An investigation of the role of cognitive bias in eating disorders and its relation to difficulties in emotion regulation

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Abstract

Difficulties in emotion regulation contributes to the maintenance of eating disorders and also to the difficulties faced in treatment when tackling behavioural change. The present research investigated factors that influence difficulties in emotion regulation with the aim to understand the relationship between disordered eating and disordered eating behaviours, and these difficulties.

The first study assessed the factor structure of one of the most commonly used measures of emotion regulation in eating disorder research, the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The scale's reliability and validity was examined in terms of its ability to predict eating disorder severity and disordered eating behaviours. Results indicated a shorter version of the scale was the best fit to the data in a sample of young women, as well as showing a better ability to predict eating disorder severity.

The second study investigated the possible mediators of the relationship between emotion regulation difficulties and disordered eating and disordered eating behaviours. Given that cognitive biases (such as memory and interpretation biases) are implicated in the onset and maintenance of depression and anxiety, and that these disorders are highly comorbid with eating disorders, it was predicted that these cognitive biases would also play a role in eating disorders. This study found negative memory biases were related to disordered eating behaviours, however, it was not related to higher levels of eating disorder psychopathology or difficulties in emotion regulation. Negative interpretation bias related to ambiguous scenarios, on the other hand, was associated with higher

levels of disordered eating, disordered eating behaviours, and difficulties in emotion regulation. Bias mediated the relationship between eating disorder severity and difficulties in emotion regulation as well as the relationship between objective binge eating and difficulties in emotion regulation. These relationships were independent of levels of depression and anxiety.

The third study attempted to replicate these findings using a sample with clinical levels of disordered eating symptoms. Our findings indicated that negative interpretation bias does not operate similarly in a sub-clinical sample. Negative bias was related to eating disorder severity, disordered eating behaviours (except exercising and fasting), and difficulties in emotion regulation. There was no evidence of mediation over and above the influence of depression and anxiety. However, once depression and anxiety were removed as covariates, interpretation bias mediated the relationship between disordered eating behaviours and difficulties in emotion regulation.

Given the cross-sectional nature of the preceding two studies, the final study aimed to investigate whether causality could be shown in an experimental design, using cognitive bias modification (CBM) training to reduce negative interpretation bias and, therefore, symptoms of disordered eating, and difficulties in emotion regulation. The study was conducted in a sample of women who reported clinical symptoms of an eating disorder. The design was a randomized controlled trial, comparing a positive training paradigm, used previously to decrease cognitive biases related to negative self-beliefs, compared to neutral training. Findings indicated no difference between groups on any outcome measure. However, there was a reduction in eating psychopathology and negative

affect, and significant improvements in confidence to recover from an eating disorder and weight satisfaction across both conditions.

In summary, this research has contributed to a better understanding of the relationship between difficulties in emotion regulation and disordered eating, and in particular the possible mediating role of interpretation bias. However, future research needs to establish causality, before implications for interventions can be explored. Discussion for future directions in research that can progress this agenda is outlined.

Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Glossary of Abbreviations [1]

AST-D	-	Ambiguous Scenarios Test for Depression
AST-D-II	-	Ambiguous Scenarios Test for Depression - Parallel Version
BMI	-	Body mass index
CBM	-	Cognitive bias modification
CBM-A	-	Cognitive Bias Modification for Attention
CBM-I	-	Cognitive bias modification for interpretation
CBT	-	Cognitive Behaviour Therapy
CFA	-	Confirmatory factor analysis
DASS-21	-	Depression, Anxiety and Stress Scale – Short Form
DBT-E	-	Dialectical Behaviour Therapy for Eating Disorders
DERS	-	Difficulties in Emotion Regulation Scale
DSM-5	-	Diagnostic and Statistical Manual of Mental Disorders, 5th Edition
EDE-Q	-	Eating Disorder Examination – Questionnaire
OSFED	-	Other specified feeding and eating disorders
PANAS	-	Positive and Negative Affect Scale
PANAS-X	-	Positive and Negative Affect Scale – Expanded Version
SRT	-	Similarity Rating Test
VAS	-	Visual analogue scale

[1] Glossary of abbreviations used within the text only.

Chapter 1.

Overview and Aims of the Research

Of all psychiatric syndromes, eating disorders account for the highest number of inpatient hospitalisations, suicide attempts, and mortalities (Harris & Barraclough, 1998; Sullivan, 1995; Thompson et al., 2004). Eating disorders are classified into four main types; Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, and Other Feeding and Eating Disorders (American Psychiatric Association, 2013). Diagnostic features of anorexia nervosa include three essential components: persistent energy intake restriction; an intense fear of gaining weight or becoming fat, or persistent behaviour that interferes with weight gain; and a disturbance in self-perceived weight or shape. Bulimia nervosa also has three essential diagnostic features: recurrent episodes of binge eating; recurrent inappropriate behaviours to prevent weight gain; and self-evaluation that is unduly influenced by body shape and weight. In addition, in order to meet diagnosis, the binge eating must occur, on average, at least once a week for three months. Binge Eating Disorder diagnostic features include recurrent episodes of binge eating that must occur, on average, a minimum of once per week for three months. Other feeding and eating disorders (OSFED), is a diagnosis which was created to capture clinically severe eating disorders which do not meet criteria for the latter types and where symptoms cause clinically significant distress. (American Psychiatric Association, 2013).

Lifetime prevalence rates indicate 0.9 - 2.2% of women experience anorexia nervosa at some point in their life, 1.5 - 4.6% experience bulimia nervosa, and 0.6 – 3.5% binge eating disorder (Wade, Keski-Rahkonen, &

Hudson, 2011). Lifetime prevalence estimates for an eating disorder using population based studies can be considered as relatively low compared to mood disorders which are estimated to be 15.0% and anxiety disorders 26.3% (Australian Bureau of Statistics, 2009). These low rates can be attributed to those with an eating disorder tending to not report symptoms of their illness resulting in under reporting, and the lack of empirically supported research which evaluates the full spectrum of disordered eating, including those who fall in the residual diagnostic category (Hoek, 2006; Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011; Wade, Bergin, Tiggemann, Bulik, & Fairburn, 2006). Across the various epidemiological studies, it is estimated between 8.7% and 15.9% of women will suffer from a clinically significant eating disorder in their lifetime (Wade, Keski-Rahkonen, & Hudson, 2011).

The severe impact of eating disorders is demonstrated through elevated rates of suicide, medical complications, mortality and comorbidity (Ackard, Richter, Egan, Engel, & Cronemeyer, 2014; Crow et al., 2009; Hudson, Hiripi, Pope, & Kessler, 2007; Mitchell & Crow, 2006; Preti et al., 2009; Steinhausen & Weber 2009). Mortality risk and elevated risk of suicide exist across eating disorder diagnoses with crude mortality rates being 4.0% for anorexia nervosa, 3.9% for bulimia nervosa and 5.2% for the residual category (Crow et al., 2009). Predictors for a poorer outcome and an increased risk of mortality in those with anorexia nervosa include older age and low body mass index (BMI) at first presentation, alcohol abuse, and the presence of other comorbid disorders such as depression or anxiety (Arcelus, Mitchell, Wales, & Nielsen, 2011). Mortality rates are often attributable to the medical complications associated with both anorexia nervosa and bulimia nervosa. In anorexia nervosa, complications often

occur as a direct result of malnutrition and weight loss. These can include gastrointestinal problems, a low heart rate which can result in cardiac arrest, osteoporosis, and neurological problems which may lead to permanent impairment (Westmoreland, Krantz, & Mehler, 2016). In bulimia nervosa mortality rates are elevated due to severe electrolyte and acid base alterations which can occur as a result of vomiting or purging behaviours. Excessive vomiting and laxative abuse can lead to potassium deficiency and metabolic-alkalosis which can lead to cardiac disease and subsequent death (Westmoreland et al., 2016).

Along with the significant impact an eating disorder has on the quality of life of sufferers, the economic and social cost is substantial. In 2012 it was estimated the cost of eating disorders in Australia was $69.7 billion (National Eating Disorders Collaboration, 2015). In comparison, the estimated social and economic cost of other serious mental illnesses such as depression, anxiety, psychotic disorders, and bipolar disorder is $56.7 (National Mental Health Commission, 2016). In addition to the high cost of treatment, presentation rates for treatment for eating disorders are notoriously low (Johnson, Cohen, Kasen, & Brook, 2002), and for those who do attend, less than half make a full recovery (Steinhausen & Weber 2009).

A substantial amount of research in eating disorders is being conducted in the areas of prevention and treatment. This research is informed by the identification of risk factors that are predictive of the onset and maintenance of eating disorders to enable the identification of high-risk individuals as well as

assisting clinicians to design, implement, and evaluate suitable prevention and treatment programs.

A body of empirical findings indicate negative affect as being one of the most robust risk factors for the development of an eating disorder (Jacobi & Fittig, 2010; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012). Negative affect is a construct which includes the experience of negative moods and feelings such as depression and anxiety (Watson & Clark, 1984), and is thought to underlie many emotional disorders (Stanton & Watson, 2014). A number of theories postulate that difficulties in emotion regulation is one of the key mechanisms of action within the general construct of negative affect (Fairburn, Cooper, & Shafran, 2003; Schmidt & Treasure, 2006). Emotion regulation can be defined as the awareness, understanding, and acceptance of emotions, and the ability to control impulsive or unhelpful behaviours when experiencing negative emotions (Gratz & Roemer, 2004). Unhelpful emotion regulation strategies include avoidance or suppression of emotions, rumination, impulsivity, poor problem solving skills, and an inability to tolerate distress (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007).

Emotion regulation is included as a key target in one of the most robust eating disorder treatments, an enhanced version of cognitive behaviour therapy (Fairburn, 2008; Fairburn et al., 2009). This treatment includes a transdiagnostic form of cognitive behavioural therapy (CBT) and was developed to be able to treat the full range of clinical eating disorders in adults (Fairburn et al., 2003). A key component of the treatment aims to modify disordered eating cognitions and

behaviours by addressing mood intolerance, perfectionism, low self-esteem and interpersonal difficulties. While 60% of people undergoing a broad form of CBT that addresses complex psychopathology have good outcomes (Fairburn et al., 2009), there is still considerable work to be done to improve outcomes for this group. Therefore, research that identifies factors that hinder treatment and investigate whether these factors, if changed, can reduce symptoms related to disordered eating, can help progress impact of current interventions. Although the current research does not directly address these issues, it does represent a step toward informing mechanisms which underlie the maintenance of difficulties in emotion regulation in eating disorders.

It is hypothesised that difficulties with emotion regulation maintain the eating disorder as well hinder behavioural change addressed in treatment. These difficulties regulating emotions when faced with intense mood states lead to disordered eating behaviours (e.g., vomiting, dieting, binge eating), eventually becoming an habitual method of coping, rather than using functional methods of coping (Fairburn et al., 2003). One unique contribution of this research will be the testing of a cross-sectional multivariate model of emotion regulation difficulties in those with eating disorders. The aim will be to identify the mechanisms which contribute to difficulties in emotion regulation which could ultimately lead to the development of suitable treatments which target reducing emotion regulation difficulties in eating disorders, and help identify high-risk individuals.

A possible underlying maintaining mechanism of emotion regulation difficulties is cognitive bias where systematic errors in how one appraises or

interprets a situation influence the behavioural or emotional reaction. Cognitive biases have been shown to be relevant in other emotional disorders and have been linked to emotion regulation difficulties. This research will use cognitive bias modification (CBM) training to attempt to modify bias, in order observe the impact on disordered eating, disordered eating behaviours, and on a range of important clinical features of disordered eating, including motivation to recover from an eating disorder, weight and shape satisfaction, negative affect, and difficulties in emotion regulation.

Throughout this research the relationships between the key variables of interest and both the cognitive and behavioural components of an eating disorder: eating disorder psychopathology (i.e., eating disorder cognitions), and disordered eating behaviours, will be investigated. The definition of a good outcome in the treatment of eating disorders is a reduction in both the cognitive and behavioural aspects of the disorder (Bardone-Cone et al., 2010; Williams, Watts, & Wade, 2012). By evaluating these two components separately we can assess and evaluate any findings and better inform current and potential treatment paradigms.

Therefore, the main aim of the current research was to further investigate difficulties in emotion regulation in eating disorders and disordered eating behaviours, and attempt to find out more about factors that influence these difficulties. More specifically, the current research investigated factors known to maintain depression and anxiety, specifically cognitive biases, to ascertain if these same biases are related to difficulties in emotion regulation, and see how they related to symptoms of disordered eating and disordered eating behaviours.

In order to address these aims, the thesis is organised in the following manner. **Chapter 2** provides a review of current research surrounding difficulties in emotion regulation, and how these difficulties play a role in the maintenance of the disorder. This chapter will also provide a review of factors known to maintain depression and anxiety, specifically cognitive biases, and discuss current knowledge surrounding how these biases operate in eating disorders.

Chapter 3 provides an analysis of the factor structure of one of the most commonly used measures of emotion regulation in eating disorder research – the Difficulties in Emotion Regulation Scale (DERS) established by Gratz and Roemer (2004). Examination of the scale and its relation to disordered eating in a young female sample (N = 486) will help inform the reliability and validity of this measure and to examine its ability to predict eating disorder severity and disordered eating behaviours.

Chapter 4 explores negative memory and interpretation biases, emotion regulation difficulties, eating disorder severity, and disordered eating behaviours in a young female university sample (N = 181). Memory biases for words containing emotional content was measured using a 60-word recall task (Neshat-Doost, Moradi, Taghavi, Yule, & Dalgleish, 1999). Negative interpretation bias was measured using the Ambiguous Scenarios Test for Depression (AST-D; Berna, Lang, Goodwin, & Holmes, 2011), which contains 24 ambiguous scenarios. Relationships between memory biases, interpretation biases and emotion regulation were investigated, including the potential mediating role of interpretation bias in the association between disordered eating and emotion regulation.

Chapter 5 was a replication of the study outlined in Chapter 4, however, this time using a sample (N = 81) with clinically significant levels of disordered eating. In addition, this sample was compared to the non-clinical sample described in Chapter 4.

Chapter 6 explores the efficacy of cognitive bias modification training in reducing negative interpretation bias, difficulties in emotion regulation, symptoms of disordered eating, and negative affect in a sample of women (N = 83) who experience clinical symptoms of an eating disorder. The ability of the training to increase motivation to recover from an eating disorder, and weight and shape satisfaction (key correlates of an eating disorder) will also be assessed. Cognitive bias modification training will be conducted using a training paradigm used in a recent study investigating cognitive biases surrounding negative self-beliefs in eating disorders.

Chapter 7 discusses the research in the context of the main aims of this thesis and discusses the limitations and broader implications for future research such as the development of novel approaches to cognitive bias modification paradigms relevant to eating disorders.

It should be noted that this research thesis is part of a Doctor of Philosophy (Clinical Psychology) which is 69% of the size of a Doctor of Philosophy thesis. In accordance with Flinders University policy, this research thesis comprises publications (accepted or submitted) as separate chapters that are formatted in the same way as the other chapters in the thesis (i.e. not presented as reprints). Chapters 3 and 4 have been published in peer reviewed journals, and

Chapter 6 has been submitted to a journal for peer review. The reprint of the published papers are presented in the Appendices.

Chapter 2.

Introduction and Literature Review[2]

2.1. Overview and Aims

The aim of the present chapter is to set the context for the research conducted over the PhD candidature by reviewing the literature in the areas of difficulties in emotion regulation and discuss how these difficulties are implicated in the maintenance of disordered eating. First, a definition of difficulties in emotion regulation is provided, including its key components, followed by a discussion of the measure used to assess this complex construct throughout this research. This is then followed by a discussion of emotion regulation difficulties across psychopathology, followed by a summary of the theories that postulate difficulties in emotion regulation plays a key role in disordered eating. This will be followed by a review of the literature showing difficulties in emotion regulation to be associated with disordered eating. Cognitive biases will be hypothesised as potential mediators of the relationship between disordered eating and difficulties in emotion regulation given the role of cognitive bias in other emotional disorders such as depression and anxiety (which are commonly comorbid with eating disorders), and the evidence to date implicating cognitive bias in eating disorders. The way one recalls and interprets a situation may affect their capacity to regulate emotions. It is possible the association between

[2] Parts of this chapter have been published [Cooper, J.L., O'Shea, A. E., Atkinson, M.J., & Wade, T.D. (2014). Examination of the Difficulties in Emotion Regulation Scale and its relation to disordered eating in a young female sample. *International Journal of Eating Disorders*, 47(6), 630-639; Cooper, J.L. & Wade, T.D. (2015). The relationship between memory and interpretation biases, difficulties with emotion regulation, and disordered eating in young women. *Cognitive Therapy and Research*, 39, 853-862; Modifying cognitive bias for interpretation in women with clinical levels of eating disorder symptoms: A randomised controlled trial. Submitted *Cognitive Therapy and Research*].

disordered eating and difficulties with emotion regulation is influenced by cognitive bias. More specifically, this research aims to explore the possibility that both negative memory biases and negative interpretation biases mediate the relationship between eating psychopathology and difficulties with emotion regulation.

While there is currently no definitive evidence to suggest that emotion regulation difficulties exist prior to the onset of an eating disorder, there is firm evidence showing that those with different types of eating disorders experience emotion regulation difficulties than people without disordered eating. Hence, the main hypothesis to be investigated is that the relationship between severity of eating psychopathology and difficulties with emotion regulation are mediated by memory biases and interpretation biases (see Figure 2.1). The model does recognise that the presence of emotion regulation difficulties can then maintain eating psychopathology.

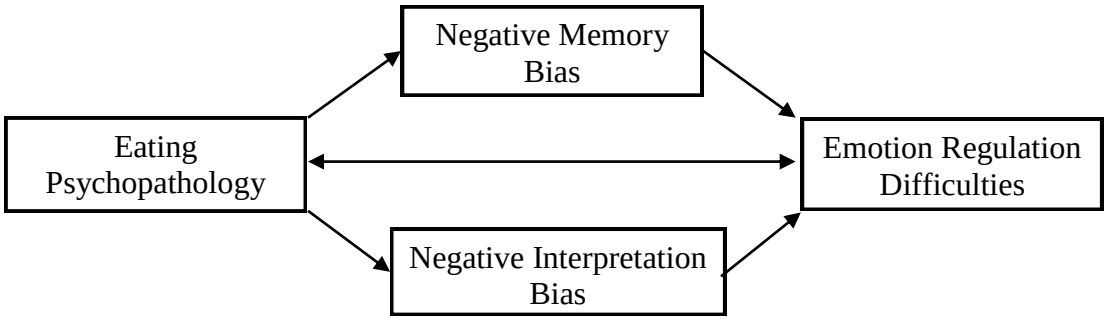

Figure 2.1. Proposed model of mediation.

2.2. Definition of Emotion Regulation

Emotion regulation can be regarded as a broad construct which can be defined in a number of ways. According to Gross (2013), emotion regulation is

an intrinsic and extrinsic process, operating on a continuum ranging from implicit, unconscious, and automatic responses, to explicit, conscious, and controlled regulation. For the purpose of this study, emotion regulation will be defined as an awareness, understanding, and acceptance of emotions, and the ability to control impulsive or unhelpful behaviours when experiencing negative emotions, ensuring appropriate behaviour in accordance with one's goals. It is the ability to use appropriate and flexible emotion regulation strategies to modulate emotional responses/reactions desirably in order to meet situational demands or personal goals (Gratz & Roemer, 2004). The absence of any or all of these abilities indicates difficulties in emotion regulation or indicates emotion regulation dysfunction (Gratz & Roemer, 2004).

Throughout this research, the multidimensional construct of emotion regulation will be measured by the Difficulties in Emotion Regulation Scale (DERS) created by Gratz and Roemer (2004), which is the most commonly utilised measure of emotion regulation in the literature. The DERS is a comprehensive measure which includes six dimensions of theoretical and empirical relevance to eating disorders, including: (a) non-acceptance of negative emotional responses; (b) difficulties engaging in goal directed behaviour when distressed; (c) difficulties controlling impulsive behaviours when distressed; (d) lack of emotional awareness representing the lack of attention to and acknowledgement of negative emotions; (e) limited access to effective emotion regulation strategies; and (f) lack of emotional clarity. The DERS is commonly used in eating disorder research.

2.3. Difficulties in Emotion Regulation across Psychopathologies

Difficulties with emotion regulation can lead to problems coping with everyday life and can cause intense emotional suffering due to dysfunctional attempts to deal with painful negative emotions (Haynos & Fruzzetti, 2011). Research in recent years has also indicated difficulties regulating emotions plays a key role in a broad range of psychological disorders. In terms of the association between different emotion regulation strategies across different psychopathologies (anxiety, depression, eating, and substance-related disorders), the largest effect sizes exist for rumination, avoidance, problem solving, and suppression (Aldao et al., 2010). For example, there is a substantial amount of evidence that shows difficulties in emotion regulation is a core construct underlying Borderline Personality Disorder, where sufferers experience deficits in all areas of emotion regulation (Gratz & Gunderson, 2006; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006). A key characteristic and diagnostic criterion of Borderline Personality Disorder is deliberate self-harm, with self-harm being conceptualised as being an emotion regulation strategy (Gratz & Gunderson, 2006). The current treatment of choice for Borderline Personality Disorder is Dialectical Behaviour Therapy which focusses on distress tolerance and strategies such as acceptance and distraction techniques (Linehan & Dexter-Mazza, 2008).

Depression is often conceptualised as a consequence of emotion regulation difficulties (Gross & Muñoz, 1995; Hollon & Shelton, 2001), and there are a number of studies that indicate depressed individuals have difficulties accepting emotions, tend to avoid emotions, and lack the ability use effective emotion regulation strategies, resulting in the maintenance of depressive symptoms. In addition, the suppression of emotions has also been shown to increase depressive symptoms (Aldao et al., 2010; Campbell-Sills, Barlow,

Brown, & Hofman, 2006; Joormann & Gotlib, 2009). Research also indicates the use of effective emotion regulation strategies predicts recovery (Arditte & Joormann, 2001).

In anxiety, deficits in emotion regulation can result in difficulties coping with reactions to fear, leading to avoidance behaviours and subsequent maintenance of symptoms with the individual not having the opportunity to learn more functional methods of coping (Cisler, Olatunji, Feldner, & Forsyth, 2010). Similarly with post-traumatic stress disorder, difficulties coping with reactions to fear result in the individual avoiding triggers, preventing functional exposure to trauma cues. In addition, symptom severity in post-traumatic stress disorder has been associated with a range of emotion regulation difficulties including a lack of emotional acceptance and clarity, impulsivity, and an inability to engage in effective regulation strategies (Tull, Barrett, McMillan, & Roemer, 2007).

2.4. Theoretical Overview of Emotion Regulation in Eating Disorders

A number of theories postulate difficulties with emotion regulation as being one of the key maintaining factors in eating disorders. According to Fairburn, Cooper and Shafran (2003) in the transdiagnostic model of eating disorders, it is one of four important maintaining processes, and creates difficulties in implementing behaviour change in treatment. They postulate that difficulty coping with intense mood states (both positive and negative) can result in disordered eating behaviours (vomiting, laxative use, excessive exercise, and dieting) which then becomes an habitual, and powerful method of coping and avoiding strong emotion. Instead of accepting the emotion and dealing with it in a functional way in order to modulate mood, individuals with an eating disorder

engage in behaviours such as binge eating or purging that provide them with immediate but temporary, short term relief. Engaging in these behaviours also reduces their awareness of the triggering mood state and neutralises it. According to Fairburn et al. (2003), difficulties in emotion regulation is a common mechanism that is involved in the persistence of all clinical eating disorders (i.e., anorexia nervosa, bulimia nervosa, and binge eating).

Difficulties coping with intense or negative mood states also play a key role in the cognitive model of bulimia nervosa (Cooper, Wells, & Todd, 2004), where binge eating is said to act as a distraction from emotional distress. This theory postulates binge eating is preceded by the activation of negative self-beliefs (e.g., "I am unlovable", "I am worthless"), expressed as negative automatic thoughts resulting in emotional distress such as anxiety or depression. Bingeing or purging occurs which provides short term relief with the process of eating and the preoccupation with food that occurs during a binge eating episode, providing a distraction from these negative emotions.

The three factor model of bulimia nervosa highlights the confluence of perfectionism, body dissatisfaction and low self-efficacy in predicting bulimic symptoms (Bardone-Cone, Abramson, Vohs, Heatherton, & Joiner Jr, 2006). This model describes a three-way interaction where individuals who are perfectionists and experience low self-efficacy experience strong negative mood when they encounter dissatisfaction with their weight and shape. In the context of doubting their abilities to achieve their desired weight, they are at an increased risk of experiencing negative mood which is then relieved via binge eating and/or purging.

In addition, the interpersonal model of binge eating (Wilfley, MacKenzie, Welch, & Ayres, 2007), also posits binge eating is an attempt to cope with negative feelings. This theory posits difficulties with social functioning results in the individual experiencing low self-esteem and negative mood, which then triggers binge eating which is employed as a coping mechanism providing short term relief from negative feelings (for a review see Pennesi & Wade, 2016).

Of note, many of the abovementioned theories posit maladaptive behaviours such as binge eating provide relief from negative emotions, and this has been supported by a vast amount of research. However, it can be argued that negative affect increases following episodes of binge eating (for a review see Haedt-Matt & Keel, 2011). A meta-analysis of ecological momentary assessment studies which examine the daily experiences, behaviour and psychological states of those with bulimia nervosa or binge eating disorder in their natural environments, indicate negative affect is an antecedent to binge eating, which supports a number of prominent eating disorder theories, however, results also suggest negative affect increases following binge eating rather than decreasing (Haedt-Matt & Keel, 2011). This method of research involves momentary ratings and repeated assessments over time is able to identify temporal antecedents and consequences of binge eating and is considered to be preferable over retrospective self-report measures (Haedt-Matt & Keel, 2011). Ultimately, although these studies do not fully support prominent eating disorder theories, they confirm the key role negative affect plays in disordered eating.

Schmidt and Treasure's (2006) cognitive-interpersonal maintenance model for anorexia nervosa combines intra- and interpersonal maintenance

factors. They postulate experiential avoidance to be one of four key maintaining factors. The other three maintaining factors include pro-anorectic beliefs, perfectionism and obsessive-compulsive traits, and unhelpful responses elicited from close others. However, the model has a particular focus on experiential avoidance of emotions, emotional memories, and intimate relationships. It is argued that avoidance is a typical coping response when someone with anorexia nervosa has difficulty coping with intense emotions. This leads to the avoidance of situations that might result in experiencing or expressing those emotions. Environments are therefore screened for threatening cues and, if necessary, avoided. This includes personal relationships which trigger strong emotions. This does not allow the person to test out their hypotheses about what may happen when emotion is strong, or to test their coping ability, and thus avoidance strengthens fear of strong or intense emotion.

The functional model of emotion avoidance in anorexia nervosa (Wildes, Ringham, & Marcus, 2010) posits eating psychopathology in anorexia nervosa functions to help individuals avoid both negative and positive emotional states. Symptoms of depression and anxiety are said to produce increased levels of avoidance which leads to greater symptom severity as a means of emotion regulation when experiencing negative emotions.

Whilst there are many theories based on cognitive aspects of the maintenance of disordered eating, specific emotions are not outlined (Fox & Power, 2009). Fox and Power (2009) postulate eating disorders are maintained by both avoidance of emotion (via disordered eating behaviours), and by directing painful emotions onto the body, usually in the form of self-disgust or shame.

They argue that anger and disgust are key emotions, and the eating disorder itself inhibits the experience of emotions within the self (Fox et al., 2012).

In summary, the role of difficulties in emotion regulation in eating disorders has strong theoretical grounding, recognized as being central to the maintenance of disordered eating across many theories that guide the development of interventions for eating disorders. A major overlap across the different theories is the understanding that difficulties with emotion regulation are a key characteristic of people with eating disorders, and that avoidance of strong emotion is a commonly utilised emotion regulation strategy. This avoidance is often powerfully accomplished by disordered eating. These relationships are also supported by a substantial amount of research. The research supporting the theoretical perspectives is discussed below.

2.5. Eating Disorders and Difficulties in Emotion Regulation - Review of the Literature

Research across a number of studies, summarised in Table 2.1, has shown that people with eating disorders lack the skills to effectively cope with negative affective states, and instead of responding to negative affect in adaptive ways, they respond by restricting, bingeing and/or purging, or excessive exercising, which provides short term distraction from the experience of strong emotions (Fairburn et al., 2003; Peñas-Lledó, Vaz Leal, & Waller, 2002; Smyth et al., 2007).

Research indicates those with an eating disorder have difficulties accepting emotions, particularly negative emotions, and tend to avoid emotions (Corstorphine et al., 2007; Haynos & Fruzzetti, 2011; Racine & Wildes, 2013;

Svaldi et al., 2012). In a study which included 72 women with an eating disorder diagnosis, results showed that the clinical sample showed significantly higher levels of emotional avoidance compared to healthy controls, and this avoidance was associated with unhealthy eating attitudes (Corstorphine et al., 2007). A meta-analysis has also shown that both avoidance and acceptance were associated with disordered eating, and, these strategies were also associated with maladaptive emotion regulation strategies such as rumination and suppression (Aldao et al., 2010).

Studies have also reported individuals with eating disorders express high levels of emotional intensity, and less emotional awareness and clarity, in addition to a decreased use of, and access to, adaptive emotion regulation strategies such as problem solving or cognitive reappraisal (Danner, Sternheim, & Evers, 2014; Harrison, Sullivan, Tchanturia, & Treasure, 2009; Sim & Zeman, 2005; Svaldi et al., 2012; Whiteside et al., 2007). Svaldi et al. (2012) found that compared to healthy controls, a disordered eating sample exhibited lower acceptance of emotions, less emotional awareness and clarity, reported more emotion regulation difficulties, and difficulties using functional emotion regulation strategies. This study also found that difficulties in emotion regulation are not linked to a particular diagnostic category, suggesting these difficulties are a transdiagnostic risk and/or maintenance factor.

Although difficulties with emotion regulation are evident across eating disorder subtypes, research suggests these difficulties may function differently depending upon subtype. Results, however, are mixed with some studies suggesting those with anorexia nervosa experience more difficulties with

emotional awareness and clarity compared to those with bulimia nervosa (Bydlowski et al., 2005; Gilboa-Schechtman, Avnon, Zubery, & Jeczmien, 2006), and other research failing to find such differences (Harrison, Sullivan, Tchanturia, & Treasure, 2010; Svaldi et al., 2012). More recently, a single study has found that eating disorder subtypes did not differ in most domains of emotion regulation with the exception of binge eating disorder where less severe emotion regulation difficulties were evident (Brockmeyer et al., 2014). In addition, this study found the binge-purge subtype of anorexia nervosa was associated with greater impulse control difficulties compared to the restricting subtype of anorexia nervosa. These findings largely support the notion that emotion regulation difficulties are transdiagnostic across the spectrum of eating disorders, and some subtypes may experience more difficulties in certain areas of emotion regulation. Understanding these differences enables the refinement of existing eating disorder treatments and inform new and developing treatments. In addition, as eating disorders are commonly comorbid with other emotional disorders such as depression and anxiety, which are also characterised by emotion regulation dysfunction, further investigating these difficulties provides the opportunity to develop more efficient therapies that target more than one disorder.

While a substantial amount of theoretical and empirical work has focussed on investigating emotion regulation strategies that are considered adaptive (e.g., acceptance, cognitive reappraisal) or maladaptive (e.g., avoidance, rumination, suppression), few studies have investigated what maintains emotion regulation difficulties in eating disorders and hence maintaining the disorder itself (Aldao & Nolen-Hoeksema, 2012). Treatment and research in eating disorders has mainly focussed on the effects of cognitive restructuring of dysfunctional

thoughts and its implementation in treatment rather than aiding the ability to tolerate and effectively regulate emotional arousal (Haynos & Fruzzetti, 2011). A recent meta-analysis which quantified the impact of negative and positive mood on eating behaviour, found that negative mood induction was associated with increased food intake across eating disorder groups (Cardi, Leppanen, & Treasure, 2015). These findings were more pronounced in participants with binge eating disorder, and restrictive eaters, and suggests difficulties regulating emotions is the mechanism which underlies this effect. These findings suggest that treatments that promote the development effective regulation and coping strategies may be effective in dealing with intense emotions and therefore decreasing disordered eating.

Studies have shown that compared to healthy controls, those with eating disorders have more self-reported emotion regulation problems (Svaldi et al., 2012). Harrison and colleagues (2009; Harrison, Sullivan, et al., 2010) found women with anorexia nervosa reported significantly more emotion regulation difficulties than healthy controls, and in a later study found that those recovered from anorexia nervosa showed no differences in emotion regulation compared to healthy controls (Harrison, Sullivan, et al., 2010). However, one other study has shown that healthy controls had significantly better emotion regulation than both those with anorexia nervosa and those recovered (Brockmeyer et al., 2012), therefore, it is unclear whether emotion regulation difficulties are a result of the disorder or a pre-dispositional trait. Studies which can inform evidence about causality are limited (see Table 2.1), with the one longitudinal study that exists suggests that once an eating disorder is established, difficulties with emotion regulation can impact on eating disorder symptoms (Racine & Wildes, 2015).

Therefore, for the purpose of this research, a conservative stance will be taken and emotion regulation will be interpreted as a consequence of disordered eating rather than as a cause of eating disorders, but it is recognised that difficulties with emotion regulation can then influence disordered eating where it is present.

Table 2.1.

Summary of relevant cross-sectional and longitudinal studies investigating emotion regulation difficulties in eating disorders

Author(s)	Measure of Emotion Regulation	Study Design	Findings
Aldao, Nolen-Hoeksema, & Schweizer, 2010	Various*	Meta Analysis	Disordered eating is associated with avoidance, lack of problem solving, rumination and suppression.
Brockmeyer, Grosse Holtforth, Bents, Kammerer, Herzog, & Friederich, 2012	DERS	Cross-sectional	Emotion regulation difficulties evident in recovered anorexia nervosa
Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007	Distress Tolerance Scale (designed by authors)	Cross-sectional	Eating disorders are associated with higher levels of avoidance compared to healthy controls
Danner, Sternheim, & Evers, 2014	Emotion Regulation Questionnaire	Cross-sectional	Difficulties with emotion regulation (including suppression) were evident across all eating disorder sub-types
Harrison, Sullivan, Tchanturia & Treasure, 2009	DERS	Cross-sectional	Compared to healthy controls, those with anorexia nervosa showed higher levels of emotion regulation difficulties, and these difficulties were associated with difficulties recognising emotion
Harrison, Sullivan, Tchanturia & Treasure, 2010	DERS	Cross-sectional	Emotion regulation difficulties evident across all eating disorder sub-types

Note: DERS = Difficulties in Emotion Regulation Scale

Table 2.1. continued

Summary of relevant cross-sectional and longitudinal studies investigating emotion regulation difficulties in eating disorders

Author(s)	Measure of Emotion Regulation	Study Design	Findings
Harrison, Tchanturia, & Treasure, 2010	DERS	Cross-sectional	No evidence of difficulties in emotion regulation in recovered eating disorder group
Manuel & Wade, 2013	DERS	Cross-sectional	Negative memory bias mediated the relationship between eating disorder diagnostic status and difficulties in emotion regulation
Racine & Wildes, 2013	DERS	Cross-sectional	Awareness and impulsivity (sub-scales within the DERS), were associated with anorexia nervosa and predicted eating psychopathology
Racine & Wildes, 2015	DERS	Longitudinal	Difficulties with emotion regulation predicted change in anorexia nervosa symptom severity
Sim & Zeman, 2005	The Emotion Expression Scale for Children The Children's Emotion Management Scale	Cross-sectional	Awareness and dysfunctional regulation strategies were found to be mediators of body dissatisfaction and symptoms of bulimia nervosa in adolescents

Note: DERS = Difficulties in Emotion Regulation Scale

Table 2.1. continued

Summary of relevant cross-sectional and longitudinal studies investigating emotion regulation difficulties in eating disorders

Author(s)	Measure of Emotion Regulation	Study Design	Findings
Svaldi, Grepenstroh, Tuschen-Caffier & Ehring, 2012	DERS Emotion Regulation Questionnaire	Cross-sectional	Disordered eating groups reported higher levels of emotion intensity, lower acceptance, awareness, clarity and use of regulation strategies compared to healthy controls, with no significant differences between eating disorder sub-types
Whiteside, Chen, Neighbors, Hunter, Lo & Larimer, 2007	DERS	Cross-sectional	Difficulties in emotion regulation accounted for unique variance in binge eating over and above key risk factors (i.e., gender, over-evaluation of weight and shape).

Note: DERS = Difficulties in Emotion Regulation Scale. * Various measures include: Acceptance and Action Questionnaire; Anger Expression Inventory; Anger Expression Scale; Behavioral Anger Response Questionnaire; Cognitive Behavioral Avoidance Scale; Cognitive Emotion Regulation Questionnaire; Coping with Health Injuries and Problems; Coping Index; Coping Inventory for Stressful Situations; Cope Inventory; Children's Response Styles Scale; Coping Strategy Inventory; Coping Styles Questionnaire;; Difficulties in Emotion Regulation Questionnaire; Emotional Approach Coping Questionnaire; Experiential Avoidance Scale; Emotional Control Questionnaire; Emotion Regulation Questionnaire; Interpersonal Problem Solving Questionnaire; Pediatric Anger Expression Scale III; Problem-Solving Inventory; Rumination Inventory; Rumination on Sadness; Rumination Reflection Questionnaire; Ruminative Response Scale; Response Styles Questionnaire; Revised Ways of Coping Checklist; Scott–McIntosh Rumination Index; Social Problem-Solving Inventory; State–Trait Anger Expression Inventory; State–Trait Anger Expression Inventory 2; Silencing the Self Scale; Temperament and Character Inventory; White Bear Suppression Inventory; Ways of Coping Questionnaire; Young–Rygh Avoidance Inventory.

2.6. Cognitive bias as a Potential Mediator of Difficulties in Emotion Regulation in Eating Disorders

Appraisal theories of emotion posit that it is the way one appraises or interprets a situation, not the situation itself, which determines the emotional response (Siemer, Mauss, & Gross, 2007), and it is suggested that bias in information processing, such as attention, memory or interpretation, underlie difficulties in emotion regulation (Joormann & D'Avanzato, 2010). Cognitive biases have been shown to be one of the underlying mechanisms of many psychiatric illnesses, including depression and anxiety. Research indicates emotional disorders are typically characterised by negative biases in attention, memory, and interpretation, and theory suggests these biases activate dysfunctional emotional and behavioural responses (Woud & Becker, 2014). Prominent cognitive theories also posit the processing of negatively valenced information plays a key role in the development and maintenance of these emotional disorders (Beck, 2008; Beck, Emery, & Greenberg, 2005; Mathews & MacLeod, 2005; Teasdale, 1985).

There is a wide breadth of literature available which examines maintaining factors in depression and anxiety. Given the strong associations between eating disorders, depression, and anxiety, it could be hypothesised that the same biases observed to maintain depression and anxiety also maintain disordered eating. Depression is commonly comorbid with eating disorders (Braun, Sunday, & Halmi, 1994), and shares genetic risk factors with eating disorders (Wade, Bulik, Neale, & Kendler, 2000). Negative affect, a construct which includes the experience of negative moods and feelings such as depression

and anxiety (Watson & Clark, 1984), is thought to underlie many emotional disorders and is considered to be one of the strongest risk factors for disordered eating (Jacobi & Fittig, 2010; Stanton & Watson, 2014). Thus, negative affect is considered to be a transdiagnostic factor across a number of emotional disorders (Watson & Clark, 1984). Given the causal association between negative affect and eating disorders, as well as the commonly observed comorbidity between depression, anxiety and eating disorders, it is possible that the same biases that are implicated with the maintenance of depression and anxiety (e.g., negative memory and interpretation bias) could also play a key role in eating disorders, above and beyond the contribution of any current symptoms of depression and anxiety.

