

A Comparison of the Recognition of Facial Emotion in Women
of Low Body Weight, Both With and Without Anorexia Nervosa

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Abstract

Facial expressions can be reliable markers of emotion, and represent an important source of social information. Consequently, the ability to judge facial expressions accurately is essential for successful interpersonal interactions. Anorexia nervosa (AN) is an eating disorder in which social difficulties are common. Past research has suggested that facial emotion recognition may be disturbed in AN, although the precise nature of this disturbance is unclear. The current study aimed to further investigate emotion recognition in AN by comparing 12 women with AN to 21 women who were constitutionally thin (CT) on the Facial Expression Recognition Test, an established computerized test of facial emotion recognition. Still photographs of faces displaying different emotional expressions and neutral expressions were presented to participants via computer screen. Participants were required to decide which emotion each face displayed from several choices. AN subjects responded faster than CT subjects to the facial emotion stimuli, regardless of which emotion was displayed. However, AN subjects did not differ from CT subjects on overall accuracy, accuracy for different emotion categories or misclassifications. Results are discussed in terms of the cognitive style of individuals with AN, recent models of socio-emotional processing, and issues of methodology.

Introduction

The Social Function of Emotion

Emotions are an integral aspect of the human condition. The events we notice and remember are not the mundane, but those that evoke feelings of joy, pleasure, sorrow and pain. However, not only do emotions colour our daily experiences, they are also crucial to our survival. From an evolutionary perspective, emotions can be regarded as adaptations to commonly encountered problems and opportunities of social and physical survival (Keltner & Gross, 1999). Repeated experiences with situations such as fighting, falling in love, and escaping predators, selected for adaptations that match behaviour, cognition, and physiology with the demands of each particular situation (Tooby & Cosmides, 2008). These adaptations are termed emotions.

One class of situations that has been studied extensively in relation to emotions is social interactions. Social functional accounts of emotion are based on the premise that humans are inherently social beings and meet many of the problems of survival in social relationships (Baumeister & Leary, 1995; Keltner & Kring, 1998). Emotions are assumed to increase the probability of survival by co-ordinating social interactions in ways that help humans develop and preserve beneficial relationships (Keltner & Kring, 1998). As outlined by Keltner and Kring (1998), research has documented three general processes by which emotions co-ordinate or shape social interactions. Firstly, the experience and expression of emotions conveys information to individuals in social interactions about their own and their interaction partners' emotions, social intentions and relational status, for example as a dominant or submissive individual. Secondly, emotions evoke complementary and reciprocal emotional responses in others that are associated with adaptive responses to social events. For example, displays of anger have been

shown to induce complementary fear in observers (Dimberg & Öhman, 1996), which could conceivably lead to an adaptive behavioral response such as avoidance. Likewise, displays of distress activate sympathy and concern in observers and are associated with behaviours such as helping, and comforting (Eisenberg et al., 1996; Eisenberg et al., 1989). Thirdly, emotions serve as incentives or deterrents for other individuals' behaviour during an ongoing social interaction. For instance, the display of positive emotion by both children and parents may act as a positive reinforcer for desired behaviours, thereby increasing the frequency of such behaviour (Tronick, 1989). Studies of adult laughter also show that during conversation laughter occurs almost exclusively at the end of utterances, suggesting that it is rewarding desirable social behaviour (Provine, 1993). Hence it is clear that emotions play an extensive role in co-ordinating smooth and successful social interactions. By implication, disturbance in recognition of emotions, or in emotional responses, may have a negative impact on the quality of social interactions and relationships.

Facial Expressions as a Source of Emotion Information

Because social interactions are guided in part by knowledge of others emotions, this information must be able to be communicated between individuals. One mechanism of communicating emotion information is facial expressions. The face is the primary medium used to express distinct emotions nonverbally (Ekman, 1965) and facial expressions of emotion can be visible communications of the internal state of another person (Ekman & Davidson, 1993; Jakobs, Manstead, & Fischer, 1999). Facial expressions can be associated with emotional events that are directly experienced, remembered, imagined or anticipated (Ekman, 1993). Many theorists propose that emotions involve co-ordinated changes across experiential, physiological, and behavioural response systems (including the face), termed 'response system coherence'

(Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). In support of this premise, associations have been established between specific facial expressions and the experience of a congruent emotion (Mauss, et al., 2005; Rosenberg & Ekman, 1994, 2005). For example, in participants watching a brief film, amusement experience and facial behaviour were found to be positively correlated to one another and to skin conductance level, somatic activation and cardiovascular activity (Mauss, et al., 2005). In the same study, sadness experience and facial behaviour were also found to be correlated to one another and negatively correlated with skin conductance level and somatic activation.

In some situations a person may choose to modify their facial expression such that it is no longer a true representation of their underlying emotion. Display rules refer to attempts to manage involuntary expressions of emotion, be it by attenuating, amplifying, inhibiting or covering the involuntary expression with the sign of another emotion (Ekman, 1997). Nonetheless, when there is no need to manage or modify the expression because of social circumstances, facial expressions can be a reliable marker of emotion.

Emotion Recognition

The ability to recognise emotions from facial expressions appears to be at least partially innate and biological. For example, studies have found that human infants as young as nine minutes old show stronger interest in a schematic face compared with a scrambled “face” or a blank head outline (Goren, Sarty, & Wu, 1975; Johnson, Dziurawiec, Ellis, & Morton, 1991). Thus, infants appear to be born with some knowledge regarding the visual structure of the human face (Morton & Johnson, 1991). Infants also appear able to discriminate between a variety of facial expressions (Field, Woodson, Greenberg, & Cohen, 1983; Serrano, Iglesias, & Loeches, 1992), to imitate them (Field, et al., 1983; Meltzoff & Moore, 1983), and to use the information

contained in facial expressions to modify their behavior (Sorce, Emde, Campos, & Klinnert, 1985). It has been suggested that the early interest patterns of infants play a role in developing behavior by focusing attention on stimuli, such as faces, that will later have adaptive significance (Fantz, 1961).

Classic studies examining the universality of emotion have also demonstrated that facial photographs of other humans expressing specific emotions can be recognized at above chance accuracy in both literate and preliterate cultures (Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969). Happiness, sadness, fear, disgust and anger have the most consistent evidence for their universality and hence have been described as “basic” emotions (Ekman, 1992). Surprise and Contempt are also sometimes included among the so-called “basic” emotions, although the evidence for these expressions is not as strong (Ekman, 1992).

Taken together, there is strong evidence that human beings have a predisposition to focusing on information contained in faces and that there is some degree of regularity both within and across cultures in the way that emotion information is represented on the face.

Emotion Recognition and Social Outcomes

Given the social information inherent in facial expressions, the ability to judge them accurately is essential for successful interpersonal interactions. Errors in emotion recognition may lead to atypical responding to the emotional expressions of others and problems in social interactions (Keltner & Kring, 1998). Accordingly, in adults, errors in decoding facial expressions and tones of voice is associated with lower relationship wellbeing and increased depression (Carton, Kessler, & Pape, 1999), and in children, inaccuracy at decoding facial expressions is related to childhood peer rejection (Edwards, Manstead, & Macdonald, 1984).

Deficits in emotion recognition have also been linked to social impairments in a variety of psychiatric disorders such as depression (Chan, Goodwin, & Harmer, 2007; Leppänen, Milders, Bell, Terriere, & Hietanen, 2004), schizophrenia (Mueser et al., 1996), social phobia (Simonian, Beidel, Turner, Berkes, & Long, 2001), and eating disorders (Jones, Harmer, Cowen, & Cooper, 2008; Kucharska-Pietura, Nikolaou, Masiak, & Treasure, 2004; Legenbauer, Vocks, & Ruddel, 2008; Zonnevylle-Bender, van Goozen, Cohen-Kettenis, van Elburg, & van Engeland, 2004a).

