can be characterised by treatment-resistance and are associated with serious physiological complications (Brownley, Berkman, Sedway, Lohr, & Bulik, 2007; Dakanalis & Clerici, 2017; Kessler et al., 2013; Mehler & Rylander, 2015).

Hence, it is suggested that future research seeks to investigate whether attentional bias and rumination may work together to predict other eating disorder symptoms, such as binge eating.

Another way to conceptualise the research problem is to consider alternative mediators in the relationship between attentional bias and eating disorder symptoms. One possibility is negative affect, given the present finding of attentional bias playing a causal role in negative affect and evidence showing that negative affect influences eating disorder symptoms (Polivy & Herman, 2002; Stice, 2001, 2002; Stice et al., 2017). Further, Stice and Shaw (1994) demonstrated that negative affect mediated the relationship between exposure to thin-ideal bodies and bulimic symptoms. Another potential mediator is memory, based on evidence for the mediating effect of recognition memory for thin-ideal images in the relationship between exposure to thin-ideal images and body dissatisfaction (Jiang & Vartanian, 2016). Additionally, a theoretical account proposes that cognitive biases, such as attention and memory, work together to predict depressive symptoms (Everaert, Koster, & Derakshan, 2012). In view of theoretical accounts of eating disorders, which implicate a role for cognitive biases specific to body shape and/or weight related information (Vitousek & Hollon, 1990; Williamson et al., 1999; Williamson et al., 2004), eating disorder-specific rumination (Park et al., 2011), and negative affect (Fairburn et al., 2003; Williamson et al., 2004) in the aetiology of eating disorders, it could be the case that there are multiple mediators in the relation between attentional bias and eating disorder symptoms. Thus, future research should
explore whether single or multiple mediators are most predictive of eating disorder symptoms.

**Study sample characteristics.** The rationale for investigating the mechanisms underlying body dissatisfaction and dietary restraint in young undergraduate women in the present research program is due to their high prevalence in this particular demographic (Eisenberg et al., 2011; Luce et al., 2008; Neighbors & Sobal, 2007; White et al., 2011), evidence showing that even minor levels of these symptoms negatively impact on quality of life (Mond et al., 2013; Wade et al., 2012), and their important role as risk factors in eating disorders (Stice et al., 2017, 2011; Stice & Shaw, 2002). Moreover, these results also serve to inform the potential causal and/or maintenance factors in clinical eating disorders without breaching the ethical consideration of exposing highly vulnerable individuals to increasing negative mood, rumination, and attentional biases (Jansen, 2016; Rieger et al., 2017). Nonetheless, future studies should extend the current findings by attempting to reduce rumination and maladaptive attentional biases in subclinical and clinical eating disorder samples since it cannot be assumed that the pattern of findings obtained in the current research using a community sample of young women extends to those with eating disorders. This type of research could help with the development of effective attention and/or rumination-focused interventions that seek to reduce harmful levels of negative affect and eating disorder symptomatology.

It is possible, however, that the mechanisms of attentional bias and rumination differ according to the specific type of clinical symptomatology. This notion is based on evidence showing distinct attentional patterns and differential effects of rumination across different eating disorder diagnoses. Beginning with research relevant to attentional processes, when viewing other female bodies, some research has found that females with anorexia nervosa (Pinhas et al., 2014) and bulimia nervosa (Blechert et al.,
2009) preferentially attend to thin bodies and/or body regions whereas females with binge eating disorder preferentially attend to non-thin body regions (Svaldi et al., 2011). It is also important to consider whether self-relevant or other body shape and/or weight-related stimuli have greater relevance for a particular clinical diagnosis. For instance, there is evidence for a greater attentional bias towards self-images, compared with other images, in women with anorexia nervosa, whereas the opposite pattern (although non-significant) was demonstrated in women with bulimia nervosa (Blechert, Ansorge, & Tuschen-Caffier, 2010). Similar to women with anorexia nervosa, women with BED have shown a heightened attentional bias towards self-images, relative to other images, compared to women without BED (Sval et al., 2012). In a similar vein, depressive rumination appears to influence different eating disorder symptoms depending on the clinical diagnosis. For example, depressive rumination was shown to exacerbate body dissatisfaction in women with anorexia nervosa and bulimia nervosa (Naumann et al., 2016) but not in women with BED (Svaldi & Naumann, 2014). Furthermore, depressive rumination was shown to increase the desire to abstain from eating in women with anorexia nervosa compared to an increased desire to binge in women with bulimia nervosa (Naumann et al., 2015).