Teasdale's (1985) theory of differential activation postulates that depressed mood leads to negative memory biases in information processing, resulting in a tendency to elaborate on more negative information compared to positive information. There have been a number of studies investigating negative memory biases in depression (e.g., Burt, Zembar, & Niederehe, 1995; Ellis, Beevers, & Wells, 2011; Matt, Vázquez, & Campbell, 1992), with a general consensus that depressed individuals have better recall of negative stimuli (e.g., sad and angry faces) over positive stimuli (e.g., happy faces), whereas non-depressed individuals display a significant memory bias for positive stimuli (Ellis et al., 2011; Gilboa-Schechtman, Erhard-Weiss, & Jeczemien, 2002). These findings have been consistent across both clinical and sub-clinical populations (for a review see Matt et al., 1992). Evidence for memory bias in anxiety disorders is less robust, however, research indicates memory biases for threat-relevant information exist, particularly in panic disorder where there is a

propensity to recall more threatening words compared to non-threatening words (for reviews see Coles & Heimberg, 2002; MacLeod & Mathews, 2004).

Studies have also investigated negative interpretation bias in depressed and anxious individuals and it is argued that interpretation bias maintain these disorders (Beard & Amir, 2010; Butler & Mathews, 1983; Constans, Penn, Ihen, & Hope, 1999; MacLeod & Cohen, 1993; Mogg, Bradbury, & Bradley, 2006; Wisco & Nolen-Hoeksema, 2010). A negative interpretation bias is the tendency to interpret ambiguous or neutral information as being negative rather than positive or benign, and a number of studies provide evidence this type of bias as a maintaining factor in depression and anxiety (see Beard & Amir, 2010; Butler & Mathews, 1983; Constans et al., 1999; MacLeod & Cohen, 1993; Mogg et al., 2006; Wisco & Nolen-Hoeksema, 2010). Depressed individuals are more likely to interpret ambiguous stimuli in a negative manner (Mogg et al., 2006; Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002), and anxious individuals are more likely to interpret ambiguous stimuli as threatening resulting in increased anxiety when exposed to every-day stressors (Beard & Amir, 2010; Constans et al., 1999). Biases in interpretations, therefore, are often congruent with emotional concerns. This bias is argued to maintain these emotional disorders where the interpretation of ambiguity influences both mood and behaviour (Hirsch, Meeten, Krahe, & Reeder, 2016). Socially anxious individuals tend to interpret ambiguous interpersonal or social events more negatively when compared to non-anxious individuals (Constans et al., 1999), and in addition, continue to interpret social events negatively even when the event goes well which ultimately fuels avoidance (Hirsch et al., 2016). In panic disorder, individuals tend to interpret benign bodily sensations as a sign of impending physical or mental catastrophe,

which then leads to an increase in anxiety followed by further negative interpretations (Hirsch et al., 2016).

Cognitive models of eating disorders also posit attention, memory, and interpretation biases play a key role in the maintenance of disordered eating, with errors in information processing resulting in habitual and automatic behaviours and cognitions such as body dissatisfaction, dietary restraint, or excessive exercise (for a review see Cooper, 2005; Siep, Jansen, Havermans, & Roefs, 2011). A number of studies support these models with a large amount of research indicating attention biases for food, body, weight, shape and appearance stimuli, in both clinical and sub-clinical populations (Brooks, Prince, Stahl, Campbell, & Treasure, 2011; Cooper, 1997; Dobson & Dozois, 2004; Rieger et al., 1998; Rosser, Moss, & Rumsey, 2010; Shafran, Lee, Cooper, Palmer, & Fairburn, 2007; Smeets, Roefs, van Furth, & Jansen, 2008; Veenstra & de Jong, 2012).

Much of the eating disorder research investigating memory biases has focused on food, weight, appearance, or disorder related stimuli with the exception of one study to date which investigated memory bias for emotional content (see Lee & Shafran, 2004; Manuel & Wade, 2013; Williamson, Muller, Reas, & Thaw, 1999). Memory biases are evident in both clinical and sub-clinical populations with a number of studies indicating recall for negative food, weight, shape or disorder salient words is increased compared to controls, however, findings are mixed with memory biases more prominent in those with anorexia nervosa (for a review see Brooks et al., 2011). A study which looked at memory bias for shape/weight related words found those with being eating disorder retrieved significantly less positive valenced shape/weight words (e.g.,

gracile, attractive) compared to overweight controls without binge eating disorder (Svaldi, Bender, & Tuschen-Caffier, 2010). A recent study also found participants high in disordered eating, showed poorer recall accuracy compared to participants with low levels of disordered eating, however, this deficit was not specific to any target words. Stimuli included food related words (e.g., cream, bacon), body related words (e.g., chubby, plump) and control words matched on length and frequency. Although the high disordered eating participants evidence poorer overall recall accuracy, this deficit disappeared for food target words, with these participants recalling food target words better than neutral and appearance related words (Fenton & Ecker, 2015). The latter study supports previous research which indicates memory bias for food related words in a sample of women high in dietary restraint. In this study, women in the high restraint group recalled more forbidden food words (e.g., pastry) than control words such as 'dolphins'(Israeli & Stewart, 2001).

To date, research into interpretation biases in eating disorders is comparatively sparse. Studies have demonstrated an increased interpretation of ambiguous situations as being negative and related to appearance in both clinical and sub-clinical populations (Cooper, 1997; Jackman, Williamson, Netemeyer, & Anderson, 1995; Rosser et al., 2010; Williamson, Perrin, Blouin, & Barbin, 2000). For example, people who are preoccupied with weight or shape concerns, tend to interpret ambiguous situations in a manner congruent with their concerns (Jackman et al., 1995). Jackman et al. (1995) found that when compared with women with low weight concern, women high in weight concern recalled their imagery of ambiguous body related situations with a negative interpretation. They suggest these findings indicate biased interpretation of ambiguous body

related stimuli may function to maintain weight concerns. The limited studies available do suggest that interpretation bias is evident in eating disorders, however, there is little research available investigating whether these biases in interpretation exist for ambiguous situations that are unrelated to appearance.

Although limited, existing research has shown an interpretation bias pertaining to ambiguous situations related to having a negative meaning for the self was associated with disordered eating (Cooper, 1997), independent of depression and anxiety (Cooper & Cowan, 2009). There is also evidence that negative interpretation bias pertaining to negative self-beliefs influences disordered eating behaviours and associated cognitions (Yiend, Parnes, Shepherd, Roche, & Cooper, 2014). Using a sub-clinical sample, Yiend et al. (2014) was successful in manipulating interpretation bias which resulted in a reduction in negative thoughts triggered by tasks related to weighing and mirror exposure, and was successful in improving symptoms of anxiety and depression. An additional study found evidence of negative interpretation bias for ambiguous social situations in patients with anorexia nervosa. However, manipulation of interpretation bias did not impact on eating disorder symptoms, but it did result in a reduction in symptoms of anxiety (Cardi, Esposito, et al., 2015).

There is limited research available which investigates the relationship between cognitive bias and emotion regulation in eating disorders, however, there is evidence that cognitive biases, such as memory bias for words with negative emotional content, and attention bias for social stimuli (male and female angry and neutral faces), are related to difficulties in emotion regulation in disordered eating populations (Harrison, Sullivan, et al., 2010; Manuel & Wade, 2013).

Harrison et al. (2010) found that in a clinical disordered eating sample, an attentional bias to social stimuli predicted difficulties in emotion regulation. Attentional bias is the propensity to look for and attend to certain stimuli (negative or positive). There is also preliminary evidence that memory bias mediates the relationship between diagnostic status (anorexia nervosa versus healthy controls) and difficulties in emotion regulation. This study investigated memory bias for negative trait adjectives (e.g., lonely, unpleasant) and found that negative memory bias was significantly related to difficulties in emotion regulation, and acted as a mediator, suggesting that this bias is a potential maintaining factor for emotion regulation difficulties in eating disorders (Manuel & Wade, 2013).

Further investigations are needed to establish whether negative memory and interpretation biases unrelated to appearance or food are experienced by those with an eating disorder, and ascertain whether these biases are implicated in the maintenance of disordered eating via their relationship with difficulties in emotion regulation. It is also necessary to further investigate the relationship between these biases and eating disorder psychopathology.

2.7. Measures of Memory and Interpretation Bias

There are a number of measures available that are used to assess both memory and interpretation biases. Memory biases can be assessed using memory recall and recognition tasks such as a 60-word memory recall test (Neshat-Doost et al., 1999) where sixty words (20 positive traits e.g., “friendly”; 20 negative traits e.g., “lonely”; and 20 neutral words semantically similar e.g., “budgie”) are presented. Following presentation of the words, participants are asked complete a

filler task. Once the filler task is completed, participants are given a limited period of time to write down as many words as they can recall. Scores are calculated by subtracting the number of positive trait adjectives from the number of negative trait adjectives, therefore, controlling for individual differences in memory performance. Memory for emotionally valenced stimuli such as faces can also be used in memory bias research. A series of faces with negative, neutral or positive expressions are presented on a computer screen. Following the presentation participants are then presented with the same faces previously presented along with an equal number of new faces. Participants are required to indicate whether each face has been previously presented (Gilboa-Schechtman et al., 2002; Harvey, Bodnar, Sergerie, Armony, & Lepage, 2009). The percentage of correct recognitions for positive, neutral, or negative faces recalled can be used to establish whether a bias exists. For example, a higher percentage of correct recognitions for sad faces (negative stimuli) versus smiling faces (positive stimuli) suggests a negative memory bias.

There are a number of measures available to assess interpretation bias. The Interpretation Questionnaire (Amin, Foa, & Coles, 1998; Butler & Mathews, 1983) comprises 22 ambiguous scenarios with three interpretations of each scenario – positive, negative and neutral. Participants are provided with a list of possible interpretations and are then asked to rank order how likely each of the interpretations would come to mind if they were in that situation. The Interpretation Questionnaire takes some time to both complete and score. The Scrambled Sentences Test (Wenzlaff & Bates, 1998) asks participants are to unscramble sentences using five of the six words that are displayed to form a grammatically correct and meaningful statement (e.g., bright looks future dismal

very the) which can be unscrambled to indicate a positive (e.g., the future looks very bright), or negative interpretation (e.g., the future looks very dismal). This test is often accompanied by a cognitive load task designed to prevent socially desirable responses (e.g., Rude et al., 2002). Homophones (Mathews, Richards, & Eysenck, 1989) are also used where participants are presented via audio recordings of words (with both negative and neutral meanings) which sound the same but have different meanings, e.g., die and dye, or liar and lyre. Participants are asked to write the word down and bias is measured by the number of negative words written down compared to neutral words. Researchers have also created their own measures of interpretation bias, most commonly by creating a series of vignettes which have an ambiguous interpretation and participants are either asked to select the most relevant interpretation from list provided or create their own which are then rated (e.g., Wisco & Nolen-Hoeksema, 2010).

The Similarity Rating Test (SRT) developed by Mathews and Mackintosh (2000) contains a number of scenarios which remain ambiguous in terms of a positive or negative outcome. The scenarios are followed by four interpretations of each scenario (positive or negative interpretation, and a positive and negative foil). Participants are then asked to indicate the level of similarity between the provided interpretations and the original ambiguous scenario. The highest similarity rating for the particular interpretation indicates direction of bias. For example, high ratings for the positive interpretation suggest a positive interpretation bias. The SRT is often used in conjunction with cognitive bias modification for interpretation (CBM-I) training paradigms (discussed in detail in section 2.8), and is a valid and reliable measure of interpretation bias (Salemink & van den Hout, 2010).

The research presented in this thesis will use the Ambiguous Scenarios Test for Depression (AST-D) which contains 24 ambiguous scenarios, (Berna et al., 2011). The AST-D was developed for use in depressed populations and the measure contains a series of ambiguous situations that allow either a positive or a negative outcome interpretation (e.g., "You give a speech at a friend's wedding. When you have finished, you observe the audience's reaction", "It's New Year's Eve. You think about the year ahead of you"), where a positive interpretation or negative interpretation is possible (e.g., for the first example scenario, it could be that the audience applauds appreciatively [positive interpretation], or that the audience is bored and no one applauds you [negative interpretation]). The scenarios are designed to be relevant to depressed populations where the scenarios depicting every-day encounters or events have been shown to be interpreted more negatively by depressed individuals compared to non-depressed individuals (Berna et al., 2011). Because of the high comorbidity with eating disorders and depression it is possible that scenarios will be viewed similarly and, therefore, be an adequate measure of interpretation bias. Each of the 24 scenarios are presented individually on a computer screen and participants are instructed to form a mental image of each scenario and imagine each scenario happening to them personally. Participants are then instructed to follow the first image that comes to mind and not to think too much about them. Participants then rate how pleasant their mental image is (pleasantness rating) and how vivid the image is (vividness rating). Higher scores on the pleasantness rating indicate a more positive interpretation, and low scores indicate a less pleasant or negative interpretation. High scores of vividness are indicative of a more vivid or clear mental image and are assessed in order to control for differences in imagination as

in previous research (Berna et al., 2011). Two 15-item parallel short versions of the AST have also been developed (AST-D-II; Berna et al., 2011; Rohrbacher & Reinecke, 2014) which enables researchers conducting experimental research to measure existing biases prior to any interventions. It is also a reasonably quick measure to complete and easy to score. The AST-D-II is a robust measure of interpretation bias which has been shown to detect changes in bias in previous CBM-I research (Berna et al., 2011; Rohrbacher, Blackwell, Holmes, & Reinecke, 2014; Rohrbacher & Reinecke, 2014).

2.8. Manipulation of Cognitive Bias in Eating Disorders

If cognitive bias does mediate the relationship between disordered eating and emotion regulation, and emotion regulation can, in turn, influence the level of disordered eating, then manipulation of cognitive bias can potentially have an impact on levels of both variables. Testing this would also add to the sparse literature that informs causality between these variables.

As outlined above, it is well established in depression and anxiety research that cognitive biases such as bias for attention, memory, and interpretation exist and play a key role in the maintenance of these emotional disorders. These biases are accompanied by a variety of dysfunctional cognitions which ultimately result in dysfunctional behavioural and/or emotional responses which perpetuate symptoms. Researchers, therefore, have examined the causal nature of these biases resulting in the development and study of cognitive bias modification (CBM) paradigms such as cognitive bias modification for attention (CBM-A) and CBM-I. Research in this area continues to progress since its inception in 2000 (Woud & Becker, 2014), and an increasing number of studies

are being published, however, questions still remain on the degree to which CBM can modify bias and reduce symptomatology (Menne-Lothmann et al., 2014).

There are few studies which target biases in memory (Koster & Bernstein, 2015). Memory bias training involves participants being asked to memorise a series of words that are positive and negative, followed by the completion of a distraction task. Participants are then shown word fragments of the previously encoded words. Positive training involves the presentation of only the fragmented positive words, and negative training involves the presentation of only the fragmented negative words (see Vrijsen et al., 2014). Recall of more positive words over negative valenced suggests a memory bias for positive stimuli.

The most widely used CBM training paradigm is cognitive bias modification for interpretation (CBM-I) with the most common type being the ambiguous situations paradigm (Menne-Lothmann et al., 2014). This paradigm manipulates the interpretive bias by training the individual to interpret an ambiguous scenario in either a positive or negative manner, inducing the desired bias. Common training paradigms include word completion tasks which require participants to read a series of ambiguous scenarios and then complete a word fragment which resolves the ambiguity of the scenario in a manner conducive to the desired interpretation. After completion of the word fragment participants are asked a comprehension question that reinforces the interpretation (Mathews & Mackintosh, 2000). This technique has been shown to successfully activate the desired bias when faced with real-life ambiguous scenarios, and is used in depression and anxiety research, often to establish causality (Hallion & Ruscio,

2011; Koster, Fox, & MacLeod, 2009; Yiend, Lee, et al., 2014). CBM techniques have the potential not only to investigate the causal nature of cognitive biases, but they also allow researchers to investigate the effects of bias manipulation on symptoms, with the ultimate aim to inform existing prevention and treatment paradigms.

A recent meta-analysis investigated the efficacy CBM-I training on interpretation bias and mood (Menne-Lothmann et al., 2014). Results indicated positive CBM-I training increased positive interpretations and decreased negative mood, however, these effects did not consistently differ from the no-training or neutral training control conditions. Of interest, results from this analysis also indicated females tended to benefit more from benign CBM-I, and that participants who had a more negative interpretation bias reported significant and large increases in positive interpretations, suggesting gender and level of bias act as moderators and may contribute to mixed findings in the literature (Menne-Lothmann et al., 2014; Micco, Henin, & Hirshfeld-Becker, 2014). Findings from another meta-analysis suggest CBM-I is effective in modifying biases and reducing symptoms of depression and anxiety. However, this reduction in symptoms was only reliable when participants experienced a stressor (Hallion & Ruscio, 2011). Overall, these two meta-analyses suggest that CBM-I may have the potential to manipulate bias, however, further research is needed to refine this paradigm.

The majority of CBM research focusses on depressed and anxious populations. Research using CBM techniques in eating disorders is in its infancy, with recent studies focussing on manipulating interpretation biases which focus

on appearance related themes, or social rejection (Aspen et al., 2015; Cardi, Esposito, et al., 2015; Martijn, Vanderlinden, Roefs, Huijding, & Jansen, 2010; Premo, Sarfan, & Clerkin, 2015). Two studies have recently use gone on to research designs that can better inform causality in relation to interpretation biases of ambiguous scenarios unrelated to appearance. The first study (Yiend, Parnes, et al., 2014) focussed on manipulating interpretation bias related to negative beliefs about the self. The study indicated that for a sub-clinical population, a modified version of CBM-I which targeted negative self-beliefs, was successful in manipulating the interpretation of ambiguous stimuli pertaining to negative self-beliefs, and influenced disordered eating behaviours and associated cognitions. Compared to the negative CBM training group, those in the positive training group showed a significant reduction in negative thoughts triggered by tasks related to weighing and mirror exposure, and significant improvements in symptoms of anxiety and depression. In addition, negative training led to increased dietary restraint. The second study, a case series of 28 patients with anorexia nervosa, found that five sessions of positive interpretation training resulted in fewer negative interpretations of ambiguous social situations depicting the risk of rejection, an increase in positive interpretations of ambiguous social stimuli, and a reduction in anxiety (Cardi, Esposito, et al., 2015). However, there was no impact on eating disorder symptoms. Therefore, while the evidence suggests that manipulation of bias can influence emotion, the evidence showing that interpretation biases of ambiguous scenarios unrelated to appearance can lead to disordered eating remains weak and further studies are needed. In addition, no studies to date have examined the impact of CBM-I on important clinical correlates of eating disorders such as difficulties in emotion regulation.

2.9. Summary and Orientation to the Thesis Aims

In summary, difficulties in emotion regulation is a hallmark feature of disordered eating based on sound theoretical grounding and supported by research. Few studies, however, have investigated models that describe how disordered eating maintains these difficulties, which then also influence the disorder itself. Due to the comorbidity between eating disorders and depression and anxiety, it is reasonable to suggest the same factors that maintain depression and anxiety may also play a key role in the maintenance of disordered eating. Cognitive biases such as memory and interpretation biases play a key role in these disorders and as such, may also play a role in eating disorders.

The following research aims to investigate difficulties in emotion regulation in eating disorders and disordered eating, and to investigate factors that contribute to the maintenance of eating disorders via their relationship with difficulties in emotion regulation. As a first step towards these aims, the following chapter (Chapter 3), examines the DERS and provides an analysis of its factor structure and its relation to disordered eating in a young female sample. Chapter 3 will help inform the reliability and validity of this measure and its ability to predict eating disorder severity and disordered eating behaviours.

Chapter 3.

Examination of the Difficulties in Emotion Regulation Scale[3]

3.1. Overview

A body of empirical findings has grown indicating negative affect as being one of the most robust risk factors for the development of an eating disorder (Jacobi & Fittig, 2010; Svaldi et al., 2012). A number of theories postulate difficulties with emotion regulation to be one of the key specific mechanisms of action within the more general construct of negative affect (Fairburn et al., 2003; Schmidt & Treasure, 2006). These different theories suggest that difficulties coping with intense mood states can result in disordered eating behaviours which then become a habitual way of coping with, and managing, difficult emotion (Fairburn et al., 2003).

As interest and research in this area grows, it is important to have a valid and reliable measure that has been shown to adequately assess difficulties with emotion regulation. The most commonly used measure in the eating disorder literature is the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), a comprehensive measure which includes several dimensions of theoretical and empirical relevance to eating disorders, including: (a) non-acceptance of negative emotional responses; (b) difficulties engaging in goal directed behaviour when distressed; (c) difficulties controlling impulsive behaviours when distressed; (d) lack of emotional awareness representing the lack of attention to and acknowledgement of negative emotions; (e) limited access to

[3] This chapter has been published in the *International Journal of Eating Disorders* [Cooper, J.L., O'Shea, A.E., Atkinson, M.J., & Wade, T.D. (2014). Examination of the difficulties in emotion regulation scale and its relation to disordered eating in a young female sample. *International Journal of Eating Disorders,* 47(6), 630-639], and is provided in Appendix C

effective emotion regulation strategies; and (f) lack of emotional clarity. The DERS is commonly used in eating disorder research, with various studies indicating eating disorder severity and behaviours are associated with difficulties with emotion regulation. In addition, difficulty with emotion regulation has been found across all eating disorders, suggesting it represents a transdiagnostic risk and/or maintenance factor (see Brockmeyer et al., 2012; Gianini, White, & Masheb, 2013; Harrison et al., 2009; Harrison, Sullivan, et al., 2010; Svaldi et al., 2012; Whiteside et al., 2007).

While the six factor structure of the DERS has been shown to be a good fit in adult non-clinical samples and both adolescent clinical and non-clinical samples (e.g., Gratz & Roemer, 2004; Neumann, van Lier, Gratz, & Koot, 2010; Perez, Venta, Garnaat, & Sharp, 2012), a more recent investigation has indicated a five-factor structure may more accurately represent the construct of emotion regulation in non-clinical samples, with omission of the 'Awareness' subscale (Bardeen, Fergus, & Orcutt, 2012). This is consistent with a number of investigations showing this subscale to have the most modest correlations with the other subscales of the DERS (*r*s = -.12-.74) where correlations amongst the other five subscales range from .39 to .77 (Bardeen et al., 2012; Gratz & Roemer, 2004; Neumann et al., 2010; Perez et al., 2012). It has been argued that it was the intention of Gratz and Roemer (2004) that the DERS assess dimensions of emotion regulation, and as such, each dimension or subscale should intercorrelate (Bardeen et al., 2012). Further investigation of the factor structure of the DERS, and the relation of this construct to variables of relevance to disordered eating, would be a useful addition to the literature.

Therefore, the first aim of the current study was to examine the factor structure of the DERS in young females in the community and indicators of the reliability and validity of this structure. The second aim was to examine the relation of the best fitting structure to variables of relevance to disordered eating. In particular, we were interested in which factors of the DERS were most strongly related to different aspects of disordered eating. The extant literature indicates that for some clinical samples, some factors of the DERS account for more variance than others in behaviours of interest. For example, research has shown that the subscale measuring limited access to effective emotion regulation strategies accounted for greater variance in a non-suicidal self-harming adolescent population above and beyond other aspects measured by the DERS (Perez et al., 2012).

3.2. Method

3.2.1. Participants

Baseline data from two different samples of young women were examined for use in the current study (N = 569): undergraduate students from Flinders University, and high school students from four South Australian schools. All participants aged 26 years or older were excluded from the analyses (n = 50) in order to examine a population in which disordered eating may commonly occur. In addition, for the Confirmatory Factor Analysis (CFA), all cases with missing data on the DERS were removed (n = 33) resulting in a final number of 486 participants aged 17 to 25 years (M age = 18.4 years, SD = 1.65). Ethnicity was reported with 79.6% of the combined sample being of Australian descent, 10.9% of Asian descent, and the remaining endorsed ‘other’.

3.2.2. Measures

3.2.2.1. Difficulties in Emotion Regulation Scale (DERS).

The DERS (Gratz & Roemer, 2004) is a 36-item self-report measure which assesses six dimensions of emotion regulation: lack of emotional awareness (Awareness), lack of emotional clarity (Clarity), difficulties controlling impulsive behaviours when distressed (Impulsivity), difficulties engaging in goal directed behaviours when distressed (Goals), non-acceptance of negative emotional responses (Non-Acceptance), and limited access to effective emotion regulation strategies (Strategies). Each item begins with the phrase, "When I'm upset…", and is rated on a five-point Likert scale ranging from *almost never* to *almost always*, with high scores representing increased difficulties with emotion regulation. The 36-item DERS demonstrates high internal consistency, $\alpha = .93$ (Gratz & Roemer, 2004), as do each of the subscales, α: non-acceptance= .90, goals= .86, impulsivity= .92, awareness= .85, strategies= .92, and clarity= .81 (Perez et al., 2012).

3.2.2.2. Eating Disorder Examination-Questionnaire (EDE-Q).

Eating disorder severity was assessed using the global score from the EDE-Q (Fairburn & Beglin, 1994). The global score consists of the summation of the four subscales, weight concern, shape concern, eating concern, and dietary restraint. Each item is assessed on a 7 point scale, with higher scores indicating greater levels of eating disorder severity. High concurrent validity between the EDE-Q and the Eating Disorder Examination has been demonstrated (Fairburn & Beglin, 1994). The EDE-Q also demonstrates high internal reliability with alphas

ranging from.70 to.93, and good convergent and predictive validity (Berg, Peterson, Frazier, & Crow, 2012).

Disordered eating behaviours which are included in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013) were also assessed using the EDE-Q, including the number of episodes over a period of 28 days of objective binges episodes (overeating associated with a loss of control); self-induced vomiting; laxative use; driven or compulsive exercise and fasting. This latter item from the dietary restraint subscale asked, "*Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?*". The items were standardised, then added together to form a total measure of the number of disordered eating episodes. High convergent validity has been demonstrated between the compensatory behaviours subscales of the EDE-Q and the interview-based EDE (*r*s = .90 - .92), and moderate convergent validity (*r*s = .37 - .55) for objective binge episodes (Berg, Peterson, Frazier, & Crow, 2011).

3.2.2.3. Negative affect.

This was calculated using either the five items assessing sadness within the Positive and Negative Affect Scale – expanded version (PANAS-X; Watson & Clark, 1999) or the seven items assessing depression from the Depression, Anxiety and Stress Survey short form (DASS-21; Lovibond & Lovibond, 1995a). With respect to the PANAS-X, participants were asked to indicate to what extent they experience these emotions and/or feelings "in the past week". Responses rated from 1 (*very slightly*) to 5 (*extremely*), with higher scores indicating high levels of positive or negative affect. The five items assessing sadness were,

'sad', 'alone', 'blue', 'lonely', and 'downhearted'. Internal reliability for the sadness subscale has been reported as ranging from α = .86 to α = .89 in a range of populations both clinical and non-clinical (Watson & Clark, 1999).

The depression subscale of the DASS-21 utilised a 7-item, Likert-type scale from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*), with higher scores indicating higher levels of depression, anxiety or stress. Participants were asked to indicate how much the statements applied to them over the past week. Sample items for depression included, "*I couldn't seem to experience any positive feeling at all*", and, "*I felt I had nothing to look forward to*". It has been demonstrated the DASS-21 has good internal reliability, α =.94 for depression (Antony, Bieling, Cox, Enns, & Swinson, 1998). In order to form one depression/sadness scale score that could be used in the analyses, scores on both questionnaires were standardised.

3.2.3. Procedure

Participants completed the measures either online or on paper. Both samples completed the DERS, and the EDE-Q, while the DASS-21 was completed by university students and, the PANAS-X by high school students. The PANAS-X was used in this latter population as it aimed to replicate a previous study which used the PANAS-X. Height and weight was also reported so that body mass index (BMI) could be calculated. Approval for these studies was received from the Flinders University Social and Behavioural Research Ethics Committee, the Catholic Education Office, and the principals of the schools involved.

3.2.4. Statistical Analyses

A CFA was conducted on the DERS using Version 20 of AMOS (IBM SPSS). Missing values were replaced using the expectation maximization method which is preferred over mean substitution. The overall model of fit was judged on the basis of the following fit indices: Root Mean Square Error or Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), Non-normed Fit Index (NNFI), and the Chi-Square/degree of fit ratio (CMIN/DF). In line with previous recommendations, (Bentler, 1990; Bentler & Bonett, 1980; Dehon, Weems, Stickle, Costa, & Berman, 2005; Schreiber, Nora, Stage, Barlow, & King, 2006), *a priori* indications of good (RMSEA $\leq$ 0.6, and CFI, NFI, and NNFI all $\geq$ 0.9) and excellent fit (RMSEA $<$ 0.6, and CFI, NFI, and NNFI all $\geq$ 0.95) were chosen. Remaining analyses were conducted using IBM Statistical Package for the Social Sciences, Version 20 (IBM SPSS). Pearson correlations were used to evaluate the strength and direction of the linear relationship between the subscales of the DERS and the EDE-Q global scale and the disordered eating behaviours. Hierarchical multiple regressions were conducted to assess the predictive abilities of the DERS and its subscales after controlling for BMI and depression/sadness. In addition, logistic regressions were also conducted to assess the predictive ability of the DERS models on assessing high levels of disordered eating and disordered eating behaviours in a young female sample.

3.3. Results

3.3.1. Preliminary Analyses

All variables were examined for normality by assessing the shape of the distribution as recommended for large samples sizes by Tabachnick and Fidell (2007) and results indicated that all variables were normally distributed. Little's

missing completely at random test was non-significant ($\chi^2(726)=784.305$, $p= .07$), indicating that data were missing at random. An independent-samples t-test was conducted to compare scores on all variables between the two samples (high school students and undergraduates). Undergraduates scored significantly higher than high school students on three measures: the global EDE-Q score ($M = 2.80$, $SD = 1.49$ and $M = 2.25$, $SD = 1.56$ respectively), $t(462) = 3.45$, $p = .001$; the DERS ($M = 2.84$, $SD = .68$ and $M = 2.53$, $SD = .59$ respectively), $t(475) = 4.984$, $p < .001$; and BMI ($M = 22.55$, $SD = 5.0$ and $M = 20.78$, $SD = 2.9$ respectively), $t(444) = 4.639$, $p < .001$. The magnitude of the differences in the means was associated with small effect sizes (Cohen's d) ranging from 0.32 to 0.46. Given these differences existed, additional hierarchical multiple regressions were conducted so that interaction terms with the two sample types could be tested.

3.3.2. Confirmatory Factor Analysis

The 6-factor 36-item first order model recommended by Gratz and Roemer (2004) and encapsulated in the scoring of the DERS was evaluated first. All factors were allowed to correlate, with each individual item allowed to load upon only one factor. Table 3.1 summarises the items and standardised factor loadings from the CFA. Fit indices indicated that the model was not a good fit to the data (Table 3.2). As six items had relatively low item-total correlations (1, 7, 20, 22, 24, 34) an alternative model was examined whereby these six items were removed to form six subscales with a minimum of three items per subscale (Table 3.1). The model fit improved and met the set indications of good fit, a significant improvement to the original 36-item model (Table 3.2). However, modification indices indicated a small number of items shared a correlated uniqueness that is

not accounted for by the model including: 14 with 19; 16 with 15; 21 with 25; 30 with 31; 27 with 32. It is theoretically feasible that these unexplained relationships unaccounted for by the model may be a result of: (a) the items following each other in sequential order in the questionnaire resulting in a response bias whereby the response to one question/item influences the response to the following item; (b) the items being similar in wording and/or meaning; or (c) the items tap into more than one construct as they are multidimensional.

We then tested a 5-factor, 30-item model with the 'Awareness' subscale removed. Table 3.2 shows that while the model fit improved, it did not meet the set indications of good fit. As five items (1, 7, 20, 22, 24) had relatively low loadings (<.50), an alternative 5-factor model was examined whereby the low-loading variables were removed, retaining 25 items, forming five subscales with a minimum of three items per subscale. The model fit improved significantly from the original 30-item model, however, did not meet the set indications of good fit (Table 3.2). The modification indices indicated a small number of items shared a correlated uniqueness that is not accounted for by the model, including: 14 and 19; 16 and 15; 21 and 25; 27 and 32; 30 and 31; 28 with 31; and 35 with 36. Overall, the 30-item 6-factor model (see Figure 3.1) was considered the best fit. Therefore, the remaining analyses examine and contrast both the reliability and validity of the original six factor 36-item model and the six factor 30-item model.

Table 3.1.

Items, Standardised Confirmatory Factor Analysis Squared Multiple Correlations and Factor Loadings on the 36 Item Six Factor and 30-Item Six Factor Models for the Difficulties in Emotion Regulation Scale (DERS) for the whole sample

Factor	Item	R^2		Loading	
		36-Item DERS	30-Item DERS	36-Item DERS	30-Item DERS
1. Impulsivity	27. When I'm upset, I have difficulty controlling my behaviours	.71	.71	.84	.84
	32. When I'm upset, I lose control over my behaviours	.74	.71	.86	.86
	14. When I'm upset, I become out of control	.77	.77	.88	.88
	19. When I'm upset, I feel out of control	.76	.76	.87	.87
	24. When I'm upset, I feel like I can remain in control of my behaviours	.02	-	.14†	-
	3. I experience my emotions as overwhelming and out of control	.43	.43	.66	.66
2. Awareness	6. I am attentive to my feelings	.57	.55	.76	.74
	8. I care about what I am feeling	.55	.58	.74	.76
	10. When I'm upset, I acknowledge my emotions	.56	.55	.75	.75
	2. I pay attention to how I feel	.61	.64	.78	.80
	34. When I'm upset, I take time to figure out what I'm really feeling	.24	-	.49	-
	17. When I'm upset, I believe that my feelings are valid and important	.35	.32	.59	.56
3. Goals	26. When I'm upset, I have difficulty concentrating	.76	.76	.87	.87
	13. When I'm upset, I have difficulty getting work done	.71	.71	.84	.84
	18. When I'm upset, I have difficulty focusing on other things	.73	.73	.86	.86
	20. When I'm upset, I can still get things done	.03	-	.16	-
	33. When I'm upset, I have difficulty thinking about anything else	.63	.63	.80	.80

Note: † = non-significant

Table 3.1. continued

Items, Standardised Confirmatory Factor Analysis Squared Multiple Correlations and Factor Loadings on the 36 Item Six Factor and 30-Item Six Factor Models for the Difficulties in Emotion Regulation Scale (DERS) for the whole sample

Factor	Item	R^2		Loading	
		36-Item DERS	30-Item DERS	36-Item DERS	30-Item DERS
4. Non-Acc	25. When I'm upset, I feel guilty for feeling that way	.71	.71	.84	.84
	21. When I'm upset, I feel ashamed with myself for feeling that way	.74	.74	.86	.86
	29. When I'm upset, I become irritated with myself for feeling that way	.71	.71	.84	.84
	12. When I'm upset, I become embarrassed for feeling that way	.61	.61	.78	.78
	23. When I'm upset, I feel like I am weak	.47	.47	.68	.68
	11. When I'm upset, I become angry with myself for feeling that way	.64	.64	.80	.80
5. Clarity	4. I have no idea how I am feeling	.66	.65	.81	.80
	9. I am confused about how I feel	.59	.59	.77	.77
	5. I have difficulty making sense out of my feelings	.77	.80	.88	.90
	7. I know exactly how I am feeling	.14	-	.37	-
	1. I am clear about my feelings	.11	-	.32	-

Note: Non-Acc = non-acceptance

Table 3.1. continued

Items, Standardised Confirmatory Factor Analysis Squared Multiple Correlations and Factor Loadings on the 36 Item Six Factor and 30-Item Six Factor Models for the Difficulties in Emotion Regulation Scale (DERS) for the whole sample

Factor	Item	R^2		Loading	
		36-Item DERS	30-Item DERS	36-Item DERS	30-Item DERS
6. Strategies	22. When I'm upset, I know that I can find a way to eventually feel better	.06	-	.24	-
	28. When I'm upset, I believe there is nothing I can do to make myself feel better	.72	.71	.85	.85
	16. When I'm upset, I believe that I'll end up feeling very depressed	.69	.69	.83	.83
	35. When I'm upset, it takes me a long time to feel better	.54	.54	.73	.73
	31. When I'm upset, I believe that wallowing in it is all I can do	.52	.52	.72	.72
	36. When I'm upset, my emotions feel overwhelming	.55	.55	.74	.74
	15. When I'm upset, I believe that I will remain that way for a long time	.70	.69	.83	.83
	30. When I'm upset, I start to feel very bad about myself	.58	.58	.76	.76

Table 3.2.

Confirmatory Factor Analyses –Model Fit Comparisons

Model #	Model	RMSEA	CFI	NFI	NNFI (TLI)	CMIN	DF	CMIN (DF) DIFFERENCE
1	6 Factor 36 items correlated	.08	.86	.82	.84	2454.248	579	
1a	6 Factor 30 items as above low loading items (i.e.,<.50) removed	.06	.93	.89	.92	1172.371	390	1281.877 (189)*
2	5 Factor 30 items Correlated	.08	.88	.85	.87	1616.827	395	
2a	5 Factor 25 item low loading items (i.e.,<.50) removed	.08	.92	.90	.91	988.491	265	628.336 (130)*

Note: RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; NFI = Normed Fit Index; NNFI = Non-normed Fit Index; CMIN/DF = Chi-square/degree of fit ratio. * significant (p <.01).

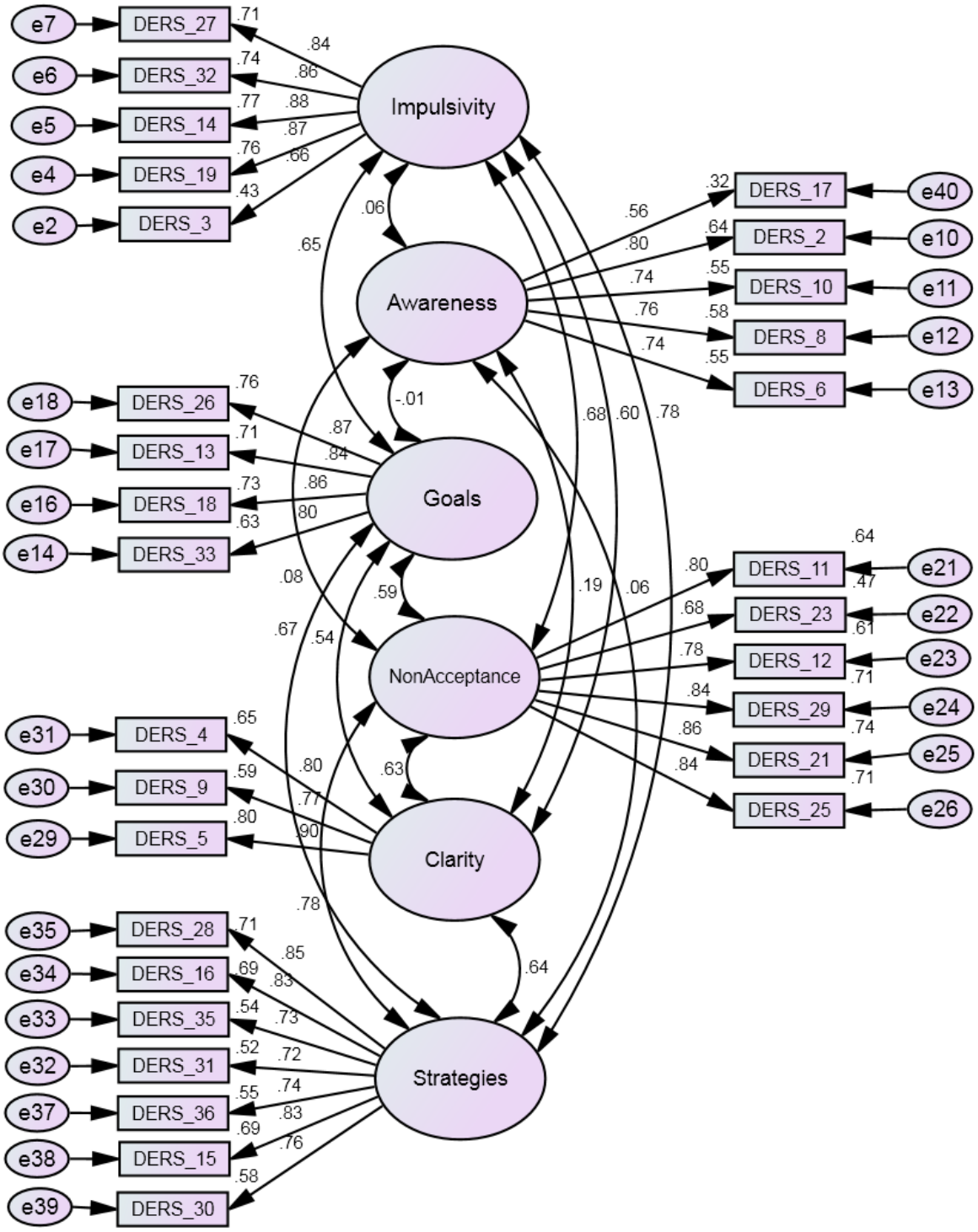

Figure 3.1. The six factor, 30-item, confirmatory factor analysis solution for the DERS.