Introduction to Anorexia Nervosa and the Eating Disorders

The present study focuses on emotion recognition in anorexia nervosa (AN). AN is one of two major eating disorders (EDs) recognised in the current Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 2000). The other recognised form of eating disorder is bulimia nervosa (BN). Binge-eating disorder (BED) has also been proposed as another possible distinct eating disorder, however, at present falls under the umbrella of “eating disorder not otherwise specified” (EDNOS), a residual category comprising of any clinical eating disorder that does not meet criteria for AN or BN.

AN and BN share in common the criterion of overvaluation of body weight and shape, meaning that individuals with these disorders judge their self worth largely or solely on the basis of their weight and shape. However, AN is distinguished by the pursuit and achievement of very low body weight (15% below expected weight), intense fear of weight gain, and in post-menarchal females, amenorrhea of at least 3 months duration (DSM-IV). Two subtypes of anorexia nervosa are defined: individuals with restricting type (AN-R) accomplish weight loss primarily through dieting, fasting or excessive exercise and do not regularly engage in binge-eating or purging, while individuals with binge-eating/purging type (AN-BP) regularly engage in binge-eating and/or purging. In contrast, the essential feature of BN is frequent (at least twice a

week for 3 months) binge-eating and compensatory behaviour such as self-induced vomiting, laxative use and excessive exercise, without extreme weight loss. BN is also further subtyped into purging and non-purging types, the latter describing individuals who use fasting or excessive exercise as compensatory behaviours and who do not regularly engage in vomiting, or misuse of laxatives, diuretics etc.

While it is beyond the scope of this thesis to discuss in any depth, it is important to note that there are a number of significant problems with the current eating disorder classification system. For example, the so-called 'residual' EDNOS category is in reality the most commonly diagnosed eating disorder in outpatient settings (Button, Benson, Nolle, & Palmer, 2005; Turner & Bryant-Waugh, 2004). Furthermore, many cases of EDNOS closely resemble AN or BN but just fail to meet their diagnostic thresholds. For example, a person's weight may be slightly above the cut-off for AN or their frequency of binge-eating may be just too low for a diagnosis of BN (Fairburn & Bohn, 2005; Wilfley, Bishop, Wilson, & Agras, 2007). This has led to criticism of some of the individual diagnostic criteria for AN and BN, in particular, the amenorrhea criterion and weight cut-off for AN, and the minimum frequency and duration of binge-eating and compensatory behaviour for BN (Fairburn & Bohn, 2005; Wilfley, et al., 2007). A related problem is the considerable cross-over between diagnostic categories within the eating disorders, and fluctuation of symptoms over time (Fairburn & Bohn, 2005). In terms of subtypes, there is some suggestion from taxometric research that the restricting and binge-purge variants of AN are qualitatively different from one another with the latter subtype appearing closer in nature to BN than to AN (Gleaves, Lowe, Green, Cororve, & Williams, 2000; Williamson et al., 2002), although this issue remains unresolved.

Prevalence and Course of AN

As is the case with all the eating disorders, with the exception of BED which has a lower female/male ratio, AN occurs predominantly in females (Striegel-Moore & Franko, 2003; Wakeling, 1996). Onset is usually in the teenage years and incidence rates of AN are highest for females 15-19 years (Lucas, Crowson, O'Fallon, & Melton, 1999). The estimated lifetime prevalence of AN in New Zealand is 0.6% (Oakley Browne, Elisabeth Wells, Scott, & McGee, 2006), which is similar to that reported for most industrialized countries, (Hudson, Hiripi, Pope Jr, & Kessler, 2007; Wakeling, 1996; Walters & Kendler, 1995). While a large proportion of individuals with AN eventually recover from the disorder (~46%), roughly 1/3 continue to be symptomatic, and a sizable minority (~20%) develop chronic AN (Steinhausen, 2002). As discussed above, cross over from AN to normal weight bulimia is also a common occurrence (Sullivan, 2002).

Medical Complications and Psychiatric Comorbidity

Numerous medical complications occur in AN. For example, renal and electrolyte abnormalities, cardiovascular system irregularities, gastrointestinal tract dysfunction, hormonal changes, and osteopenia and osteoporosis, are all possible consequences of AN (Fairburn & Harrison, 2003; Pomeroy & Mitchell, 2002). Some of these complications can be fatal, and this is reflected in the high mortality rate for AN, compared to both females in the general population and female psychiatric outpatients (Sullivan, 1995). Suicide also contributes to the high rate of mortality. In addition to medical complications, AN is also associated with substantial psychiatric co-morbidity. Depression is the most frequently diagnosed co-morbid disorder, and may be present in 1/3 of cases, with lifetime rates reaching 60% (Agras, 2001). Anxiety disorders, particularly social phobia and obsessive compulsive disorder, are also common and

lifetime prevalence data ranges from 20-65% (Kaye, Bulik, Thornton, Barbarich, & Masters, 2004; Wonderlich, Peterson, & Mitchell, 1997). Common axis II diagnoses include obsessive-compulsive personality disorder in AN-R, and borderline personality disorder in AN-BP (O'Brien & Vincent, 2003).

Social Difficulties in AN: A Consequence of Poor Emotion Recognition?

Among the psychological features of the disorder, disturbances in social functioning and interpersonal relationships are common. Studies show that individuals with AN may find the sharing of friendships and relationships difficult (Dare & Crowther, 1995), and have deficient social networks (Tiller et al., 1997). High levels of social inhibition and intimacy deficits have also been found in women with AN (Holliday, Uher, Landau, Collier, & Treasure, 2006). These problems in social interactions persist after the behavioural symptoms of the eating disorder have been resolved (Herpertz-Dahlmann, Wewetzer, Hennighausen, & Remschmidt, 1996; Holliday, et al., 2006; Wentz, Gillberg, Gillberg, & Råstam, 2001).

It has been suggested that problems with social functioning in AN could be the result of impaired emotional processing, and in particular the ability to recognise the affective state of another person (Kucharska-Pietura, et al., 2004). As mentioned previously, decreased sensitivity to the emotional displays of others could lead to less successful social interactions and subsequent difficulties in interpersonal relationships. Social difficulties in turn, could contribute to the development or maintenance of eating pathology. In support of this premise, life stresses involving relationships often precede onset of both AN and bulimia nervosa (Vosk, et al.) (Tiller, et al., 1997), and the presence of interpersonal problems has been correlated with increases in eating disturbances in female college students (Jackson, Weiss, Lunquist, & Soderlind, 2005).

Emotional Processing Difficulties in AN

Alexithymia.

Most research examining emotional processing in AN has focused on the concept of alexithymia. Alexithymia, originally described by Nemiah, Freyberger, and Sifneos (1976), is a multidimensional construct consisting of difficulty identifying feelings and distinguishing between feelings and body sensations of emotional arousal, difficulty describing feelings to other people, a poor imaginative life, and an externally oriented way of thinking (Taylor, Bagby, & Parker, 1991). Alexithymia is postulated to represent an arrest in emotional development, resulting from problems in early attachment relationships (Taylor, Bagby, Parker, & Grotstein, 1997). Due to unavailability or misattunement of attachment figures, individuals with alexithymia fail to develop from early stages of emotional functioning, characterized by the somatic experience of emotion and a unidimensional cognitive experience of emotion (Taylor, et al., 1997). Importantly, alexithymia is regarded not as an all or nothing categorical phenomenon but as a dimensional construct that is normally distributed within the general population (Taylor, et al., 1997).