A final but equally important consideration is that one cannot assume that selective attention serves to influence eating disorder symptomatology in individuals with a clinically diagnosed eating disorder via the same mechanism as non-clinical individuals. Perhaps rumination will be more relevant as a mediator in the relation between attentional bias and eating disorder symptoms, in clinical samples compared to non-clinical samples. Taken together, the aforementioned findings suggest that the combined roles of attention and rumination may differ depending on the clinical eating disorder diagnosis, emphasising the need for further investigation.
Concluding Comments

The four studies in this research program collectively highlight the maladaptive role of both attentional bias towards thin-ideal bodies and eating disorder-specific rumination in psychopathology. One particularly important finding was that attentional bias toward thin-ideal bodies was shown to play a causal role in susceptibility for a heightened negative mood, which has been implicated as a vulnerability factor for both depressive and eating disorder symptoms. Thus, selectively attending to thin bodies may serve as a transdiagnostic risk factor for depressive and eating disorder symptoms. In addition, the present research revealed that inducing eating disorder-specific rumination served to increase this maladaptive bias of selectively attending to thin-ideal images. Taken together, these findings suggest that cognitively-focused strategies which target rumination and/or attention may help promote emotional resilience and ultimately reduce the likelihood of developing depression or an eating disorder.
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Appendices

APPENDICES

Appendix A: Body Image-Related Stressor (Studies 3 and 4)

[Instructions] Please imagine how you’d feel and what you would think and do if this situation were to happen to you. You will automatically proceed to the next task after a couple of minutes.

You wake up and slowly start to get ready for the day. You pause at the mirror and sigh. You feel unattractive and fat. You stare at the mirror and can’t help but feel disgusted with yourself. You start to cry. You had promised yourself that you would lose weight within the last month but you haven’t been able to do it. To make matters worse, you are certain that yesterday you overheard someone say that you have put on weight.
Appendix B: Rumination and Distraction Induction Items (Study 4)

[Instructions] For the next few minutes, try your best to focus your attention on each of the ideas which will be presented to you. Read each item slowly and silently to yourself. As you read the items, use your imagination and concentration to focus your mind on each of the ideas. Spend a few moments visualizing each item and write down any thoughts that come to mind during this time. Do not worry about spelling and grammar, just focus on expressing your thoughts. Each item will be presented for one minute before automatically proceeding to the next item.

Rumination items:

1. Why do I have the body shape that I do?
2. Why can’t I handle my eating better?
3. What do other people notice about my body?
4. What are the possible consequences of the way I feel about my weight and shape?
5. Are my weight and shape acceptable to me?
6. How has my appearance affected different aspects of my life?
7. How does my personality influence my eating?
8. What could I do to be more successful at controlling my shape and weight?

Distraction items:

1. Describe in as much detail as you can the layout of the room you are in currently.
2. Think of and list as many possible uses for a coffee mug.
3. Imagine and describe in detail a clown putting on his or her make-up.
4. Explain the shape and structure of the Eiffel Tower.

5. Compare and contrast a tiger and a lion.

6. Visualize and try to explain the expression on the face of the Mona Lisa.

7. List all the animals that you can think of which are brightly coloured.

8. Describe in as much detail as you can the layout of your bedroom.