3.3.3. Inter-correlations between the DERS Subscales

In line with previous findings, five of the DERS subscales shared moderate to strong inter-correlations, with the exception of the 'Awareness' subscale which had no significant associations with the other subscales except for a weak relationship with the 'Clarity' subscale (Table 3.3).

3.3.4. Descriptives and Internal Reliability

Means, standard deviations, and internal reliability for the DERS subscales and total scores, EDE-Q global score, disordered eating behaviours, BMI, depression, and sadness are presented in Table 3.4**.** All subscales indicated very good internal consistency with the exception of the 'Clarity' subscale from the 36-item model. Improvements in reliability between the 36-and 30-item models were seen across the majority of subscales and scales with the exception of the 'Awareness', 'Non-Acceptance', and 'Impulsivity' subscales.

Table 3.3.

Intercorrelations for the Six Factor 36 Item and 30 Item Difficulties in Emotion Regulation Scale

Factor	Impulsivity	Awareness	Goals	Non-Acceptance	Clarity	Strategies
Impulsivity	-	.06†	.65	.68	.60	.78
Awareness	.04†	-	-.01†	.08†	.19	.06†
Goals	.65	-.04†	-	.59	.54	.67
Non-Acceptance	.68	.06†	.59	-	.63	.78
Clarity	.59	.24	.54	.63	-	.64
Strategies	.77	.06†	.67	.78	.64	-

Note: All correlations are significant ($p<.01$) unless otherwise noted. †Correlation not significant at .05. Factor intercorrelations for the 36 item Six Factor Model are presented below the diagonal. Factor intercorrelations for the 30 item Six Factor Model are above the diagonal in bold

Table 3.4.

Minima, Maxima, Means, Standard Deviations and Internal Consistency (Cronbach's Alpha) for the 36 and 30 Item Difficulties in Emotion Regulation Scale (DERS) Subscales and Total Scores, Eating Disorder Examination – Questionnaire total (EDE-Q), Body Mass Index (BMI), Depression, and Sadness for the whole sample

	36 Item DERS						30 Item DERS					
	N	Min	Max	M	SD	α	N	Min	Max	M	SD	α
Impulsivity	481	1.00	5.00	2.29	.87	.81	482	1.00	5.00	2.16	1.05	.81
Awareness	479	1.00	4.83	2.87	.85	.84	479	1.00	5.00	2.94	.88	.84
Goals	481	1.00	5.00	3.10	.90	.76	482	1.00	5.00	3.18	1.12	.91
Non-Acceptance	481	1.00	5.00	2.45	1.05	.91	481	1.00	5.00	2.45	1.05	.91
Clarity	483	1.00	5.00	2.63	.63	.41	483	1.00	5.00	2.40	1.05	.86
Strategies	481	1.00	5.00	2.51	.88	.85	482	1.00	5.00	2.43	1.03	.91
Total DERS	477	1.00	4.72	2.62	.64	.92	477	1.00	4.77	2.57	.75	.94
EDE-Q Total	464	.00	7.32	2.42	1.57	.89						
EDE Behaviours	473	.00	14.29	2.57	2.74	.60						
BMI	446	14.95	49.31	21.33	3.80							
Depression	142	0.0	3.00	.88	.69	.88						
Sadness	341	1.00	5.00	2.26	1.09	.90						

3.3.5. Convergent Validity

Pearson correlations between the two six factor 36- and 30-item models, EDE-Q global scores, disordered eating behaviours, BMI, and depression/sadness were examined (Table 3.5). There was a significant, moderate positive relationship between the global EDE-Q scores and all subscales for both models with the exception of the 'Awareness' subscale. The associations between the EDE-Q global score, and the 'Goals', 'Clarity', and 'Strategies' subscales, as well as the total DERS score, were slightly stronger for the 30-item compared to the 36-item model. To test if these differences in correlations were significant, a Steiger's *z*-test was conducted given our variables were not independent of each other (Steiger, 1980). The increase in strength in correlations between the six factor 36-item DERS and the six factor 30-item DERS was significant for the 'Clarity' (z = -3.668; p< .001), 'Strategies' subscales (z = -3.027; p = .002), and DERS total score (z = -3.774; p< .001).

Pearson correlations also showed significant, moderate positive relationships between disordered eating behaviours and each of the subscales with the exception of the 'Awareness' subscale. While the associations were higher for the 30-item compared to the 36-item measure, these were not significant for the 'Goals' (z = -0.853; p =.394), 'Clarity' (z = -1.464; p = .143), and 'Strategies' subscales (z = -1.452; p = .147). The significant positive association between disordered eating behaviours and the total DERS score was significantly stronger for the 30-item model than the 36-item model (z = -2.42; p = .016).

Table 3.5.

Pearson Correlations between the Six Factor 36-Item and 30-Item Difficulties in Emotion Regulation Scale Total Score and Subscales, Body Mass Index (BMI), Depression/Sadness, Global Eating Disorder – Questionnaire (EDE-Q) Scores and Disordered Eating Behaviours for whole sample

	Impulsivity	Goals	Non-Acceptance	Clarity	Strategies	Awareness	DERS Total	BMI	Depression/ Sadness
Six Factor 36 Item									
EDE-Q Total (*N* = 464)	.42	.39	.43	.26	.46	-.07†	.46	.24	.41
EDE Behaviours Subscale (*N* = 473)	.40	.27	.34	.26	.37	-.06†	.38	.08†	.39
Six Factor 30 Item									
EDE-Q Total (*N*= 464)	.42	.40	.43	.36	.48	-.08†	.49	.24	.41
EDE Behaviour Subscale (*N* = 473)	.40	.28	.34	.30	.38	-.05†	.40	.08†	.39

Note: All correlations are significant ($p<.01$) unless otherwise noted. †Correlation not significant at .05 (two-tailed)

Convergent validity was also assessed using hierarchical multiple regressions with the global EDE-Q score and disordered eating behaviours as the dependent variables respectively, controlling for BMI and negative affect (Tables 3.6 and 3.7). With regard to the global EDE-Q scores, the covariates explained 21.9% of the variance. For the 36-item model, the DERS subscales explained an additional 8.2% of the variance in global EDE-Q scores, where the 'Awareness' and 'Goals' subscales were the only significant independent predictors. For the 30-item model the DERS subscales explained an additional 8.4% of the variance in global EDE-Q scores, with the 'Goals' subscale as the only significant independent predictor.

With regard to disordered eating behaviours, the covariates of BMI and negative affect explained 15.9% of the variance in disordered eating and the subscales from the 36-item DERS explained an additional 5.2% of the variance, with 'Impulsivity' as the only significant predictor. For the 30-item model, the DERS subscales explained an additional 4.7% of the variance in disordered eating with the 'Impulsivity' subscale again being the only significant independent predictor of an increase in disordered eating (Table 3.7).

Table 3.6.

Summary of Regression Analyses with the 36 and 30 Item Difficulties in Emotion Regulation Scale Subscales, controlling for Body Mass Index (BMI) and Depression/Sadness with Global Eating Disorder Examination – Questionnaire (EDE-Q) Scores as the Dependent Variable

		36 Item DERS				30 Item DERS			
Step	Predictors and Order of Entry	B	SE	β	p	B	SE	β	p
1	BMI	.09	.02	.22	<.001	.09	.02	.22	<.001
	Depression/Sadness	.62	.07	.40	<.001	.62	.07	.40	<.001
		R^2=.219, F(2,422) = 59.147, p <.001				R^2=.219, F(2,422) = 59.147, p <.001			
2	Clarity	.03	.13	.01	.844	.00	.08	.00	.999
	Awareness	-.20	.08	-.11	.014	-.14	.08	-.08	.070
	Impulsivity	.20	.12	.11	.091	.16	.10	.11	.091
	Non-Acceptance	.14	.09	.09	.124	.13	.09	.09	.170
	Goals	.27	.10	.16	.005	.22	.08	.16	.005
	Strategies	.10	.13	.05	.473	.12	.12	.08	.315
		R^2 change =.082, F(6,416) = 8.136, p <.001				R^2 change =.084, F(6,416) = 8.358, p <.001			

Note: SE = standard error

Table 3.7.

Summary of Regression Analyses with the 36 and 30 Item Difficulties in Emotion Regulation (DERS) Subscales, controlling for Body Mass Index (BMI) and Depression/Sadness with Disordered Eating Behaviours as the Dependent Variable

		36 Item DERS				30 Item DERS			
Step	Predictors and Order of Entry	B	SE	β	p	B	SE	β	p
1	BMI	.01	.01	.05	.227	.01	.01	.05	.227
	Depression/Sadness	.23	.03	.40	<.001	.23	.03	.39	<.001
		R^2=.159, F(2,427) = 40.243, p <.001				R^2=.159, F(2,427) = 40.243, p <.001			
2	Clarity	.05	.05	.06	.296	-.01	.03	-.02	.789
	Awareness	-.06	.03	-.08	.067	-.03	.03	-.04	.336
	Impulsivity	.18	.05	.26	.000	.14	.04	.25	<.001
	Non-Acceptance	.01	.04	.00	.940	.01	.04	.01	.833
	Goals	.17	.04	.03	.650	.02	.03	.03	.574
	Strategies	-.04	.05	-.06	.438	-.02	.04	-.03	.716
		R^2 change =.052, F(6,421) = 4.664, p <.001				R^2 change =.047, F(6,421) = 4.180, p <.001			

Note: SE = standard error

Hierarchical regressions were conducted to see if group membership (high school student versus undergraduate) influenced the predictive ability of each of the DERS models. Analyses indicate that the 'Awareness' and 'Goals' subscales of the 36-item DERS and the 'Goals' subscale of the 30-item DERS were able to significantly predict a change in global EDE-Q scores regardless of group. In contrast there was a significant interaction between the 'Impulsivity' subscale of 36-item DERS and group (p =.014) showing an increase in disordered eating behaviours in high school students only. The 'Impulsivity' subscale of the 30-item DERS was able to predict an increase in disordered eating in both groups.

3.4. Discussion

Difficulties with emotion regulation is argued to be one of the key maintaining factors in eating disorders, therefore it is important we have a valid and reliable measure that assesses this construct and helps us understand how this relates to variables of relevance to eating disorders. This study is the first to investigate the validity and reliability of the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004) and its relation to eating disorder severity and disordered eating behaviours in a young female sample.

The first aim of the current study was to investigate the factor structure of the DERS. Although there is evidence the six factor 36-item DERS is a suitable measure of emotion regulation difficulties in both clinical and non-clinical populations (e.g., Gratz & Roemer, 2004; Neumann et al., 2010; Perez et al., 2012), recent research has provided support for a five-factor model in non-clinical samples (Bardeen et al., 2012). While previous research suggests the 'Awareness' subscale should not be included in the DERS (Bardeen et al., 2012),

findings from the present study indicate that a 30-item six factor structure provided best fit for our data which included the 'Awareness' subscale. Results indicate some relevance of the 'Awareness' subscale to disordered eating. While no significant relationship between this subscale and disordered eating was indicated in the univariate analyses, multivariate analyses showed this subscale to be significantly associated with the global EDE-Q score for the 36-item DERS, and approaching significance for the association with the global EDE-Q score for the 30-item DERS and with disordered eating in the 36-item DERS. A 30-item version of the DERS was supported, providing a shorter scale for more parsimonious assessment. Indeed, the subscales and total score of the 30-item DERS evidenced a significant improvement in the strength of the relationship with the global EDE-Q score, as well as disordered eating behaviours, compared to the 36-item DERS. Therefore this shorter version may also exhibit more robust relationships with variables assessing disordered eating.

The second aim of this study was to examine which aspects of difficulties in emotion regulation are most relevant to eating disorder severity and disordered eating behaviours in young females. Both the 36- and 30-item DERS were predictors of eating disorder severity in a young female sample with the 'Goals' and 'Awareness' subscales being significant predictors independent of BMI and negative affect. Those who had difficulties engaging in goal directed behaviour (e.g., difficulty concentrating or focussing attention away from the problem) and those who were aware of, and acknowledged their feelings whilst experiencing negative emotions, reported higher levels of disordered eating severity. This suggests those who attend to negative emotions and have trouble disengaging from them are likely to report elevated levels of disordered eating.

These findings contradict recent research using a clinical population with anorexia nervosa, where the 'Goals' subscale failed to predict an increase in eating disorder severity, and a lack of emotional awareness predicted an increase rather than a decrease in eating disorder severity (Racine & Wildes, 2013). These contradictions lend support for further investigation of the validity of the DERS using a clinical population.

Both models were also able to predict higher levels of disordered eating behaviours, with the 'Impulsivity' subscale being a robust independent predictor indicating those who have difficulties controlling their behaviour when upset are more likely to exhibit disordered eating behaviours. However, the 36-item DERS was only able to predict an increase in disordered eating behaviours in the student group, whereas the 30-item DERS was able to predict these behaviours across both samples. Our findings support past research where impulsivity is shown to be both a risk factor for disordered eating behaviours such as binge eating, purging, and restricting (Claes, Vandereycken, & Vertommen, 2002, 2005; Racine & Wildes, 2013). Our findings indicate that both the 36- and 30-item DERS are able to clearly discriminate between eating disorder severity and disordered eating behaviours with 'Goals' being an independent predictor of eating disorder severity and 'Impulsivity' being an independent predictor of disordered eating behaviours. These findings highlight the usefulness of this tool in discriminating between disordered eating symptoms and behaviours.

Overall, our findings support the utility of treatments such as Dialectical Behaviour Therapy for Eating Disorders (DBT-E), that focus on distraction techniques, distress tolerance, and acceptance strategies that have shown a

reduction in eating disorder severity (Telch, Agras, & Linehan, 2001; Wisniewski & Kelly, 2003). Redirecting the focus of attention from the negative emotion to a more positive experience of emotion encourages the endurance of distressing situations which reduces maladaptive responses to, or perceptions of, negative emotions. By accepting the emotional experience in a non-judgemental way the person learns to accept the negative emotion or experience enabling them to access more adaptive strategies to cope with negative emotions (Wisniewski & Kelly, 2003). DBT-E addresses components of these key areas identified in this study as being predictors of eating disorder severity and disordered eating behaviours.

This study has several limitations. Using a cross-sectional design does not enable us to make conclusions about the causal importance of emotion regulation dysfunction in disordered eating. Further research using data collected at multiple time points is recommended. In addition, although we can recommend the use of the 36-item and 30-item DERS in a non-clinical sample, we cannot apply this to a clinical sample. Further research of the effectiveness of the DERS in a clinical sample is needed. Although it was not the aim of the current study, it is important to note that we only compared the Gratz and Roemer (2004) model and did not investigate other measures of emotion regulation used in the literature which does not enable us to compare the validity of the 36- or 30-item DERS over another measure of emotion regulation dysfunction. This, however, is a valuable question that needs answering. Another limitation included the use of two different measures of negative affect. Although the scores were standardised, it is recommended for future research that one measure of be used. It is also important to note, that the fasting item included in the

measure of behaviours was also included in the global measure of eating disorder severity. However, although they overlap, these scores were used differently, for example, Likert versus a continuous count of days. In future, researchers could include a different measure of fasting behaviour.

Finally, it is important to note that all low loading variables that were removed from the 36-item model to create the 30-item model were reverse-keyed, and indeed, as are all items on the 'Awareness' subscale. These findings are similar to past research with other scales that include reverse-keyed items, suggesting the use of reversed-keyed items affects the psychometric performance of a measure (Bardeen et al., 2012; Rodebaugh, Woods, & Heimberg, 2007). Further research using of straightforward-worded items instead of reverse-keyed items to assess emotional awareness might provide further insight into this construct and its relation with disordered eating.

In summary, both the six factor 36- and 30-item models were able to adequately predict eating psychopathology and disordered eating behaviours in our non-clinical population of young women. Our study has shown that the 'Awareness' subscale may be of relevance to disordered eating, but that a reduced scale of 30 rather than 36 items improved the model fit, strengthened associations with variables of relevance to disordered eating, and explained greater variance in these outcome variables. Although both models are adequate predictors of eating disorder symptoms, findings from this study indicate the 30-item DERS to be the more parsimonious measure of the two with stronger associations to variables assessing different facets of disordered eating.

Chapter 4.

The Relationship between Memory and Interpretation Biases, Difficulties with Emotion Regulation, and Disordered Eating in Young Women[4]

4.1. Overview

Prominent theories suggest cognitive biases operate to maintain depression and anxiety in terms of both memories for negative emotional information and interpretation biases. Teasdale's (1985) theory of differential activation postulates that depressed mood leads to negative memory biases in information processing, resulting in a tendency to elaborate on more negative information compared to positive information. There have been a number of studies investigating negative memory biases in depression (e.g., Burt et al., 1995; Ellis et al., 2011; Matt et al., 1992), with a general consensus that depressed individuals have better recall of negative stimuli (e.g., angry or sad faces) over positive stimuli (e.g., happy or sad faces), whereas non-depressed individuals display a significant memory bias for positive stimuli (Ellis et al., 2011). Evidence for memory bias in anxiety disorders is less robust, however, research indicates memory biases for threat-relevant information exist, particularly in panic disorder (for reviews see Coles & Heimberg, 2002; MacLeod & Mathews, 2004). Studies have also supported the maintaining role of negative interpretation biases (i.e., the interpretation of ambiguous or neutral information as being negative rather than positive or benign) in depressed and anxious individuals (Beard & Amir, 2010; Butler & Mathews, 1983; Constans et al., 1999; MacLeod

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& Cohen, 1993; Mogg et al., 2006; Wisco & Nolen-Hoeksema, 2010). Depressed individuals are more likely to interpret ambiguous stimuli in a negative manner (Mogg et al., 2006; Rude et al., 2002), and anxious individuals are more likely to interpret ambiguous stimuli as threatening resulting in increased anxiety when exposed to every-day stressors (Beard & Amir, 2010; Constans et al., 1999).

Given the strong associations between eating disorders and depression, it could be hypothesised that the same biases observed for depression also maintain disordered eating. Depression is commonly comorbid with eating disorders (Braun et al., 1994), and shares genetic risk factors with eating disorders (Wade et al., 2000). Negative affect, a construct which includes the experience of negative moods and feelings such as depression and anxiety (Watson & Clark, 1984), is thought to underlie many emotional disorders and is considered to be one of the strongest risk factors for disordered eating (Jacobi & Fittig, 2010; Stanton & Watson, 2014). Thus, negative affect is considered to be a transdiagnostic factor across a number of emotional disorders. Given the causal association between negative affect and eating disorders, as well as the commonly observed comorbidity between depression, anxiety and eating disorders, it is possible that the same biases that are implicated with the maintenance of depression and anxiety (e.g., negative memory and interpretation bias) could also play a key role in eating disorders, over and above the contribution of any current symptoms of depression and anxiety.

Although there is substantial research indicating both negative memory and negative interpretation biases are implicated in the onset and maintenance of depression, there is far less research available that investigates whether these

biases exist in eating disorders and whether these biases exist independent of the influences of depression and anxiety. Much of the eating disorder research investigating memory biases has focused on food, weight, appearance, or disorder related stimuli rather than emotional content (see Lee & Shafran, 2004; Williamson et al., 1999). There is, however, preliminary evidence that those with eating disorders show memory biases for negative emotional content, with one study showing that women with anorexia nervosa displayed a bias toward negative trait adjectives as opposed to positive trait adjectives using a memory recall task (Manuel & Wade, 2013).

To date, research of negative interpretation biases in eating disorders has focussed primarily on interpretation biases in terms of negative self-beliefs, weight, shape, and appearance, with support for the existence of such biases (Cooper, 1997; Pringle, Harmer, & Cooper, 2010; Williamson et al., 1999; Yiend, Parnes, et al., 2014). To date, no research has examined the association of disordered eating with the negative interpretations of ambiguous every-day scenarios. Evidence of such an association would suggest widening the focus of cognitive behaviour therapy for eating disorders from appearance-based interpretations to the many different situations encountered on a daily basis. Therefore, further investigations to establish whether a broad range of negative interpretation biases for every-day ambiguous scenarios (i.e., stimuli not relevant to specific areas of concern such as food, weight or shape) are experienced by those with an eating disorder as they are in depression, could be informative for further development of therapy for eating disorders.

Investigating factors that maintain emotional disorders is important as it can lead to further developments in treatment paradigms. For example, the existence of memory and interpretation biases in depression has provided support for the use of tools such as cognitive bias modification techniques to modify these biases. Research has shown that these techniques are successful and can reduce symptoms of depression (Koster et al., 2009; Woud & Becker, 2014). In addition, the promotion of less negative interpretation bias is a core component of cognitive behaviour therapy for depression (Hollon, DeRubeis, Shelton, & et al., 2005). Cognitive bias modification research within the eating disorder field, however, is comparatively lacking (MacLeod, 2012).

In contrast, a greater degree of theoretical and research attention has been directed at difficulties in emotion regulation as a maintaining factor in eating disorders and some treatment paradigms, such as Cognitive Behaviour Therapy-Enhanced and Dialectical Behaviour Therapy for Eating Disorders, are designed to address these difficulties. According to Fairburn, Cooper and Shafran (2003), difficulties with emotion regulation is one of four important maintaining processes of an eating disorder, and can impede implementation of behaviour change in treatment. Research has shown that people with eating disorders lack the skills to effectively cope with negative affective states, instead responding by restricting, bingeing and/or purging, or compulsive exercising, which provides short term distraction from the experience of negative emotion (Fairburn et al., 2003; Peñas-Lledó et al., 2002; Smyth et al., 2007). Although a substantial amount of theoretical and empirical work has focussed on investigating emotion regulation strategies that are considered adaptive (e.g., acceptance, cognitive reappraisal) or maladaptive (e.g., avoidance, rumination, suppression), few

studies have investigated how disordered eating might be associated with emotion regulation difficulties (Aldao & Nolen-Hoeksema, 2012). There is also substantial evidence which indicates depression is linked to emotion regulation difficulties (Aldao et al., 2010) raising the question as to whether cognitive biases that are relevant to depression may also play a role in disordered eating by influencing emotion regulation. Existing research indicates maladaptive emotion regulation strategies (e.g., rumination) are associated with cognitive biases such as memory biases for negative content (Joormann & Gotlib, 2009).

For the purpose of testing a meaningful model, we made two assumptions. First, the current evidence is unclear as to whether emotion regulation difficulties are a result of an eating disorder or a pre-dispositional trait (see Ashworth et al., 2011; Brockmeyer et al., 2012). It is likely that both are true to some extent and a bidirectional relationship exists between emotion regulation and disordered eating. To date, there is inconsistent evidence to suggest that those with eating disorders experience emotion regulation difficulties prior to the onset of the disorder, however, there is strong evidence to suggest that those with eating disorders experience emotion regulation difficulties after the onset of the eating disorder (Brockmeyer et al., 2012; Harrison, Sullivan, et al., 2010; Harrison, Tchanturia, & Treasure, 2010). Hence this cross-sectional study takes a conservative stance, postulating that difficulty with emotion regulation is a consequence of disordered eating rather than as a cause. Second, based on Teasdale's (1985) theory of differential activation for depression, we assumed that cognitive biases were a result of the disorder rather than a cause of eating disorders. Teasdale's (1985) theory postulates that depressed mood leads to biases in information processing, which in turn contributes to the maintenance of

depressive symptoms. This study also draws upon cognitive and information processing theories of eating disorders (for a review see Williamson, White, York-Crowe, & Stewart, 2004) where these models suggest information processing errors (such as cognitive biases) contribute to the maintenance or disordered eating and disordered eating behaviours. Therefore, in addition to hypothesising that disordered eating and disordered eating behaviours, and difficulties in emotion regulation are significantly and positively related to memory biases and negatively related to interpretation biases, it was also hypothesised that memory biases and interpretation biases mediate the relationship between disordered eating, disordered eating behaviours and difficulties in emotion regulation. Current levels of depression and anxiety were included as covariates in our analyses to allow us to ascertain whether disordered eating *per se* was associated with biases and difficulties with emotion regulation independent of any comorbidity with depression and anxiety.

4.2. Method

4.2.1. Participants

This study included 181 female first year university Psychology students aged 17 to 26 years (M = 19.24, SD = 1.59), with a body mass index ranging from 15.22 to 47.78 (M = 22.99, SD = 4.54). Participants were recruited from a volunteer research pool where research participation earned credit points. Informed consent was obtained from all individual participants included in the study. This study received approval from the Flinders University Social and Behavioural Research Ethics Committee.

4.2.2. Measures

4.2.2.1. Difficulties in Emotion Regulation Scale (DERS).

The DERS (Gratz & Roemer, 2004) is a 36-item self-report measure which assesses six dimensions of emotion regulation: lack of emotional awareness (Awareness), lack of emotional clarity (Clarity), difficulties controlling impulsive behaviours when distressed (Impulsivity), difficulties engaging in goal directed behaviours when distressed (Goals), non-acceptance of negative emotional responses (Non-Acceptance), and limited access to effective emotion regulation strategies (Strategies). Each item is assessed on a 5 point Likert-type scale ranging from *almost never* to *almost always*, with high scores representing increased difficulties with emotion regulation. For this study a 30-item, six factor version of the DERS (DERS-30) was used as there is evidence that this abbreviated version exhibits stronger relationships with eating disorder severity and disordered eating behaviours in a non-clinical population than the original 36-item version of the scale (Cooper, O'Shea, Atkinson, & Wade, 2014). In the current study the mean item score was used and internal reliability for the 30-item DERS was $\alpha = .94$.

4.2.2.2. Eating Disorder Examination-Questionnaire (EDE-Q).

The severity of eating disorder psychopathology was assessed using the global score from the EDE-Q (Fairburn & Beglin, 1994). The global score consists of the summation of the four subscales; weight concern, shape concern, eating concern, and dietary restraint. Each item is assessed on a 7 point scale, with higher scores indicating greater levels of eating disorder severity. Scores over 4 are considered to be of clinical significance. The mean item score was used and internal consistency in the current study was $\alpha = .95$.

Disordered eating behaviours over the previous 28 days which conform to the frequency and intensity levels included in the DSM-5 diagnostic criteria (American Psychiatric Association, 2013) were also assessed using the EDE-Q. This included the number of episodes of objective binges (overeating associated with a loss of control); self-induced vomiting; laxative use; driven exercise (e.g., feeling compelled to exercise, pushing oneself to exercise even if injured, or experiencing feelings of guilt if not exercising), and fasting. This latter item, from the dietary restraint subscale asked, "*Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?*" Eating psychopathology and behaviours were assessed separately in order to test whether each of these components of an eating disorder operate differently.

4.2.2.3. Negative affect.

Depression and anxiety was measured using the Depression, Anxiety and Stress Survey (short form; DASS-21; Henry & Crawford, 2005). Only the depression and anxiety subscales were utilised in the current study, where each item is measured on a 4-point, Likert-type scale from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*), with higher scores indicating higher levels of depression or anxiety. Participants were asked to indicate how much the statements applied to them over the past week. Sample items for depression and anxiety included, "*I couldn't seem to experience any positive feeling at all*", "*I was aware of a dryness of my mouth*", respectively. The mean item score was used and in the current study internal reliability was α =.91 and α =.85 respectively.

4.2.2.4. Memory biases.

Memory biases for negative emotional content were assessed using a 60-word memory recall test developed for use with children and adolescents (Neshat-Doost et al., 1999). Sixty words (20 positive traits e.g., "friendly", 20 negative traits e.g., "lonely", and 20 neutral words semantically similar e.g., "budgie") were presented on a computer screen for seven seconds. Following presentation of the words, participants were given a sheet containing ten mathematical problems and were asked to answer each question. This task was designed to act as a filler task. Once the problems were completed, participants were given five minutes to write down as many words as they could remember. They were instructed that spelling did not matter. Scores were calculated by subtracting the number of positive trait adjectives from the number of negative trait adjectives, therefore, controlling for individual differences in memory performance. A positive number was indicative of more negative words being recalled, therefore, indicating greater levels of negative memory bias. Responses to the recall task were hand written and scoring was completed by two independent raters with 100% inter-rater reliability.

4.2.2.5. Interpretation biases.

Negative interpretation biases were measured using the Ambiguous Scenarios Test for Depression (AST-D) which contains 24 ambiguous scenarios, (Berna et al., 2011). The AST-D was developed for use in depressed populations and the measure contains a series of ambiguous situations that allow either a positive or a negative outcome interpretation (e.g., "You give a speech at a friend's wedding. When you have finished, you observe the audience's reaction",

"It's New Year's Eve. You think about the year ahead of you"), where a positive interpretation or negative interpretation is possible (e.g., for the first example scenario, it could be that the audience applauds appreciatively or that the audience is bored and no one applauds you). Each of the 24 scenarios was presented individually on a computer screen and participants were instructed to form a mental image of each scenario and imagine each scenario happening to them personally. They were also instructed to follow the first image that comes to mind and not to think too much about them. Participants were then asked to rate how pleasant their mental image is (pleasantness rating) and how vivid the image is (vividness rating). The pleasantness rating was rated on a 9-point Likert-type scale with higher scores indicating a more pleasant rating (positive interpretation) and low scores indicating a less pleasant rating (negative interpretation). Vividness was measured on a 7-point Likert-type scale with higher scores indicating a more vivid mental image. Ratings of vividness were assessed in order to control for differences in imagination as in previous research (Berna et al., 2011). The AST-D had good internal consistency in the current study with α =.83.

4.3. Procedure

All data were collected using a single computer in a laboratory at Flinders University. Participants were asked to complete the self-report questionnaire battery comprising demographic questions (e.g., date of birth, height, current and ideal weight, and ethnicity), and the questionnaires measuring the variables of interest.

4.3.1. Data Analysis

In order to test the mediating role of negative biases on the relationship between disordered eating and emotion regulation difficulties, three preconditions are required to be met. The first requires the predictor variable (in this case the EDE-Q global score or disordered eating behaviours) to be significantly related to the outcome variable (difficulties in emotion regulation). The second precondition requires the proposed predictor variable(s) to be significantly related to the proposed mediator variables (negative memory bias or negative interpretation bias). Third, the proposed mediator variable(s) must be significantly related to the outcome variable. All preconditions were assessed using correlational and multiple regression analyses. Finally, it is also required that, in the presence of the mediator, the relationship between the predictor and the outcome variable is significantly reduced, as indicated by the Sobel test.

Mediation was tested using the 'Process' regression analyses macro which allows for simultaneous multivariate analysis, using bootstrapping to examine a mediation model (Preacher & Hayes, 2008). The severity of eating disorder psychopathology or disordered eating behaviours was entered as the predictor variables and difficulties with emotion regulation as the outcome variable. Hypothesised mediators which met all preconditions were included whilst depression, anxiety, and vividness were entered as covariates. The term 'total effect' denotes the relationship between the predictor variables (*x*) and the outcome variable (*y*). 'Indirect effect' refers to the mediating pathway between *x* and the mediating variables, and between the mediating variables and *y*. The term 'direct effect' refers to the relationship between *x* and *y* whilst controlling for the indirect effects (Preacher & Hayes, 2008). Indirect effects were tested via corrected bootstrapping, the recommended method in contemporary mediation

analyses. This method has strong statistical power in detecting indirect effects and is less sensitive to small sample size (Preacher & Hayes, 2008). For the current study, bootstrapping with 1000 samples was used to generate 95% confidence intervals to determine the statistical significance of the indirect effect.

4.4. Results

4.4.1. Preliminary Analyses

All variables were examined for normality by assessing the shape of the distribution as recommended by Tabachnick and Fidell (2007). Results indicated that all variables were normally distributed. Little's missing completely at random test was non-significant ($\chi^2(64)=31.767$, $p= 1.00$), indicating that data were missing at random. The means and standard deviations for all study variables are presented in Table 4.1. Twenty-four (13.3%) women reported clinically significant scores on the EDE-Q (i.e., ≥4).

Table 4.1.

Means (M) and standard deviations (SD) for all relevant variables

	N	M	SD	Min	Max
Eating Disorder Examination-Questionnaire Global Score	181	2.29	1.3	0	5.0
Difficulties in Emotion Regulation Scale (30 Item)	181	2.5	.69	1	4.0
Negative Interpretation Biases[1]	180	5.29	.88	3	8.0
Negative Memory Biases[2]	178	.67	2.38	-9	7.0
Objective Binge Episodes* (last 28 days)[a]	181	3.68	5.32	0	28.0
Purging Behaviours (last 28 days)[b]	181	.17	1.19	0	14.0
Compulsive Exercising & Fasting (last 28 days)[c]	181	3.27	4.14	0	24.0
Vividness	180	4.58	.83	2	7.0
Anxiety	180	.64	.60	0	3.0
Depression	180	.71	.66	0	3.0

Note: [a] 150 people experienced objective binge episodes; [b] 10 people experienced purging; [c] 115 people experienced compulsive exercise and/or fasting. [1] a lower score indicates a greater level of negative interpretation biases; [2] a higher score indicates a greater level of negative memory bias. *Note: Objective binge eating was calculated differently in the published version, however, mediational relationships were the same.

4.4.2. Testing Mediation Preconditions

Correlational analyses which tested the required preconditions of mediation are presented in Table 4.2. Results showed all our predictor variables (disordered eating, objective binge episodes, purging and fasting/driven or excessive exercise) were significantly correlated with difficulties in emotion regulation meeting the first precondition for mediation, with the exception of negative memory bias. Therefore, this latter variable failed to meet the required preconditions of mediation and was subsequently excluded from further analyses. The remaining predictor variables, with the exception of purging, were also significantly related to negative interpretation bias, and in turn, negative interpretation bias was significantly related to difficulties in emotion regulation, therefore, meeting all preconditions for mediation.

Table 4.2.

Pearson correlations for disordered eating severity, objective binge eating behaviours, 30 item Difficulties in Emotion Regulation Scale, negative interpretation bias, negative memory bias, anxiety, depression, purging behaviours, and exercising and fasting behaviours.

	1	2	3	4	5	6	7	8	9
1. EDE-Q Global	-								
2. OBE	.51***	-							
3. DERS-30	.50***	.32***	-						
4. NIB	-.39***	-.27***	-.54***	-					
5. NMB	.09	.18*	.12	-.09	-				
6. Anxiety	.38***	.26***	.65***	-.41***	.11	-			
7. Depression	.39***	.14*	.71***	-.36***	.002	.72***	-		
8. Purging	.29***	.42***	.26***	-.14	.12	.32***	.17*	-	
9. Exercising & Fasting	.60***	.32***	.33***	-.23**	.09	.31***	.29***	.32***	-

Note: EDE-Q global = disordered eating severity; OBE = objective binge eating behaviours; DERS-30 = 30 item Difficulties in Emotion Regulation Scale; NIB = negative interpretation biases; NMB = negative memory biases. *p <.05, **p <.01, ***p <.001. Objective binge eating was calculated differently in the published version, however, trends were the same.

4.4.3. Mediational Relationships

Results supporting mediational relationships are shown in Figures 4.1 and 4.2. Figure 4.1 includes the direct effect of global eating disorder severity on difficulties in emotion regulation after including the mediator variable (negative interpretation bias) and controlling for the effects of vividness, depression and anxiety. The total effect (sum of the direct and indirect effects) of .12 (SE = .28, $p < .001$) indicates disordered eating predicts difficulties in emotion regulation over and above vividness, depression and anxiety, accounting for 12% of the variance. When negative interpretation biases were taken into account, the amount of variance explained decreased to 9% (.09, SE = 3.26, $p < .05$) whilst remaining significant, suggesting partial mediation. The individual path coefficients and indirect effect estimates indicate negative interpretation biases have a significant and unique contribution to the mediation process. Results of the Sobel test indicate the decrease in variance explained is significant ($z = 2.93$, $p <0.01$), which suggests that the association between eating disorder severity and difficulties in emotion regulation is mediated by negative interpretation biases.

Results from correlational analyses showed the only behavioural predictor variable significantly correlated with negative interpretation bias after controlling for vividness, depression and anxiety was objective bingeing. Results from the mediational analyses are shown in Figure 4.2, including the direct effect of objective binge eating on difficulties in emotion regulation after controlling for the mediator variable (negative interpretation bias) and the effects of vividness, depression and anxiety. The total effect (sum of the direct and indirect effects) of .15 (SE = .04, $p < .000$) indicates objective binge eating predicts difficulties in

emotion regulation over and above depression and anxiety, accounting for 15% of the variance. When negative interpretation biases were taken into account, the amount of variance explained decreased to 11% (.11, SE = .04, $p < .01$) whilst remaining significant which suggests partial mediation. The individual path coefficients and indirect effect estimates shown in Figure 4.2 indicate negative interpretation biases have a significant and unique contribution to the mediation process. Results of the Sobel test indicate the decrease in variance explained is significant ($z = 2.07$, $p < 0.03$), which suggests that the association between objective binge eating and difficulties in emotion regulation is mediated by negative interpretation biases.

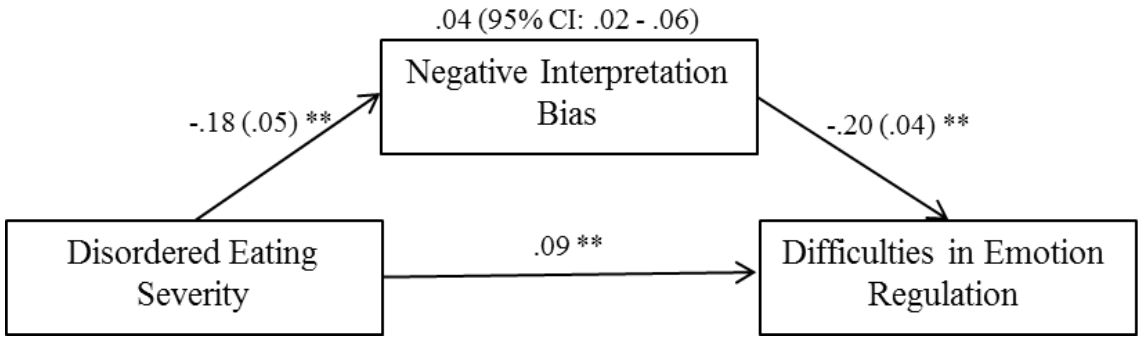

Figure 4.1. Mediation analyses with unstandardised unstandardized coefficients and standard error (SE) with estimates of the direct effect of disordered eating severity on difficulties with emotion regulation and the effect of the indirect pathways with 95% confidence intervals (CI) whilst controlling for vividness, anxiety and depression. (**p <.01, *** p <.001)

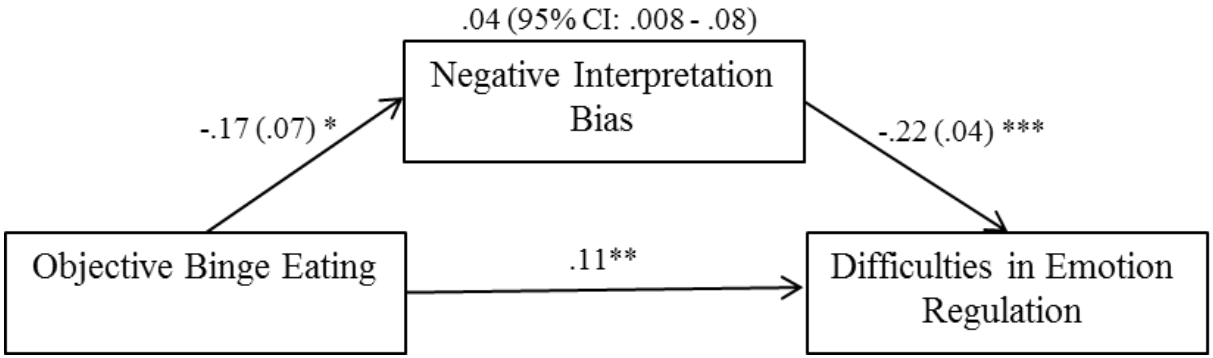

Figure 4.2. Mediation analyses with unstandardized coefficients and standard error (SE) with estimates of the direct effect of objective binge eating on difficulties with emotion regulation and the effect of the indirect pathways with 95% confidence intervals (CI) whilst controlling for vividness, anxiety and depression. (**p <.01, *** p <.001)

4.5. Discussion

There is substantial research indicating both negative memory biases and negative interpretation biases are implicated in the maintenance of depression and anxiety. To date, there is far less research that investigates whether these biases exist in eating disorders despite the presence of shared risk factors across eating disorders, depression, and anxiety, including negative affect and difficulties in emotion regulation. The current study used cross-sectional mediational analyses to investigate our hypothesis that memory for negative emotional content and negative interpretations of ambiguous situations mediate the relationship between disordered eating, disordered eating behaviours, and difficulties in emotion regulation. Our hypotheses were partially supported whereby our findings indicate negative interpretation biases mediate the relationship between disordered eating/objective binge eating, and emotion regulation. In the current study, preconditions for examining whether negative memory biases mediate the relationship between disordered eating and emotional regulation were not met. It would of interest to see if this finding is replicated in future studies.