Alexithymia has been linked to eating disorders and AN, both on a theoretical and empirical level. Theoretically, it has been hypothesized that the difficulty of alexithymic individuals in modulating emotions through cognitive processing may lead them to discharge tension associated with unpleasant emotional states through compulsive behaviour, such as bingeing or self-starvation (Taylor, et al., 1997). Correspondingly, empirical research, using either the original Toronto Alexithymia Scale (TAS) or the revised version (TAS-20), has consistently found that individuals with AN display significantly elevated levels of alexithymia in comparison to healthy control subjects (Bourke, Taylor, Parker, & Bagby, 1992; Bydlowski et

al., 2005; Cochrane, Brewerton, Wilson, & Hodges, 1993; Corcos et al., 2000; Eizaguirre, de Cabezón, de Alda, Olariaga, & Maite, 2004; Montebanocci et al., 2006; Parling, Mortazavi, & Ghaderi, 2010; Sexton, Sunday, Hurt, & Halmi, 1998; Speranza et al., 2005; Taylor, Parker, Bagby, & Bourke, 1996; N. A. Troop, Schmidt, & Treasure, 1995). A number of studies have also found that individuals with AN are more alexithymic than individuals with BN (Cochrane, et al., 1993; Corcos, et al., 2000; Sexton, et al., 1998), although the differences are not always significant (Cochrane, et al., 1993; Speranza, et al., 2005; N. A. Troop, et al., 1995). When subscale scores for the TAS/TAS-20 have been examined, higher scores on the ‘difficulty describing/expressing feelings’ subscale seem to distinguish AN subjects from BN subjects as well as healthy controls, indicating that difficulty in expressing feelings may be an aspect of alexithymia that is particularly characteristic of individuals with AN.

One criticism of the alexithymia construct, as measured by the TAS/TAS-20, is that studies in both clinical (Haviland, Hendryx, Shaw, & Henry, 1994) and general populations (Berthoz, Consoli, Perez-Diaz, & Jouvent, 1999; Hendryx, Haviland, & Shaw, 1991) have found that it is highly correlated with depression and anxiety, and therefore may simply be a proxy for negative affect. However, at present, the relationship between depression, anxiety and alexithymia in eating disordered samples is not clear. While some studies using ED samples have found that depression can fully account for alexithymia (Bydlowski, et al., 2005; Parling, et al., 2010), others have found that elevations in either overall alexithymia scores (de Groot, Rodin, & Olmsted, 1995), or individual subscales (Montebanocci, et al., 2006; Sexton, et al., 1998; Speranza, et al., 2005), remain after controlling for depression. The few studies examining anxiety in relation to alexithymia in ED subjects have reported a similar pattern of results (Bydlowski, et al., 2005; Eizaguirre, et al., 2004; Jimerson, Wolfe, Franko, Covino, & Sifneos,

1994; Parling, et al., 2010). Consequently, efforts have been made to examine emotion processing deficits in eating disorders using alternative measures that are not confounded by negative affect. One such measure is the Levels of Emotional Awareness Scale (LEAS) (Lane, Quinlan, Schwartz, Walker, & Zeitlin, 1990), a performance based measure aimed at evaluating an individual's capacity to describe his/her own emotional experience as well as the emotional experience of others. Of note, level of emotional awareness, as measured by the LEAS, has been shown to be independent of depression and anxiety (Bydlowski, et al., 2005; Parling, et al., 2010). Three studies have used the LEAS to examine emotional processing in individuals with AN and two of these found significant differences between AN subjects and control subjects. Bydlowski et al. (2005) found that AN participants displayed significantly lower levels of emotional awareness for both themselves and others, compared with BN participants and control participants, and Oldershaw, Hambrook, Tchanturia, Treasure, and Schmidt (2010), found that individuals with AN were significantly worse than controls at describing their own emotional experience. Conversely, Parling et al. (2010) did not find any differences between AN subjects and control subjects on emotional awareness, for either themselves or others.

Overall, the literature reviewed above indicates that individuals with AN have difficulties in the area of emotional processing, particularly with expressing their own emotions and representing the emotional experience of others. Although depression and anxiety may partially account for this relation, it would appear that some difficulties are independent of affective symptoms and thus may be related to the core psychopathology of AN. Simulation based theories of emotion recognition propose that perceivers recognise emotions by generating a similar emotional state in themselves, which then triggers conceptual knowledge regarding the experience of the other person (Adolphs, 2002). Therefore, lack of knowledge regarding one's

own emotional state and the emotional state of others may have downstream effects on the recognition of facial emotion in other people. Indeed, numerous studies have shown that individuals with high levels of alexithymia are poorer than those with low levels of alexithymia in the recognition of facial expressions of emotion (Jessimer & Markham, 1997; Lane et al., 1996; Lane, Sechrest, Riedel, Shapiro, & Kaszniak, 2000; Mann, Wise, Trinidad, & Kohanski, 1994; Parker, Taylor, & Bagby, 1993), although others have not confirmed this relationship (P. W. McDonald & Prkachin, 1990). Low levels of emotional awareness, as measured by the LEAS, have also been related to poor recognition of facial emotion (Lane, et al., 1996). Therefore, in AN, difficulties in recognising one's own emotions may extend to difficulties recognising facial emotions in others (Kucharska-Pietura, et al., 2004).

Emotional inhibition and avoidance.

AN is also associated with emotional inhibition and avoidance (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Davies, Schmidt, Stahl, & Tchanturia, 2010; Geller, Cockell, Hewitt, Goldner, & Flett, 2000; Wildes, Ringham, & Marcus, 2010). For instance, a recent meta-analysis of emotion regulation strategies across different forms of psychopathology found that avoidance and suppression were both positively associated with eating disorder psychopathology (Aldao, et al., 2010). Likewise, experimental research utilizing film clips as a means of eliciting emotion found that people with AN were less facially expressive than control subjects when watching both positive and negative film clips, and also looked away significantly more than controls during the negative film clip (Davies, et al., 2010), possibly in an attempt to regulate their emotional experience.

Accordingly, dysfunctional emotion regulation strategies are included in many theoretical models of AN. Schmidt & Treasure (2006) outline a cognitive interpersonal maintenance model

of AN that includes emotional avoidance as one of the central maintaining factors of the disorder. According to this model, avoidance in AN centres on a need to avoid the experience and expression of intense negative emotions and the need to avoid close relationships which trigger these emotions. Dysregulated eating behaviours such as binge-eating and food restriction have also been conceptualized as attempts to suppress or ameliorate negative affect that the individual cannot tolerate (Cooper, Wells, & Todd, 2004; Waller, Kennerley, & Ohanian, 2007). Studies using qualitative (Nordbø, Espeset, Gulliksen, Skårderud, & Holte, 2006; Serpell, Treasure, Teasdale, & Sullivan, 1999) and self-report (Cockell, Geller, & Linden, 2002; Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007; Gale, Holliday, Troop, Serpell, & Treasure, 2006; Wildes, et al., 2010) methodology to assess patients' views of the functional value of their eating disorder symptoms, support the notion that eating pathology can serve as a method of avoiding or coping with emotions or distress. For example, avoidance of uncomfortable emotions was one of the themes to emerge in a study where patients were asked to write letters to 'anorexia my friend' (Serpell, et al., 1999). Correspondingly, Wildes et al. (2010) found that individuals with AN endorsed levels of emotional avoidance that were similar to, or higher than, published data for people with avoidant personality disorder and social phobia, and were in excess of levels reported for community controls. Furthermore, in this study, emotional avoidance partially explained the relationship between depressive and anxiety symptoms and severity of eating disorder psychopathology. The authors suggested that affective symptoms may contribute to increased levels of emotional avoidance in persons with AN, that, in turn, could lead to greater severity of eating disorder psychopathology in an attempt to regulate unpleasant emotions.

Emotional schemas and negative beliefs about emotions.