Our study provided evidence that negative interpretation biases are associated with disordered eating in community samples. The relationship between higher levels of disordered eating and more difficulties with emotion regulation was partially mediated by the tendency to interpret ambiguous situations in a negative rather than positive manner. Mood intolerance has long been recognised as one of the maintaining factors of disordered eating in theoretical considerations (Cooper et al., 2004; Fairburn et al., 2003), resulting in a vicious cycle between eating and mood, but the role of interpretation biases in

this relationship has not previously been highlighted. If these patterns are similar to those outlined in theories of depression, as well as those found in previous research (see Aldao et al., 2010; Teasdale, 1985), then we would postulate that disordered eating leads to negative interpretation bias which in turn leads to mood dysregulation, which can then act as a trigger for disordered eating, thereby maintaining the cycle. This suggestion is somewhat supported by our finding that negative interpretation biases are also associated with binge eating i.e., the relationship between higher levels of binge eating and greater difficulties in emotion regulation was partially mediated by the tendency to interpret ambiguous situations more negatively. These findings are consistent with recent research indicating negative interpretation biases related to self-identity increased a behavioural indicator of dietary restraint (Yiend, Parnes, et al., 2014). This study had a focus on self-loathing beliefs, due to their relationship with eating disorders symptoms (Cooper & Cowan, 2009), independent of depression and anxiety. Although our study indicated negative interpretation biases did not mediate the relationship between other behaviours that are characteristic of an eating disorder (e.g., fasting, or excessive exercise), these findings may have been a result of a lack of power as this relationship met preconditions for mediation testing until covariates (depression and anxiety) were included.

We were unable to support previous research which indicates negative memory biases for emotional content mediated the relationship between disordered eating and emotion regulation difficulties in a clinical population being treated for anorexia nervosa (Manuel & Wade, 2013). As preconditions required to test for mediation were not met, we were unable to investigate this in our population even though negative memory bias was significantly associated with

the frequency of objective binge episodes. Given emotion regulation difficulties increase as eating disorder symptoms become more severe (Lavender et al., 2014), investigation of this relationship in a clinical population may yield different results, if emotion regulation difficulties influence memory biases (i.e., a bidirectional relationship exists). In addition, there are mixed findings in anxiety research where negative memory biases are found to be associated with some subtypes of anxiety disorders such as panic disorder, and not with others (Mathews & MacLeod, 2005). Given that eating disorders have been found to be highly comorbid with anxiety disorders (Kaye et al., 2004), it may be that this comorbidity leads to inconsistent results in an eating disorder population. It is likely memory bias is a complex construct, affecting key underlying mechanisms of each disorder differently, and this relationship requires further investigation.

Future research should seek to replicate these findings in a clinical population with the view to assess potential tools such as cognitive bias modification techniques which have been developed to use as potential supplements to psychological interventions for anxiety and depression (Koster et al., 2009; Woud & Becker, 2014). The main goal of cognitive bias modification, particularly those which target interpretation biases (CBM-I), is to induce the desired interpretation bias by consistently asking participants to resolve ambiguous scenarios in either a positive or negative manner. This procedure has been shown to be successful in activating the desired bias when faced with real-life ambiguous scenarios (Koster et al., 2009). One of the first experimental approaches to show that CBM-I can influence disordered eating behaviours (Yiend, Parnes, et al., 2014) showed training in negative interpretation bias resulted in a significant increase in dietary restraint, with positive interpretation

training having no significant impact on eating psychopathology. This study provides a promising pathway for future research, with results from the current study suggesting that positive interpretation bias training may be strengthened if focused on the wider variety of depressogenic ambiguous stimuli, rather than just negative self-referent stimuli. It may also indicate that more novel approaches to CBM-I in eating disorders need to be explored, for example those that utilise more visual tasks given the visual nature of some aspects of eating disorders such as body image perception. Research shows that body satisfaction and self-esteem increased in women when photographs of their bodies were always followed by a smiling face, whereas in the control condition, body satisfaction and self-esteem remained unchanged, when the photographs were randomly followed by smiling, neutral, and frowning faces (Martijn et al., 2010). This finding may have links with the trauma field, where use of a visual task to interrupt embedding of traumatic images is significantly more effective than using a verbally based task (Holmes, James, Kilford, & Deeprose, 2010). In addition, given previous findings showing links with attention bias for stimuli related to food or appearance in disordered eating (e.g., Smith & Rieger, 2006; Werthmann et al., 2012), and the suggestion that a combination of CBM-I and CBM related to attention bias (CBM-A) may offer a synergistic influence (MacLeod, 2012), the use of a combination approach could also be evaluated in future research.

This study had a number of limitations. It is a cross-sectional examination of the mediational relationship between our variables of interest, and further experimental work and longitudinal research is required to more clearly understand patterns of causation. In addition, our sample was a non-clinical sample of undergraduate students, therefore, we cannot apply these findings to a

clinical sample. Although our sample was shown to experience the same risk factors, e.g., semi-starvation and binge eating, it would be expected that clinical samples would display greater levels of eating psychopathology, more frequent and larger episodes of binge eating, and suffer more severe physical consequences resulting in a more severe and complex impact on mood.

Chapter 5.

The Relationship between Interpretation Bias, Difficulties in Emotion Regulation, and Disordered Eating in a Sample with Clinical Levels of Eating Disorder Symptoms: A Replication Study

5.1. Overview

In Chapter 4, a cross-sectional association was established between negative interpretation bias and disordered eating and disordered eating behaviours in a non-clinical population. In addition, the relationship between eating disorder severity/objective binge eating and difficulties in emotion regulation was partially mediated by the tendency to interpret ambiguous situations in a negative manner. Investigating the role of interpretation bias in a sample which reports a greater level of eating disorder symptomatology is key to understanding what role interpretation bias plays in the relationship between emotion regulation and maintenance of eating disorder psychopathology, and provides insight into the possible utility of cognitive bias modification techniques within this population.

Therefore, the current chapter attempts to replicate the cross-sectional findings of the previous study in a sample with clinically significant levels of disordered eating. Given the findings in our previous study, it was hypothesised that interpretation bias would be significantly and negatively related to disordered eating, and disordered eating behaviours, and difficulties in emotion regulation. In addition, it was hypothesised that negative interpretation bias will be negatively related to specific behaviours such as objective binge eating, purging, and excessive exercising and fasting. It was also hypothesised that negative

interpretation bias would mediate the relationship between disordered eating, disordered eating behaviours, and difficulties in emotion regulation.

5.2. Method

5.2.1. Participants

This study included 83 females, 18 to 61 years (M = 24.07, SD = 7.6), with a body mass index (BMI) ranging from 12.72 to 37.39 (M = 24.73, SD = 5.5). Participants were recruited nationally via advertisements on relevant websites, medical clinics, and from two South Australian Universities. Inclusion criteria required participants to be female, over 18 years of age, and to have a clinically significant level of disordered eating. Disordered eating was initially assessed with the SCOFF (Hill, Reid, Morgan, & Lacey, 2010), which consists of five items including eating disorder behaviours (e.g., purging) and cognitions (e.g., loss of control when eating). The SCOFF is a valid and reliable measure able to detect the presence of an eating disorder and exclude non-cases (Mond et al., 2008), and has proven to be an effective screening tool for anorexia nervosa and bulimia nervosa. Participants who answered two or more questions in the affirmative were able to proceed into the study. Ineligible participants were unable to proceed and were subsequently provided with a list of eating disorder service providers and information sources.

In addition to the participants screened out by the SCOFF, a further 26 participants who completed the self-report questionnaire battery did not meet the criteria for disordered eating as defined by a cut-off of score of ≥2.8 on the global scale of the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994). Research has shown that a cut-off score of ≥2.8 on the global

scale of the EDE-Q is optimal in both detecting cases of eating disorders and excluding non-cases (Mond et al., 2008). While both the SCOFF and the EDE-Q are adequate measures to detect clinical cases and exclude non-clinical participants (Mond et al., 2008), the EDE-Q is considered the more robust indicator of disordered eating and used to make a final decision about participant inclusion. Informed consent was obtained from all individual participants included in the study. This study received approval from the Southern Adelaide Clinical Human Research Ethics Committee.

5.2.2. Design and Procedure

Eligible participants were asked to complete the self-report questionnaire battery comprising demographic questions (e.g., date of birth, height, current and ideal weight, and ethnicity), and the questionnaires measuring the variables of interest.

5.2.3. Measures

5.2.3.1. Disordered eating.

Eating disorder psychopathology was indicated by the global score from the EDE-Q (Fairburn & Beglin, 1994). The global score is described in detail in Chapter 4. In the current sample internal reliability was acceptable at $\alpha = .83$.

5.2.3.2. Objective binge episodes.

The number of objective binge episodes (overeating associated with a loss of control) were assessed using the item specific to bingeing using the EDE-

Q. This item, referring to the previous question regarding amount of food eating, asked, *"Over the past 28 days, on how many of these times did you have a sense of having lost control over your eating (at the time you were eating)?"*.

5.2.3.3. Purging.

Purging behaviours were assessed using two items from the EDE-Q, specifically, "*Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?*", and "*Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape and weight?*".

5.2.3.4. Exercising and fasting

Driven exercise (e.g., feeling compelled to exercise, or experience feelings of guilt if not exercising) and fasting behaviours were also assessed using relevant items from the EDE-Q. Items included "*Over the past 28 days, how many times have you exercised in a 'driven' or 'compulsive' way as a means of controlling your weight, shape, or amount of fat, or to burn off calories?",* and "*Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?".* Responses to latter item were re-coded in order to represent the number of times fasting over the past 28 days, e.g., a response of '2' indicating fasting occurring on 6-12 days over the last 28 days was converted to '8' indicating 8 times fasting in line with the number of times exercising over the past 28 days, therefore, eliminating the need to standardise the variable.

5.2.3.5. Disordered eating behaviours.

The number of disordered eating behaviours in the previous month was calculated by adding together the number of episodes of objective binges, self-induced vomiting, laxative use; driven exercise, and fasting. All items were standardised, then added together to form a total number of disordered eating behaviours.

5.2.3.6. Difficulties in emotion regulation.

Difficulties in emotion regulation was measured using the DERS (Gratz & Roemer, 2004), described in detail in Chapter 4. In the current sample the questionnaire showed acceptable internal reliability at $\alpha = 95$.

5.2.3.7. Negative affect.

Depression and anxiety was measured using the Depression, Anxiety and Stress Survey (short form; DASS-21; Henry & Crawford, 2005). Chapter 4 describes this measure in detail. Internal reliability for depression and anxiety in this sample was $\alpha = .94$, and $\alpha = .87$, respectively.

5.2.3.8. Interpretation bias.

Interpretation bias was measured using one of the two 15-item parallel short versions of the Ambiguous Scenarios Test for Depression (AST-D-II; Berna et al., 2011; Rohrbacher & Reinecke, 2014). The AST-D was developed for use in depressed populations and the measure contains a series of ambiguous scenarios that allow either a positive or a negative outcome interpretation (e.g., "On a rainy Sunday, you let your thoughts wander freely. Many memories come back"; "Your next birthday is approaching soon. You reflect on your life so far"). Each scenario was presented individually on a computer screen and participants

were instructed to form a mental image of each scenario, and to imagine each scenario happening to them personally. They were also instructed to follow the first image that comes to mind and not think too much about them. Participants were then asked to rate how pleasant their mental image is (pleasantness rating). The pleasantness rating was measured using a VAS representing a scale from 1 "*not at all*" to 9 "*extremely*" with higher scores indicating a more pleasant rating (positive interpretation), and low scores indicating a less pleasant rating (negative interpretation). Vividness was also measured using a VAS with a scale from 1 "not at all" to 7 "extremely", with high scores indicating a more vivid mental image. Ratings of vividness were assessed in order to control for differences in imagination as in previous research (Berna et al., 2011). The AST-D-II showed acceptable internal validity with $\alpha = .86$ for pleasantness, and $\alpha = 87$ for vividness.

5.2.4. Statistical Analyses

All variables were examined for normality using the skewness/standard error of skewness with significant departures from normality defined by z = >2.575 or <-2.575, $p < .01$ as recommended by Tabachnick and Fidell (2007). Results indicated that all variables were normally distributed with the exception of objective binge eating ($z = 6.57$, $SE = 2.64$), and purging behaviours ($z = 3.23$, $SE = .26$). As suggested by Tabachnick and Fidell (2007), square root transformations were performed. Following transformations purging behaviours exhibited skewness and kertosis scores within an acceptable range, however, objective binge eating remained positively skewed. Measures of depression and

anxiety were included as covariates for all variables. In addition, vividness was included as a covariate for pleasantness (interpretation bias measure).

To test the mediating role of interpretation biases on the relationship between disordered eating and emotion regulation difficulties, three preconditions are required to be met. The first precondition requires the predictor variable (i.e., the EDE-Q global score, disordered eating behaviours, objective binge eating episodes, purging behaviours, and exercising and fasting) to be significantly related to the outcome variable (difficulties in emotion regulation). The second precondition requires the proposed predictor variable(s) to be significantly related to the proposed mediator variable (i.e., negative interpretation bias). Third, the proposed mediator variable must be significantly related to the outcome variable. All preconditions were assessed using correlational and multiple regression analyses. Finally, it is required that in the presence of the mediator, the strength of the relationship between the predictor and the outcome variable is significantly reduced. This is indicated by the Sobel test.

Mediation was tested using the 'Process' regression analyses macro which allows for simultaneous multivariate analysis, using bootstrapping to examine a mediation model (Preacher & Hayes, 2008). Eating disorder psychopathology, disordered eating behaviours, or purging behaviours were entered as the predictor variables and difficulties with emotion regulation as the outcome variable. The hypothesised mediator which met all preconditions was included whilst depression, anxiety, and vividness were entered as covariates. The term 'total effect' denotes the relationship between the predictor variables (x) and the outcome variable (y). 'Indirect effect' refers to the mediating pathway

between *x* and the mediating variable, and between the mediating variable and *y*. The term 'direct effect' refers to the relationship between *x* and *y* whilst controlling for the indirect effects (Preacher & Hayes, 2008). Indirect effects were tested via corrected bootstrapping, the recommended method in mediation analyses, as this method has strong statistical power in detecting indirect effects and is less sensitive to small sample size (Preacher & Hayes, 2008). For the current study, bootstrapping with 1000 samples was used to generate 95% confidence intervals to determine the statistical significance of the indirect effect.

5.3. Results

5.3.1. Participant Descriptives

Means and standard deviations for all study variables are presented in Table 5.1, along with the means and standard deviations for the non-clinical study reported in Chapter 4 for ease of reference and comparison. Also included are the effect sizes (*d*) and 95% confidence intervals (CI) which indicates that compared to the non-clinical sample, the clinical sample was significantly higher on all variables of interest with the exception of disordered eating behaviours. Results also indicated that our clinical sample scored significantly lower on vividness, suggesting they had more difficulty imaging themselves in the ambiguous scenarios presented.

In addition, a significantly larger proportion of this sample reported clinical levels of depression (33.7%) and anxiety (33.7%) compared to our non-clinical sample (12.7%, z = -4.01, p <.001, and 22.1%, z = -2.01, p <.05 respectively) when using the recommended cut-off scores in the severe range on the DASS-21 (see Lovibond & Lovibond, 1995b). Of the non-clinical sample,

9.4% reported a BMI of ≤18.5 compared to 10.8% in our clinical sample, with no significant difference in proportions, $z = -.37$, $p = .37$.

5.3.2. Testing Mediation Preconditions

Correlational analyses which tested the required preconditions of mediation are presented in Table 5.2. Results showed our predictor variables (disordered eating, disordered eating behaviours, exercising and fasting behaviours, and purging behaviours) were significantly correlated with difficulties in emotion regulation meeting the first precondition for mediation. Objective binge eating, however, was not significantly correlated with difficulties in emotion regulation, therefore, failed to meet the required preconditions of mediation and was subsequently excluded from further analyses. The remaining predictor variables, with the exception of exercising and fasting behaviours, were also significantly related to negative interpretation bias, and in turn, negative interpretation bias was significantly related to difficulties in emotion regulation, meeting preconditions for mediation. Variables that failed to meet preconditions for mediation were excluded from further analyses. In summary, variables meeting all preconditions included disordered eating, disordered eating behaviours, and purging behaviours.

Table 5.1.

Means (M), standard deviations (SD) for clinical and non-clinical samples with between group effect sizes (d), and 95% confidence intervals (CI).

	Clinical Sample			Non-Clinical Sample				
	N	*M*	*SD*	*N*	*M*	*SD*	*d*	CI
BMI	83	24.73	5.50	181	22.98	4.53	.36	**-0.62 to -0.10**
EDE-Q Global	83	4.07	.80	181	2.29	1.32	1.50	**-1.79 to -1.22**
Behaviours†	83	.09	.53	181	0.00	.62	.15	-0.41 to 0.10
DERS	83	2.98	.80	181	2.50	.69	0.66	**-0.92 to -0.40**
Interpretation Biases [1]	83	4.58	1.29	180	5.29	.88	0.70	**0.43 to 0.96**
Vividness	83	4.34	1.01	180	4.58	.83	0.27	**.008 to 0.53**
Depression	83	1.13	.84	180	.71	.66	0.59	**-0.84 to -0.32**
Anxiety	83	.89	.69	180	.64	.60	0.38	**-0.64 to -0.12**
Objective Binge Eating	83	2.40	2.01	181	3.68	5.32	.28	**0.02 to 0.54**
Purging Behaviours	83	.79	1.19	181	.17	1.19	0.52	**-0.79 to -0.26**
Exercising & Fasting	83	.14	.77	181	3.27	4.14	1.30	**-1.02 to -0.74**

Note: EDE-Q global score = disordered eating severity; Behaviours = disordered eating behaviours; DERS = difficulties in emotion regulation. † Standardised variable; [1] a lower score indicates a greater level of negative interpretation biases; bolded CI indicate significant difference between two samples.

Table 5.2.

Pearson correlations for disordered eating severity, disordered eating behaviours, objective binge eating episodes, purging behaviours and exercising and fasting behaviours, 30 Item Difficulties in Emotion Regulation Scale, negative interpretation biases, anxiety, and depression

	1	2	3	4	5	6	7	8
2.	.47***	-						
3.	.13	.45***	-					
4.	.34*	.63***	-.05	-				
5.	.43***	.74***	.17	.23*	-			
6.	.47***	.34**	.14	.31**	.29**	-		
7.	-.24*	-28*	-.31**	-.28*	-.02	-.45***	-	
8.	.37**	.38***	.05	.31**	.45***	.59***	-.34**	-
9.	.37**	.23*	.03	.17	.33**	.70***	-.42***	.59***

Note: 1 = EDE-Q global score; 2 = disordered eating behaviours; 3 = objective binge eating episodes; 4 = purging; 5 = exercising and fasting; 6 = difficulties in emotion regulation; 7 = negative interpretation biases; 8 = anxiety; 9 = depression. *p <.05, **p <.01, ***p <.001.

5.3.3. Mediational Relationships

Simultaneous multivariate analyses indicated no evidence that interpretation bias acts as a mediator of any of the relationships between our predictor and outcome variables (see Table 5.3) when the analyses were adjusted for depression and anxiety. Once depression and anxiety were removed as covariates, results indicated evidence of a mediational relationship depicted in Figure 5.1. Figure 5.1 includes the direct effect of disordered eating behaviours on difficulties in emotion regulation after including the mediator variable

(negative interpretation bias) and controlling for the effects of vividness and BMI. The total effect (sum of the direct and indirect effects) of .48 (SE = .16, $p < .05$) indicates disordered eating behaviours predicts difficulties in emotion regulation over and above vividness and BMI, accounting for 48% of the variance. When negative interpretation biases were taken into account, the amount of variance explained decreased to 34% (.34, SE = .16, $p < .05$) whilst remaining significant, suggesting partial mediation. The individual path coefficients and indirect effect estimates indicate negative interpretation biases have a significant and unique contribution to the mediation process. Results of the Sobel test indicate the decrease in variance explained is significant ($z = 1.97$, $p < .05$), which suggests that the association between disordered eating behaviours and difficulties in emotion regulation is mediated by negative interpretation biases.

Table 5.3.

Summary of process regression analyses testing the mediating effects of interpretation biases on the relationship between disordered eating behaviours and difficulties in emotion regulation

Covariates	Total Effect B (t) *p*	A B (t) *p*	B B (t) *p*	Direct Effect B (t) *p*	Z Score	Normal Test (Sobels)
Vividness and BMI	0.48 (3.05) <.05	-.57 (-2.53) <.05	-.25 (-3.37) <.05	0.34 (2.19) <.05	1.97	<.05
Vividness, BMI & Depression	0.30 (2.42) <.05	-.44 (-2.02) <.05	-.11 (-1.80) .08	.25 (2.00) <.05	1.26	.21
Vividness, BMI & Anxiety	.16 (1.16) .25	-.27 (-1.19) .23	-.12 (-1.74) .09	.13 (.93) .35	.89	.37
Vividness, BMI, Depression & Anxiety	0.19 (1.54) .13	-.28 (-1.25) .22	-.08 (-1.28) .20	.17 (1.35) .18	.78	.43

Note: ‘Total Effect’ refers to the relationship between disordered eating behaviours and difficulties in emotion regulation whilst controlling for covariates; ‘A’ denotes the relationship between disordered eating behaviours and the mediating variable (interpretation bias); ‘B’ denotes the relationship between the mediator and the outcome variable (difficulties in emotion regulation); ‘Direct Effect’ describes the relationship between disordered eating behaviours and the outcome variable after including the mediator variable.

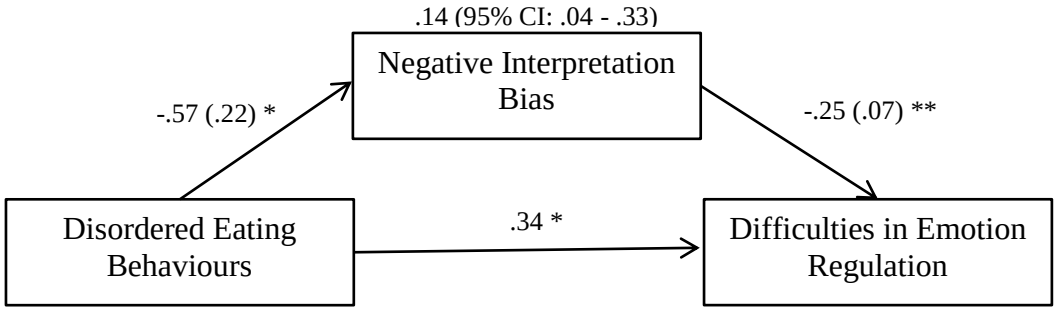

Figure 5.1. Mediation analyses with unstandardized coefficients and standard error (SE) with estimates of the direct effect of disordered eating behaviours on difficulties with emotion regulation and the effect of the indirect pathways with 95% confidence intervals (CI) whilst controlling for vividness. (*p <.05; **p<.01).

5.4. Discussion

The current study aimed to investigate the relationship between interpretation bias and disordered eating, disordered eating behaviours and difficulties in emotion regulation in a clinical sample, as well as investigating the possible mediating effects this bias has on the relationship between these key eating disorder correlates and difficulties in emotion regulation. Comparisons with the non-clinical samples validated the clinical nature of the current sample, showing it to experience significantly higher symptoms of disordered eating, disordered eating behaviours such as purging and excessive exercising and fasting, and difficulties in emotion regulation.

Our previous study showed interpretation bias was significantly and negatively related to these key eating disorder correlates in a non-clinical population, and this study aimed to replicate these findings in a clinical sample.

First we predicted that interpretation bias would be significantly and negatively related to disordered eating, disordered eating behaviours, objective binge eating, purging, excessive exercise and difficulties in emotion regulation. Our hypothesis was partially supported. Our results indicate interpretation bias was significantly and negatively related to all variables of interest with the exception of exercising and fasting. These results suggest that as disordered eating and disordered eating behaviours such as purging and binge eating increase, so too does the tendency to view ambiguous every day scenarios as being more negative, rather than positive or benign. In addition, a negative bias is related to increased difficulties in emotion regulation within this population.

Although interpretation bias was associated with key eating disorder correlates, it did not mediate the relationships between disordered eating severity, disordered eating behaviours and difficulties in emotion regulation, over and above the influence of depression and anxiety. However, once these covariates were removed, interpretation bias played a key role in the relationship between disordered eating behaviours and difficulties in emotion regulation, acting as a partial mediator. These results indicate the relationship between disordered eating behaviours and difficulties in emotion regulation are possibly influenced by a tendency to interpret ambiguous situations as being negative rather than positive, however, results also indicate both depression and anxiety play a role.

Results from the current study suggest that in a clinical population, interpretation bias does operate in clinical eating disorder samples, however, perhaps not in the same fashion evidenced in a non-clinical population high in disordered eating. Comorbidity with depression and anxiety became more

pronounced in this sample compared to the non-clinical sample. It is possible that as comorbidity increases, thereby increasing shared variance among disordered eating, depression, and anxiety, there is less unique variance of disordered eating to predict. Hence, attempting to examine the influence of interpretation bias on this unique variance becomes more difficult and would require greater power to detect variance. This would suggest that a larger sample size is required to conduct these mediational analyses if the object is to adjust for depression and anxiety so that the impact of interpretation bias on disordered eating alone can be detected. Because both depression and anxiety are highly comorbid with eating disorders, it was important to ensure any findings related to disordered eating were independent of the effects of these constructs.

Another possible interpretation for the lack of a mediational relationship when adjusting for depression and anxiety, is the use of a single interpretation bias measure rather than including another measure which may better tap into the unique variance of disordered eating over and above that shared with depression and anxiety. Measuring interpretation bias in eating disorder research is in its infancy and it is not yet known which measure is the most suitable in this population. However, very few measures assess interpretation of ambiguous every-day situations and often researchers create their own vignettes (e.g., Constans et al., 1999; Wisco & Nolen-Hoeksema, 2010). Often used in the assessment of interpretation bias is the Scrambled Sentences Task (Wenzlaff & Bates, 1998), which assesses emotional biases in interpretation by asking participants to unscramble a sentence which can be done so resulting in either a positive or negative manner. This measure, however, does not assess interpretations of every-day situations. Another commonly used measure of

interpretation bias is the Interpretation Questionnaire (Butler & Mathews, 1983), which measures the interpretation of ambiguous social scenarios. This measure, however, focusses on ambiguous situations designed to assess cognitions relevant to anxiety such as threat. It is important for future studies to adjust for the influence of depression and anxiety as they are highly comorbid with eating disorders. A large body of research supports the strong relationships between anxiety, depression, and cognitive biases such as interpretation bias. In order to assess the role this type of bias plays in an eating disorder population, it is a reasonable to suggest that the independent influence of depression and anxiety be removed in order to enable us to investigate the relationship between interpretation bias and key eating disorder correlates. However, it can also be argued that by removing the influences of depression and anxiety in eating disorder research, we risk removing a key component of eating disorder psychopathology.

Although related to key eating disorder correlates, interpretation bias may play different role, or at least, less of a role in a clinical population due to symptom severity and comorbidity. It is evident that an interpretation bias exists in those with an eating disorder, however, it is less clear whether this influences the relationship between eating disorder correlates and difficulties in emotion regulation, a key maintaining factor. Another way to examine this question in future research would be to investigate whether modifying bias can lead to eating disorder symptom reduction as has been found in anxiety and depression research (for a review see Hallion & Ruscio, 2011; Menne-Lothmann et al., 2014).

This study has a number of limitations. First it is cross sectional which does not enable us to make claims of causality. Second, it is possible that the measure of interpretation bias is less effective in this more symptomatic population. When compared to the non-clinical sample, the clinical sample experienced more difficulty imagining themselves in the scenarios presented, which may account for a lack of findings. As we did not have another measure of interpretation bias we cannot determine whether this measure is effective in a clinical disordered eating population. Alternatively, this measure of interpretation bias may be less relevant to an eating disorder population, and comparative studies which include the use of different measures of interpretation bias are required to investigate whether this idea is supported.

In summary, the current study provides insight into the existence of interpretation bias in a clinical eating disorder sample. To our knowledge, this is the first study to examine the relationship between interpretation bias and key eating disorder correlates. Further research is needed extend our knowledge regarding information processing biases in eating disorders, and to ascertain whether this type of bias, if modified, can reduce symptoms of disordered eating and difficulties in emotion regulation in a clinical sample. By ascertaining whether modifying bias can result in symptom reduction, we can inform eating disorder prevention and treatment paradigms.

Chapter 6.

Modifying Cognitive Bias for Interpretation in Women with Clinical Levels of Eating Disorder Symptoms: A Randomised Controlled Trial[5]

6.1. Overview

Cognitive biases have been shown to be one of the underlying mechanisms of many psychiatric illnesses, including depression and anxiety. Prominent cognitive theories posit the processing of negatively valenced information plays a key role in the development and maintenance of these emotional disorders (Beck, 2008; Beck et al., 2005; Mathews & MacLeod, 2005; Teasdale, 1985). Research indicates emotional disorders are typically characterised by negative biases in attention, memory, and interpretation, and theory suggests these biases activate dysfunctional emotional and behavioural responses (Woud & Becker, 2014). Cognitive bias modification (CBM) techniques have been evaluated extensively in depression and anxiety research to modify information processing biases via repeated practice that reinforces more adaptive processing styles.

The particular focus of the current investigation is on negatively biased interpretations, where depressed individuals tend to interpret ambiguous stimuli as negative rather than positive or benign, and anxious individuals interpret these stimuli as being threatening (Beard & Amir, 2010; Butler & Mathews, 1983; Constans et al., 1999; Lawson, MacLeod, & Hammond, 2002; MacLeod & Cohen, 1993; Mogg et al., 2006; Rude et al., 2002; Wisco & Nolen-Hoeksema,

[5] This chapter has been submitted to *Cognitive Therapy and Research* [Cooper, J.L., Yiend, J., Cooper, M. J., & Wade, T.D. (2016). Modifying cognitive bias for interpretation in women with clinical levels of eating disorder symptoms: A randomised controlled trial]

2010). Modification of this type of bias utilises CBM for Interpretation (CBM-I) training which trains the individual to interpret an ambiguous scenario in either a positive or negative manner, inducing the desired bias. A common training paradigm is a word completion task which requires participants to read a series of ambiguous scenarios and then complete a word fragment which resolves the ambiguity of the scenario in a manner conducive to the desired interpretation. After completion of the word fragment, participants are asked a comprehension question that reinforces the interpretation (Mathews & Mackintosh, 2000). A recent meta-analysis investigated the efficacy of CBM-I training on interpretation bias and mood (Menne-Lothmann et al., 2014). This technique has been shown to successfully activate the desired bias when faced with real-life ambiguous scenarios and is used in depression and anxiety research (Hallion & Ruscio, 2011; Koster et al., 2009; Yiend, Lee, et al., 2014). Results from the meta-analysis indicate positive CBM-I training increased positive interpretations and decreased negative mood, however, these effects did not consistently differ from the no-training or neutral training control conditions. Results from this analysis also indicated females tended to benefit more from benign CBM-I compared to males, and that participants who had a more negative interpretation bias reported significant and large increases in positive interpretations, suggesting gender and level of bias act as moderators and may contribute to mixed findings in the literature (Menne-Lothmann et al., 2014; Micco et al., 2014). Findings from another meta-analysis suggest CBM-I is effective in modifying biases and reducing symptoms of depression and anxiety (Hallion & Ruscio, 2011). However, this reduction in symptoms was only reliable when participants experienced a stressor.

Cognitive models of eating disorders also posit attention, memory, and interpretation biases play a key role in the maintenance of disordered eating, with errors in information processing resulting in habitual and automatic behaviours and cognitions such as body dissatisfaction, dietary restraint, or excessive exercise (for a review see Cooper, 2005; Siep et al., 2011). A number of studies support these models with a large amount of research indicating attention biases for food, body, weight, shape and appearance stimuli, in both clinical and sub-clinical populations (Brooks et al., 2011; Cooper, 1997; Dobson & Dozois, 2004; Rieger et al., 1998; Rosser et al., 2010; Shafran et al., 2007; Smeets et al., 2008; Veenstra & de Jong, 2012). Memory biases are also evident in clinical and sub-clinical populations with a number of studies indicating recall for negative food, weight, shape or disorder salient words is increased compared to controls, however, findings are mixed with memory biases more prominent in those with anorexia nervosa (for a review see Brooks et al., 2011).

To date, research into interpretation biases in eating disorders is comparatively sparse. Studies have demonstrated an increased interpretation of ambiguous situations as being negative and related to appearance in both clinical and sub-clinical populations (Cooper, 1997; Jackman et al., 1995; Rosser et al., 2010; Williamson et al., 2000). For example, people who are preoccupied with weight or shape concerns, tend to interpret ambiguous situations in a manner congruent with their concerns (Jackman et al., 1995). However, there is little research available investigating whether these biases in interpretation exist for ambiguous situations that are unrelated to appearance. Cross-sectional research has shown an interpretation bias pertaining to ambiguous situations related to having a negative meaning for the self was associated with disordered eating

(Cooper, 1997), independent of depression and anxiety (Cooper & Cowan, 2009). In addition, a cross-sectional study in a university sample, examined interpretation biases in terms of emotionally ambiguous situations relevant to depression, and found interpretation biases were associated with disordered eating and disordered eating behaviours such as binge-eating (Cooper & Wade, 2015). This association was also independent of depression and anxiety. In addition, interpretation biases mediated the relationship between disordered eating and difficulties in emotion regulation (Cooper & Wade, 2015), a hallmark feature of eating disorders considered to be a key maintaining factor (Fairburn et al., 2003). Across these studies, research suggests that negative interpretation bias relevant to depression is associated with increased eating psychopathology, disordered eating behaviours and difficulties in emotion regulation, independent of levels of depression.

Two studies have gone on to use research designs that can better inform causality in relation to interpretation biases of ambiguous scenarios unrelated to appearance. The first study (Yiend, Parnes, et al., 2014) focussed on manipulating interpretation bias related to negative beliefs about the self. The study indicated that for a sub-clinical population, a modified version of CBM-I which targeted negative self-beliefs, was successful in manipulating the interpretation of ambiguous stimuli pertaining to negative self-beliefs, and influenced disordered eating behaviours and associated cognitions. Compared to the negative CBM training group, those in the positive training group showed a significant reduction in negative thoughts triggered by tasks related to weighing and mirror exposure, and significant improvements in symptoms of anxiety and depression. In addition, negative training led to increased dietary restraint. The

second study, a case series of 28 patients with anorexia nervosa, found that five sessions of positive interpretation training resulted in fewer negative interpretations of ambiguous social situations depicting the risk of rejection, an increase in positive interpretations of ambiguous social stimuli, and a reduction in anxiety (Cardi, Esposito, et al., 2015). However, there was no impact on eating disorder symptoms. Therefore, the evidence showing that interpretation biases of ambiguous scenarios unrelated to appearance can lead to disordered eating remains weak. In addition, no studies examine the impact of CBM-I on important clinical correlates of eating disorders such as difficulties in emotion regulation.

The aim of this study is, therefore, to use CBM-I to modify interpretations of ambiguous every-day situations, and in doing so, observe the impact on disordered eating, disordered eating behaviours, and a range of important clinical features of disordered eating, including motivation to recover from an eating disorder, weight and shape satisfaction, negative affect, and difficulties in emotion regulation. We used the CBM-I paradigm for negative self-beliefs given this showed some promise in modifying disordered eating (Yiend, Parnes, et al., 2014).

As previously observed (Cardi, Esposito, et al., 2015; Yiend, Parnes, et al., 2014), we predicted that compared to a neutral training condition, positive CBM-I training would lead to an increase in positive interpretation bias. We also predicted a decrease in disordered eating psychopathology, decreased difficulties in emotion regulation and negative affect, as well as an increase in motivation to recover, and improved weight and shape satisfaction. Current levels of depression and anxiety were included as covariates in all analyses, in order to

allow us to ascertain whether any changes were independent of comorbidity with depression and anxiety.

6.2. Method

6.2.1. Participants

This online study included 83 females, 18 to 61 years (*M* = 24.07, *SD* = 7.6), with a body mass index (BMI) ranging from 12.72 to 37.39 (*M* = 24.73, *SD* = 5.5). Participants were recruited nationally via advertisements on relevant websites, medical clinics, and from two South Australian Universities. Inclusion criteria required participants to be female, over 18 years of age, and to have a clinically significant level of disordered eating. This latter criterion was initially assessed with the SCOFF, a valid and reliable measure able to detect presence of an eating disorder (Hill et al., 2010). Participants who answered two or more questions in the affirmative were able to proceed into the study. Ineligible participants were provided with a list of eating disorder service providers and information sources.

Of the 198 potential participants responding to advertisements, 36 declined to participate, 52 were screened out by the SCOFF, and a further 26 participants did not meet the criteria for disordered eating at baseline assessment as defined by a cut-off of 2.8 on the global scale of the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994). Research has shown this cut-off score is the optimal score to identify presence of an eating disorder and was used in order to ensure a clinically distressed population was identified. While research indicates the both the SCOFF and the EDE-Q are adequate measures to detect clinical cases and exclude non-clinical participants

(Mond et al., 2008), the EDE-Q is considered the more robust indicator of disordered eating. The data belonging to the excluded participants was not analysed in this report. A CONSORT diagram is shown in Figure 6.1. Consent was obtained from all individual participants included in the study. This study received approval from the Southern Adelaide Clinical Human Research Ethics Committee.

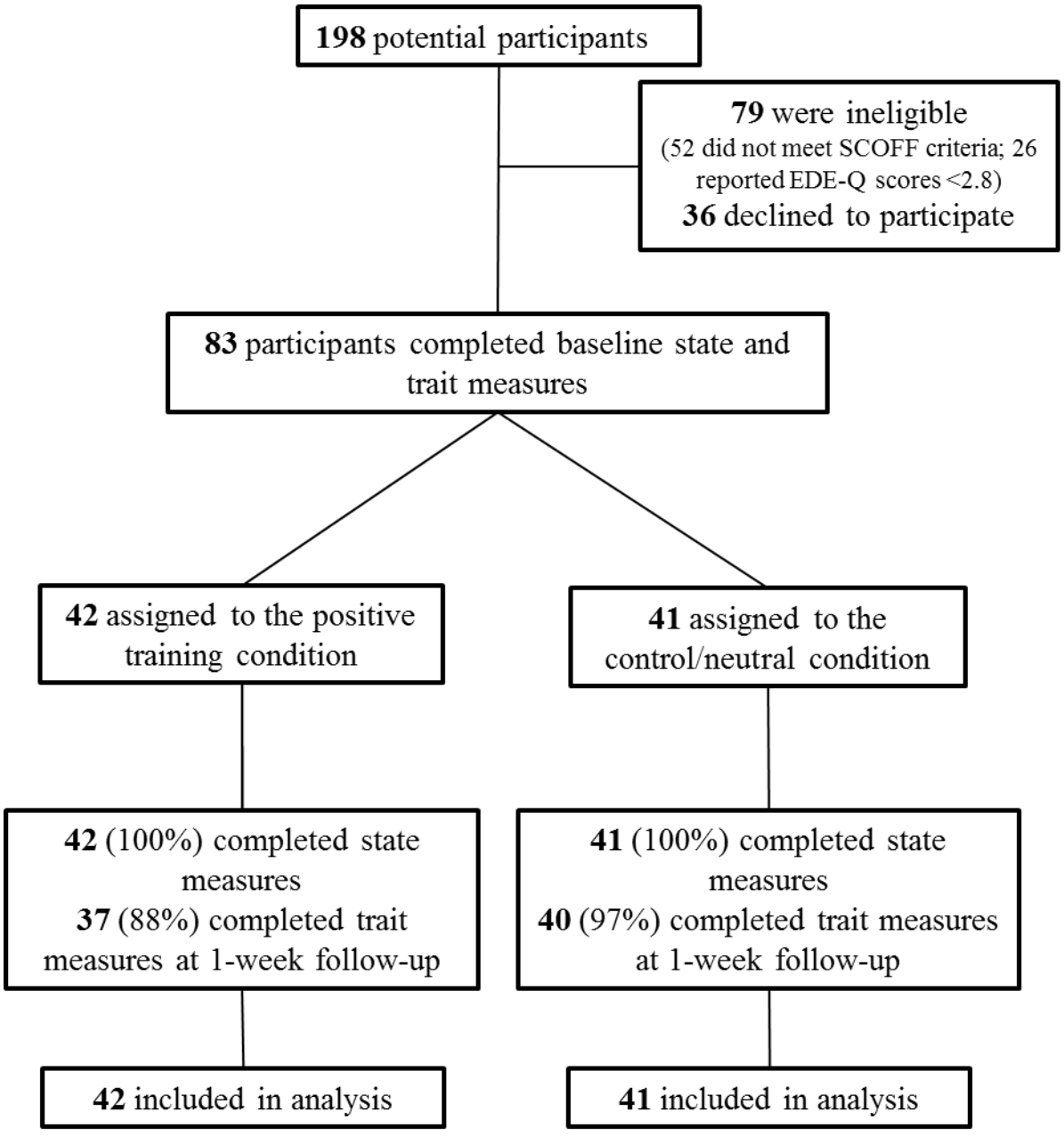

Figure 6.1. Consort diagram illustrating participant flow

6.2.2. Design and Procedure

A randomised controlled trial was conducted on two parallel groups. Participants completed a range of demographic questions followed by the state measures and the trait questionnaires. All questionnaires we completed online. They were then randomly allocated into either the positive training group or the control group. Random allocation was computer generated with participants blind to the condition. One session of training was conducted, followed by administration of the state measures. Upon completion of the first phase of the study, participants were reminded that they would be contacted in seven days and provided with a link to the second phase of the study via email. Seven days following the intervention, participants were emailed a link to the online questionnaire and asked to complete the trait questionnaires again, all of which focussed on functioning over the past week, and the measure of interpretation bias. Participants were paid upon completion of the second phase of the study.

6.2.3. Measures

6.2.3.1. State measures.

Six state measures were included. Motivation to recover from an eating disorder was assessed using three visual analogue scales (VAS) measured by dragging the slider along a horizontal line representing a scale from 1 "*not at all*" to 10 "*very much*". Participants were asked "*How important is that you recover from your eating disorder?*", "*How confident are you that you will recover from your eating disorder?*", and "*How ready are you to recover from your eating disorder?*" Weight satisfaction and shape satisfaction were also assessed using two VAS, both representing a scale from 1 "*not at all*" to 10 "*very much*".

Participants indicated their responses to the questions, "*How satisfied do you feel about your weight right now*", and "*How satisfied do you feel about your shape right now*". Higher scores indicated high levels of state weight concern and state shape concern. State negative affect was assessed using items relevant to anxiety and depression within the Positive and Negative Affect Scale – expanded version (PANAS-X; Watson & Clark, 1999). Participants were asked to indicate to what extent they experienced certain emotions and/or feelings "in the past week". Responses rated from 1 "*very slightly or not at all*" to 5 "*extremely*", with higher scores indicating higher levels of negative affect. The mean item score was used, and in the current study internal reliability was acceptable at $\alpha = .89$ at baseline, and $\alpha = .92$ at post-training.

6.2.3.2. Trait questionnaires.

Disordered Eating. The severity of eating disorder psychopathology was indicated by the global score from the EDE-Q (Fairburn & Beglin, 1994). The global score consists of the summation of the four subscales; weight concern, shape concern, eating concern, and dietary restraint. Each item is assessed on a 7 point Likert-type scale ranging from 0 "*Not at all"* to 6 "*Markedly*", with higher scores indicating greater levels of eating disorder severity. Disordered eating was assessed over the previous 28 days (baseline) and the previous 7 days (follow-up). In the current study internal reliability was acceptable at $\alpha = .83$ at baseline, and $\alpha = .90$ at follow-up.

Behaviours. Disordered eating behaviours were also assessed using the EDE-Q. This included the number of episodes of objective binges (overeating associated with a loss of control); self-induced vomiting; laxative use; driven

exercise (e.g. feeling compelled to exercise even if injured, or experiencing feelings of guilt if not exercising), and fasting. This latter item, from the dietary restraint subscale asked, "*Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?*" All items were standardised, then added together to form a total number of disordered eating behaviours score.

Difficulties in Emotion Regulation Scale. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a self-report measure which assesses six dimensions of emotion regulation. Each item is assessed on a 5 point Likert-type scale ranging from 1 "*almost never"* to 5 "*almost always"*, with high scores representing increased difficulties with emotion regulation. The current study used a 30-item, six factor version of the DERS (DERS-30) as there is evidence that this abbreviated version exhibits stronger relationships with eating disorder severity and disordered eating behaviours than the original 36-item version of the scale (Cooper et al., 2014). The questionnaire showed acceptable internal reliability at both baseline ($\alpha = 95$) and at follow-up ($\alpha = 96$).

Negative Affect. Depression and anxiety was measured at baseline and follow-up using the Depression, Anxiety and Stress Survey (short form; DASS-21; Henry & Crawford, 2005). Measures of Stress were omitted with only the depression and anxiety subscales being utilised in the current study. Each item is measured on a 4 point Likert-type scale from 0 "*did not apply to me at all"* to 3 "*applied to me very much, or most of the time"*, with higher scores indicating higher levels of depression or anxiety. Participants were asked to indicate how much the statements applied to them over the past week. Sample items for

depression and anxiety included, "*I felt I had nothing to look forward to*", "*I felt scared without any good reason*", respectively. Mean item scores for both subscales were used with each subscale indicating acceptable internal reliability at each time point. Internal reliability at baseline for depression and anxiety was α = .94, and α = .87, and at follow-up α = .91, and α = .88 respectively.

Interpretation Bias. Interpretation bias was measured using two 15-item parallel short versions of the Ambiguous Scenarios Test for Depression (AST-D-II; Berna et al., 2011; Rohrbacher & Reinecke, 2014) at baseline and follow-up. The AST-D was developed for use in depressed populations and the measure contains a series of ambiguous scenarios that allow either a positive or a negative outcome interpretation. Each of the scenarios was presented individually on a computer screen and participants were instructed to form a mental image of each scenario and imagine each scenario happening to them personally. They were also instructed to follow the first image that came to mind and not to think too much about it. Participants were then asked to rate how pleasant their mental image was (pleasantness rating). The pleasantness rating was measured using a VAS representing a scale from 1 "*not at all*" to 9 "*extremely*" with higher scores indicating a more pleasant rating (positive interpretation), and lower scores indicating a less pleasant rating (negative interpretation). Vividness was also measured using a VAS with a scale from 1 "not at all" to 7 "extremely", with higher scores indicating a more vivid mental image. Ratings of vividness were assessed in order to control for differences in imagination as in previous research (Berna et al., 2011). The AST-D-II was the primary outcome variable and showed acceptable internal reliability with α = .86 at baseline, and α = .84 at

follow-up for pleasantness, and α = .87 at baseline and α = .90 at follow-up for vividness.

6.2.3.3. Conditions

Positive training condition. The cognitive bias training procedure used 66 items from Yiend et al. (2014). Prior to commencing the procedure, participants were provided with instructions and two practice questions. Participants were required to read an emotionally ambiguous scenario ending with a word fragment similar to previous cognitive bias modification for interpretation procedures (e.g., Mathews & Mackintosh, 2000). Completion of the word fragment resolved the ambiguity of the scenario with each modification item designed to allow a positive interpretation of each scenario. Upon completion of the word fragment, participants were asked a subsequent question (requiring a yes/no response) designed to reinforce the positive interpretation. Participants were notified if they made a mistake, and could not continue to the next scenario without correctly completing the word fragment and subsequent question. An example item is as follows:

> A friend mentions that she is organising a special holiday to mark her 30th birthday. She plans to invite a group of friends along to celebrate the occasion. You have known your friend for many years but you don't get asked to join the group holiday. You think you are
>
> ov_rl_ _k_d overlooked (positive interpretation)
>
> Do you think she has accidentally forgotten to include you? YES (forced response)

Control/neutral condition. The control condition was a similar design to the positive training condition, however, items were unambiguous and emotionally neutral. An example item is as follows:

> You are watching a clip on the internet about great engineering achievements. It describes the construction of the Golden Gate Bridge. The length of the bridge is over two and a half thousand
>
> met_ _s metres (neutral response)
>
> Have you been watching a clip about a bridge? YES (forced response)

6.2.4. Statistical Analyses

All variables were examined for normality using the skewness/standard error of skewness with significant departures from normality defined by z = >2.575 or <-2.575, $p < .01$ as recommended by Tabachnick and Fidell (2007). Results indicated that all variables were normally distributed. Baseline differences between the two conditions were assessed using independent groups t-tests for each outcome variable including covariates (trait depression and anxiety). The impact of the training condition on the state variables was assessed using a mixed analysis of variance (ANOVA). Given the presence of missing data at follow-up ($n = 6$), the effectiveness of the training condition on the primary and secondary outcome variables was assessed using linear mixed model analyses. Linear mixed models are preferred with data which has unbalanced groups, missing follow-up data, and varying time points, and is the recommended statistical technique for analysing repeated-measures designs (Field, 2013; Gueorguieva & Krystal, 2004).

In all analyses, baseline measures of depression and anxiety were included as covariates for all variables with the exception of the PANAS. In addition, the baseline measure of vividness was also included as a covariate for pleasantness (interpretation bias) analyses.

6.3. Results

6.3.1. Baseline Data

Participant groups were compared on all baseline measures with results indicating no significant differences (see Table 6.1 for demographic variables and covariates, and Table 6.2 for state and trait variables). Binary logistic regressions were conducted to see if there were any baseline characteristics which predicted the missing data at one week follow-up (see Table 6.2). Results showed no significant predictors, indicating missing data were random. Correlational analyses indicated that pleasantness (interpretation bias) was significantly and negatively correlated with disordered eating, disordered eating behaviours, and difficulties in emotion regulation (ranging from r = -.24 to r = -.45), and with the state measure of negative affect (r = -.34). Baseline mean ratings of pleasantness for the whole sample (M = 4.58, SD = 1.29) were comparable to a previous study using a clinical sample, M = 4.18, SD = 1.15 (Williams, Blackwell, Mackenzie, Holmes, & Andrews, 2013), and lower than a non-clinical sample, M = 5.29, SD = .88 (Cooper & Wade, 2015), suggesting a more negative bias is characteristic of a sample with high levels of clinical symptoms.

Table 6.1.

Baseline demographic and covariate questionnaire data

	Training Condition		Baseline Differences		
	Positive (n = 42)	Control/Neutral (n = 41)	t	df	p
Demographics					
Age (years)	25.15 (9.2)	23.0 (5.4)	1.33	66.4	.19
BMI	25.04 (6.1)	24.4 (4.9)	-.50	81	.62
Covariates					
Depression	1.09 (.84)	1.17 (.84)	.43	81	.67
Anxiety	.81 (.74)	.97 (.65)	1.07	81	.29
Vividness	4.32 (.98)	4.36 (1.1)	.17	81	.86

Note: Standard deviations are shown in parenthesis. BMI = body mass index; Vividness = vividness rating from the Ambiguous Scenarios Test for Depression.

6.3.2. Intervention Impact on the State Variables

As can be seen in Table 6.3, there were no significant interactions or main effects of condition. There were, however, significant main effects of time for confidence to recover (d = .72), weight satisfaction (d = .59), and negative affect (d = 1.17). These results indicated participants' scores for confidence to recover and weight satisfaction increased for both groups (positive training and control/neutral) following the intervention with moderate to large effect sizes, and participants' scores for negative affect were significantly lower at post-training for both groups.

6.3.3. Intervention Impact on the Trait Variables

Also reported in Table 6.3 are results of the linear mixed model analyses which indicate there was also a main effect for time for disordered eating, with

significant improvements at 1-week follow-up in both groups (d =.68). There were no changes for the other variables. Both state and trait variables were reanalysed removing depression and anxiety as a covariate, and also adding BMI as a covariate, however, no significant effects of condition were detected.

Table 6.2.

Means (and standard deviations) of state measures by condition and time, adjusted means (and standard errors) of trait measures by condition and time, baseline differences and predictors of participation from baseline to follow-up

	Training Condition				Baseline Differences			Predictors of Participation (Baseline to Follow-up)
	Positive (*n* = 42)		Control/Neutral (*n* = 41)					
State variables	Baseline	Post-Training	Baseline	Post-Training	*t*	*df*	*p*	Wald Chi *(p)*
Importance to Recover	7.00 (2.7)	6.83 (2.6)	6.95 (2.7)	6.73 (3.1)	-.08	81	.93	1.85 (.17)
Confidence to Recover	4.74 (2.4)	5.52 (2.4)	5.10 (2.4)	5.46 (2.6)	.58	81	.57	.57 (.45)
Readiness to Recover	5.71 (2.3)	6.43 (2.5)	5.63 (2.7)	6.05 (2.9)	-.15	81	.89	.46 (.50)
Weight Satisfaction	2.43 (1.8)	3.05 (2.2)	2.22 (1.8)	3.05 (2.2)	-.55	81	.58	.56 (.45)
Shape Satisfaction	2.79 (1.8)	3.17 (2.1)	2.49 (1.8)	3.17 (2.1)	-.83	81	.41	.53 (.47)
Negative Affect	23.9 (9.8)	20.0 (9.4)	24.1 (8.2)	21.1 (8.8)	.13	81	.89	1.71 (.40)
Trait variables								
AST-D Pleasantness Rating	4.64 (.16)	4.33 (.20)	4.69 (.16)	4.44 (.19)	.53	81	.60	1.30 (.26)
EDE-Q Global	3.97 (.11)	3.76 (.14)	4.19 (.12)	3.97 (.14)	1.58	81	.12	.09 (.77)
EDE-Q Behaviours	.09 (.73)	.10 (.74)	.09 (.73)	.06 (.74)	.38	81	.71	.88 (.35)
DERS-30	2.97 (.09)	2.89 (.09)	3.00 (.09)	3.03 (09)	.70	81	.48	1.27 (.72)

Note: Standard deviations are shown in parenthesis. Baseline differences for trait measures were analysed using unadjusted means. Negative Affect = measured by the Positive and Negative Affect Scale (PANAS). Baseline measures of depression and anxiety were included as covariates for all variables excluding negative affect. AST-D = Ambiguous Scenarios Test for Depression; EDE-Q Global = global score from the Eating Disorder Examination – Questionnaire; EDE-Q Behaviours = disordered eating behaviours; DERS-30 = Difficulties in Emotion Regulation Scale (30-item). Baseline measures of depression and anxiety were included as covariates. Baseline measures of vividness, depression and anxiety were included as covariates for pleasantness (interpretation bias).

Table 6.3.

Main and interaction effects for state, primary, and trait variables.

Variable	*F*	*df*	*p*
State Measures:			
Importance to Recover			
Time	3.34	1,79	.07
Condition	.03	1,79	.87
Time X Condition	.03	1,79	.87
Confidence to Recover			
Time	10.25	1,79	<.01
Condition	.06	1,79	.81
Time X Condition	.991	1,79	.39
Readiness to Recover			
Time	3.69	1,79	.06
Condition	.15	1,79	.70
Time X Condition	.52	1,79	.48
Weight Satisfaction			
Time	7.01	1,79	<.05
Condition	.51	1,79	.48
Time X Condition	.08	1,79	.78
Shape Satisfaction			
Time	.21	1,79	.65
Condition	1.66	1,79	.20
Time X Condition	1.30	1,79	.26
Negative Affect			
Time	27.9	1,81	<.001
Condition	.12	1,81	.73
Time X Condition	.351	1,81	.56
Pleasantness (interpretation bias)			
Time	2.49	1,76.21	.12
Condition	.59	1,77.30	.44
Time X Condition	.24	1,76.22	.62
Global EDE-Q			
Time	8.76	1,75.39	<.01
Condition	1.57	1,79.70	.21
Time X Condition	.00	1,75.39	.98
EDE-Q Behaviours[a]			
Time	.03	1,75.12	.87
Condition	.03	1,79.62	.87
Time X Condition	.13	1,75.12	.72
DERS-30			
Time	.59	1,76.56	.45
Condition	.73	1,79.74	.40
Time X Condition	1.75	1,76.57	.19

[a] Standardised variable. Baseline measures of depression and anxiety were included as covariates for all variables excluding the PANAS. Baseline measures of vividness, depression and anxiety were included as covariates for pleasantness (interpretation bias).

6.3.4. Post Hoc Analyses Assessing the Impact of Initial Level of Bias on the Manipulation

In the absence of significant effects of condition, *post hoc* analyses were conducted to assess whether there was a moderating influence of initial bias level on the efficacy of the intervention. Participants with scores ≤4 on pleasantness were coded as 1 (indicating a negative bias, $n = 29$), and those over 4 coded as 0 (indicating no bias, $n = 54$). This cut-off was used as two studies of clinical participants reported means between 3.90 and 4.18 (Orchard, Pass, & Reynolds, 2015; Williams et al., 2013), and two studies of subclinical populations reported means between 5.03 and 5.29 (Berna et al., 2011; Cooper & Wade, 2015). The impact of negative bias on the effectiveness of the intervention was assessed via analysis of covariance (ANCOVA). We used ANCOVA in order to include baseline observations of the dependent variables as covariates, along with baseline measures of depression and anxiety. For pleasantness (interpretation bias), the baseline measure of vividness was the only covariate. No significant interactions were found.

6.4. Discussion

The main aim of this study was to investigate the use of positive CBM-I training to decrease negatively biased interpretations of ambiguous situations, and consequently to observe hypothesised improvements with respect to disordered eating psychopathology, disordered eating behaviours, and a range of clinical correlates relevant to disordered eating in a sample of females with clinical symptoms of disordered eating. In contrast to the two studies which found that positive interpretation training resulted in fewer negative interpretations of

ambiguous social situations (Cardi, Esposito, et al., 2015; Yiend, Parnes, et al., 2014), positive training did not decrease interpretation bias involving ambiguous situations in our sample.

There are several possible explanations for this finding which represent limitations of the current research. First, the modification procedure may not have been powerful enough to alter biases or influence our key outcome variables after only a single session. Research suggests that multiple training sessions tend to yield stronger effect sizes, suggesting multiple sessions influence the effectiveness of the intervention (Hallion & Ruscio, 2011). In addition, it is also possible that a proportion of the positive training items were not overtly positive and could be construed as being more neutral. Additionally, research suggests clinical participants struggle to identify themselves with overly positive event outcomes described in the training, and find it difficult to endorse unrealistic interpretations (Mathews, Ridgeway, Cook, & Yiend, 2007). Using a more graded approach, i.e., starting with neutral items and gradually increasing the positive interpretation as the training progresses, may be a more suitable approach in clinically symptomatic populations. In comparison to the Yiend et al. (2014) study, we did not include a negative training group where post-training differences in bias can be expected to be more pronounced when positive and negative groups are compared (Menne-Lothmann et al., 2014). Another possible explanation is that the measure of interpretation bias may not have been able to detect changes, however, the AST-D-II is a robust measure of interpretation bias which has been shown to detect changes in bias in previous CBM-I research (Berna et al., 2011; Rohrbacher et al., 2014; Rohrbacher & Reinecke, 2014). In addition, we administered the AST-D-II seven days after the intervention/control

session, by which time induced effects on interpretation may have waned, making them harder to detect. Alternatively, this measure of interpretation bias may be less relevant to an eating disorder population. The parallel version of the AST-D was used as the measure of interpretation bias as it enabled us to measure existing biases prior to the training, and enabled us to adhere to time constraints being a relatively quick measure to complete. It has been suggested, however, that the optimal measure of interpretation bias when using CBM-I training is one that resembles the training procedure itself. However, although the items in the AST-D-II were not modified versions of the same scenarios used for the items in the training procedures, they were very similar in that the scenarios were both emotionally ambiguous and similar in structure and context. However, ratings of pleasantness do not *directly* establish what interpretation was made of the encoded ambiguity in the manner that other lengthier interpretation bias tasks would allow. It is also possible that participants were susceptible to being distracted. Participants completed all questionnaires online and we cannot be certain that participants completed the modification technique in one sitting or paid attention to the task itself.

Not surprisingly, in view of a lack of impact on interpretation bias, our hypothesis predicting superiority of positive CBM-I training compared to the control/neutral training condition across our outcome variables was not supported. We found no evidence of significant group differences on any of the outcome measures. Our results indicated that over time, both groups showed significant improvements in confidence to recover, weight satisfaction, negative affect, and eating psychopathology. Our finding that both training conditions reduce disordered eating psychopathology over time is somewhat surprising, as research

has shown that eating psychopathology can be expected to be stable over time (Steele & Wade, 2008). However, these findings are similar to previous research where both the control group and the positive training group were both found to reduce negative mood over time (Blackwell et al., 2015; Menne-Lothmann et al., 2014; Micco et al., 2014; Salemink, Kindt, Rienties, & van den Hout, 2014).

Several explanations for these findings exist. First, it is possible that the control/neutral condition is not entirely neutral as first thought. Although the items were emotionally neutral, it is possible that the positive feedback (e.g., the word 'correct'), which was displayed following the successful completion of the word fragment and subsequent reinforcing question, led to a decrease in negative mood and an increase in self-efficacy, a core element of motivation to recover. The tasks were not difficult so it is possible many participants rarely encountered an error message whilst completing the word completion task or subsequent question. It is also possible that both training conditions acted as a distraction technique resulting in an increase in confidence to recover, and in weight satisfaction, and a decrease in negative affect. Distraction techniques have been shown to be successful in reducing disordered eating symptoms (Telch et al., 2001; Wisniewski & Kelly, 2003). It may also be that behavioural indicators of disordered eating, shown to be more sensitive to CBM-I than clinical self-report outcomes (Yiend, Parnes, et al., 2014), may have better differentiated between the conditions. Finally, it is possible that by controlling for the influences of depression and anxiety, we also removed the key underlying mechanisms of cognitive biases, therefore, the intervention was less effective. However, reanalysis of our data showed that this did not make a difference to our results.

Given previous research indicating that pre-intervention levels of interpretation bias may be important in moderating response in CBM-I, suggesting those with a with a negative interpretation bias benefit more from positive CBM-I training (Menne-Lothmann et al., 2014; Micco et al., 2014), we investigated the role of initial bias level. Our findings, however, indicated no evidence that pre-intervention levels of bias influenced the effectiveness of the CBM-I training on any of our outcome variables.

In addition, the randomised controlled trial was conducted on-line rather than having participants come into a laboratory. It is a risk with all on-line studies, particularly when conducting experimental research, that there are factors that cannot be controlled. The amount of time taken to complete the questionnaires and the training varied among participants, therefore, it is possible that some participants did not complete the training in one sitting and may have been distracted and carried out other tasks, e.g., answer a telephone call, or suffered fatigue. Had participants attended a laboratory, possible confounds such as these may have been eliminated or reduced. Obtaining qualitative feedback from participants regarding their perceived level of attention paid to the task or the number of distractions they experienced would have been informative for future research.

In summary, the current study investigated the efficacy of a cognitive bias modification training paradigm in modifying interpretation bias and reducing symptoms of disordered eating. The study was able to demonstrate the existence of an interpretation bias in women with clinical levels of disordered eating, with this bias being associated with disordered eating psychopathology, disordered

eating behaviours, difficulties in emotion regulation and negative affect. However, the use of CBM-I to manipulate bias for every-day events in our sample, did not influence any of our outcome variables and there was no evidence that the baseline level of bias can influence the efficacy of the training paradigm. It may be that in order to advance the utility of CBM-I in the eating disorder field, future work needs to refine this paradigm in a non-clinical population, particularly with respect to evaluating the optimal number of training sessions required to lead to reliably significant changes and larger effect sizes. It is also possible that more novel CBM-I training paradigms should be trialled in non-clinical populations prior to being employed in eating disorder research. For example, using auditory and visual stimuli which have both been shown to be effective in bias modification research (Aspen et al., 2015; Cardi, Esposito, et al., 2015; Martijn et al., 2010). This novel study suggests further research evaluating the efficacy of CBM-I techniques in reducing symptoms of disordered eating is needed before we can make any conclusions about its usefulness in supplementing existing treatment and prevention paradigms.

Chapter 7.

Overall Discussion

7.1. Overview

This final chapter integrates the findings of the four studies undertaken as part of this PhD thesis, and discusses the overall contribution of this research to understanding the role of cognitive bias in eating disorders and its relationship to difficulties in emotion regulation. The themes that emerged across the four studies will be discussed followed by a discussion of methodological considerations and limitations of the research, and recommendations for future research.

7.2. Summary of the findings

Difficulties with emotion regulation commonly feature in the unhelpful cycle involving disordered eating, across a number of different models. It is commonly postulated that disordered eating leads to emotion dysregulation which in turn leads to disordered eating and disordered eating behaviours. To better understand the maintenance process involved in this cycle, it is important that research which investigates the mechanisms of difficulties in emotion regulation is conducted, however this specific area of research is somewhat lacking. In order to address this gap in current knowledge, the overall aim of the thesis was to explore difficulties in emotion regulation in eating disorders and to attempt to further investigate factors that influence these difficulties. More specifically, this

research aimed to explore the role of memory and interpretation biases in eating disorders and investigate whether these biases mediate the relationship between difficulties in emotion regulation and disordered eating, and disordered eating behaviours. In order to achieve these aims, the first study investigated the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) to ascertain whether the measure was suitable to use with a disordered eating population. This research showed that a shorter measure of the DERS best modelled the structure of emotion regulation in both high school and university populations. This measure, therefore, was used throughout this research.

The next study investigated the role of negative memory and interpretation biases. It was predicted these biases play a key role in the relationship between difficulties in emotion regulation and disordered eating. This was tested using a sample of female high school and university students. This study was then replicated, in part, using a sample of adult women who experienced clinical levels of disordered eating. Between both studies, negative interpretation bias was associated with difficulties in emotion regulation, disordered eating, and disordered eating behaviours. This indicates those with both sub-clinical and clinical levels of disordered eating tend to interpret ambiguous events in a negative manner and that this bias is also linked to increased emotion regulation difficulties. Negative interpretation bias mediated the relationship between difficulties in emotion regulation and disordered eating, and disordered eating behaviours. However, mediation in the sample of women with clinical levels of disordered eating was not present once adjustments were made for depression and anxiety.

This research also investigated cognitive bias modification (CBM) training to produce interpretation bias change and observe whether a reduction in eating disorder symptoms and difficulties in emotion regulation occurred. CBM training in our sample did not modify interpretation bias, nor did it reduce eating disorder symptoms or difficulties in emotion regulation.

7.3. Integration of Key Findings and Clinical Implications

7.3.1. Difficulties in Emotion Regulation

This research demonstrated that emotion regulation difficulties are evident in both those with sub-clinical and clinical symptoms of disordered eating supporting both theory and existing research. Examination of the DERS highlighted the relevance of goal directed behaviours, emotional awareness and impulsivity to disordered eating. This research indicated that disordered eating was associated with difficulties engaging in goal directed behaviours, and difficulties disengaging from the experience of negative emotions. It can be argued that both of these concepts are linked in that these individuals experience difficulties focussing away from the problems they are experiencing, and away from the experience of negative emotions.

This does not support Schmidt and Treasure's (2006) cognitive-interpersonal maintenance model for anorexia nervosa or Fox and Power's (2009) model, where there is a focus on avoidance of emotions. However, emotional avoidance may be an explicit (or implicit) cognitive process that occurs following difficulties to disengage from problems or negative emotions. Initially, the individual may have difficulties disengaging from negative emotions, resulting in an increase in emotional distress which they then aim to avoid. They then avoid

situations that trigger the negative emotion or they redirect negative emotions onto the self, in the form of self-disgust or shame. Difficulties with goal directed behaviour and emotional awareness may provide a barrier to recovery, especially when treatment paradigms include emotional acceptance, mindfulness or distraction techniques, and the implementation of emotion regulation strategies. Treatment paradigms such as Dialectical Behaviour Therapy for example, focus on distraction techniques and acceptance strategies, and treatment success may be hindered by this inability to disengage from problems experienced or from negative emotions. An initial treatment focus on problem solving and mindful observation and distancing from emotion may better enable the patient to take advantage of subsequent skills in acceptance.

Impulsivity was also identified as being associated with an increase in disordered eating behaviours. Individuals who experience difficulties controlling their behaviour when they are experiencing emotional distress are more likely to engage in disordered eating behaviours such as binge eating, purging, and dieting. Because these behaviours, according to both the transdiagnostic model of eating disorders (Fairburn et al., 2003), and the cognitive model of bulimia nervosa (Cooper et al., 2004), provide relief and distraction from emotional distress, the individual may experience difficulties in choosing to engage in more adaptive forms of emotion regulation which may not provide the immediate relief or distraction that is sought after. Impulsivity may be a barrier to behaviour change (e.g., binge eating or purging) in treatment. This finding also supports research where impulsivity is a risk factor for disordered eating behaviours (Claes et al., 2002, 2005; Racine & Wildes, 2013).

7.3.2. Negative Interpretation Bias

This research demonstrated that negative interpretation biases are associated with increased difficulties in emotion regulation, disordered eating, and disordered eating behaviours in both sub-clinical and clinical populations. This finding supports existing research where interpretation biases play a role in eating disorders, however, this research is unique in that it provides evidence of interpretation biases for stimuli other than food or appearance related stimuli. This research indicates that interpretation bias, which is relevant to depression and anxiety, is also relevant to disordered eating, suggesting interpretation bias is a transdiagnostic risk factor.

Although interpretation bias for ambiguous every-day stimuli was evident in both samples, the influence of this bias on the relationship between emotion regulation difficulties and disordered eating, and disordered eating behaviours differed between samples. As would be expected, the levels of symptom severity and comorbidity in the clinical sample were greater than those in the sub-clinical sample and that, combined with the small sample size, is likely to have made detection of the unique influence of negative interpretation bias on disordered eating more difficult. These findings highlight the role of depression and anxiety in eating disorders and raise questions regarding whether depression and anxiety should be included as covariates in eating disorder research, a topic discussed later.

In summary, this research was the first to investigate the possible mediating role of interpretation bias in eating disorders and lends the way to further research using a larger sample. Findings in the sub-clinical sample

suggest reducing interpretation bias may weaken the relationship between difficulties in emotion regulation and disordered eating, and disordered eating behaviours (specifically binge eating), however, further research is needed.

7.3.3. Negative Memory Bias

This research found negative memory bias was not related to eating disorder psychopathology, or difficulties in emotion regulation. In addition, in the sub-clinical sample, negative memory bias was not related to anxiety or depression. These findings did not support previous research where memory bias was associated with depression and anxiety, and shown to be evident in anorexia nervosa (e.g., Burt et al., 1995; Coles & Heimberg, 2002; Ellis et al., 2011; MacLeod & Mathews, 2004; Manuel & Wade, 2013; Matt et al., 1992). Memory bias was not investigated in the clinical sample due to both the findings in the sub-clinical sample, and due to a desire to reduce respondent burden related to assessment. As there is evidence of memory bias for food and appearance related stimuli, preliminary evidence of memory bias for emotional content in anorexia nervosa, and preliminary evidence of these biases being significantly associated with the frequency of objective binge episodes, further research investigating memory bias for emotional content in sub-types of eating disorders would add to existing knowledge. It is likely that memory bias is a complex construct and it is possible that these biases operate differently within eating disorder sub-types. To date no studies have directly investigated the relationship between memory bias for emotional content and the different eating disorder sub-types.

7.3.4. Proposed Mediating Role of Interpretation Bias

This research tested a cross-sectional multivariate model which depicted the proposed mediating role of cognitive biases in the relationship between disordered eating and difficulties with emotion regulation. The proposed model specifically predicted that negative interpretation bias and negative memory bias would mediate the relationship between disordered eating and difficulties in emotion regulation. This research provided partial support for our model, where negative interpretation bias acted as a mediator only in the sub-clinical population, however, negative memory bias did not. In addition, this research suggests negative interpretation bias is also a mediator of the relationship between disordered eating behaviours and difficulties in emotion regulation, however, the influence of depression and anxiety also plays a role in this process in a clinical population.

This research supports a modified model which includes disordered eating behaviours as well as disordered eating psychopathology. In addition, the model may be improved by the incorporation of depression and anxiety as key constructs. Although it is yet to be established which comes first, the eating disorder or difficulties in emotion regulation, this research took a conservative stance where difficulties with emotion regulation was determined to be a consequence of disordered eating. With this is mind, the amended model depicts a more cyclical process. Theory posits in eating disorders, disordered eating behaviours occur as a result of mood intolerance, which is preceded by negative affect. Appraisal theories of emotion posit the interpretation of an event determines the emotional response, therefore, cognitive bias is likely to precede negative affect, effectively determining the emotion generated and the subsequent behaviour. The proposed model, therefore, describes a process where those with

an eating disorder tend to interpret ambiguous events as being negative, leading to experiencing negative affect. The experience of negative affect is difficult to tolerate, and the individual seeks relief and distraction, therefore, engages in disordered eating behaviours. Engagement in these behaviours, then results in dysfunctional cognitions (e.g., I am worthless), which are characteristic of eating disorders. When the relationship between disordered eating behaviours and emotion regulation was investigated in the clinical sample, this research showed mediation was no longer evident once depression and anxiety were removed, which provides preliminary evidence in support of this process, however, further longitudinal research is required.

This research provides support for incorporating cognitive bias for interpretation into existing models of eating disorders. In addition, the amended model suggests depression and anxiety need to be included in analyses rather than being included as covariates where we potentially risk removing key elements of the maintenance process.

7.3.5. Manipulation of Cognitive Bias in Eating Disorders

This research was the first to investigate the influence of cognitive bias modification on difficulties with emotion regulation, motivation to recover from an eating disorder, and weight and shape satisfaction in those with clinical symptoms of disordered eating. Recent studies have shown that cognitive bias modification is successful in reducing interpretation bias related to the both the self and ambiguous social situations, as well as disordered eating behaviours and associated cognitions (Cardi, Esposito, et al., 2015; Yiend, Parnes, et al., 2014). The research conducted as part of this thesis, however, was unsuccessful in

reducing interpretation bias. Consequently, the intervention group compared to the control group, did not experience a reduction in symptoms of disordered eating, disordered eating behaviours, or difficulties in emotion regulation, or an increase in motivation to recover, or shape and weight satisfaction. Of note, there were reductions in eating psychopathology, negative affect, and an increase in confidence to recover, and weight satisfaction across both training groups, suggesting our understanding of the use of cognitive bias modification is still limited. These results add to the mixed findings in the literature and indicate there is still a lot of work to be done to refine this paradigm, particularly in eating disorder research. These findings are also likely to be due to methodological limitations and are discussed in greater detail below. This area is both important and understudied in eating disorders and there is a lack of longitudinal and experimental research. As interpretation bias plays a key role in eating disorders, and difficulties in emotion regulation, it is important that this be investigated further using eating disorder specific cognitive bias modification training paradigms and robust measures of interpretation bias that are relevant to this population. Cognitive bias modification paradigms can be implemented with relative ease and can be administered on-line, therefore, these paradigms have potential clinical utility, and can be easily incorporated into existing treatment paradigms. Cognitive bias modification is, however, complex with a number of recent studies in depression and anxiety literature which indicate CBM to be promising, however, questions still remain on the degree to which CBM training can modify bias and reduce symptoms, indicating further research is necessary not only in eating disorders but across a range of disorders (Hallion & Ruscio, 2011; Menne-Lothmann et al., 2014).

7.4. Methodological considerations and limitations

The research provides useful information with regard to the measurement of difficulties in emotion regulation in eating disorders, as well as factors that influence these difficulties. In addition, this research contributes to the existing knowledge surrounding cognitive bias and cognitive bias modification in eating disorders. However, current findings must be interpreted within the context of several limitations related to the method and designs employed.

Throughout this research the effects of depression and anxiety were controlled for. Because both these disorders are highly comorbid with eating disorders, it was important to ensure any findings related to disordered eating were independent of the effects of these constructs. A vast amount of research links cognitive biases to both depression and anxiety, while very little research has been conducted investigating cognitive bias unrelated to food or appearance in eating disorders. Therefore, it was deemed appropriate to remove the independent effects of depression and anxiety, and the effects of depression and anxiety were adjusted when examining associations between the DERS and disordered eating, as it was when cognitive biases were assessed. However, it can be argued, and the amended model discussed in this research suggests, that by removing depression and anxiety from the analyses, you remove the constructs which are a result of interpretation bias, and precede mood intolerance. Future research will need to carefully consider if it is appropriate to remove these key variables, or include them.

With regard to the experimental component of this research, there were a number of methodological limitations. First, interpretation bias was measured

seven days following the CBM-I which may have led to reduced effects of the interpretation modification. By measuring interpretation bias using the remaining 15 items of the AST-D-II immediately following the training, it would have been possible to assess any direct bias change. The full version (30 items) of the AST-D-II could have been administered one week later. However, due to the number of questionnaires administered along with the CBM-I training, this would have increased the time for participants to complete the survey. Brief pilot testing suggested the average time for a participant to complete the demographic questionnaires, state, and trait measures, and then the CBM-I training, was approximately one hour. Including another measure post training would have increased the duration which was already a concern raised by the ethics committee.

The Similarity Rating Test (SRT; Mathews & Mackintosh, 2000) may have been a more suitable measure of interpretation bias in this research. The SRT is able to implicitly measure the proposed cognitive process or outcome, rather than just a positive or negative interpretation. The SRT maps directly onto the different possible interpretations by providing four possible interpretations after each ambiguous scenario. Two of the four sentences present either a positive or negative interpretation and the remaining two sentences are foils which imply either a positive or negative meaning but do not represent a possible interpretation of the scenario. Selection of either the negative or positive interpretation over the foils indicates participants are not merely selecting an item of a particular valence, but the item that matches those they have been exposed to in the training condition (i.e., negative or positive training).

In addition, this research used CBM-I that was created specifically for a disordered eating population by using item content that was based on counteracting negative self-belief themes (e.g., vile, disgusting, worthless) which are associated with disordered eating symptoms (Cooper & Cowan, 2009). The AST-D-II, however, is a measure of interpretation bias using scenario content relevant to depression and not specific to relevant eating disorder content. It is possible that bias change and symptom reduction was not evident due to the measure of interpretation bias. Careful consideration of the measure of interpretation bias in future research is essential.

Lastly, the randomised controlled trial was conducted on-line rather than having participants come into a laboratory. It is a risk with all on-line studies, particularly when conducting experimental research, that there are factors that cannot be controlled. The amount of time taken to complete the questionnaires and the training varied among participants, therefore, it is possible that some participants did not complete the training in one sitting and may have been distracted and carried out other tasks, e.g., answer a telephone call, or suffered fatigue. Had participants attended a laboratory, possible confounds such as these may have been eliminated or reduced. However, because the target sample were participants who experienced clinical levels of disordered eating symptoms located both nationally and locally, they needed to be provided with an easy option of participating, which they could do in their own time without the inconvenience of travel. In addition, requiring participants to come into a laboratory, may have substantially reduced the number of participants. Another option, however, would be to conduct the research over two days, with the first day having participants complete the demographic and trait questionnaires

(including interpretation bias), and then have them complete the state measures, CBM-I training, and interpretation bias measure the following day, effectively spreading participation over two days, allowing for all appropriate measures to be completed, and without tiring the participant. It is possible that sub-clinical (and clinical) participants are more susceptible to fatigue compared to healthy participants, so by spreading the research over two days may eliminate the possible confounding effects of fatigue.

7.5. Directions for future research

This research suggests a more novel approach to modifying interpretation biases in eating disorders is needed. Research has shown that using both auditory and visual conditioning stimuli is effective in reducing some of the variables associated with disordered eating (Aspen et al., 2015; Cardi, Esposito, et al., 2015; Martijn et al., 2010), and a combination of the two may also be effective to supplement CBM-I training. The CBM-I paradigm used in this research was a word completion task followed by a subsequent question which reinforced the interpretation. Future studies could include visual stimuli such as a smiling face to reinforce a positive interpretation following the word completion task or question. In addition, an audio recording of the ambiguous scenario could also be used in conjunction with the participant reading the scenario, using tone of voice to reinforce the desired interpretation (e.g., a positive tones versus negative tones).