Maladaptive beliefs about the consequences of emotional experience and expression have been hypothesized to contribute to the high levels of emotional inhibition and avoidance observed in AN. Drawing on the theory of Dialectical Behavioral Therapy (Linehan, 1993), Corstorphine (2006) has described how growing up in an invalidating environment, where communication of emotion is ignored or responded to in a negative way, may lead an individual to develop beliefs about emotions as ‘bad’, ‘unacceptable’, or ‘dangerous’. Consequently, when the individual experiences a primary emotion (appropriate and adaptive emotional response to the environment), beliefs regarding the unacceptability of that emotion are activated and lead to secondary emotions, such as feelings of guilt or shame about experiencing the primary emotion. These secondary emotions intensify distress and interfere with problem-solving and coping abilities, resulting in the use of eating behaviours such as restriction and bingeing to manage affect. A number of studies have supported the view that individuals with AN have maladaptive emotional schemas. For example, Hambrook (2010) found that relative to healthy controls, participants with AN reported more maladaptive beliefs about experiencing negative thoughts and feelings, the acceptability of expressing their emotions to others, and the perceived consequences of communicating their emotions to others. Qualitative research examining parents’, patients’ and clinicians’ views of emotions in anorexia also found that difficulty expressing emotions in AN, accompanied by negative beliefs about emotions as ‘dangerous’, ‘unacceptable’, and ‘confusing’, was a salient theme across all three participant groups (Kyriacou, Easter, & Tchanturia, 2009). Supporting the role of the early environment in shaping emotional schemas, Leung, Waller, and Thomas (2000) demonstrated a link between unhealthy parental bonding behaviours and dysfunctional core beliefs about emotions in individuals with AN. In this study, perceived low levels of maternal care were found to predict AN women’s

beliefs that their emotional needs will never be met (emotional deprivation) and that their emotions should not be expressed lest they result in adverse consequences (emotional inhibition).

Conceivably, negative beliefs about emotions, and associated emotional avoidance and inhibition in AN, could impact on emotion recognition in a number of ways. Inhibiting rather than expressing emotions is cognitively demanding (Richards & Gross, 1999, 2000) and may decrease attentional resources necessary for accurate perception of others' emotions. Furthermore, others' emotional expressions have the potential to trigger the experience of a wide range of emotions that may be perceived as unwanted or aversive to a person with AN. Consequently, individuals with AN may avoid emotional interactions with others or any interaction at all, which could subsequently affect their ability to accurately recognise facial emotion. This is in line with the previously described model by Schmidt and Treasure (2006), which posits that people with AN avoid close relationships that may trigger the experience of negative emotions. Alternatively, individuals with AN may be very aware of emotional cues in the environment, as rapid identification of others' emotions would allow negative social interactions to be avoided.

AN and Effects of Starvation

One issue that must be considered in AN research is the extent to which associated mood, anxiety, personality, and emotional features are artefacts of starvation or weight loss, rather than due to the core psychopathology of AN. Studies of natural and experimental starvation have shown the deleterious effects that food deprivation has on behaviour, personality and mood. For example, the Minnesota starvation experiment in which 36 well adjusted males lived on a severely restricted diet for 6 months, found that depression, anxiety, rigidity, obsessiveness, irritability, social withdrawal, food preoccupation, and low sexual interest were evident in the

men within weeks of restricted intake, and progressed as starvation continued (Keys, 1950; Keys, Brozek, Henschel, Mickelson, & Taylor, 1950). These symptoms are similar to many of those observed in AN, suggesting caloric deprivation may play a role in some of the observed symptomatology. Research comparing currently ill AN individuals to those that have recovered from AN seem to support this premise, finding that symptoms such as depression, anxiety, and obsessiveness are exaggerated by weight-loss and malnutrition and improve with weight restoration (Pollice, Kaye, Greeno, & Weltzin, 1997). However, there is also research indicating that these mood and personality features remain upon weight restoration, albeit in a milder form (Holtkamp, Muller, Heussen, Remschmidt, & Herpertz-Dahlmann, 2005; Kaye, et al., 2004; Pollice, et al., 1997; Srinivasagam et al., 1995). This could either indicate that starvation-related biological changes exacerbate a pre-existing disposition that remains upon recovery, or alternatively, that being ill with AN induces long term changes in personality and mood. In terms of emotional variables, studies examining the relationship between BMI and alexithymia have produced mixed results. Some researchers have found that low BMI is correlated with higher TAS scores (Eizaguirre, et al., 2004; Sexton, et al., 1998), whereas others have not confirmed this association (Bourke, et al., 1992; Schmidt, Jiwany, & Treasure, 1993). Nonetheless, the results of the aforementioned Minnesota Starvation experiment, and self-report by patients that reduced internal emotional experience is a valued symptom of AN (Cockell, et al., 2002), would suggest that at the very least, emotional disturbances in AN are intensified by the effects of starvation and malnutrition.

Summary and Introduction to Facial Emotion Recognition Studies in AN and the EDs

Taken together, the research reviewed in the preceding sections indicates that individuals with AN have difficulties with alexithymia, and emotional awareness, and display high levels of

emotional avoidance and inhibition. These emotional difficulties may extend to poor recognition of facial affect in other people. In view of this, a number of previous studies have investigated facial emotion recognition in AN and the EDs using experimental methods in which participants are required to classify the emotion present in social affective stimuli. Most commonly, studies have used some variation on a task wherein participants are presented with a series of still photographs of faces displaying different emotional expressions and are asked to make a judgement about which emotion the face is displaying from several choices (forced choice paradigm). A few studies also include a free labelling version, where participants are required to generate their responses themselves. Using these methods, there have been many reports of impaired recognition of facial emotion in individuals with AN, relative to the performance of healthy control subjects. However, studies vary widely in the choice of stimuli, the duration for which stimuli is presented, medication status of participants, and consideration of affective symptoms. These methodological differences across studies will be presented first in order to provide a context for the findings from studies of facial emotion processing in AN and other EDs.

Methodological Issues in Studies Examining Facial Emotion Recognition in AN and Other EDs

Choice of stimuli.

The choice of facial emotion stimuli varies across studies, ranging from five (Mendlewicz, Linkowski, Bazelmans, & Philippot, 2005) to nine (Kucharska-Pietura, et al., 2004) emotions. As discussed earlier, only six or seven “basic” emotions are universally recognized (Ekman, 1992) and it is possible that basic and social (e.g. guilt, jealousy, shame) emotions are processed differently. What’s more, only a few studies have included a neutral face condition. This is an important feature, as it allows any interpretive biases to neutral stimuli to be

identified. In studies of depression, emotion recognition paradigms that include neutral and/or ambiguous (displaying only small amount of a particular emotion or a mixture of emotions) facial expressions have commonly found that individuals with depression interpret these expressions as negative.

Stimulus duration and number of presentations.

Another area where the conditions diverge across the AN emotion recognition literature is in the presentation time of the stimuli. At one end of the continuum, some studies present the stimuli for as long as ten seconds (Kucharska-Pietura, et al., 2004), whereas others show the stimuli for only 200-500 milliseconds (Jänsch, Harmer, & Cooper, 2009; Jones, et al., 2008; Kessler, Schwarze, Filipic, Traue, & von Wietersheim, 2006). Differing presentation times may mean that studies are measuring different constructs, as the longer stimuli are presented for, the more that top-down modulation from higher regions of the brain is involved (Adolphs, Damasio, Tranel, & Damasio, 1996). The number of stimulus presentations also differs across research, with some studies including as little as 6-8 stimuli per emotion category. This may be insufficient to generate an accurate measure of emotion recognition.

Medication status of participants.

In several studies investigating emotion recognition in AN samples, the medication status of the participants is unclear and some have been reported to be taking selective serotonin reuptake inhibitors (SSRIs). It is well documented that pharmacological intervention can enhance the salience of emotional expressions. For example, using healthy volunteers, manipulations acting on serotonergic pathways differentially affect the processing of fearful and happy expressions (Harmer et al., 2003a; Murphy, Norbury, O'Sullivan, Cowen, & Harmer, 2009);

those acting on noradrenergic pathways differentially affect the processing of sad faces (Harmer, Perrett, Cowen, & Goodwin, 2001); while dopaminergic and GABAergic manipulations differentially affect the processing of angry expressions (Blair & Curran, 1999; Borrill, Rosen, & Summerfield, 1987; Zangara, Blair, & Curran, 2002). Consequently, it is difficult to draw conclusions about the effect of eating disorder psychopathology on emotion recognition from studies where participants are taking medication. Any observed similarities or differences between groups may be due to the effects of medication.

Affective symptoms.

Another issue that deserves attention is the failure of some prior research to control for depression and anxiety. As mentioned previously, both depression (Lewinsohn, Striegel-Moore, & Seeley, 2000; Zaider, Johnson, & Cockell, 2000) and anxiety (Hinrichsen, Wright, Waller, & Meyer, 2003; Kaye, et al., 2004) are common co-morbid conditions in individuals with AN, and EDs in general. Moreover, research has found that both depression and anxiety are associated with deficits in facial emotion recognition (Easter et al., 2005; Leppänen, et al., 2004; Mendlewicz, et al., 2005). Consequently, facial emotion recognition should not be examined in ED samples without considering the influence of comorbid affective symptoms

Previous Research Examining Facial Emotion Recognition in AN and Other EDs

Research employing still facial photographs as stimuli

Prior research examining facial emotion recognition has predominantly used still facial photographs as stimuli. Consequently, studies using these methods will be reviewed first. In the first study to assess facial emotion recognition in EDs, Zonneville-Bender, van Goozen, Cohen-Kettenis, van Elburg, and van Engeland (2002) examined emotion recognition in adolescents

with eating disorders (AN, BN and EDNOS) using pictures of seven different emotions (happiness, anger, sadness, fear, disgust, surprise and contempt) taken from Matsumoto and Ekman's Japanese and Caucasian Facial Expressions of Emotion (JACFEE) (Matsumoto & Ekman, 1988), and presented in slide form. Results demonstrated that, compared to healthy control subjects, the ED group performed significantly worse overall on both free labelling and forced choice versions of the emotion recognition task (Zonneville-Bender, et al., 2002). In a second study using the same measure, Zonneville Bender and colleagues (Zonneville-Bender, et al., 2004a) found that adolescents with AN performed worse than healthy controls, but not a psychiatric control group, on the free labelling version of the ERT. Moreover, these results were unaffected when levels of depression were controlled for. No group differences were found on the forced choice version of the task. In neither of these studies were results for individual emotions examined, so the source of any differential processing is unknown. The same authors also compared emotion recognition performance of adolescents with AN, to that of adults with AN, and concluded that both adults and adolescents showed similar problems (Zonneville-Bender et al., 2004b).

Using nine emotions (interest, happiness, surprise, sadness, disgust, contempt, anger, shame & fear) presented on slides, Kucharska-Pietura et al. (2004) showed that individuals with anorexia were less accurate in recognising negative emotions as a group, particularly sadness and fear, and that results remained after adjustments for depression. More recently, Pollatos, Herbert, Schandry, & Gramann (2008) investigated emotion recognition performance in a group of individuals with AN. Stimuli were taken from the Karolinska Directed Emotional Faces set (Lundqvist, Flykt, & Ohman, 1998), and included 6 emotions (neutral, sad, happy, fear, anger & disgust) presented via computer screen. The AN group were found to be less accurate at

recognising sad, neutral and disgusted faces than were controls, and depression did not significantly predict accuracy. Misclassifications were also examined, however no differences between groups were found in the types of errors made.

In a recent study using similar methods to that of the current research, Jansch, Harmer, & Cooper (2009) used the Facial Expression Recognition Task (FERT) to assess emotion recognition in women with AN. The FERT is a computerized task of emotional recognition that utilizes six basic emotion stimuli (happy, sad, anger, disgust, surprise, fear) and a neutral face stimulus from Ekman and Friesen's Pictures of Facial Affect Series (Ekman & Friesen, 1976). Overall, it was found that those with AN correctly identified fewer faces, responded more slowly, and misclassified more faces than did healthy volunteers. However, after the effect of depression was taken into account, only the significant group difference on reaction time remained. Exploratory analyses of subgroups (medicated vs. unmedicated patients) were also conducted and revealed different patterns of results for each subgroup. In particular, for those that were not on medication, high levels of eating disorder symptoms were associated with increased misclassification of faces as angry, whereas for those on medication, higher levels of eating disorder symptoms were correlated with fewer misclassifications of faces as angry. The medication group was also more accurate and made fewer overall misclassifications, although, due to small sample size, these results did not reach statistical significance.

There are also studies that have found no performance deficit when comparing individuals with AN to controls on facial emotion recognition tasks. For instance, Mendlewicz, Linkowski, Bazelmans, and Philippot (2005), used a computerized task featuring pictures of 5 different emotions (happiness, anger, sadness, disgust, & fear) from the JACFEE (Matsumoto & Ekman, 1988) and found no difference between those with AN and a healthy control group, in

accuracy or reaction time. The effect of stimulus intensity was also examined and results showed that AN subjects performed comparably to control subjects on low, medium and high intensity presentations of each emotion. Likewise, Kessler, Schwarze, Filipic, Traue, and von Wietersheim (2006) also using stimuli from the JACFEE and computerized presentation, found no difference between individuals with AN and controls for either reaction time to, or recognition of, the six basic facial emotions of anger, fear, sadness, happiness, surprise and disgust, with the exception of a trend for the AN group to recognize surprise less rapidly than controls.

Research employing photographs of the eye area as stimuli.

Emotion recognition has also been examined in AN samples using the revised version of the ‘Reading the Mind in the Eyes (RME) task (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). This task features black and white photographs, each cropped to show only the target’s eye region. Participants are asked to choose from a list of four words, the one which best describes what the person in the photograph is thinking or feeling. Only ‘complex’ mental states are included in the revised version of the task. According to Baron Cohen et al. (2001), ‘complex’ mental states involve attribution of a belief or an intention to another person. In contrast ‘basic’ mental states, are universally recognized, and recognized purely as emotions without any need to ascribe a belief to the person.

Using this task, Harrison, Sullivan, Tchanturia, and Treasure (2009) found that women with AN provided significantly fewer correct answers than did controls and that lower scores on the RME task were significantly related to difficulties in emotional regulation as measured by The Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004). Low RME scores were also significantly correlated with two DERS subscales: non-acceptance of emotional

responses and limited access to emotional regulation strategies. The non-acceptance of emotional responses subscale measures a propensity towards having negative secondary responses to one's own negative emotions or not accepting emotional reactions to distress (Gratz & Roemer, 2004). The association between this tendency and low scores on the RME provides some preliminary evidence for a link between negative emotion schemas as described by Corstorphine (2006) and Fox & Power (2009), and difficulties in recognizing others' emotions in individuals with AN. Replicating these results, Harrison, Sullivan, Tchanturia, & Treasure (2010) administered the RME to individuals with EDs (AN and BN) and found that that participants with AN-R, but not other ED groups, had difficulty recognizing emotion from the eyes. Likewise, Russell, Schmidt Doherty, Young, & Tchanturia (2009) found that participants with AN performed more poorly on the RME than did control participants.

The RME task has also been used with individuals who have recovered from AN. For example, Harrison, Tchanturia, and Treasure (2010) compared women with acute AN, women recovered from AN and healthy control women on the RME. Results showed that both the acute and recovered AN groups performed significantly worse than controls and there were no significant differences between the AN groups. Conversely, Oldershaw et al. (2010) found that, while currently ill AN participants were poorer at recognizing complex emotions from the eyes on the RME, recovered AN participants performed at a similar level to healthy control subjects. However, when the RME task was examined by valence of emotion, recovered AN participants were found to recognize positive emotions at a level intermediate to currently ill subjects and healthy controls, although no significant differences were observed. These findings suggest that some difficulties in emotion recognition may persist after recovery from AN and could represent a vulnerability factor for the development of AN. Alternatively, these difficulties may be a result

or outcome of the eating disorder itself. The observation of more severe emotion recognition difficulties in acutely ill AN women fits with reports of changes in personality and decreased desire for social interaction in the underweight state, and improvement after weight gain (Keys, 1950; Keys, et al., 1950) .