From a clinical perspective, the first study in this research showed that a shorter, 30 item DERS is a valid and reliable measure of emotion regulation difficulties in a population who experiences high levels of disordered eating. This

measure was shown to be effective in both high school and university populations, and it was able to predict eating disorder severity and disordered eating behaviours. This suggests that the 30-item DERS would be effective in assessing emotion regulation difficulties in populations at risk for developing an eating disorder, and suggests targeting difficulties in emotion regulation might be effective in eating disorder prevention programs. However, the use of this still lengthy measure in youth may make it difficult to utilise reliably, and future research should continue to investigate validity of shorter measurements.

This research confirms difficulties in emotion regulation plays a key role in disordered eating which provides support for existing treatments and prevention programs which target emotion regulation. Research into cognitive bias modification in eating disorders, however, has a long way to go before we can claim clinical utility. If CBM training paradigms that are effective in eating disorders can be developed, it is possible cognitive bias modification could be an effective addition to existing treatment paradigms, with the aim to improve success rates.

7.6. Summary

Research into cognitive bias and bias modification in eating disorders is in its infancy. This research has advanced current understanding of cognitive bias in eating disorders and how it is related to disordered eating, disordered eating behaviours and difficulties in emotion regulation. The findings from this research provide support for further research into the area of cognitive bias in eating disorders and have identified negative interpretation bias as a key construct in disordered eating, and one that is associated with difficulties in emotion

regulation. This research also suggests the targeting of negative interpretation bias in eating disorders may be a step towards weakening the relationship between disordered eating, disordered eating behaviours and difficulties in emotion regulation. If the modification of negative interpretation bias can lead to a reduction in eating disorder symptoms and difficulties in emotion regulation, we can begin to incorporate bias training with current treatment paradigms. In order to do this, current CBM training paradigms need to be refined and longitudinal research needs to be conducted.

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Appendix A

Questionnaires and Measures

Appendix A1

Difficulties in Emotion Regulation Scale

Please indicate how often the following items apply to you.						
		Almost Never (0 – 10%)	Sometimes (11 -35%)	About half the time (36 – 65%)	Most of the time (66 – 90%)	Almost always (91 – 100%)
1	I am clear about my feelings	○	○	○	○	○
2	I pay attention to how I feel	○	○	○	○	○
3	I experience my emotions as overwhelming and out of control	○	○	○	○	○
4	I have no idea how I am feeling	○	○	○	○	○
5	I have difficulty making sense out of my feelings	○	○	○	○	○
6	I am attentive to my feelings	○	○	○	○	○
7	I know exactly how I am feeling	○	○	○	○	○
8	I care about what I am feeling	○	○	○	○	○
9	I am confused about how I feel	○	○	○	○	○
10	When I'm upset, I acknowledge my emotions	○	○	○	○	○
11	When I'm upset, I become angry with myself for feeling that way	○	○	○	○	○
12	When I'm upset, I become embarrassed for feeling that way	○	○	○	○	○
13	When I'm upset, I have difficulty getting work done	○	○	○	○	○
14	When I'm upset, I become out of control	○	○	○	○	○
15	When I'm upset, I believe that I will remain that way for a long time	○	○	○	○	○
16	When I'm upset, I believe that I will remain that way for a long time	○	○	○	○	○
17	When I'm upset, I believe that my feelings are valid and important	○	○	○	○	○
18	When I'm upset, I have difficulty focusing on other things	○	○	○	○	○
19	When I'm upset, I feel out of control	○	○	○	○	○
20	When I'm upset, I can still get things done	○	○	○	○	○

		Almost Never (0 – 10%)	Sometimes (11 -35%)	About half the time (36 – 65%)	Most of the time (66 – 90%)	Almost always (91 – 100%)
21	When I'm upset, I feel ashamed with myself for feeling that way	○	○	○	○	○
22	When I'm upset, I know that I can find a way to eventually feel better	○	○	○	○	○
23	When I'm upset, I feel like I am weak	○	○	○	○	○
24	When I'm upset, I feel like I can remain in control of my behaviours	○	○	○	○	○
25	When I'm upset, I feel guilty for feeling that way	○	○	○	○	○
26	When I'm upset, I have difficulty concentrating	○	○	○	○	○
27	When I'm upset, I have difficulty controlling my behaviours	○	○	○	○	○
28	When I'm upset, I believe there is nothing I can do to make myself feel better	○	○	○	○	○
29	When I'm upset, I become irritated with myself for feeling that way	○	○	○	○	○
30	When I'm upset, I start to feel very bad about myself	○	○	○	○	○
31	When I'm upset, I believe that wallowing in it is all I can do	○	○	○	○	○
32	When I'm upset, I lose control over my behaviours	○	○	○	○	○
33	When I'm upset, I have difficulty thinking about anything else	○	○	○	○	○
34	When I'm upset, I take time to figure out what I'm really feeling	○	○	○	○	○
35	When I'm upset, it takes me a long time to feel better	○	○	○	○	○
36	When I'm upset, my emotions feel overwhelming	○	○	○	○	○

Appendix A2

Eating Disorder Examination – Questionnaire

Instructions: The following questions are concerned with the past four weeks (28 days) only. Please read each question carefully. Please answer all of the questions. Thank you.

Questions 1 to 12: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days) only.

	On how many of the past 28 days.....	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
1.	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
2.	Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3.	Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
4.	Have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
5.	Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6
6.	Have you had a definite desire to have a totally flat stomach?	0	1	2	3	4	5	6
7.	Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6

	On how many of the past 28 days.....	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
8.	Has thinking about your shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9.	Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10.	Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11.	Have you felt fat?	0	1	2	3	4	5	6
12.	Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

Questions 13 to 18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days). Over the past four weeks (28 days).....		
13.	Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?	.....
14.	.....On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?	.....
15.	Over the past 28 days, on how many DAYS have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?	.....
16.	Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?	.....
17.	Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?	.....
18.	Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories?	.....

Questions 22 to 28: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days).

	Over the past 28 days	Not at all		Slightly		Moderately		Markedly
22.	Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23.	Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6

Questions 22 to 28: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days).								
	Over the past 28 days	Not at all		Slightly		Moderately		Markedly
24.	How upset would you be if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?	0	1	2	3	4	5	6
25.	How dissatisfied have you been with your weight?	0	1	2	3	4	5	6
26.	How dissatisfied have you been with your shape?	0	1	2	3	4	5	6
27.	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28.	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

Note: At follow-up participants were asked questions pertaining to the last 7 days only.

Appendix A3

Ambiguous Scenarios Test for Depression

Form a mental image of each of the scenarios. Imagine each scenario happening to you personally. Follow the first image that comes to mind, don't think too much about each one. Then, using the slider rate how pleasant your image is, as well as how vivid or clear it is.

1. Your partner asks you to buy a present for their sister's birthday, as they are busy. When the sister opens it, her face shows you how she feels.
2. Your best friend convinces you to go on a blind date and as you sit in the bar waiting to meet your date, you think about how it will go.
3. You give a speech at your friend's wedding. When you have finished, you observe the audience's reaction.
4. You wake up, get out of bed, stretch and really notice how you feel today.
5. You go to a place you visited as a child. Walking around makes you feel emotional.
6. You are about to move with your partner into a new home. You think about living there.
7. You are going to see your sister in her school play. You've left it to the last minute to get there. As you drive up to the school and see the parking bays you anticipate the time it will take you to arrive.
8. You are lost in a part of a big city you don't know well. You ask someone on the street for directions when they pull out something from their pocket.
9. You join a tennis club and before long you are asked to play in a doubles match. It's a tough match and afterwards you discuss your performance with your partner.
10. You have recently taken an important exam. Your results arrive with an unexpected letter of explanation about your grade.
11. As you walk into the interview room the panel of interviewers welcomes you and proceeds to ask some tough questions. By the end of the interview you know what the outcome is.
12. You are starting a new job that you very much want. You think about what it will be like.
13. You go to a wedding where you know very few other guests. After the party, you reflect on how the other guests behaved.
14. You are organising the annual office party on a small budget. On the night of the party, you look around to see if people are enjoying themselves.
15. You are going to see a very good friend at the station. You haven't seen them for years. You feel emotional, thinking about how much they might have changed.
16. It's New Year's Eve. You think about the year ahead of you.
17. You are in a reflective mood and think back at past achievements and disappointments that you have experienced during your life. Overall, your main feelings about your life so far emerge.

18. It is an overcast day and you are sitting on the beach. You look up to notice the weather really beginning to change.
19. Your neighbours have just had a new baby. You hear it crying. Through the window you see how the husband holds it.
20. You are camping in a forest and are very cold. You decide to light a fire. The flames grow in intensity much faster than you imagined.
21. Your friend is very keen on skating and persuades you to try it out. At the rink you put on the skates and step on the ice. You glide forward, slowly at first, then faster.
22. At the company you are working for there have been big cut backs. One day you are called in to see your boss. When you enter the room, the boss's face is tired.
23. You are interested in a job, but think you might be under-qualified and so ask for details. When you speak to the people, you realise what your chances are to get the job.
24. Some important people are visiting the office and you are asked at the last minute to present a project to them. Afterwards, you get feedback on your performance.

Appendix A4

Ambiguous Scenarios Test for Depression – Parallel Version

Form a mental image of each of the scenarios. Imagine each scenario happening to you personally. Follow the first image that comes to mind, don't think too much about each one. Then, using the slider rate how pleasant your image is, as well as how vivid or clear it is.

(Baseline - Questions 1 – 15; Follow up – Questions 16 – 30)

1. As you enter the room, the commission welcomes you and begins with the oral examination. After just a few minutes you know intuitively how the examination will go.
2. At the company you are working for there have been big cut backs. One day you are called in to see your boss. When you enter the room, the boss's face is tired.
3. You are interested in a job, but think you might be under-qualified and so ask for details. When you speak to the people, you realise what your chances are to get the job.
4. You are camping in a forest and are very cold. You decide to light a fire. The flames grow in intensity much faster than you imagined.
5. You are going to see a very good friend at the station. You haven't seen them for years. You feel emotional, thinking about how much they might have changed.
6. You are hosting a dinner party for 10 people and got pretty stressed out while preparing the food. You can tell from the initial reaction of the guests how they liked the food.
7. It is an overcast day and you are sitting on the beach. You look up to notice the weather really beginning to change.
8. Your partner asks you to buy a present for their sister's birthday, as they are busy. When the sister opens it, her face shows you how she feels.
9. On a rainy Sunday, you let your thoughts wander freely. Many memories come back…
10. Your best friend convinces you to go on a blind date and as you sit in the bar waiting to meet your date, you think about how it will go.
11. You give a speech at your friend's wedding. When you have finished, you observe the audience's reaction.
12. Some important people are visiting the office and you are asked at the last minute to present a project to them. Afterwards, you get feedback on your performance.
13. You are in a reflective mood and think back at past achievements and disappointments that you have experienced during your life. Overall, your main feelings about your life so far emerge.
14. You are going to see your sister in her school play. You've left it to the last minute to get there. As you drive up to the school and see the parking bays you anticipate the time it will take you to arrive.
15. You go to a wedding where you know very few other guests. After the party, you reflect on how the other guests behaved.

16. You are starting a new job that you very much want. You think about what it will be like.
17. You next birthday is coming soon. You reflect about your life so far.
18. Your friend is very keen on skating and persuades you to try it out. At the rink you put on the skates and step on the ice. You glide forward, slowly at first, then faster.
19. As you walk into the interview room the panel of interviewers welcomes you and proceeds to ask some tough questions. By the end of the interview you know what the outcome is.
20. You are a passionate hobby photographer and wonder if you could publish a photo book. A friend of yours who works for a publishing company tells you what she thinks about the idea.
21. You go to a place you visited as a child. Walking around makes you feel emotional.
22. The probation period at your new job is almost over. You get invited to meet with your boss and receive feedback on how you have done so far.
23. You would love to join a choir and go to an audition. The next day the director of the choir calls you on the phone to tell you if you can join the choir.
24. You want to refresh your Italian language skills and enrol for an advanced-level language course. The teacher, however, would like to give a placement test first.
25. It's the end of December. You reflect upon the year behind you.
26. You've been invited to a class reunion. That makes you remember your school days…
27. When you clean up the attic, you find some of your old photo albums you have not looked at in a while. You begin to browse…
28. You colleague just came back from the holidays and tells you enthusiastically about her experiences. While you listen to her, you think of your last vacation.
29. You are organising the annual office party on a small budget. On the night of the party, you look around to see if people are enjoying themselves.
30. You buy a new outfit for a party. You can tell if you made the right choice by the reaction of the other people.

Appendix A5

Depression, Anxiety and Stress Scale (DASS-21)

Please indicate how much each of the following statements applied to you over the PAST WEEK. There are no right or wrong answers. Do not spend too much time on any one statement.					
		Did not apply to me at all	Applied to me in some degree, or some of the time	Applied to me a considerable degree, or a good part of the time	Applied to me very much, or most of the time
1	I was aware of dryness of my mouth	○	○	○	○
2	I couldn't seem to experience any positive feeling at all	○	○	○	○
3	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	○	○	○	○
4	I felt that I had nothing to look forward to	○	○	○	○
5	I felt I wasn't worth much as a person	○	○	○	○
6	I felt scared without any good reason	○	○	○	○
7	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	○	○	○	○
8	I felt down-hearted and blue	○	○	○	○
9	I felt I was close to panic	○	○	○	○
10	I was unable to become enthusiastic about anything	○	○	○	○
11	I felt that life was meaningless	○	○	○	○
12	I was worried about situations in which I might panic and make a fool of myself	○	○	○	○
13	I experienced trembling (e.g. in the hands)	○	○	○	○
14	I found it difficult to work up the initiative to do things	○	○	○	○

Appendix A6

Memory for emotional trait adjectives

In the following task you will be asked to remember as many words as possible. During the task, repeat the word three times, think about the word and whether the word makes sense to you.

You will be shown the each word for seven seconds. After being shown the words you will be asked to write down as many as you can recall.

You will now be shown the words to remember, please repeat the word three times, think about the word and whether the word makes sense to you.

You will be shown the each word for seven seconds.

You have now seen all the words that you will be asked to recall. Please indicate to the experimenter that you have finished this task. You have 5 minutes to write down as many words as you can remember. The experimenter will give you a sheet of paper to start this task and will start the timing for you when you are ready.

Positive trait stimuli	Negative trait stimuli	Neutral stimuli
Brave	Silly	Rhino (5)
Fantastic	Unpleasant	Crocodile (9)
Perfect	Grumpy	Cheetah (7)
Trustful	Spiteful	Goldfish (8)
Friendly	Horrible	Football (8)
Happy	Angry	Glass (5)
Best	Sad	Slug (4)
Lucky	Cross	Table (5)
Lovely	Unkind	Budgie (6)
Jolly	Upset	Galah (5)
Rich	Bored	Lion (4)
Pleased	Worried	Peacock (7)
Glad	Hurt	Goat (4)
Gentle	Stupid	Lizard (6)
Okay	Down	Bear (4)
Free	Evil	Deer (4)
Pleasant	Terrible	Elephant (8)
Intelligent	Disappointed	Photograph (10)
Excellent	Friendless	Cartwheel (9)
Handsome	Lonely	Kangaroo (8)

Appendix A7

State Measures

Motivation to Recover

Please indicate using the slider how much each of the following statements apply to you <u>RIGHT NOW</u>…

1. How important is it that you recover from your eating disorder?
2. How confident are you that you will recover from your eating disorder?
3. How ready are you to recover from your eating disorders?
4. How satisfied are you with your weight right now?
5. How satisfied are you with your shape right now?

Positive and Negative Affect Scale

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way *right now*. Use the following scale to record your answers:

		Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1	Afraid	○	○	○	○	○
2	Scared	○	○	○	○	○
3	Frightened	○	○	○	○	○
4	Nervous	○	○	○	○	○
5	Jittery	○	○	○	○	○
6	Shaky	○	○	○	○	○
7	Sad	○	○	○	○	○
8	Blue	○	○	○	○	○
9	Downhearted	○	○	○	○	○
10	Alone	○	○	○	○	○
11	Lonely	○	○	○	○	○

Appendix A8

Cognitive Bias Modification – Positive Training

Next you will be asked to read a series of scenarios. At the end of each scenario you will be asked to complete missing letters in a word fragment using keys on your keyboard. Each word fragment has only one possible answer.

After completing the word fragment you will then be asked a question about the scenario to which the answer is either 'Yes' or 'No'. To answer this question, type either 'Y' (for yes) or 'N' (for no) using keys on your keyboard.

1. You make a slightly critical remark about a friend who has been good to you recently. You blame her for not being sympathetic when you broke your leg. You then learn that by chance she has heard your critical remark and is very offended. You think you are

   u-l-ck- unlucky

   Do you think that you are a nasty person? NO

2. A friend mentions that she is organising a special holiday to mark her 30th birthday. She plans to invite a group of friends along to celebrate the occasion. You have known your friend for many years but you don't get asked to join the group holiday. You think you are

   ov-rl--k-d overlooked

   Do you think she has accidentally forgotten to include you? YES

3. An acquaintance approaches you as you are leaving the hairdressers with a new hairstyle. You don't feel very confident about the cut because it is very different from your usual style. Just as you are about to say hello, she crosses over to the other side of the street. You think this means you are

   unr-c-gn-z-ble unrecognizable

   Do you think she has failed to recognize you? YES

4. You are walking to the shops to pick up a few things for dinner on your way home from work. You stop to look at a clothes display in a department store where you often enjoy shopping for new items for your wardrobe. Some teenagers run past you, shouting loudly. You think this means they are

   e-c-t-d excited

Do the teenagers think you have an offensive smell? NO

5. You sit down on the bus with several large bags of shopping in your bag. It is a bit of a squeeze to fit you and your shopping on the seat without obstructing the gangway for other passengers. The man in the next seat gets up to move as you try to settle down. You think you must be

f-rt-n-te fortunate

Were you pleased to have some extra space? YES

6. You have had a long day at work, and have had to deal with a complaint from a colleague about your lack of tact when dealing with difficult clients. You start to have some very negative thoughts about your colleague. You hope something terrible happens to her. You think you are

an--y-d annoyed

Do you really want her to come to serious harm? NO

7. A friend leaves her child with you as she goes to fetch a cup of coffee in a cafe where you are meeting up for lunch. The child is tired and hungry after a long morning of shopping. He cries as you look into his pushchair and try to comfort him. You think you must look

unf-m-l--r unfamiliar

Would the child have responded that way to anyone? YES

8. Your friend is getting married and so far the day has gone very well You are at the formal reception after the Church ceremony. As you are making your way over to the marquee buffet, you fall over and get very muddy. You think that you are

unl-ck- unlucky

Do the other guests find you repulsive? NO

9. You have an argument with a friend about an evening out you asked her to rearrange as you could no longer make the date agreed. Afterwards you want to apologize for being impatient. Rather than call or go around to see her, you decide it's easiest to send a quick e-mail. You think you are being

pr-ct-c-l practical

Is sending an e-mail the best thing to do? YES

10. You forget that a friend's father has died recently. You are currently making arrangements for your own father's 80th which is happening in a few weeks time. You talk at length about how difficult your father is being about making arrangements. You conclude that you are

    f-rg-tf-l forgetful

    Do you think that you deserve to be punished for forgetting? NO

11. A letter appears in your mailbox and you see that it is addressed to one of your close friends. You inform your friend that you have the letter but keep forgetting to deliver it. You begin to realise that your friend might be inconvenienced by the delay. You think you are being

    c-nsci-nti--s conscientious

    Is forgetting a sign of how bad your behaviour is? NO

12. You have a terrible argument with your partner and they say some extremely hurtful things to you. You begin to wonder why you have stayed together. When you have finished arguing, you briefly wish that they were dead. You think you must be

    u-s-t upset

    Do you really wish your partner to come to harm? NO

13. You have run over your parking time by a few minutes. You say some very sarcastic and hurtful things to the attendant who is trying to give you the ticket. Eventually, the attendant decides to back down and tears up the ticket. You think you are being

    s--rt m smart

    Do you handle the situation well? YES

14. You have been nominated for a special job that involves dealing with some difficult people. You do not yet have much experience with this sort of work. You are not at all sure how your meeting with the clients concerned has gone, and start to worry about it. On reflection, you think you appeared

    c-mp-t-nt competent

    Are you worried about your lack of experience? NO

15. You take your driving test for the first time and fail on a couple of minor points. Your instructor congratulates you on a good first attempt He

seems confident that you stand a very good chance of passing the next time without too much extra practice. You feel

ple-s-d pleased

All things considered, do you think you have done well? YES

16. You agree to play five aside football with some friends after work. People are chosen to make up different teams. Out of your friends, you can't help noticing that you are the last to be picked to join a team. You know this confirms you are

n-n athl-t-c non-athletic

Are you left out because your friends think you are irrelevant? NO

17. You arrive to check into a hotel but there is a crowd of people around reception, with no organised queue. You find it hard to attract the attention of the staff but eventually you succeed. You notice that other guests do not have as much hassle in getting a staff member's attention. You think they are just

b--y busy

Are you totally insignificant to the staff on reception? NO

18. You are working on a very difficult project. It is late at night, and you have already been working on it for several hours. Halfway through the task, you discover that you have made some basic errors and will now have to start from the beginning again. You fear you are

t-r-d tired

Will getting some sleep help to conquer the project? YES

19. A friend with a terminal illness tells you a harrowing story about a recent hospital visit. During the visit, she received more bad news about her illness. You struggle to connect with her despair. You think you must be

f-rt-n-te fortunate

Do you think that you no longer have any feelings for your friend? NO

20. You hear a joke from a colleague that you would normally find distasteful or unacceptable. To your surprise, you find yourself laughing and thinking the joke is really quite funny. Your other colleagues are laughing at the joke too. You think this means that you are

h-ppy happy

Do you have a warped sense of humour? NO

21. You were not that inspired by your course and didn't work very hard for your first year exams. You are therefore not expecting to do very well. However, your exam results are truly dreadful even worse than you had expected. You feel

r-s-gn-d resigned

Do you remain largely unaffected by the bad results? YES

22. You are on your way to the canteen at work for lunch. A colleague from your department walks past you in the corridor without acknowledging you. This is despite you having smiled and said hello to them. You assume they think you are

r-sh-ng rushing

Are you tainted with something bad? NO

23. Some of your relatives don't get on very well. You remember the bad atmosphere last time they met up at a family social event. You decide not to invite any of them to your house warming party. You consider yourself to be

s-ns-ble sensible

Do you think you have made a good decision? YES

24. You are having a night in at home and decide to watch a DVD. The DVD was recommended as gripping by a friend in work. As you watch some sad scenes in the film, you feel your attention wandering. You sense that you are

r-l-x-d relaxed

Was watching the film a good idea for you? YES

25. You are doing your weekly food shopping on a busy Saturday. A family are shopping with a whining toddler who is trying everyone's patience .You notice that they are carefully keeping their distance from you in the supermarket queue. You think this means that you must be

r-sp-ct-d respected

Are the family being thoughtful? YES

26. You spend much time preparing a good application for a highly regarded course. Your personal statement includes mention of relevant unpaid work experience during your summer holidays. However, you fail to get on the course. You are being

    p-rs-st-nt persistent

    Do the course recruiters want to hurt you? NO

27. One of your friends has been having a tough time with an illness recently. A mutual friend of yours organizes a birthday party for your unwell friend. You seem to be the only one of your friends who hasn't been invited. You haven't been included because you are

    a--y away

    Do your friends dislike you? NO

28. You are adding up your petrol expenses at work ready to submit to your boss for approval. Your boss checks your figures carefully to make sure they add up. Your boss points out an error where you have miscalculated some distances. You conclude that you are

    l--rn-ng learning

    Have you made an understandable mistake? YES

29. A moving account of homelessness amongst young people with mental health problems moves you when you first hear it. When the story is repeated on the radio, you don't feel as strongly for the young people involved. However this is not characteristic of you. You consider yourself to be

    c-r-ng caring

    Has hearing the account again demonstrated how unfeeling you are? NO

30. You are giving a talk on environmental issues to about 500 people. Some of the audience are very knowledgeable on this topic. A member of the audience points out some flaws in your argument and you begin to respond. You feel

    e-gr-ss-d engrossed

    Do you feel pleased with the challenge from the audience? YES

31. You are on your way to a dentist's appointment. Unexpectedly, you encounter lots of traffic and take a long time to find a parking space. You are going to be very late for your appointment. You think this means that you are

d-l-yed delayed

Does it feel like the end of the world? NO

32. You are asked to welcome an important visitor as a representative of your local community centre. The visitor is quite a prominent and well-known politician. When they arrive, you are temporarily lost for words. You realise that this is because you were

i-pr-ss-d impressed

Did you relish meeting the politician? YES

33. You are dining at a friend's house. You lose your grip on the serving bowl. It falls to the floor and people start to laugh. You decide that, because of the accident, you are

a-tr-ct-ve attractive

Does your slip up add to the fun of the party? YES

34. You are one of the most recent members of staff to be taken on at your workplace. You recently made an application for a promotion to a more senior post. Although you were quite hopeful, a colleague who has worked there longer than you receives the promotion. You presume that you need to be

p-ti-nt patient

Do you feel like an insignificant meaningless person? NO

35. You promise to take a young friend's child to the zoo for a summer holiday treat. You become very busy with some friends who have come to visit you. At the end of the summer holiday, you realise you have not delivered on your promise. You realise that you are

ov-rc-mm-tted overcommitted

Are you fundamentally a reliable person? YES

36. You try to plaster your kitchen in order to save some money. After a couple of attempts, it looks dreadful and you realise the job is beyond your capability. You end up having to employ a professional to re-do the job. You conclude that you are

d-r-ng daring

Was it bad to give up on the plastering job? NO

37. Your friend asks you if you are romantically interested in a colleague at work. You completely deny any interest in this colleague of yours. Your friend mistakenly get the impression that you are not being completely honest about your feelings. You believe that really you are being

    mis-nderst- -d misunderstood

    Does your friend think that you have deliberately lied to them? NO

38. You reluctantly agree to spend a day with your distant cousins. You do not have much in common with your cousins and you know you will probably be quite bored. You know that your way of behaving is

    p-l-te polite

    Are you behaving well towards your cousins? YES

39. You have forgotten to wish your good friend a happy birthday. You had even been reminded yesterday that today was to be their special occasion. You discover that you have really hurt your friend's feelings. You think there are no two ways about it, you are simply

    ov-rlo-d-d overloaded

    Do you think that after a while they will soon forget? YES

40. At a party you spend a long time chatting to people you find very irritating. You tell your host later how much you enjoyed their company. Your host thanks you for being considerate since these people didn't know very many at the party. You consider yourself to have been

    d-pl-mat-c diplomatic

    Do you feel you have betrayed your true self? NO

41. Your employer tells you that he will reluctantly be forced to terminate some staff contracts in the next financial year. You are informed that you are very likely to lose your job. This is due to the recession and not your lack of competence. You feel

    r-l-as-d released

    Will you enjoy the freedom to move on? YES

42. You forget to pay your gas bill and receive two reminders. This is followed by a warning that your gas could get cut off. If you don't pay up within a

week, your gas company will call in a debt recovery agency. You think this is

n-rm-l normal

Is the gas company pursuing you unfairly? NO

43. You go to a fancy dress party in a bright sparkly orange costume that glows in the dark. Most people cannot guess who you are. However you still get lots of attention and comments about the costume. You sense that you are

i-sp-r-ng inspiring

Is your orange costume a real hit at the party? YES

44. You have had a long day of classes and get back late after missing your train. Your housemate is insisting you sit down and sort out some of your joint bills the moment you get in. You lose your temper and complain that they are annoying you. You think that under the circumstances, you are being

re-s-n-ble reasonable

Are you raging out of control with your housemate? NO

45. You are making your best efforts at a task at work. You have had much experience with this rather straightforward computer program. However you make a basic mistake on the task. This goes to show that you are

h-m-n human

Is your mistake an understandable one that anyone would make? YES

46. You go to a musical festival that you have really been looking forward to. You are with some of your very good friends and the venue is amazing. After a very intense week at work, you find that you are enjoying yourself less than you expected. You feel

d-d-c-ted dedicated

Are you out of touch with the good things around you? NO

47. You ask a colleague if they wouldn't mind swapping their holiday dates with yours. This is because you would like to take your children out at half-term. After considering your request they eventually change the dates to suit you. You think that you are being

c-ns-der-te considerate

Are you being a good parent? YES

48. You have accepted a date for an important delivery. You later find that this clashes with another commitment. You check your diary, call the company and ask if they can deliver another day. You feel like you are

org-n-s-d organized

Are you being unreasonable? NO

49. A family member asks if they can borrow your new car for the weekend. You are worried they might damage it, although you know they drive carefully. You hesitate before making a decision. You feel like you are being

ca-ti--s cautious

Are you right to be careful with your new car? YES

50. You fail to notice that your partner is upset when you arrive home. You start to engage in a light-hearted conversation about your rather boring day. After a few minutes, your partner bursts into tears. You soon realise how much you are

c-nc-rn-d concerned

Are you really only interested in trivial things? NO

51. Your friend asks you to change your travel plans so that you can meet up with them during your holiday. They invite you to spend a few days with them in an expensive villa they are renting. However, you decide not to join them. You think you are being

ec-n-m-c-l economical

Is your decision justifiable because you are trying to keep to a reasonable budget? YES

52. You ex-partner who you rarely see nowadays tells you they have begun to see a friend of yours from University. You had not thought about your partner for a great deal of time before this. Yet you find yourself feeling distressed by the news. You decide you must still be

att-ch-d attached

Do you really need to grow up? NO

53. You are working as a senior leader on a team project. Your junior member is slowing down the completion of a project. You are in danger of failing to meet the deadline and you snap at your junior. Later you think you have shown

le-d-rsh-p leadership

Do you feel proud of your reprimand? YES

54. Your partner has been acting distant. You seek to reassure yourself that they are not annoyed with you for doing something wrong. You call them twice in quick succession. In your view you are being

l-v-ng loving

Are you too dependent on your partner? NO

55. You don't see your elderly parents very often and they are quite independent. They are well able to deal with routine domestic chores. However you agree to help them with the chores. You think that you are

c-r-ng caring

Is agreeing to help, even when not needed, a good way to show you care? YES

56. You have planned a long session in the gym. Your housemate has recorded a new movie from TV the night before. You decide to stay in and watch the movie with them. You think this shows you are

s-c--ble sociable

Are you pleased you gave up on the gym? YES

57. It is the weekend and you have had several late nights at work. You turn off the alarm in order to stay in bed and get more sleep. You will attend a family event later that day where a golden anniversary will be celebrated. You decide that you are being

s-ns-b-e sensible

Are you making a bad decision? NO

58. You have been trawling around lots and lots of shops for most of your day off. You finally find the new coat you were looking for. It seems expensive but you buy it without further thought. You realise that you are being very

h-p-y happy

Were you right to make the sudden decision to buy the coat? YES

59. You find the noise from the teenage children next door intrusive. Their loud music is getting on your nerves and they play it for long after you go to bed. You decide to go around and ask if they will turn it down. You realise how much you are

n-ig-borly neighborly

Are you out to complain for the sake of it? NO

60. You blow your salary on an expensive weekend trip to a luxury resort.When you get back your best friend tells you about a charity she is supporting in a third world country. You can only offer her a small contribution as you are now broke. You have a strong sensation of being

f-n l-v-ng fun loving

In retrospect are you pleased you took your expensive trip? YES

61. You double book some clients and then lose your diary. Having located your diary, you find that you have missed an important appointment and you feel stressed. Later you manage to lose a file you need and you friend asks you have you been sleeping properly. You think you are hopelessly

f-n-y funny

Are you a chaotic, disorganised person? NO

62. You have the flu and you find yourself at home longing for someone to look after you. Your housemates are all out at university lectures. You get out your teddy bear and call your mother for advice and a chat. You decide that you are

s-pp-rt-d supported

Would most people seek support in a similar situation? YES

63. You have a work deadline to meet but you really need a break. Your friend calls you to invite you out but you tell them you have to stay in to work on your report. Your friend points out that you will work better after a break and you reluctantly go out. Half way through the evening, you realise your decision was

r-g-t right

Are you pleased you let go of your self-discipline and allowed yourself to go out? YES

64. Some DIY you are doing isn't going as well as you would like. You think some tiles are not perfectly lined up even though your partner thinks they look fine. When your parents visit, they compliment your work but you are still dissatisfied. When you survey you work later, you decide that the minor flaws are

    u-n-tice-ble unnoticeable

    Did the little details of your work matter in the end? NO

65. You have been trying to solve a complex puzzle. Although you are not getting very far, you refuse to give up on it. You turn down an invitation to a fun party in the hope of cracking it. Later in the evening, you feel your decision was

    m-st-k-n mistaken

    Do you think it's good to be so persistent and miss out on all the fun? NO

66. Everyone else has given up on a very complex jigsaw puzzle. However you spend hours working on the intricate design. You even get the very smallest pieces of the jigsaw in place. By the end, you feel like you have been

    obs-ss-d obsessed

    Was the time and effort you put into the puzzle worth it in the end? NO

Appendix A9

Cognitive Bias Modification – Control/Neutral Training

Next you will be asked to read a series of scenarios. At the end of each scenario you will be asked to complete missing letters in a word fragment using keys on your keyboard. Each word fragment has only one possible answer.

After completing the word fragment you will then be asked a question about the scenario to which the answer is either 'Yes' or 'No'. To answer this question, type either 'Y' (for yes) or 'N' (for no) using keys on your keyboard.

1. You turn the kettle on and wait for the water to boil. You get a teabag out of the tin, which you put into a mug, and pour the boiling water onto the teabag. Next, you add the

   m- - k milk

   Have you made a cup of tea? YES

2. You get into the lift down to the railway platform. You wait for four minutes until the next train arrives. You get onto the train and sit down. You get out your book and start

   re - di –g reading

   Did you get a seat on the train? YES

3. The first electronic digital computers were developed in the mid 20th century to efficiently carry out complex calculations. Originally, they were the size of a large room, consuming as much power as several hundred modern personal

   c-m-u-e-s computers

   Were the first computers the size of modern personal computers? NO

4. Monarch butterflies are known for their lengthy migration. In North America they migrate downwards in August and northwards in the spring. The monarchs are the only butterflies known to migrate annually both north and south similarly to

   b-r-s birds

   Do the Monarchs migrate on an annual basis YES

5. You are reading a book about the history of DNA. It describes how Watson and Crick deduced the double-helix structure with help from their collaborator Rosalind Franklin at Cambridge

   U-ivers- -y University

   Are you reading a book about DNA? YES

6. You are watching a clip on the internet about great engineering achievements. It describes the construction of the Golden Gate Bridge. The length of the bridge is over two and a half thousand

   met- - s metres

   Have you been watching a clip about a bridge? YES

7. You are watching a gardening program. The presenter is explaining how to grow fruit and vegetables. He explains that strawberries grow best in the

   su-m-r summer

   Does the program have a presenter? YES

8. You sort out your dirty laundry in two piles, whites and colours. You put the whites in the washing machine and select the quick and cool program. When finished, you wash the other

   cl-th-s clothes

   Have you been vacuuming? NO

9. A visual illusion is a distortion of the senses, revealing how the brain normally organises and interprets sensory stimulation. The information gathered by the eye, does not tally with a physical measurement of the stimulus

   s-u-ce source

   Do visual illusions reveal how the brain normally organises information? YES

10. You queue up at the checkout with your shopping trolley. As the person in front of you moves forward you start to put your shopping onto the conveyor belt. Soon the sales assistant starts scanning your

    sh - ppi – g shopping

Did you join the queue? YES

11. You ordered several DVDs and books from AMAZON but you missed them a few days ago. You notice that the deliveryman left a "something for you" memo card. You check your local delivery office to collect your

pa_c_ls parcels

Did you order music CDs and books from AMAZON? NO

12. You see your neighbour the street and talk about their new beagle dog. They explained that Beagles are very small, energetic and good with children, and most live 12 to 17 years on

a_er_ge average

Did your neighbour get a golden retriever? NO

13. You are reading an article about the weather in a science magazine. The scientists report that low UV output from the sun might contribute to more cold winters than usual whereas high UV output has the opposite

ef-e-t effect

Do you review the weather broadcasting? NO

14. Green tea originated in China and has become associated with many cultures throughout Asia. Lately its possible health benefits have been acknowledged in the Western world. The polyphenols present in the tea are believed to have antioxidant effects on

c-l-s cells

Is it believed that polyphenols have antioxidant effects? YES

15. You are ordering grocery items online. You turn on the computer, find the website and begin adding items to your shopping cart. You now decide the delivery date and time and finish

pa-me-t payment

Do you go to the store for your grocery items? NO

16. You find a book in the bookstore. The story starts when a British film producer moves to Los Angeles. They then make the film called Compton Cricket Club which is about a group of young men from a homeless

co-mu-ity community

Have you found an interesting book? YES

17. Your colleague brings their new camera to the office. They said that it was on sale online, so they bought it at a cheaper price than they expected. They take a picture of everyone in the

of_ice office

Does your colleague bring a phone to the office? NO

18. You measure the width of wooden planks to make a fence. It will go around the whole garden and once finished it will be treated and painted in brown which is the same colour as the other fences in the

ne-ghb-u-h-od neighbourhood

Are you building a fence? YES

19. You are building a sandcastle on the beach. You have buckets and spades varying in size and shape and you start by digging a little pit. Next you fill the buckets with sand mixed with water and create the castle

fo-nd-ti-on foundation

Are you building a sandcastle? YES

20. You listen to the weather report broadcasted on radio. The meteorologist reports that the weather will be mostly dry and cloudy in the east, but spells of rain will continue in western areas, becoming heavy and

pe-si-t-nt persistent

Did you watch the weather report? NO

21. You mix flour and baking powder to make muffins. You then add the butter, eggs and sugar and stir in some milk. Before pouring the mixture into the muffin cases, you add the vanilla and the

bl-eb-rr-es blueberries

Are you baking muffins? YES

22. You opened the handbag that you found in the restaurant's toilet. Inside there was a little mirror, a book, some cigarettes and business cards. You called the phone number and informed the

ow-er owner

Did you find a backpack? NO

23. You are reading art magazine. An artist has embraced many different media since the 1950s, including painting, printmaking, installation and industrial design and this exhibition focuses on his political

wo-ks works

Are you going to a gallery? YES

24. You are eating a fresh baguette. It is made from wheat-flour dough that is cultured with yeast, allowed to rise, and finally baked in an oven. Common wheat is the most usual grain used for the preparation of

br-ad bread

Did you eat a fresh bagel? NO

25. You are sewing a loose button back onto a shirt. You have the thread which is put through the needle hole and then you start making the stitches in single loops of thread brought in and out of the fabric in a particular

w-y way

Are you sewing a loose button? YES

26. You are constructing a flat-packed chest of drawers. The instructions say that you will require a Phillips-head screwdriver and a hammer and estimate the construction takes sixty

m-nut-s minutes

Are you constructing a desk? NO

27. You have just finished writing your letter and so fold it up and put it into an envelope. You write the address on the front of the envelope in block capitals and fix a stamp to the top right hand

c-rn-r corner

Did you write the address in capital letters? YES

28. You collect your washing off the washing line and put it into a basket. You then carry the basket into the house and turn the iron on. You wait for the iron to heat up before beginning to iron a

sh-r- shirt

Have you been cleaning the house? NO

29. You are watching the nightly news. It reports that as technology improves, it is becoming more common for people to download bigger files. These include songs, videos and emails with large

at_ta_hments attachments

Are you listening to radio? NO

30. You are planning your journey home from work. You check the train times and work out the journey on the internet. One option is to get the bus but the quicker and easiest form of transport is to get the direct

t-a-n train

Did you plan your journey? YES

31. You are watching a football game on TV. Both teams are from the same city and there are an equal number of supporters for each team in the stadium. The referee blows the whistle because it is half

t-me tim

Are you watching a baseball game? NO

32. You are getting ready to cook a curry. You have been to the shop to get all the ingredients and laid them all out on the table. Next you take out the utensils and an apron but before you start cooking you double check the

r-c-pe recipe

Are you cooking a curry? YES

33. You are reading about photography in a newspaper. The article says that digital imaging uses an electronic image sensor to record the image as a set of electronic data rather than as chemical changes on

f-lm film

Are you reading about photography? YES

34. You are watching an episode of ‘counting-down’ on the television. One of the contestants is doing well and has a score of ninety-six, the longest word he made was seven

    l-tt-rs letters

    Has the best contestant made a word longer than 5 letters? YES

35. You are turning up the volume on the radio to hear the music. You are not familiar with the piece but you try to make out the instruments and can hear drums, horns, saxophone, trombone, megaphone and

    tr-mp-t trumpet

    Did you turn the volume down? NO

36. You watch a program about penguins. You learn that during the breeding season penguins form monogamous pairs and that with the exception of the Emperor penguin where the male does everything, penguins share the incubation

    d-ti-s duties

    Did you watch a program about seals? NO

37. You find a magazine in the train on your way to work. You read about greenhouse gases which are gases in the atmosphere that absorbs and emits radiation within the infrared range and this process causes the greenhouse

    e-ff-ct effect

    Have you found a leaflet? NO

38. You feel a raindrop on your cheek, you open your bag and quickly find your umbrella. You open up the umbrella and then use it to walk all the way home to stop you from getting

    w – t wet

    Is it raining? YES

39. You open the telephone directory and find the section beginning with: ‘T’. You then find the taxi service section. You find the nearest taxi service and make a note of their

    n-mb-r number

Were you looking for the bus timetable? NO

40. You walk into the restaurant. The waitress takes you to your table. You sit down at your table and ask the waitress for an orange juice. In a few minutes the waitress comes back with your

d - - nk drink

Did you order a coke? NO

41. You are walking down to the canteen for lunch. You see your boss walking towards you with his/her colleagues and you say "hello" to each other. You are now looking at the menu and wait in the queue to get the food you

c-ose chose

Did you meet your boss in the canteen? YES

42. You would like to buy a new laptop. You are looking at cheap laptop sales online and reading descriptions about design, technical details, and product details. Finally, you are checking for a reasonable

pr-ce price

Are you going to buy a new desktop computer? NO

43. You walk past a currency exchange shop. Exchange rates are displayed in the window of the shop. One US Dollar is equivalent to 0.63 British pounds. One Euro is equivalent to 0.86 British

p-und- pounds

Is the euro worth less than the dollar? NO

44. You read about Yorkshire which is an historic county of Northern England and the largest in the United Kingdom. The emblem of Yorkshire is the white rose of the English royal House of