Of note, a recent critical review of the RME task by Johnston, Miles, and McKinlay (2008) identified several limitations of the task as a measure of sensitivity to the emotional or psychological state of others. These authors questioned the assumption that the eye area alone contains enough information to denote specific psychological states. Johnston et al. also raised the issue of the criterion against which participants' accuracy is scored. The photographs used in the RME task come from magazines and the 'correct' response for each stimulus photograph was generated by the test authors. Stimuli were subsequently included in the task on the basis of the degree of consensus obtained by judges in a pilot test. Assessing accuracy via consensus raises the possibility that impaired performance on the RME task could be related to a participant possessing different social norms from the creators of the RME, rather than resulting from an inability to identify the psychological state of others (Johnston, et al., 2008). While disparity in social norms or beliefs between two individuals may affect social interactions, social difficulties of this type may have different implications in terms of therapy, compared to social difficulties resulting from an inability to recognize the psychological or emotional state of others from information specified by facial expressions.

Meta-analysis of emotion recognition in AN.

One meta-analysis examining emotion recognition in individuals currently ill with AN has been conducted and is included in a paper by Oldershaw, Hambrook, Stahl, et al. (2010). This meta-analysis included ten forced choice emotion recognition studies (all reviewed

previously) and found a small to medium ($d=-.33$) effect size between control and AN samples for 'basic' emotion recognition and a large effect size for 'complex' emotion recognition ($d=-1.01$). Across all studies (basic and complex emotions), deficits in AN individuals were shown with a medium to large effect size ($d=-.51$). The authors also noted that studies with more complex emotion recognition paradigms, such as those involving free-naming, complex emotions, or morphing of stimuli yielded larger effect sizes. It was suggested that emotion recognition deficits in AN may be subtle and therefore less easily detected using basic emotions in forced choice paradigms (Oldershaw, Hambrook, Stahl, et al., 2010)

Assessment of Emotion Recognition in Sub-Clinical or 'High Risk' Participants

Studies of facial emotion recognition have also been conducted with participants who display high levels of ED symptoms on self-report scales. For instance, Jones, Harmer, Cowen, and Cooper (2008) used the FERT (described previously) to compare emotion recognition in students with high scores on the Eating Attitudes Test-26 (EAT-26) to those with low scores. Students with high EAT scores were found to be less accurate on happy and neutral face recognition than those with low EAT scores. Results remained when depression and anxiety were controlled for. Visual inspection of the means also indicated that high EAT participants tended to categorize happy faces as neutral and neutral faces as angry or sad.

Recent research by Ridout, Thom, and Wallis (2010) made use of the Emotion Evaluation section of The Awareness of Social Inference Test (TASIT) (S. McDonald, Flanagan, Rollins, & Kinch, 2003) to assess emotion recognition in females who scored high on the Eating Disorders Inventory (EDI). This task consists of a series of short video clips of social interactions in which one of either six primary emotions (happiness, sadness, anger, surprise, disgust, and fear) or neutral affect is present. Subjects are required to identify the emotion state of the central

character by making a forced choice out of the aforementioned options. Relative to low EDI participants, the high EDI group were found to have a general deficit in the recognition of emotion, in addition to a specific deficit in the recognition of anger. Moreover, levels of depression and trait anxiety were found to be unrelated to emotion recognition accuracy. These two studies suggest that the emotional processing deficits observed in individuals with eating disorders may also be present in people with non-clinical or sub-threshold disordered eating. As noted by Ridout, Thom, and Wallis, it is possible that poor emotion recognition could exacerbate eating psychopathology by leading to interpersonal conflict or undermining relationships, which may further increase eating disorder symptoms.

Summary of Emotion Recognition Studies in the EDs

Despite some discrepancies between individual studies, and large variation in methods of assessment, overall, the evidence seems to point toward impaired facial emotion recognition in AN. This conclusion is in line with the aforementioned meta-analysis, which found a medium to large effect size across all basic and complex emotion recognition studies in AN. However, the results for individual emotions are considerably less consistent. Of the studies described above, six examined whether or not there were differences in accuracy for specific emotion states, and particular impairments were reported for happiness (Jones, et al., 2008), sadness (Kucharska-Pietura, et al., 2004; Pollatos, et al., 2008), neutral expressions (Jones, et al., 2008; Pollatos, et al., 2008), anger (Ridout, et al., 2010), and fear (Kucharska-Pietura, et al., 2004). One study concluded that no emotion specific deficits exist for individuals with eating disorders (Jänsch, et al., 2009).

The few studies that have examined misclassifications (Jänsch, et al., 2009; Jones, et al., 2008; Pollatos, et al., 2008) indicate that increased misclassification of faces as angry may be a

feature of individuals with high levels of eating disorder symptoms. Only a minority of studies have examined reaction time, and of these, two studies found that AN subjects did not differ on reaction time to facial emotion stimuli (Jones, et al., 2008; Kessler, Schwarze, Filipic, Traue, & von Wietersheim, 2006), while one study found that AN participants displayed slower overall reaction time (Jänsch, et al., 2009). At present, only one study employing morphed stimuli has examined the effect that intensity of stimulus material has on accuracy, and the results of this study showed that AN subjects did not differ from controls in their accuracy at low, medium, and high stimulus intensities (Mendlewicz, et al., 2005).

The Role of Specific Emotions in AN

As yet, there has been little research considering the role of specific emotions in AN or other EDs. Although many theorists have made links between bingeing and restricting as methods of managing negative affect, there has been little consideration of exactly which emotions are important in the EDs (Fox & Power, 2009). Fox and Power (2009) point out that the simplistic and unidimensional approach to emotions in ED research does not fit with contemporary theories of emotion development, such as the Schematic Propositional Analogical Associative Representation Systems (SPAARS) model (Power & Dalgleish, 1997). The SPAARS model argues that emotions develop as semi-independent cognitive modules and therefore different learning experiences can lead an individual to have different relationships with each of their basic emotions. Consequently, the limited research pertaining to the relevance of different basic emotions in individuals with eating disorders is reviewed below.

Anger.

Anger is one emotion that has been researched thoroughly in relation to people with eating disorders. Overall, studies examining anger in relation to EDs suggest that women with eating disorders appear to experience increased levels of anger, but also have a tendency to suppress or inhibit this emotion (Fox & Harrison, 2008; Geller, et al., 2000; Ioannou & Fox, 2009; Milligan, Waller, & Andrews, 2002; Waller et al., 2003). In AN participants, high levels of anger suppression and avoidance have been related to negative beliefs and schemas regarding anger as threatening (Fox, 2009; Ioannou & Fox, 2009; Joos, Cabrillac, Hartmann, Wirsching, & Zeeck, 2009). Qualitative research by Fox (2009) also found that the early socio-emotional environments of AN participants in his study were characterized by little or no emotional expression, punctuated by episodes of overwhelming emotion, particularly anger. This research fits with the facial emotion recognition findings indicating that increased misclassification of faces as angry may be characteristic of individuals with eating disorders.

Sadness.

There is a small amount of research on the role of sadness in EDs. A qualitative study by Fox (2009) found that, in addition to anger, sadness was also a difficult emotion for individuals with AN, and was associated with negative beliefs about sadness as a sign of weakness. Using the Basic Emotions Scale (BES), Fox and Froom (2009) examined the relationship of five basic emotions (anger, happiness, sadness, fear, and disgust) in relation to disordered eating patterns, and found that all four 'negative' emotions were strongly correlated with disordered eating patterns. These correlations were maintained when depression and anxiety were partialled out of the analysis, with the exception of the correlation between fear and disordered eating, which was reduced to a non-significant level. These studies provide preliminary evidence that sadness is a

relevant emotion to the EDs, although it is unclear how this may affect facial emotion recognition. Studies of facial emotion recognition in depression may be informative here, as intuitively, research has confirmed that sadness is one of the main emotions of depression (Power & Tarsia, 2007). Furthermore, eating disorders are highly comorbid with depression. Although findings are mixed, some studies have found that depressed individuals misclassify more neutral faces as sad, in comparison with control subjects (Douglas & Porter, 2010; Gur et al., 1992). As highlighted previously, Jones et al. (2008) found a similar negative interpretive bias in participants with high levels of eating disorder symptoms, such that participants with high scores on the EAT displayed an increased tendency to classify neutral facial expressions as sad (as well as angry) compared to participants with low EAT scores. However, these results were independent of depression. Two studies have also found poorer recognition of sad faces in AN subjects compared with control subjects (Kucharska-Pietura, et al., 2004; Pollatos, et al., 2008).

Fear.

Fear has not really been investigated in the eating disorders, although the relationship between eating disorders and anxiety is well established. Theoretically, both eating disorders and the recognition of facial expressions of fear have been linked to the neurotransmitter serotonin. Serotonergic input to the amygdala appears to modulate the processing of fearful facial expressions (Harmer, et al., 2003a), and there is evidence that serotonergic functioning is aberrant in individuals with both AN and BN. Therefore, one could speculate that recognition of fearful expressions may be disturbed in individuals with AN. As noted above, Kucharska-Pietura et al. (2008) found poorer fear recognition in AN subjects compared with healthy control subjects, although other studies have not confirmed this result.

Disgust.

Disgust is an emotion that is highly related to food and eating. Consequently, several studies have investigated the relationship between disgust and EDs. Davey, Buckland, Tantow, and Dallos (1998) found that disgust sensitivity was related to ED symptoms in female (but not male) students. In a second study, Davy et al. (1998) found higher disgust sensitivity in a small sample of adolescents with anorexia than in non-eating disordered schoolgirls, particularly for the areas of foodstuffs of animal origin, the human body and its products, and gastroenteric products. Troop, Murphy, Bramon, and Treasure (2000) investigated disgust sensitivity in a larger sample of individuals with eating disorders and failed to find any significant differences on disgust sensitivity between individuals with eating disorders and those without. However, in this study, the eating disordered group was separated into five subgroups (AN-R, AN-BP, BN, BED, EDNOS), and as a result, power to detect significant differences was reduced. Troop, Treasure, and Serpell (2002) subsequently re-analyzed the results of Troop et al. (2000) by combining the ED subgroups and found that ED participants were more sensitive to disgust stimuli overall than control participants. ED participants in the Troop et al. (2000) study were also more sensitive to disgust than controls on items relating to food, animals, body products and sex, but not more sensitive to disgust on items relating to body envelope violations, death, hygiene and magical contagion. Troop, Treasure, and Serpell (2002) also investigated disgust sensitivity in a new sample of people with both current and remitted eating disorders (AN-R, AN-BP, BN, EDNOS). Comparison to previously published results for non-clinical female participants, showed that both current and remitted individuals with eating disorders reported higher levels of disgust towards foodstuffs of animal origin, the human body and its products, and to invertebrate animals. One result common to all three of these studies is increased levels of disgust sensitivity to food/food stuffs of animal origin and the human body/body products in

individuals with eating disorders. Troop, Treasure, and Serpell (2002) concluded that eating disorders are not associated with greater overall disgust sensitivity, instead disgust sensitivity is higher for areas related to food and the body. Again, it is not clear what these results mean for recognition of facial expressions of disgust in AN. One study has found reduced accuracy at recognizing facial expressions of disgust in individuals with AN compared to control participants (Pollatos, et al., 2008), but this has not been replicated thus far.

Happiness and surprise.

As already mentioned, research has tended to focus on the role of negative emotions in eating disorders and consequently, there is limited consideration of happiness or surprise in subjects with EDs.

Description of the Current Research

The current study aimed to further investigate the nature of emotion recognition in AN by comparing emotion recognition in women with AN to a comparison group of women who were constitutionally thin (CT). Understanding the nature of emotional difficulties in AN has implications for therapy as problems in understanding others' emotions are likely to make cognitive therapy tasks difficult to complete successfully (Jones, et al., 2008). In addition, inclusion of emotional processing difficulties into models of anorexia nervosa may enhance understanding of the development and maintenance of this disorder.

This research was part of a larger study examining cognitive functioning and appetite hormones in low weight women and was unique in its use of a weight matched “constitutionally thin” comparison group to control for the confounding factor of BMI. Constitutional thinness is characterized by a low and stable body mass index (BMI) without any hormonal abnormality or

changes in feeding behaviour (Bossu et al., 2007; Tolle et al., 2003). In order to detect any subtle differences that may exist between the two groups a range of outcome measures were included, such as accuracy, reaction time, and misclassifications. In addition, results for individual emotion categories were examined to explore the possibility of any emotion-specific differences between the AN and CT groups. The current study also aimed to improve on some of the methodological limitations of previous studies by controlling for depression and anxiety statistically, and excluding participants who were taking centrally acting medication.

The FERT (Harmer, et al., 2003a; Harmer, et al., 2001), a well-characterized, computerized task of emotional recognition was part of the battery of tests used in the wider study, and consequently was employed as the measure of facial emotion recognition in the present research. The FERT features six basic emotion stimuli (angry, happy, sad, disgusted, surprised, and fearful) and a neutral face stimulus, and has been used extensively in research examining the effects of psychiatric medication on emotion recognition (Harmer, Heinzen, O'Sullivan, Ayres, & Cowen, 2008; Murphy, Downham, Cowen, & Harmer, 2008). The FERT has also proven sensitive to changes in depressive symptoms in previous studies (Bhagwagar, Cowen, Goodwin, & Harmer, 2004; Hayward, Goodwin, Cowen, & Harmer, 2005) and has recently been used to investigate emotion recognition in women with eating disorders (Jansch, et al., 2009; Jones, et al., 2008). The task uses morphed stimuli to provide emotional expressions of different intensities, creating a potentially more sensitive measure. While the ecological validity of morphing techniques has been criticized, morphing is useful as a systematic means of deriving large numbers of stimuli that potentially vary only in a limited number of ways (i.e., intensity of the emotion) and prevents the need for matching and controlling of other dimensions (Jones, et al., 2008).

Hypotheses.

Because of the conflicting results of previous studies examining facial expression recognition in individuals with eating disorders, and the dearth of research into the relation of specific emotions to eating disorder psychopathology, this study was designed to be largely exploratory. However, given the research highlighting anger as a threatening emotion for individuals with AN, and the results of Jones et al. (2008) and Jänsch et al. (2009), indicating that a tendency toward misclassifying faces as angry may be typical of individuals with eating disorders, it was hypothesized that AN subjects would show an increased tendency toward misclassifying neutral faces as angry compared to CT subjects. It was also hypothesized that AN subjects would be more likely to misclassify faces as angry, regardless of which emotion the faces were displaying.

In regards to reaction time, it was hypothesized that, given the salience of anger for individuals with AN, AN participants would respond significantly faster to facial expressions of anger than CT participants.

The effect of stimulus intensity was examined in relation to angry face stimuli. It was predicted that AN subjects would be more sensitive to facial displays of anger as evidenced by higher accuracy for anger at low intensity levels, compared with the CT subjects.

Accuracy, reaction time and misclassifications were also examined with regard to each of the other 5 emotions and the neutral face stimuli.

Method

Overview

The current study was completed as part of the Eating and Wellbeing in Women of Low Weight Study, being carried out by the Clinical Research Unit of the Department of Psychological Medicine, University of Otago, Christchurch. The Eating and Wellbeing Study involved investigation of appetite hormones and cognitive functioning in low weight women, with and without eating disorders.

The current research examined a subset of the assessment data, from the underweight participants, both with a diagnosis of AN and without. Data was collected between November 2008 and October 2010, initially as part of a summer studentship, and subsequently extended for the purpose of this thesis.