Y-rk York

Did you read about Yorkshire? YES

45. You are planting a seed. It is a small embryonic plant enclosed in a covering called the seed coat, usually with some stored food that is a store of nutrients for the seedling that will grow from the

em-ryo embryo

Are you planting a seed? YES

46. You are reading about the secret of Rolex watches and it says that Rolex's secret is sports marketing. They advertised that a swimmer named Mercedes Gleitz crossed the English Channel in 1927, wearing a waterproof

R_l_x Rolex

Is the secret of Rolex brand sport marketing? YES

47. You watched a television programme on organic farming. It was suggested that conventional agriculture might be more energy efficient for certain foods. However, others have told you that organic really is better for the

en_iron_ent environment

Is conventional agriculture really better for the environment? NO

48. After months of use it is time for you to buy a new rucksack. You decide that you still prefer the company that you bought your original rucksack from. You buy the same model but one of a different

c-lo-r colour

Are you buying a new rucksack? YES

49. You read a science fiction book. It is set on a spaceship in a distant galaxy and it is about the adventures of a young boy who is trying to find his way back home to his planet where everyone is looking for

h-m him

Did you read a science fiction book? YES

50. You have done some research on birds. You find that migratory birds live in rainforests during the winter and return to cooler regions during the spring and summer, for example many songbirds that nest in the United States winter in the

Am-z-n Amazon

Have you been researching reptiles? NO

51. You are washing an old wool jumper by hand. You have heard that wool can easily lose its shape and become less defined if washed without care. That's why you use a special laundry

d-te-g-nt detergent

Did you wash it in the machine? NO

52. You tried to solve a crossword puzzle during the bus ride. There was one word missing when you had to get off the bus and you decided to ask the person sitting next to you. He gave you the right

an-w-r answer

Did you try to solve a crossword puzzle? YES

53. You are going to go food shopping this afternoon and check the items you have to buy and make a note of them. When you arrive at Coles and start collecting vegetables first, you notice your neighbour is in the opposite

co-n-r corner

Are you shopping for food? YES

54. You receive a letter from your local council about updates to recycling and waste procedures. Collection for recycling had previously been twice a month. You are notified that this will now be done on a weekly

b-sis basis

Have you received new information about your taxes? NO

55. You have recently finished construction work on your outside garden. You find that you are now left with an excess of broken bricks. You decide to take the rubbish to the tip this

we-ke-d weekend

Have you put a pool in your outside garden? NO

56. You decide to update your appliances and go to the store and purchase a new washing machine. You ring the company to ask when you should it expect it to be delivered. You are told that it will arrive on

M-nd-y Monday

Have you bought a new dishwasher? NO

57. You are watching the 6 O'Clock news. The news presenter is describing a story about recent changes to the government's economic policy. A politician is being

in-erv-ewed interviewed

Is it early evening? YES

58. You check the clock at the train station and the time is 12.45. You check the time on your watch and it says it is 12.50. Your watch must be 5 minutes too

f-st fast

Are you at the train station? YES

59. You are using a compass. It has four different points, North, South, East and West and is a navigational instrument. There are two different kinds of compasses, gyro and

m-gne-ic magnetic

Are you using a telephone? NO

60. You go onto the internet and use Bing. Bing is a web search engine from Microsoft. In October 2011, Bing announced it is working on delivering faster and more relevant search

re- -lts results

Did you use google? NO

61. You look at the London underground tube map. You notice that there are four connections at Liverpool Street and three connections at Oxford circus. There are many tube lines and they all have different

co-ou-s colours

Did you look at a tube map? YES

62. You listen to a guitar playing. It is a plucked string instrument, usually played with fingers or a pick and consists of a body with a rigid neck to which the strings, generally six in number are

att-ch-d attached

Did you listen to the piano? NO

63. You are going for a walk. You pass by the local corner shop, a pub and charity shop. You walk down the street and when you make it to the crossing, you turn

l-ft left

Did you turn right? NO

64. You start reading a book about wildlife and learn that it includes all non-domesticated plants, animals and other organisms. Wildlife can be found in all ecosystems including fauna, rain forests and

de-er-ts deserts

Are you reading about the weather? NO

65. You are watching a documentary about evolution. The narrator mentions that evolution is a change across successive generations in the heritable characteristics of

p-pul-at-io-s populations

Is the documentary about evolution? YES

66. You read about The Great Wall of China. It was built in the 5th century BC. All the walls measure close to 9000 km and include actual wall and natural defence barriers such as hills and

r-v-r- rivers

Does the Great Wall of China only consist of actual wall? NO

Appendix B

Participant Information Sheets

Appendix B1

Participant Information Sheet[6]

What is the purpose of this research?

The purpose of the current study is to explore issues related to different eating styles in women.

What does this research involve?

This project involves the completion of a questionnaire survey, a memory task, and an attention task, and will take no more than one hour of your time. Questionnaires include questions about your beliefs, attitudes, mood, and eating styles.

Participation is confidential and voluntary

Your participation in the study is entirely voluntary and you have the right to withdraw from the study at any time. In accordance with usual practice, study results (questionnaire data) become the property of the researchers and will be published in scientific journals at a later date. All records containing personal information will remain confidential and no information that could lead to your identification will be released or published. You will be asked to give your name and email address so that we can contact you in the second semester to do the follow-up study associated with this research but be assured that this infomraiton will be stored confidentially.

Questions about this project

Should you have any questions about the project, either before, during or after the study, you may contact Professor Tracey Wade in the School of Psychology at Flinders University, using the contact details in the letterhead. Thank you for your attention and assistance.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project #6392). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email, human.researchethics@flinders.edu.au.

[6] Participants indicated their consent online

Appendix B2

On-line Participant Information Sheet/Consent Form

Part 1 What does my participation involve?

1 Introduction

You are invited to participate in this research study of eating disorders and emotion in women. You have been invited to take part in this research project because you have an eating disorder or because you experience disordered eating.

Before you decide to participate or not, it is important for you to understand why the study is being done and what is involved. Please take the time to read the following information carefully and discuss it with others if you wish. Your decision to participate or not is entirely up to you and will not in any way affect the treatment you receive. Your medical care and relationship with Flinders University and/or its services will not be affected in any way, now, or in the future.

This Participant Information Sheet/Consent Form tells you about the research project. It explains the assessments involved. Knowing what is involved will help you decide if you want to take part in the research.

Please read this information carefully. Please contact the researcher if you have any questions about anything that you don't understand or want to know more about. Before deciding whether or not to take part, you might want to talk about it with a relative, friend or your local doctor.

Participation in this research is voluntary. If you don't wish to take part, you don't have to. You will receive the best possible care whether or not you take part. If you decide you want to take part in the research project, you will be asked to sign the consent section. By signing it you are telling us that you:

• Understand what you have read

• Consent to take part in the research project

• Consent to partake in the assessments

• Consent to the use of your personal and health information as described.

It is recommended that you print a copy of this information sheet for your records.

2 What is the purpose of this research?

This research aims to enhance our understanding of what factors contribute to the maintenance of eating disorders, with a particular focus on the relationship between the regulation of difficult emotions and eating.

Identifying factors that contribute to the maintenance of eating disorders may assist clinicians in developing suitable treatments which target reducing these factors in those with an eating disorder and help identify high risk individuals.

We know that difficulties with emotion regulation is a maintaining factor in eating disorders so by being able to find out what influences these difficulties will ultimately help us treat and prevent eating disorders.

The results of this research will be used by Jane Cooper to obtain a Doctorate of Philosophy (Clinical Psychology) degree. This research has been initiated by the researcher, Jane Cooper.

3 What does participation in this research involve?

If you agree to participate you will be asked to complete a range of questionnaires asking you about how you are feeling, how you respond to emotional situations, your eating, and eating behaviours, as well as completing unfinished words in sentences. You will be then asked to complete the same questionnaires one week later. The first assessment should take approximately one hour, and the second assessment should take about 30 minutes. You may feel uncomfortable having to answer questions about your eating patterns or emotions. You can discuss this with your primary clinician, or alternatively you can contact your GP or Lifeline on 131114 should you need to talk to someone after completing the questionnaires. We also have services available on campus at Flinders University and you will be provided with these details if you choose to participate in the study.

If you chose to participate in this study you will be reimbursed for your time with an iTunes voucher the value of $20.00 at the completion of the second assessment and the voucher will be mailed to you.

This research project has been designed to make sure the researchers interpret the results in a fair and appropriate way and avoids study doctors or participants jumping to conclusions.

4 Do I have to take part in this research project?

Your participation is entirely voluntary and you have the right to participate or not, or to withdraw from the study at any time without giving a reason if you choose. If you decide not to participate in this study, or if you withdraw from the study later on, you may do so freely without affecting the treatment or standard of care you will receive now or in the future. In accordance with usual practice, study results (questionnaire data) become the property of the researchers and will be published in scientific journals at a later date. All records containing personal information will remain confidential and no information that could lead to your identification will be released or published. You will be asked to give your initials, date of birth and email address and contact telephone number if you wish to receive feedback on your results at the conclusion of the study and to enable us to forward you your voucher. Please be assured that this information will be stored in a secure database to ensure confidentiality and anonymity.

5 What are the possible benefits of taking part?

Identifying factors that contribute to the maintenance of eating disorders may assist clinicians in developing suitable treatments which target reducing these factors in those with an eating disorder and help identify high risk individuals.

6 What are the possible risks and disadvantages of taking part?

You may feel uncomfortable having to answer questions about your eating patterns or emotions. You can discuss this with your primary clinician, or alternatively you can contact your GP or Lifeline on 131114 should you need to talk to someone after completing the questionnaires. We also have services available on campus at Flinders University and you will be provided with these details if you choose to participate in the study.

7 What will happen to my data?

All records containing personal information will remain confidential and no information which could lead to your identification will be released, except as required by law. Records and data about your participation in this study are for the use by Flinders University for research purposes outlined in this information sheet and for no other purposes . All such records and your right to them will be protected in accordance with Australian law.

8 What if I withdraw from this research project?

If you decide to withdraw from the project, please notify Jane Cooper. If you do withdraw your consent during the research project, we will not collect any additional personal information from you, although personal information already collected will be retained to ensure that the results of the research project can be measured properly and to comply with law. You should be aware that data collected by the researcher up to the time you withdraw will form part of the research project results. If you do not want them to do this, you must tell them before you join the research project.

9 What happens when the research project ends?

You will be asked to give your initials, date of birth and email address or contact telephone number if you wish to receive feedback on results at the conclusion of the study.

Part 2 How is the research project being conducted?

10 What will happen to information about me?

By clicking 'Yes' on the consent form you consent to the study doctor and relevant research staff collecting and using personal information about you for the research project. Any information obtained in connection with this research project that can identify you will remain confidential. All records will be stored on a secure database and only accessible by the researcher. Your information will only be used for the purpose of this research project and it will only be disclosed with your permission, except as required by law.

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that you cannot be identified, except with your permission. Your initials, date of birth, email address and contact telephone number will remain confidential.

11 Complaints and compensation

This study has been reviewed by the Southern Adelaide Clinical Human Research Ethics Committee. If you wish to discuss the study with someone not directly involved, in particular in relation to policies, your rights as a participant, or should you wish to make a confidential complaint, you may contact the Executive Officer on 8204 6453 or email research.ethics@health.sa.gov.au

Participants in this study are insured under Flinders University's general and liability protections. If you suffer injury as a result of participation in this research or study, compensation might be paid without litigation. However, such compensation is not automatic and you may have to take legal action to determine whether you should be paid.

12 Who has reviewed the research project?

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC). The ethical aspects of this research project have been approved by the HREC of Flinders University.

This project will be carried out according to the *National Statement on Ethical Conduct in Human Research (2007)*. This statement has been developed to protect the interests of people who agree to participate in human research studies.

13 Further information and who to contact

Although we believe that this research project poses no risk for participants, it does deal with some sensitive personal issues. If completing this survey has raised any concerns that you would like to discuss with someone, please do not hesitate to contact the following services or contact your current treating clinician:

State-Wide Eating Disorder Service	8198 0800
Flinders University Student Counselling	8201 2117
Flinders University Services for Eating Disorders	8201 5563
Assessment and Crisis Intervention Services (8am – 10.30 pm)	131 465
Women's Health Statewide	8239 9600
	1300 882 880
Life Line: 24 hour service telephone counselling	131 114

- **I have read and understood the participant information sheet**

Consent Form

I have read the Participant Information Sheet or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research described in the project.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time during the study without affecting my future health care.

I understand that my involvement in this research project may not be of any direct benefit to me and that I may withdraw my consent at any stage without affecting my rights or the responsibilities of the researchers in any respect.

I declare that I am aged 18 years or over.

Click here to indicate your consent ○

Appendix C

Publications

EMPIRICAL ARTICLE

Examination of the Difficulties in Emotion Regulation Scale and Its Relation to Disordered Eating in a Young Female Sample

Jane L. Cooper, B.Psych (Hons)*
Anne E. O'Shea, BBSc (Hons)
Melissa J. Atkinson, BSc (Hons)
Tracey D. Wade, PhD

Abstract

Objective: Difficulties with emotion regulation is considered an important maintaining factor of disordered eating. One of the most commonly used measures of this construct is the Difficulties in Emotion Regulation Scale (DERS). The aim of this study was to explore the factor structure of this measure in young females and to examine its reliability and validity with respect to disordered eating.

Method: Females aged 17–25 years (*M* age = 19.6 years, *N* = 486) were examined in the analyses. Confirmatory factor analyses were conducted followed by regression analyses examining the DERS subscales as predictors of eating disorder severity and disordered eating behaviors.

Results: The original 6-factor 36-item model did not fit well and analyses indicated a 6-factor 30-item solution was a more suitable fit for our population. Validity and reliability of the 30-item solution were found to be acceptable. Regression analyses also indicated the 36- and 30-item models were able to adequately predict eating disorder severity and disordered eating behaviors with the "Awareness" and "Goals" subscales being predictors of the former, and the "Impulsivity" subscale being a significant predictor of the latter.

Discussion: The overall findings suggest that an abbreviated version of the DERS might be more appropriate than the original version with young females and that this measure exhibits stronger relationships with eating disorder severity and disordered eating behaviors than the longer version. Further examinations of the psychometric properties of the DERS with clinical populations are indicated. © 2014 Wiley Periodicals, Inc.

Keywords: emotion regulation; disordered eating; lack of emotional awareness; impulsivity

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Introduction

A body of empirical findings has grown indicating negative affect as being one of the most robust risk factors for the development of an eating disorder.[1,2] A number of theories postulate difficulties with emotion regulation to be one of the key specific mechanisms of action within the more general construct of negative affect.[3,4] These different theories suggest that difficulties coping with intense mood states can result in disordered eating behaviors, which then become a habitual way of coping with, and managing, difficult emotion.[3]

As interest and research in this area grows, it is important to have a valid and reliable measure that has been shown to adequately assess difficulties with emotion regulation. The most commonly used measure in the eating disorder literature is the Difficulties in Emotion Regulation Scale (DERS),[5] a comprehensive measure, which includes several dimensions of theoretical and empirical relevance to eating disorders, including: (a) nonacceptance of negative emotional responses; (b) difficulties engaging in goal directed behavior when distressed; (c) difficulties controlling impulsive behaviors when distressed; (d) lack of emotional awareness representing the lack of attention to and acknowledgement of negative emotions; (e) limited access to effective emotion regulation strategies; and (f) lack of emotional clarity. The DERS is commonly used in eating disorder research, with various studies indicating eating disorder severity and behaviors are associated with difficulties with emotion regulation. In addition, difficulty with emotion regulation has been found across all eating disorders, suggesting it represents a transdiagnostic risk and/or maintenance factor.[2,6–10]

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While the six factor structure of the DERS has been shown to be a good fit in adult nonclinical samples, and both adolescent clinical and nonclinical samples,[5,11,12] a more recent investigation has indicated a five-factor structure may more accurately represent the construct of emotion regulation in nonclinical samples, with omission of the "Awareness" subscale.[13] This is consistent with a number of investigations showing this subscale to have the most modest correlations with the other subscales of the DERS (rs = −0.12 − 0.74) where correlations amongst the other five subscales range from 0.39 to 0.77.[5,11–13] It has been argued that it was the intention of Gratz and Roemer[5] that the DERS assess dimensions of emotion regulation, and as such, each dimension or subscale should intercorrelate.[13] Further investigation of the factor structure of the DERS, and the relation of this construct to variables of relevance to disordered eating, would be a useful addition to the literature.

Therefore, the first aim of this study was to examine the factor structure of the DERS in young females in the community and indicators of the reliability and validity of this structure. The second aim was to examine the relation of the best fitting structure to variables of relevance to disordered eating. In particular, we were interested in which factors of the DERS were most strongly related to different aspects of disordered eating. The extant literature indicates that for some clinical samples, some factors of the DERS account for more variance than others in behaviors of interest. For example, research has shown that the subscale measuring limited access to effective emotion regulation strategies accounted for greater variance in a nonsuicidal self-harming adolescent population above and beyond other aspects measured by the DERS.[12]

Method

Participants

Baseline data from two different samples of young women were examined for use in this study (N = 569): undergraduate students from Flinders University, and high school students from four South Australian schools. All participants aged 26 years or older were excluded from the analyses (N = 50) to examine a population in which disordered eating may commonly occur. In addition, for the Confirmatory Factor Analysis (CFA), all cases with missing data on the DERS were removed (N = 33) resulting in a final number of 486 participants aged 17–25 years (M age = 18.4 years, SD = 1.65). Ethnicity was reported with 79.6% of the combined sample being of Australian descent, 10.9% of Asian descent, and the remaining endorsed "other."

Measures

Difficulties in Emotion Regulation Scale. The DERS[5] is a 36-item self-report measure which assesses six dimensions of emotion regulation: lack of emotional awareness (Awareness), lack of emotional clarity (Clarity), difficulties controlling impulsive behaviors when distressed (Impulsivity), difficulties engaging in goal directed behaviors when distressed (Goals), nonacceptance of negative emotional responses (Nonacceptance), and limited access to effective emotion regulation strategies (Strategies). Many of the items begin with the phrase, "When I'm upset . . .", and are rated on a five-point Likert scale ranging from almost never to almost always, with high scores representing increased difficulties with emotion regulation. The 36-item DERS demonstrates high internal consistency, α = 0.93,[5] as do each of the subscales, α: nonacceptance = 0.90, goals = 0.86, impulsivity = 0.92, awareness = 0.85, strategies = 0.92, and clarity = 0.81.[12]

Eating Disorder Examination-Questionnaire (EDE-Q). Eating disorder severity was assessed using the global score from the EDE-Q.[14] The global score consists of the summation of the four subscales, weight concern, shape concern, eating concern, and dietary restraint. Each item is assessed on a 7 point scale, with higher scores indicating greater levels of eating disorder severity. High concurrent validity between the EDE-Q and the Eating Disorder Examination (EDE) has been demonstrated.[14] The EDE-Q also demonstrates high internal reliability with alphas ranging from 0.70 to 0.93, and good convergent and predictive validity.[15]

Disordered eating behaviors which are included in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5)[16] were also assessed using the EDE-Q, including the number of episodes over a period of 28 days of objective binge episodes (overeating associated with a loss of control); self-induced vomiting; laxative use; driven or compulsive exercise, and fasting. This latter item, from the dietary restraint subscale asked, "Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?". The items were standardized, then added together to form a total measure of the number of disordered eating episodes. High convergent validity has been demonstrated between the compensatory behaviors subscales of the EDE-Q and the interview-based EDE (rs = 0.90 − 0.92), and moderate convergent validity (rs = 0.37 − 0.55) for objective binge episodes.[17]

Negative Affect. This was calculated using either the five items assessing sadness within the Positive and Negative Affect Scale–expanded version (PANAS-X)[18] or the seven items assessing depression from the Depression,

Anxiety and Stress Survey short form (DASS-21).[19] With respect to the PANAS-X, participants were asked to indicate to what extent they experience these emotions and/or feelings "in the past week." Responses rated from 1 (very slightly) to 5 (extremely), with higher scores indicating high levels of positive or negative affect. The five items assessing sadness were, "sad," "alone," "blue," "lonely," and "downhearted." Internal reliability for the sadness subscale has been reported as ranging from $\alpha = 0.86$ to $\alpha = 0.89$ in a range of populations both clinical and nonclinical.[18]

The depression subscale of the DASS-21 used a 7-item, Likert-type scale from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time), with higher scores indicating higher levels of depression, anxiety or stress. Participants were asked to indicate how much the statements applied to them over the past week. Sample items for depression included, "I couldn't seem to experience any positive feeling at all", and, "I felt I had nothing to look forward to." It has been demonstrated the DASS-21 has good internal reliability, $\alpha = 0.94$ for depression.[20] To form one depression/sadness scale score that could be used in the analyses, scores on both questionnaires were standardized.

Procedure

Participants completed the measures either online or on paper. Both samples completed the DERS, and the EDE-Q, with the DASS-21, being completed by university students, and the PANAS-X being completed by high school students. The PANAS-X was used in this latter population as it aimed to replicate a previous study which used the PANAS-X. Height and weight was also reported so that body mass index (BMI) could be calculated. Approval for these studies was received from the Flinders University Social and Behavioral Research Ethics Committee, the Catholic Education Office and the principals of the schools involved.

Statistical Analyses

A CFA was conducted on the DERS using Version 20 of AMOS (IBM SPSS). Missing values were replaced using the expectation maximization method which is preferred over mean substitution. The overall model of fit was judged on the basis of the following fit indices: Root Mean Square Error or Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), Non-normed Fit Index (NNFI), and the Chi-Square/degree of fit ratio (CMIN/DF). In line with previous recommendations,[21–24] a priori indications of good (RMSEA ≤ 0.6, and CFI, NFI, and NNFI all ≥ 0.9) and excellent fit (RMSEA < 0.6, and CFI, NFI, and NNFI all ≥ 0.95) were chosen. Remaining analyses were conducted using IBM Statistical Package for the Social Sciences, Version 20 (IBM SPSS). Pearson correlations were used to evaluate the strength and direction of the linear relationship between the subscales of the DERS and the EDE-Q global scale and the disordered eating behaviors. Hierarchical multiple regressions were conducted to assess the predictive abilities of the DERS and its subscales after controlling for BMI and depression/sadness.

Results

Preliminary Analyses

All variables were examined for normality by assessing the shape of the distribution as recommended for large samples sizes by Tabachnick and Fidell,[25] and results indicated that all variables were normally distributed. Little's missing completely at random test was nonsignificant ($\chi^2(726) = 784.305$, $p = .07$), indicating that data was missing at random. An independent-samples t-test was conducted to compare scores on all variables between the two samples (high school students and undergraduates). Undergraduates scored significantly higher than high school students on three measures: the global EDE-Q score ($M = 2.80$, SD = 1.49, and $M = 2.25$, SD = 1.56 respectively), $t(462) = 3.45$, $p = .001$; the DERS ($M = 2.84$, SD = 0.68 and $M = 2.53$, SD = 0.59, respectively), $t(475) = 4.984$, $p < .001$; and BMI ($M = 22.55$, SD = 5.0 and $M = 20.78$, SD = 2.9, respectively), $t(444) = 4.639$, $p < .001$. The magnitude of the differences in the means was associated with small effect sizes (Cohen's d) ranging from 0.32 to 0.46. Given these differences existed, additional hierarchical multiple regressions were conducted so that interaction terms with the two sample types could be tested.

Confirmatory Factor Analysis

The 6-factor 36-item first order model recommended by Gratz and Roemer[5] and encapsulated in the scoring of the DERS was evaluated first. All factors were allowed to correlate, with each individual item allowed to load upon only one factor. **Table 1** summarizes the items and standardized factor loadings from the CFA. Fit indices indicated that the model was not a good fit to the data (**Table 2**). As six items had relatively low item-total correlations (1, 7, 20, 22, 24, and 34), an alternative model was examined whereby these six items were removed to form six subscales with a minimum of three items per subscale (**Table 1**). The model fit improved and met the set indications of good fit, a significant improvement to the original 36-item model (**Table 2**). However, modification indices

TABLE 1. Items, standardized CFA squared multiple correlations and factor loadings on the 36 item six factor and 30-item six factor models for the DERS for the whole sample

		R^2		Loading	
Factor	Item	36-Item DERS	30-Item DERS	36-Item DERS	30-Item DERS
1. Impulsivity	27. When I'm upset, I have difficulty controlling my behaviors	0.71	0.71	0.84	0.84
	32. When I'm upset, I lose control over my behaviors	0.74	0.71	0.86	0.86
	14. When I'm upset, I become out of control	0.77	0.77	0.88	0.88
	19. When I'm upset, I feel out of control	0.76	0.76	0.87	0.87
	24. When I'm upset, I feel like I can remain in control of my behaviors	0.02	–	0.14[a]	–
	3. I experience my emotions as overwhelming and out of control	0.43	0.43	.66	.66
2. Awareness	6. I am attentive to my feelings	0.57	0.55	0.76	0.74
	8. I care about what I am feeling	0.55	0.58	0.74	0.76
	10. When I'm upset, I acknowledge my emotions	0.56	0.55	0.75	0.75
	2. I pay attention to how I feel	0.61	0.64	0.78	0.80
	34. When I'm upset, I take time to figure out what I'm really feeling	0.24	–	0.49	–
	17. When I'm upset, I believe that my feelings are valid and important	0.35	0.32	0.59	0.56
3. Goals	26. When I'm upset, I have difficulty concentrating	0.76	0.76	0.87	0.87
	13. When I'm upset, I have difficulty getting work done	0.71	0.71	0.84	0.84
	18. When I'm upset, I have difficulty focussing on other things	0.73	0.73	0.86	0.86
	20. When I'm upset, I can still get things done	0.03	–	0.16	–
	33. When I'm upset, I have difficulty thinking about anything else	0.63	0.63	0.80	0.80
4. Nonacceptance	25. When I'm upset, I feel guilty for feeling that way	0.71	0.71	0.84	0.84
	21. When I'm upset, I feel ashamed with myself for feeling that way	0.74	0.74	0.86	0.86
	29. When I'm upset, I become irritated with myself for feeling that way	0.71	0.71	0.84	0.84
	12. When I'm upset, I become embarrassed for feeling that way	0.61	0.61	0.78	0.78
	23. When I'm upset, I feel like I am weak	0.47	0.47	0.68	0.68
	11. When I'm upset, I become angry with myself for feeling that way	0.64	0.64	0.80	0.80
5. Clarity	4. I have no idea how I am feeling	0.66	0.65	0.81	0.80
	9. I am confused about how I feel	0.59	0.59	0.77	0.77
	5. I have difficulty making sense out of my feelings	0.77	0.80	0.88	0.90
	7. I know exactly how I am feeling	0.14	–	0.37	–
	1. I am clear about my feelings	0.11	–	0.32	–
6. Strategies	22. When I'm upset, I know that I can find a way to eventually feel better	0.06	–	0.24	–
	28. When I'm upset, I believe there is nothing I can do to make myself feel better	0.72	0.71	0.85	0.85
	16. When I'm upset, I believe that I'll end up feeling very depressed	0.69	0.69	0.83	0.83
	35. When I'm upset, it takes me a long time to feel better	0.54	0.54	0.73	0.73
	31. When I'm upset, I believe that wallowing in it is all I can do	0.52	0.52	0.72	0.72
	36. When I'm upset, my emotions feel overwhelming	0.55	0.55	0.74	0.74
	15. When I'm upset, I believe that I will remain that way for a long time	0.70	0.69	0.83	0.83
	30. When I'm upset, I start to feel very bad about myself	0.58	0.58	0.76	0.76

[a]Nonsignificant.

TABLE 2. Confirmatory Factor Analyses–Model Fit Comparisons

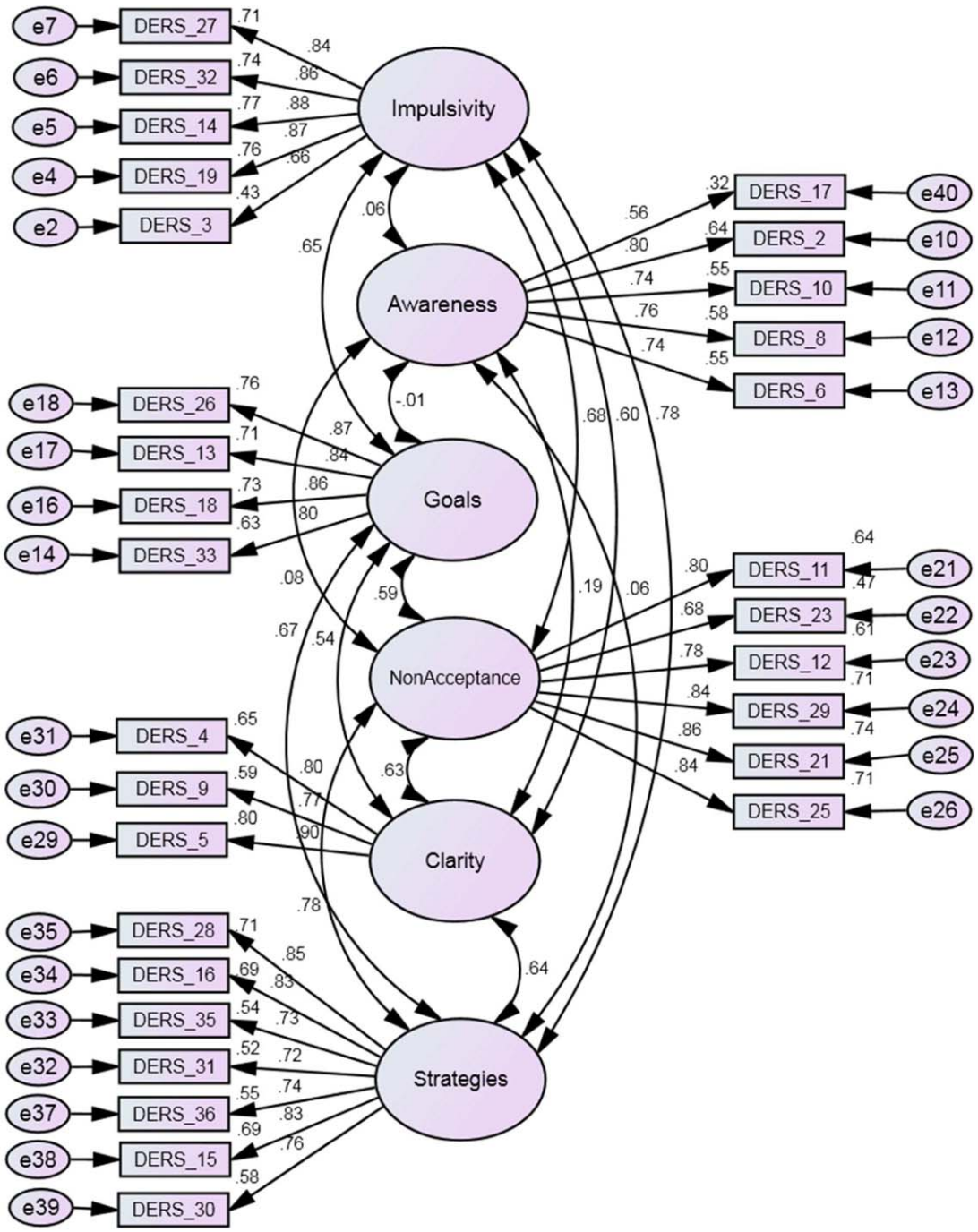
Model #	Model	RMSEA	CFI	NFI	NNFI (TLI)	CMIN	DF	CMIN (DF) DIFFERENCE
1	6 Factor 36 Items Correlated	0.08	0.86	0.82	0.84	2454.248	579	
1a	6 Factor 30 items as above low loading items (i.e.,<.50) removed	0.06	0.93	0.89	0.92	1172.371	390	1281.877 (189)[a]
2	5 Factor 30 items Correlated	0.08	0.88	0.85	0.87	1616.827	395	
2a	5 Factor 25 item low loading items (i.e.,<.50) removed	0.08	0.92	0.90	0.91	988.491	265	628.336 (130)[a]

Note: CFI: Comparative Fit Index; CMIN/DF: Chi-square/degree of fit ratio; NFI: Normed Fit Index; NNFI: Non-normed Fit Index; RMSEA: Root Mean Square Error of Approximation.
[a]Significant ($p < .01$).

indicated a small number of items shared a correlated uniqueness that is not accounted for by the model including: 14 with 19; 16 with 15; 21 with 25; 30 with 31; 27 with 32. It is theoretically feasible that these unexplained relationships unaccounted for by the model may be a result of: (a) the items following each other in sequential order in the questionnaire resulting in a response bias whereby the response to one question/item influences the response to the following item; (b) the items being similar in wording and/or meaning; or (c) the items tap into more than one construct as they are multidimensional.

We then tested a 5-factor, 30-item model with the "Awareness"' subscale removed. **Table 2** shows that while the model fit improved, it did not meet the set indications of good fit. As five items (1, 7, 20, 22, and 24) had relatively low loadings (<0.50),

FIGURE 1. The six factor, 30-item, CFA solution for the DERS. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]



an alternative 5-factor model was examined whereby the low-loading variables were removed, retaining 25 items, forming five subscales with a minimum of three items per subscale. The model fit improved significantly from the original 30-item model, however, did not meet the set indications of good fit (**Table 2**). The modification indices indicated a small number of items shared a correlated uniqueness that is not accounted for by the model, including 14 and 19; 16 and 15; 21 and 25; 27 and 32; 30 and 31; 28 with 31; and 35 with 36.

Overall, the 30-item 6-factor model (see **Fig. 1**) was considered the best fit. Therefore, the remaining analyses examine and contrast both the

TABLE 3. Intercorrelations for the Six Factor 36 Item and 30 Item DERS

Factor	Impulsivity	Awareness	Goals	Nonacceptance	Clarity	Strategies
Impulsivity	–	**0.06**[a]	**0.65**	**0.68**	**0.60**	**0.78**
Awareness	0.04[a]	–	**−0.01**[a]	**0.08**[a]	**0.19**	**0.06**[a]
Goals	0.65	−0.04[a]	–	**0.59**	**0.54**	**0.67**
Non-Acceptance	0.68	0.06[a]	0.59	–	**0.63**	**0.78**
Clarity	0.59	0.24	0.54	0.63	–	**0.64**
Strategies	0.77	0.06[a]	0.67	0.78	0.64	–

All correlations are significant ($p < .01$) unless otherwise noted.
[a]Correlation not significant at 0.05. Factor intercorrelations for the 36 item Six Factor Model are presented below the diagonal. Factor intercorrelations for the 30 item Six Factor Model are above the diagonal in bold.

TABLE 4. Minima, Maxima, Means, Standard Deviations, and Internal Consistency (Cronbach's Alpha) for the 36 and 30 Item DERS Subscales and Total Scores, Eating Disorder Examination–Questionnaire total (EDE-Q), BMI, Depression, and Sadness for the whole sample

	36 Item DERS						30 Item DERS					
	N	Min	Max	*M*	SD	α	*N*	Min	Max	*M*	SD	α
Impulsivity	481	1.00	5.00	2.29	0.87	0.81	482	1.00	5.00	2.16	1.05	0.81
Awareness	479	1.00	4.83	2.87	0.85	0.84	479	1.00	5.00	2.94	0.88	0.84
Goals	481	1.00	5.00	3.10	0.90	0.76	482	1.00	5.00	3.18	1.12	0.91
Nonacceptance	481	1.00	5.00	2.45	1.05	0.91	481	1.00	5.00	2.45	1.05	0.91
Clarity	483	1.00	5.00	2.63	0.63	0.41	483	1.00	5.00	2.40	1.05	0.86
Strategies	481	1.00	5.00	2.51	0.88	0.85	482	1.00	5.00	2.43	1.03	0.91
Total DERS	477	1.00	4.72	2.62	0.64	0.92	477	1.00	4.77	2.57	0.75	0.94
EDE-Q Total	464	.00	7.32	2.42	1.57	0.89						
EDE Behaviors	473	.00	14.29	2.57	2.74	0.60						
BMI	446	14.95	49.31	21.33	3.80							
Depression	142	0.0	3.00	.88	0.69	0.88						
Sadness	341	1.00	5.00	2.26	1.09	0.90						

TABLE 5. Pearson Correlations between the Six Factor 36-Item and 30-Item DERS Total Score and Subscales, BMI, Depression/Sadness, Global Eating Disorder–Questionnaire (EDE-Q) Scores and Disordered Eating Behaviors for whole sample

	Impulsivity	Goals	Nonacceptance	Clarity	Strategies	Awareness	DERS Total	BMI	Depression/ Sadness
Six Factor 36 Item EDE-Q Total ($N = 464$)	0.42	0.39	0.43	0.26	0.46	−0.07[a]	0.46	0.24	0.41
EDE Behaviors Subscale ($N = 473$)	0.40	0.27	0.34	0.26	0.37	−0.06[a]	0.38	0.08[a]	0.39
Six Factor 30 Item EDE-Q Total ($N = 464$)	0.42	0.40	0.43	0.36	0.48	−0.08[a]	0.49	0.24	0.41
EDE Behavior Subscale ($N = 473$)	0.40	0.28	0.34	0.30	0.38	−0.05[a]	0.40	0.08[a]	0.39

All correlations are significant ($p < .01$) unless otherwise noted.
[a]Correlation not significant at 0.05 (two-tailed).

reliability and validity of the original six factor 36-item model and the six factor 30-item model.

Intercorrelations Between the DERS Subscales

In line with previous findings, five of the DERS subscales shared moderate to strong intercorrelations, with the exception of the "Awareness" subscale, which had no significant associations with the other subscales except for a weak relationship with the "Clarity" subscale (**Table 3**).

Descriptives and Internal Reliability

Means, standard deviations, and internal reliability for the DERS subscales and total scores, EDE-Q global score, disordered eating behaviors, BMI, depression, and sadness are presented in **Table 4**. All subscales indicated very good internal consistency with the exception of the "Clarity" subscale from the 36-item model. Improvements in reliability between the 36-and 30-item models were seen across the majority of subscales and scales with the exception of the "Awareness," "Nonacceptance," and "Impulsivity" subscales.

Convergent Validity

Pearson correlations between the two six factor 36- and 30-item models, EDE-Q global scores, disordered eating behaviors, BMI, and depression/sadness were examined (**Table 5**). There was a significant, moderate positive relationship between

TABLE 6. Summary of Regression Analyses with the 36 and 30 Item DERS Subscales, controlling for BMI, and Depression/Sadness with Global Eating Disorder Examination–Questionnaire (EDE-Q) Scores as the Dependent Variable

		36 Item DERS				30 Item DERS			
Step	Predictors and Order of Entry	*B*	SE	*β*	*p*	*B*	SE	*β*	*p*
1	BMI	0.09	0.02	0.22	<.001	0.09	0.02	0.22	<.001
	Depression/Sadness	0.62	0.07	0.40	<.001	0.62	0.07	0.40	<.001
		$R^2 = .219$, $F(2,422) = 59.147$, $p < .001$				$R^2 = .219$, $F(2,422) = 59.147$, $p < .001$			
2	Clarity	0.03	0.13	0.01	.844	0.00	0.08	0.00	.999
	Awareness	−0.20	0.08	−0.11	.014	−0.14	0.08	−0.08	.070
	Impulsivity	0.20	0.12	0.11	.091	0.16	0.10	0.11	.091
	Nonacceptance	0.14	0.09	0.09	.124	0.13	0.09	0.09	.170
	Goals	0.27	0.10	0.16	.005	0.22	0.08	0.16	.005
	Strategies	0.10	0.13	0.05	.473	0.12	0.12	0.08	.315
		R^2 change = .082, $F(6,416) = 8.136$, $p < .001$				R^2 change = .084, $F(6,416) = 8.358$, $p < .001$			

SE: Standard Error.

TABLE 7. Summary of Regression Analyses with the 36 and 30 Item Difficulties in Emotion Regulation (DERS) Subscales, controlling for BMI, and Depression/Sadness with Disordered Eating Behaviors as the Dependent Variable

		36-Item DERS				30-Item DERS			
Step	Predictors and Order of Entry	*B*	SE	*β*	*p*	*B*	SE	*β*	*p*
1	BMI	0.01	0.01	0.05	.227	0.01	0.01	0.05	.227
	Depression/Sadness	0.23	0.03	0.40	<.001	0.23	0.03	0.39	<.001
		$R^2 = 0.159$, $F(2,427) = 40.243$, $p < .001$				$R^2 = 0.159$, $F(2,427) = 40.243$, $p < .001$			
2	Clarity	0.05	0.05	0.06	.296	−0.01	0.03	−0.02	.789
	Awareness	−0.06	0.03	−0.08	.067	−0.03	0.03	−0.04	.336
	Impulsivity	0.18	0.05	0.26	.000	0.14	0.04	0.25	<.001
	Nonacceptance	0.01	0.04	0.00	.940	0.01	0.04	0.01	.833
	Goals	0.17	0.04	0.03	.650	0.02	0.03	0.03	.574
	Strategies	−0.04	0.05	−0.06	.438	−0.02	0.04	−0.03	.716
		R^2 change = .052, $F(6,421) = 4.664$, $p < .001$				R^2 change = .047, $F(6,421) = 4.180$, $p < .001$			

SE = Standard Error

the global EDE-Q scores and all subscales for both models with the exception of the "Awareness" subscale. The associations between the EDE-Q global score, and the "Goals," "Clarity," and "Strategies" subscales, as well as the total DERS score, were slightly stronger for the 30-item compared with the 36-item model. To test if these differences in correlations were significant, a Steiger's z_j-test was conducted given our variables were not independent of each other.[26] The increase in strength in correlations between the six factor 36-item DERS and the six factor 30-item DERS was significant for the 'Clarity' ($z_j = -3.668$; $p < .001$), "Strategies" subscales ($z_j = -3.027$; $p = .002$), and DERS total score ($z_j = -3.774$; $p < .001$).

Pearson correlations also showed significant, moderate positive relationships between disordered eating behaviors and each of the subscales with the exception of the "Awareness" subscale. While the associations were higher for the 30-item compared with the 36-item measure, these were not significant for the "Goals" ($z_j = -0.853$; $p = .394$), "Clarity" ($z_j = -1.464$; $p = .143$), and "Strategies" subscales ($z_j = -1.452$; $p = .147$). The significant positive association between disordered eating behaviors and the total DERS score was significantly stronger for the 30-item model than the 36-item model ($z_j = -2.42$; $p = .016$).

Convergent validity was also assessed using hierarchical multiple regressions with the global EDE-Q score and disordered eating behaviors as the dependent variables respectively, controlling for BMI and negative affect (**Tables 6** and **7**). With regard to the global EDE-Q scores, the covariates explained 21.9% of the variance. For the 36-item model, the DERS subscales explained an additional 8.2% of the variance in global EDE-Q scores, where the "Awareness" and "Goals" subscales were the only significant independent predictors. For the 30-item model the DERS subscales explained an additional 8.4% of the variance in global EDE-Q scores, with the "Goals" subscale as the only significant independent predictor.

With regard to disordered eating behaviors, the covariates of BMI and negative affect explained 15.9% of the variance in disordered eating and the subscales from the 36-item DERS explained an additional 5.2% of the variance, with "Impulsivity" as the only significant predictor. For the 30-item model, the DERS subscales explained an additional

4.7% of the variance in disordered eating with the "Impulsivity" subscale again being the only significant independent predictor of an increase in disordered eating (**Table 7**).

Hierarchical regressions were conducted to see if group membership (high school student versus undergraduate) influenced the predictive ability of each of the DERS models. Analyses indicate that the "Awareness" and "Goals" subscales of the 36-item DERS and the "Goals" subscale of the 30-item DERS were able to significantly predict a change in global EDE-Q scores regardless of group. In contrast there was a significant interaction between the 'Impulsivity' subscale of 36-item DERS and group ($p = .014$) showing an increase in disordered eating behaviors in high school students only. The "impulsivity" subscale of the 30-item DERS was able to predict an increase in disordered eating in both groups.

Discussion

Difficulties with emotion regulation is argued to be one of the key maintaining factors in eating disorders, therefore, it is important we have a valid and reliable measure that assesses this construct and helps us understand how this relates to variables of relevance to eating disorders. This study is the first to investigate the validity and reliability of the DERS[5] and its relation to eating disorder severity and disordered eating behaviors in a young female sample.

The first aim of this study was to investigate the factor structure of the DERS. Although there is evidence the six factor 36-item DERS is a suitable measure of emotion regulation difficulties in both clinical and nonclinical populations,[5,11,12] recent research has provided support for a five-factor model in nonclinical samples.[13] While previous research suggests the "Awareness" subscale should not be included in the DERS,[13] findings from this study indicate that a 30-item six factor structure provided best fit for our data which included the "Awareness" subscale. Results indicate some relevance of the "Awareness" subscale to disordered eating. While no significant relationship between this subscale and disordered eating was indicated in the univariate analyses, multivariate analyses showed this subscale to be significantly associated with the global EDE-Q score for the 36-item DERS, and approaching significance for the association with the global EDE-Q score for the 30-item DERS and with disordered eating in the 36-item DERS. A 30-item version of the DERS was supported, providing a shorter scale for more parsimonious assessment. Indeed, the subscales and total score of the 30-item DERS evidenced a significant improvement in the strength of the relationship with the global EDE-Q score, as well as disordered eating behaviors, compared to the 36-item DERS. Therefore, this shorter version may also exhibit more robust relationships with variables assessing disordered eating.

The second aim of this study was to examine which aspects of difficulties in emotion regulation are most relevant to eating disorder severity and disordered eating behaviors in young females. Both the 36- and 30-item DERS were predictors of eating disorder severity in a young female sample with the "Goals" and "Awareness" subscales being significant predictors independent of BMI and negative affect. Those who had difficulties engaging in goal directed behavior (e.g., difficulty concentrating or focussing attention away from the problem) and those who were aware of, and acknowledged their feelings whilst experiencing negative emotions, reported higher levels of eating disorder severity. This suggests those who attend to negative emotions, and have trouble disengaging from them are likely to report elevated levels of eating disorder severity. These findings contradict recent research using a clinical population with anorexia nervosa, where the "Goals" subscale failed to predict an increase in eating disorder severity, and a lack of emotional awareness predicted an increase, rather than a decrease, in eating disorder severity.[27] These contradictions lend support for further investigation of the validity of the DERS using a clinical population.

Both models were also able to predict higher levels of disordered eating behaviors, with the "Impulsivity" subscale being a robust independent predictor indicating those who have difficulties controlling their behavior when upset are more likely to exhibit disordered eating behaviors. However, the 36-item DERS was only able to predict an increase in disordered eating in the student group, whereas the 30-item DERS was able to predict these behaviors across both samples. Our findings support past research where impulsivity is shown to be both a risk factor for disordered eating behaviors such as binge eating, purging, and restricting.[27–29] Our findings indicate that both the 36- and 30-item DERS are able to clearly discriminate between eating disorder severity and disordered eating behaviors with "Goals" being an independent predictor of eating disorder severity and "Impulsivity" being an independent predictor of disordered eating behaviors. These findings

highlight the usefulness of this tool in discriminating between disordered eating symptoms and behaviors.

Overall, our findings support the utility of treatments such as Dialectical behavior Therapy for Eating Disorders (DBT-E), that focus on distraction techniques, distress tolerance, and acceptance strategies that have shown a reduction in eating disorder severity.[30,31] Redirecting the focus of attention from the negative emotion to a more positive experience of emotion encourages the endurance of distressing situations which reduces maladaptive responses to, or perceptions of, negative emotions. By accepting the emotional experience in a nonjudgemental way the person learns to accept the negative emotion or experience enabling them to access more adaptive strategies to cope with negative emotions.[31] DBT-E addresses components of these key areas identified in this study as being predictors of eating disorder severity and disordered eating behaviors.

This study has several limitations. Using a cross-sectional design does not enable us to make conclusions about the causal importance of emotion regulation dysfunction in disordered eating. Further research using data collected at multiple time points is recommended. In addition, although we can recommend the use of the 36-item and 30-item DERS in a non-clinical sample, we cannot apply this to a clinical sample. Further research of the effectiveness of the DERS in a clinical sample is needed. Although it was not the aim of this study, it is important to note that we only compared the Gratz and Roemer[5] model and did not investigate other measures of emotion regulation used in the literature, which does not enable us to compare the validity of the 36- or 30-item DERS over another measure of emotion regulation dysfunction. This, however, is a valuable question that needs answering. Another limitation included the use of two different measures of negative affect. Although scores were standardized, it is recommended for future research that one measure be used. It is also important to note, that the fasting item included in the measure of behaviors was also included in the global measure of eating disorder severity. However, although they overlap, these scores were used differently, for example, Likert scale versus a continuous count of days. In future, researchers could include a different measure of fasting behavior.

Finally, it is important to note that all low loading variables that were removed from the 36-item model to create the 30-item model were reverse-keyed, and indeed, as are all items on the "Awareness" subscale. These findings are similar to past research with other scales that include reverse-keyed items, suggesting the use of reversed-keyed items affects the psychometric performance of a measure.[13,32] Further research using of straightforward-worded items instead of reverse-keyed items to assess emotional awareness might provide further insight into this construct and its relation with disordered eating.

In summary, both the six factor 36- and 30-item models were able to adequately predict eating disorder severity and disordered eating behaviors in our nonclinical population of young women. Our study has shown that the "Awareness" subscale may be of relevance to disordered eating, but that a reduced scale of 30 rather than 36 items improved the model fit, strengthened associations with variables of relevance to disordered eating, and explained greater variance in these outcome variables. Although both models are adequate predictors of eating disorder symptoms, findings from this study indicate the 30-item DERS to be the more parsimonious measure of the two with stronger associations to variables assessing different facets of disordered eating.

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ORIGINAL ARTICLE

The Relationship Between Memory and Interpretation Biases, Difficulties with Emotion Regulation, and Disordered Eating in Young Women

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Abstract Disordered eating and difficulties with emotion regulation have shown strong associations but there has been little attention paid to possible mediators that would explain this relationship. In depression and anxiety, negative memory and interpretation biases are implicated in the onset and maintenance of these disorders, however, little is known about whether these biases also exist in eating disorders, and if they are related to difficulties with emotion regulation. Females ($n = 181$) aged 17–26 years, completed self-report measures of disordered eating and behaviours, difficulties in emotion regulation, depression, anxiety, and memory and interpretation bias. While negative memory bias was related to objective binge episodes, it was not related to difficulties in emotion regulation. Negative interpretation biases were associated with higher levels of eating psychopathology and objective binge eating when controlling for depression and anxiety. Cross-sectional testing showed this bias to mediate the relationship between both measures of disordered eating and difficulties with emotion regulation. Findings support further research into the effectiveness of cognitive bias modification techniques with respect to disordered eating and the reduction of emotion regulation difficulties.

Keywords Memory bias · Interpretation bias · Emotion regulation · Disordered eating

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Introduction

Prominent theories suggest cognitive biases operate to maintain depression and anxiety in terms of both memories for negative emotional information and interpretation biases. Teasdale's (1985) theory of differential activation postulates that depressed mood leads to negative memory biases in information processing, resulting in a tendency to elaborate on more negative information compared to positive information. There have been a number of studies investigating negative memory biases in depression (e.g., Burt et al. 1995; Ellis et al. 2011; Matt et al. 1992), with a general consensus that depressed individuals have better recall of negative stimuli over positive stimuli, whereas non-depressed individuals display a significant memory bias for positive stimuli (Ellis et al. 2011). Evidence for memory bias in anxiety disorders is less robust, however, research indicates memory biases for threat-relevant information exist, particularly in panic disorder (for reviews see Coles and Heimberg 2002; MacLeod and Mathews 2004). Studies have also supported the maintaining role of negative interpretation biases (i.e., the interpretation of ambiguous or neutral information as being negative rather than positive or benign) in depressed and anxious individuals (Beard and Amir 2010; Butler and Mathews 1983; Constans et al. 1999; MacLeod and Cohen 1993; Mogg et al. 2006; Wisco and Nolen-Hoeksema 2010). Depressed individuals are more likely to interpret ambiguous stimuli in a negative manner (Mogg et al. 2006; Rude et al. 2002), and anxious individuals are more likely to interpret ambiguous stimuli as threatening resulting in increased anxiety when exposed to every-day stressors (Beard and Amir 2010; Constans et al. 1999).

Given the strong associations between eating disorders and depression, it could be hypothesised that the same

biases observed for depression also maintain disordered eating. Depression is commonly comorbid with eating disorders (Braun et al. 1994), and shares genetic risk factors with eating disorders (Wade et al. 2000). Negative affect, a construct which includes the experience of negative moods and feelings such as depression and anxiety (Watson and Clark 1984), is thought to underlie many emotional disorders and is considered to be one of the strongest risk factors for disordered eating (Jacobi and Fittig 2010; Stanton and Watson 2014). Thus, negative affect is considered to be a transdiagnostic factor across a number of emotional disorders. Given the causal association between negative affect and eating disorders, as well as the commonly observed comorbidity between depression, anxiety and eating disorders, it is possible that the same biases that are implicated with the maintenance of depression and anxiety (e.g., negative memory and interpretation bias) could also play a key role in eating disorders, above and beyond the contribution of any current symptoms of depression and anxiety.

Although there is substantial research indicating both negative memory and negative interpretation biases are implicated in the onset and maintenance of depression, there is far less research available that investigates whether these biases exist in eating disorders. Much of the eating disorder research investigating memory biases has focused on food, weight, appearance, or disorder related stimuli rather than emotional content (see Lee and Shafran 2004; Williamson et al. 1999). There is, however, preliminary evidence that those with eating disorders show memory biases for negative emotional content, with one study showing that women with anorexia nervosa displayed a bias toward negative trait adjectives as opposed to positive trait adjectives using a memory recall task (Manuel and Wade 2013).

To date, research of negative interpretation biases in eating disorders has focussed primarily on interpretation biases in terms of negative self-beliefs, weight, shape, and appearance, with support for the existence of such biases (see Cooper 1997; Pringle et al. 2010; Williamson et al. 1999; Yiend et al. 2014). To date, no research has examined the association of disordered eating with the negative interpretations of ambiguous every-day scenarios. Evidence of such an association would suggest widening the focus of cognitive behaviour therapy for eating disorders from appearance-based interpretations to the many different situations encountered on a daily basis. Therefore, further investigations to establish whether a broad range of negative interpretation biases for every-day ambiguous scenarios (i.e., stimuli not relevant to specific areas of concern such as food, weight or shape) are experienced by those with an eating disorder as they are in depression, could be informative for further development of therapy for eating disorders.

Investigating factors that maintain emotional disorders is important as it can lead to further developments in treatment paradigms. For example, the existence of memory and interpretation biases in depression has provided support for the use of tools such as cognitive bias modification techniques to modify these biases. Research has shown that these techniques are successful and can reduce symptoms of depression (Koster et al. 2009; Woud and Becker 2014). In addition, the promotion of less negative interpretation bias is a core component of cognitive behaviour therapy for depression (Hollon et al. 2005). Cognitive bias modification research within the eating disorder field, however, is comparatively lacking (MacLeod 2012).

In contrast, a greater degree of theoretical and research attention has been directed at difficulties in emotion regulation as a maintaining factor in eating disorders and some treatment paradigms, such as Cognitive Behaviour Therapy-Enhanced and Dialectical Behaviour Therapy for Eating Disorders, are designed to address these difficulties. According to Fairburn et al. (2003), difficulties with emotion regulation is one of four important maintaining processes of an eating disorder, and can impede implementation of behaviour change in treatment. Research has shown that people with eating disorders lack the skills to effectively cope with negative affective states, instead responding by restricting, bingeing and/or purging, or compulsive exercising, which provides short term distraction from the experience of negative emotion (Fairburn et al. 2003; Peñas-Lledó et al. 2002; Smyth et al. 2007). Although a substantial amount of theoretical and empirical work has focussed on investigating emotion regulation strategies that are considered adaptive (e.g., acceptance, cognitive reappraisal) or maladaptive (e.g., avoidance, rumination, suppression), few studies have investigated how disordered eating might be associated with emotion regulation difficulties (Aldao and Nolen-Hoeksema 2012). There is also substantial evidence which indicates depression is linked to emotion regulation difficulties (Aldao et al. 2010) raising the question as to whether cognitive biases that are relevant to depression may also play a role in disordered eating by influencing emotion regulation. Existing research indicates maladaptive emotion regulation strategies (e.g., rumination) are associated with cognitive biases such as memory biases for negative content (Joormann and Gotlib 2009).

For the purpose of testing a meaningful model, we made two assumptions. First, the current evidence is unclear as to whether emotion regulation difficulties are a result of an eating disorder or a pre-dispositional trait (see Ashworth et al. 2011; Brockmeyer et al. 2012). It is likely that both are true to some extent and a bidirectional relationship exists between emotion regulation and disordered eating. To date, there is inconsistent evidence to suggest that those with eating disorders experience emotion regulation difficulties

prior to the onset of the disorder, however, there is strong evidence to suggest that those with eating disorders experience emotion regulation difficulties after the onset of the eating disorder (Brockmeyer et al. 2012; Harrison et al. 2010a, b). Hence this cross-sectional study takes a conservative stance, postulating that difficulty with emotion regulation is a consequence of disordered eating rather than as a cause. Second, based on Teasdale's (1985) theory of differential activation for depression, we assumed that cognitive biases were a result of the disorder rather than a cause of eating disorders. Teasdale's (1985) theory postulates that depressed mood leads to biases in information processing, which in turn contributes to the maintenance of depressive symptoms. This study also draws upon cognitive and information processing theories of eating disorders (for a review see Williamson et al. 2004) where these models suggest information processing errors (such as cognitive biases) contribute to the maintenance or disordered eating and disordered eating behaviours. Therefore, in addition to hypothesising that disordered eating and disordered eating behaviours, and difficulties in emotion regulation are significantly and positively related to memory biases and negatively related to interpretation biases, it was also hypothesised that memory biases and interpretation biases mediate the relationship between disordered eating, disordered eating behaviours and difficulties in emotion regulation. Current levels of depression and anxiety were included as covariates in our analyses to allow us to ascertain whether disordered eating per se was associated with biases and difficulties with emotion regulation independent of any comorbidity with depression and anxiety.

Method

Participants

This study included 181 female first year university Psychology students aged 17–26 years ($M = 19.24$, $SD = 1.59$), with a body mass index ranging from 15.22 to 47.78 ($M = 22.99$, $SD = 4.54$). Participants were recruited from a volunteer research pool where research participation earned credit points. Informed consent was obtained from all individual participants included in the study. This study received approval from the Flinders University Social and Behavioural Research Ethics Committee.

Measures

Difficulties in Emotion Regulation Scale (DERS)

The DERS (Gratz and Roemer 2004) is a 36-item self-report measure which assesses six dimensions of emotion regulation: lack of emotional awareness (Awareness), lack of emotional clarity (Clarity), difficulties controlling impulsive behaviours when distressed (Impulsivity), difficulties engaging in goal directed behaviours when distressed (Goals), non-acceptance of negative emotional responses (Non-Acceptance), and limited access to effective emotion regulation strategies (Strategies). Each item is assessed on a 5 point Likert-type scale ranging from *almost never* to *almost always*, with high scores representing increased difficulties with emotion regulation. For this study a 30-item, six factor version of the DERS (DERS-30) was used as there is evidence that this abbreviated version exhibits stronger relationships with eating disorder severity and disordered eating behaviours in a non-clinical population than the original 36-item version of the scale (Cooper et al. 2014). In the current study the mean item score was used and internal reliability for the 30-item DERS was $\alpha = .94$.

Eating Disorder Examination-Questionnaire (EDE-Q)

The severity of eating disorder psychopathology was assessed using the global score from the EDE-Q (Fairburn and Beglin 1994). The global score consists of the summation of the four subscales; weight concern, shape concern, eating concern, and dietary restraint. Each item is assessed on a 7 point scale, with higher scores indicating greater levels of eating disorder severity. Scores over 4 are considered to be of clinical significance. The mean item score was used and internal consistency in the current study was $\alpha = .95$.

Disordered eating behaviours over the previous 28 days which conform to the frequency and intensity levels included in the DSM-5 diagnostic criteria (American Psychiatric Association 2013) were also assessed using the EDE-Q. This included the number of episodes of objective binges (overeating associated with a loss of control); self-induced vomiting; laxative use; driven exercise (e.g., feeling compelled to exercise, pushing oneself to exercise even if injured, or experiencing feelings of guilt if not exercising), and fasting. This latter item, from the dietary restraint subscale asked, "Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?"

Negative Affect

Depression and anxiety was measured using the Depression, Anxiety and Stress Survey (short form; DASS-21; Henry and Crawford 2005). Only the depression and anxiety subscales were utilised in the current study, where each item is measured on a 4-point, Likert-type scale from 0 (*did not apply to me at all*) to 3 (*applied to me very much,*

or most of the time), with higher scores indicating higher levels of depression or anxiety. Participants were asked to indicate how much the statements applied to them over the past week. Sample items for depression and anxiety included, "I couldn't seem to experience any positive feeling at all", "I was aware of a dryness of my mouth", respectively. The mean item score was used and in the current study internal reliability was $\alpha = .91$ and $\alpha = .85$ respectively.

Memory Biases

Memory biases for negative emotional content were assessed using a 60-word memory recall test developed for use with children and adolescents (Neshat-Doost et al. 1999). Sixty words (20 positive traits e.g., "friendly", 20 negative traits e.g., "lonely", and 20 neutral words semantically similar e.g., "budgie") were presented on a computer screen for 7 s. Following presentation of the words, participants were given a sheet containing ten mathematical problems and were asked to answer each question. This task was designed to act as a filler task. Once the problems were completed, participants were given 5 min to write down as many words as they could remember. They were instructed that spelling did not matter. Scores were calculated by subtracting the number of positive trait adjectives from the number of negative trait adjectives, therefore, controlling for individual differences in memory performance. A positive number was indicative of more negative words being recalled, therefore, indicating greater levels of negative memory bias. Responses to the recall task were hand written and scoring was completed by two independent raters with 100 % inter-rater reliability.

Interpretation Biases

Negative interpretation biases were measured using the Ambiguous Scenarios Test for Depression (AST-D) which contains 24 ambiguous scenarios, (Berna et al. 2011). The AST-D was developed for use in depressed populations and the measure contains a series of ambiguous situations that allow either a positive or a negative outcome interpretation (e.g., "You give a speech at a friend's wedding. When you have finished, you observe the audience's reaction", "It's New Year's Eve. You think about the year ahead of you"), where a positive interpretation or negative interpretation is possible (e.g., for the first example scenario, it could be that the audience applauds appreciatively or that the audience is bored and no one applauds you). Each of the 24 scenarios was presented individually on a computer screen and participants were instructed to form a mental image of each scenario and imagine each scenario happening to them personally. They were also instructed to follow the first image that comes to mind and not to think too much about them. Participants were then asked to rate how pleasant their mental image is (pleasantness rating) and how vivid the image is (vividness rating). The pleasantness rating was rated on a 9-point Likert-type scale with higher scores indicating a more pleasant rating (positive interpretation) and low scores indicating a less pleasant rating (negative interpretation). Vividness was measured on a 7-point Likert-type scale with higher scores indicating a more vivid mental image. Ratings of vividness were assessed in order to control for differences in imagination as in previous research (Berna et al. 2011). The AST-D had good internal consistency in the current study with $\alpha = .83$.

Procedure

All data were collected using a single computer in a laboratory at Flinders University. Participants were asked to complete the self-report questionnaire battery comprising demographic questions (e.g., date of birth, height, current and ideal weight, and ethnicity), and the questionnaires measuring the variables of interest.

Data Analysis

In order to test the mediating role of negative biases on the relationship between disordered eating and emotion regulation difficulties, three preconditions are required to be met. The first requires the predictor variable (in this case the EDE-Q global score or disordered eating behaviours) to be significantly related to the outcome variable (difficulties in emotion regulation). The second precondition requires the proposed predictor variable(s) to be significantly related to the proposed mediator variables (negative memory bias or negative interpretation bias). Third, the proposed mediator variable(s) must be significantly related to the outcome variable. All preconditions were assessed using correlational and multiple regression analyses. Finally, it is also required that, in the presence of the mediator, the relationship between the predictor and the outcome variable is significantly reduced, as indicated by the Sobel test.

Mediation was tested using the 'Process' regression analyses macro which allows for simultaneous multivariate analysis, using bootstrapping to examine a mediation model (Preacher and Hayes 2008). The severity of eating disorder psychopathology or disordered eating behaviours was entered as the predictor variables and difficulties with emotion regulation as the outcome variable. Hypothesised mediators which met all preconditions were included whilst depression, anxiety, and vividness were entered as covariates. The term 'total effect' denotes the relationship between the predictor variables (x) and the outcome

variable (y). 'Indirect effect' refers to the mediating pathway between x and the mediating variables, and between the mediating variables and y. The term 'direct effect' refers to the relationship between x and y whilst controlling for the indirect effects (Preacher and Hayes 2008). Indirect effects were tested via corrected bootstrapping, the recommended method in contemporary mediation analyses. This method has strong statistical power in detecting indirect effects and is less sensitive to small sample size (Preacher and Hayes 2008). For the current study, bootstrapping with 1000 samples was used to generate 95 % confidence intervals to determine the statistical significance of the indirect effect.

Results

Preliminary Analyses

All variables were examined for normality by assessing the shape of the distribution as recommended by Tabachnick and Fidell (2007). Results indicated that all variables were normally distributed. Little's missing completely at random test was non-significant ($\chi^2(64) = 31.767$, $p = 1.00$), indicating that data was missing at random. The means and standard deviations for all study variables are presented in Table 1. Twenty-four (13.3 %) women reported clinically significant scores on the EDE-Q (i.e., $\geq$4).

Testing Mediation Preconditions

Correlational analyses which tested the required preconditions of mediation are presented in Table 2. Results showed all our predictor variables (disordered eating, objective binge episodes, purging and fasting/driven or excessive exercise) were significantly correlated with difficulties in emotion regulation meeting the first precondition for mediation, with the exception of negative memory bias. Therefore, this latter variable failed to meet the required preconditions of mediation and was subsequently excluded from further analyses. The remaining predictor variables, with the exception of purging, were also significantly related to negative interpretation bias, and in turn, negative interpretation bias was significantly related to difficulties in emotion regulation, therefore, meeting all preconditions for mediation.

Mediational Relationships

Results supporting mediational relationships are shown in Figs. 1, 2. Figure 1 includes the direct effect of global eating disorder severity on difficulties in emotion regulation after including the mediator variable (negative interpretation bias) and controlling for the effects of vividness, depression and anxiety. The total effect (sum of the direct and indirect effects) of .12 (SE = .28, $p < .001$) indicates disordered eating predicts difficulties in emotion regulation over and above vividness, depression and anxiety, accounting for 12 % of the variance. When negative interpretation biases were taken into account, the amount of variance explained decreased to 9 % (.09, SE = 3.26, $p < .05$) whilst remaining significant, suggesting partial mediation. The individual path coefficients and indirect effect estimates indicate negative interpretation biases have a significant and unique contribution to the mediation process. Results of the Sobel test indicate the decrease in

Table 1 Means (M) and standard deviations (SD) for all relevant variables

	N	M	SD	Min	Max
Eating Disorder Examination-Questionnaire Global Score	181	2.29	1.3	0	5.0
Difficulties in Emotion Regulation Scale (30 item)	181	2.5	.69	1	4.0
Negative interpretation biases[d]	180	5.29	.88	3	8.0
Negative memory biases[e]	178	.67	2.38	-9	7.0
Objective binge episodes (last 28 days)[a]	181	3.78	4.0	0	22.6
Purging behaviours (last 28 days)[b]	181	.17	1.19	0	14.0
Compulsive exercising and fasting (last 28 days)[c]	181	3.27	4.14	0	24.0
Vividness	180	4.58	.83	2	7.0
Anxiety	180	.64	.60	0	3.0
Depression	180	.71	.66	0	3.0

[a] 150 people experienced objective binge episodes

[b] 10 people experienced purging

[c] 115 people experienced compulsive exercise and/or fasting

[d] A lower score indicates a greater level of negative interpretation biases

[e] A higher score indicates a greater level of negative memory bias

Table 2 Pearson correlations for the disordered eating severity, objective binge eating behaviours, 30 Item Difficulties in Emotion Regulation Scale, negative interpretation biases, negative memory biases, anxiety, depression, purging behaviours and exercising and fasting behaviours

	1	2	3	4	5	6	7	8	9
1. EDE-Q global	–								
2. OBE	.50***	–							
3. DERS-30	.50***	.33***	–						
4. NIB	−.39***	−.26***	−.54***	–					
5. NMB	.09	.22**	.12	−.09	–				
6. Anxiety	.38***	.25**	.65***	−.41***	.11	–			
7. Depression	.39***	.18*	.71***	−.36***	.002	.72***	–		
8. Purging	.29***	.31***	.26***	−.14	.12	.32***	.17*	–	
9. Exercising and fasting	.60***	.35***	.33***	−.23**	.09	.31***	.29***	.32***	–

EDE-Q global disordered eating severity, *OBE* objective binge eating behaviours, *DERS-30* 30 item Difficulties in Emotion Regulation Scale, *NIB* negative interpretation biases, *NMB* negative memory biases

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

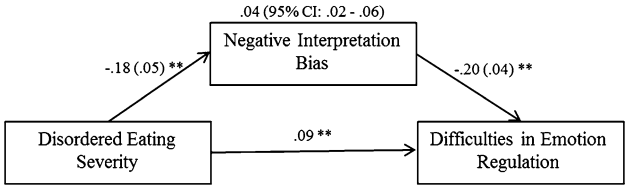

Fig. 1 Mediation analyses with unstandardized coefficients and standard error (SE) with estimates of the direct effect of disordered eating severity on difficulties with emotion regulation and the effect of the indirect pathways with 95 % confidence intervals (CI) whilst controlling for vividness, anxiety and depression (**$p < .01$, *** $p < .001$)

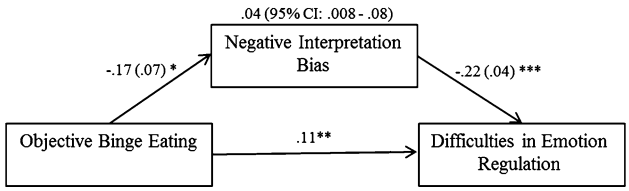

Fig. 2 Mediation analyses with unstandardized coefficients and standard error (SE) with estimates of the direct effect of objective binge eating on difficulties with emotion regulation and the effect of the indirect pathways with 95 % confidence intervals (CI) whilst controlling for vividness, anxiety and depression (**$p < .01$, *** $p < .001$)

variance explained is significant ($z = 2.9285$, $p < 0.01$), which suggests that the association between eating disorder severity and difficulties in emotion regulation is mediated by negative interpretation biases.

Results from correlational analyses showed the only behavioural predictor variable significantly correlated with negative interpretation bias after controlling for vividness, depression and anxiety was objective bingeing. Results from the mediational analyses are shown in Fig. 2, including the direct effect of objective binge eating on difficulties in emotion regulation after controlling for the mediator variable (negative interpretation bias) and the effects of vividness, depression and anxiety. The total effect (sum of the direct and indirect effects) of .15 (SE = .04, $p < .000$) indicates objective binge eating predicts difficulties in emotion regulation over and above depression and anxiety, accounting for 15 % of the variance. When negative interpretation biases were taken into account, the amount of variance explained decreased to 11 % (.11, SE = .04, $p < .01$) whilst remaining significant which suggests partial mediation. The individual path coefficients and indirect effect estimates shown in Fig. 2 indicate negative interpretation biases have a significant and unique contribution to the mediation process. Results of the Sobel test indicate the decrease in variance explained is significant ($z = 2.0684$, $p < 0.03$), which suggests that the association between objective binge eating and difficulties in emotion regulation is mediated by negative interpretation biases.

Discussion

There is substantial research indicating both negative memory biases and negative interpretation biases are implicated in the maintenance of depression and anxiety. To date, there is far less research that investigates whether these biases exist in eating disorders despite the presence of shared risk factors across eating disorders, depression, and anxiety, including negative affect and difficulties in emotion regulation. The current study used cross-sectional mediational analyses to investigate our hypothesis that

memory for negative emotional content and negative interpretations of ambiguous situations mediate the relationship between disordered eating, disordered eating behaviours, and difficulties in emotion regulation. Our hypotheses were partially supported whereby our findings indicate negative interpretation biases mediate the relationship between disordered eating/objective binge eating, and emotion regulation. In the current study, preconditions for examining whether negative memory biases mediate the relationship between disordered eating and emotional regulation were not met. It would of interest to see if this finding is replicated in future studies.

Our study provided evidence that negative interpretation biases are associated with disordered eating in community samples. The relationship between higher levels of disordered eating and more difficulties with emotion regulation was partially mediated by the tendency to interpret ambiguous situations in a negative rather than positive manner. Mood intolerance has long been recognised as one of the maintaining factors of disordered eating in theoretical considerations (Cooper et al. 2004; Fairburn et al. 2003), resulting in a vicious cycle between eating and mood, but the role of interpretation biases in this relationship has not previously been highlighted. If these patterns are similar to those outlined in theories of depression, as well as those found in previous research (see Aldao et al. 2010; Teasdale 1985), then we would postulate that disordered eating leads to negative interpretation bias which in turn leads to mood dysregulation, which can then act as a trigger for disordered eating, thereby maintaining the cycle. This suggestion is somewhat supported by our finding that negative interpretation biases are also associated with binge eating i.e., the relationship between higher levels of binge eating and greater difficulties in emotion regulation was partially mediated by the tendency to interpret ambiguous situations more negatively. These findings are consistent with recent research indicating negative interpretation biases related to self-identity increased a behavioural indicator of dietary restraint (Yiend et al. 2014). This study had a focus on self-loathing beliefs, due to their relationship with eating disorders symptoms (Cooper and Cowen 2009), independent of depression and anxiety. Although our study indicated negative interpretation biases did not mediate the relationship between other behaviours that are characteristic of an eating disorder (e.g., fasting, or excessive exercise), these findings may have been a result of a lack of power as this relationship met preconditions for mediation testing until covariates (depression and anxiety) were included.

We were unable to support previous research which indicates negative memory biases for emotional content mediated the relationship between disordered eating and emotion regulation difficulties in a clinical population being treated for anorexia nervosa (Manuel and Wade 2013). As preconditions required to test for mediation were not met, we were unable to investigate this in our population even though negative memory bias was significantly associated with the frequency of objective binge episodes. Given emotion regulation difficulties increase as eating disorder symptoms become more severe (Lavender et al. 2014), investigation of this relationship in a clinical population may yield different results, if emotion regulation difficulties influence memory biases (i.e., a bidirectional relationship exists). In addition, there are mixed findings in anxiety research where negative memory biases are found to be associated with some subtypes of anxiety disorders such as panic disorder, and not with others (Mathews and MacLeod 2005). Given that eating disorders have been found to be highly comorbid with anxiety disorders (Kaye et al. 2004), it may be that this comorbidity leads to inconsistent results in an eating disorder population. It is likely memory bias is a complex construct, affecting key underlying mechanisms of each disorder differently, and this relationship requires further investigation.

Future research should seek to replicate these findings in a clinical population with the view to assess potential tools such as cognitive bias modification techniques which have been developed to use as potential supplements to psychological interventions for anxiety and depression (Koster et al. 2009; Woud and Becker 2014). The main goal of cognitive bias modification, particularly those which target interpretation biases (CBM-I), is to induce the desired interpretation bias by consistently asking participants to resolve ambiguous scenarios in either a positive or negative manner. This procedure has been shown to be successful in activating the desired bias when faced with real-life ambiguous scenarios (Koster et al. 2009). One of the first experimental approaches to show that CBM-I can influence disordered eating behaviours (Yiend et al. 2014) showed training in negative interpretation bias resulted in a significant increase in dietary restraint, with positive interpretation training having no significant impact on eating psychopathology. This study provides a promising pathway for future research, with results from the current study suggesting that positive interpretation bias training may be strengthened if focused on the wider variety of depressogenic ambiguous stimuli, rather than just negative self-referent stimuli. It may also indicate that more novel approaches to CBM-I in eating disorders need to be explored, for example those that utilise more visual tasks given the visual nature of some aspects of eating disorders such as body image perception. Research shows that body satisfaction and self-esteem increased in women when photographs of their bodies were always followed by a smiling face, whereas in the control condition, body satisfaction and self-esteem remained unchanged, when the photographs were randomly followed by smiling, neutral,

and frowning faces (Martijn et al. 2010). This finding may have links with the trauma field, where use of a visual task to interrupt embedding of traumatic images is significantly more effective than using a verbally based task (Holmes et al. 2010). In addition, given previous findings showing links with attention bias for stimuli related to food or appearance in disordered eating (e.g., Smith and Rieger 2006; Werthmann et al. 2012), and the suggestion that a combination of CBM-I and CBM related to attention bias (CBM-A) may offer a synergistic influence (MacLeod 2012), the use of a combination approach could also be evaluated in future research.

This study had a number of limitations. It is a cross-sectional examination of the mediational relationship between our variables of interest, and further experimental work and longitudinal research is required to more clearly understand patterns of causation. In addition, our sample was a non-clinical sample of undergraduate students, therefore, we cannot apply these findings to a clinical sample. Although our sample was shown to experience the same risk factors, e.g., semi-starvation and binge eating, it would be expected that clinical samples would display greater levels of eating psychopathology, more frequent and larger episodes of binge eating, and suffer more severe physical consequences resulting in a more severe and complex impact on mood.

Given that cognitive biases of relevance to depression are also of relevance to disordered eating, and these negative interpretations of everyday scenarios are likely to contribute to low mood and lead to maladaptive forms of emotion regulation, the relevance of this type of bias across different emotional disorders should be further investigated. It may represent a transdiagnostic risk factor that can be targeted in treatment. Of particular pertinence to the current investigations is the relevance of this bias to the maintenance of eating disorders and its potential to hinder treatment. However, further experimental research using cognitive bias modification techniques are needed before we can claim clinical utility in eating disorders. Our findings support the need for further investigations into these biases within both a non-clinical and a clinical population with the view to investigating the efficacy of cognitive bias modification techniques and their ability to provide a valuable supplement in prevention and treatment of eating disorders.

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Compliance with Ethical Standards

Conflict of Interest Jane L. Cooper and Tracey D. Wade declare that they have no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants included in the study. This study received approval from the Flinders University Social and Behavioural Research Ethics Committee and all procedures followed were in accordance with the ethical standards of the committee.

Animal Rights No animal studies were carried out by the authors for this article.

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