My role in this study included the following tasks; I chose the research question I wanted to examine and proposed hypotheses relating to this. I also distributed posters for recruitment, conducted the telephone screening, and forwarded details of eligible participants to one of the researchers. On the day of the assessment, I contributed to obtaining informed consent, recording height and weight, and administering the Cambridge Neuropsychological Test Automated Battery (CANTABeclipse; Cambridge Cognition, 2004), Facial Expression Recognition Test (FERT; Harmer, et al., 2001), and the Structured Clinical Interview for DSM-IV-TR Axis I Disorders (SCID I/P; First, Spitzer, Gibbon, & Williams, 2002) for some participants. I entered the data from the self-report questionnaires and clinical interview into the database, carried out the statistical analyses of data relevant to the research questions I proposed, and wrote up the results.

Participants

Females aged between 18 and 55 years with a body mass index (BMI) of between 15 and 19 were recruited from the community and eating disorder services. Posters (see appendix A) were displayed at the University of Canterbury and University of Otago, Christchurch, in public libraries, supermarkets, fitness centres, and in the outpatient waiting room of the South Island Eating Disorders Service at the Princess Margaret Hospital. Participants were also recruited through articles and advertisements in the local community newspaper.

A total of 74 women were screened for the study. Of these potential participants, 41 women were excluded due to having a BMI above the cut-off for the study, taking psychoactive medication, or having a major medical or neurological condition that was part of the exclusion criteria for the larger study. This left a sample of 33 low weight participants.

Twelve participants had a diagnosis of AN. As per the protocol for the larger study, the AN group included participants diagnosed to the strict DSM-IV weight criterion (BMI <17.5) and those diagnosed to a lenient weight criterion (BMI 17.5-19) (McIntosh et al., 2004). Previous research has found that AN subjects diagnosed according to 'lenient' weight criteria are largely indistinguishable from those diagnosed according to 'strict' weight criteria on body image measures, ED behaviours and eating pathology, thereby providing evidence for the validity of a more lenient BMI cut-off in the diagnosis of AN (McIntosh, et al., 2004). Lenient weight criteria in the diagnosis of AN has also been employed in prior research by the Department of Psychological Medicine examining three psychotherapies for AN (McIntosh et al., 2005). The remaining 21 participants had no symptoms of an eating disorder and were classified as "constitutionally thin" (CT). Constitutional thinness is characterized by a low and stable body

mass index (BMI) without any hormonal abnormality or changes in feeding behaviour (Bossu, et al., 2007; Tolle, et al., 2003).

Exclusion criteria were as follows; severe depression; severe psychoactive substance dependence; current or past bipolar I disorder, schizophrenia or major developmental disorder; cognitive/intellectual impairment; major medical or neurological illness; currently taking psychoactive medication.

Procedure

Participants contacted the present study by telephone or email and were screened by telephone briefly (approximately 5 minutes) to ensure they met the aforementioned inclusion and exclusion criteria. During this screening participants were informed of the research protocol. Those who were eligible and wished to participate were mailed an information pack that contained the study's information sheet (see appendix B).

Participants then attended a full day assessment at the Clinical Research Unit, Department of Psychological Medicine, University of Otago, Christchurch. Participants provided written informed consent (see appendix C for consent form) before beginning the assessment. During the morning, participants completed a neurobiological assessment and self report questionnaires assessing social and psychological functioning and eating attitudes and behaviours. Participants' weight and height were also measured and BMI was calculated. Lunch was provided, after which participants completed a computerised neuropsychological test battery (CANTAB) and took part in a structured clinical interview (SCID I/P) with either the current author or one of the researchers. Participants were reimbursed \$100 in Westfield Mall vouchers

for their time and transport costs. Only a subset of the assessment data is relevant to this thesis and will be described in detail below.

Ethical approval

Ethical Approval for this study was granted by the Upper South A Regional Ethics Committee (see appendix D).

Measures

Demographic information.

Participants were asked to provide their age, ethnicity (NZ European, Maori, Samoan, Cook Island Maori, Tongan, Niuean, Chinese, Indian, and other) and total number of years spent in education.

Assessment of body mass index.

Body mass index (BMI) is a standardized ratio of weight to height and is calculated by dividing weight in kilograms by the square of height in metres. Participants' height and weight were measured on the day of assessment using regularly calibrated Tanita Body Composition Analyzer scales (Model TBF-300).

Diagnosis: The Structured Clinical Interview for DSM-IV, Research Edition (SCID-I/P) (First, et al., 2002).

The diagnostic status of participants was assessed via the SCID-I/P and informed the division of participants into the AN and CT groups. The SCID-I/P is a clinician rated interview designed to assess the presence of current and past Axis I major psychiatric disorders, including eating disorders. In a multi-site reliability study involving 84 rater-pairs from 4 sites, and a 7-10

day retest interval, the median inter-rater reliability of ‘any eating disorder’ was found to be excellent ($\kappa = .77$) and the test-retest reliability of ‘any eating disorder’ was satisfactory ($\kappa = .64$) (Zanarini et al., 2000).

Emotion recognition: The Facial Expression Recognition Test (FERT) (Harmer, et al., 2001).

The FERT is a forced-choice computer-based emotion recognition task, developed by Harmer and colleagues at Oxford University, United Kingdom. The FERT has been used by the Department of Psychological Medicine in past research (Bell et al., 2011; Douglas & Porter, 2010) and is included in the neuropsychological battery of the Eating and Wellbeing Study. As discussed previously, the FERT has proven sensitive to pharmacological manipulations in healthy controls (Harmer, et al., 2003a; Harmer, Rogers, Tunbridge, Cowen, & Goodwin, 2003b), and to changes in depressive symptoms. It has also been used to investigate emotion recognition in eating disorders (Jänsch, et al., 2009; Jones, et al., 2008).

The stimuli consist of black and white photographs of both male and female actors displaying emotional facial expressions, and were developed in Oxford, England as an alternative to the Ekman and Friesen Pictures of Affect Series (Ekman & Friesen, 1976). The developers tried to capture naturalistic facial expressions and consequently the intensity of these faces may be lower than that of the traditional Ekman series (C. Harmer, personal communication, November 26, 2010).

The FERT includes 6 basic facial emotions (happy, surprise, sad, fear, anger and disgust) and a neutral expression. Each facial emotion has been morphed between each prototype expression (100% intensity) and neutral (0% intensity) in 10% steps of intensity, leading to a

range of emotional intensities. (Young et al., 1997). Morphing is a useful method of obtaining large numbers of stimuli that potentially vary only in a limited number of ways (i.e., intensity of the emotion), and prevents the need for matching and controlling of other dimensions (Jones, et al., 2008).

The task consists of 264 stimuli presented across 3 blocks of trials, with each block containing 88 stimuli presented in a pseudorandom order. Across each of the three blocks, 4 examples of each of the 6 emotions at each of the ten levels of intensity are presented. This gives a total of 40 stimuli for each emotion, in addition to 24 examples of neutral expressions.

During the task, each stimulus was presented on a computer screen for 500ms then immediately replaced by a blank screen. Participants were asked to indicate the emotion seen by pressing one of seven labelled keys (ANGRY, HAPPY, SAD, NEUTRAL, DISGUSTED, SURPRISED and FEARFUL) on the response pad, as quickly as possible. The next stimuli did not appear until the participant had made a response to the current stimuli. Participants were informed that facial expressions from each category would appear, including neutral, but also that the faces would contain different levels or intensities of each emotion. The task was broken down into three parts, with an untimed rest period between each to prevent fatigue, and took approximately 15 minutes to complete. The accuracy and reaction time for each facial emotion was generated and recorded using SuperLab® software. Although the software did not generate this automatically, analysis of misclassification errors was also possible.

Anxiety and depression: The Symptom Checklist-90-Revised (SCL-90-R) (Derogatis, Lipman, & Covi, 1973).

The SCL-90-R is a 90 item self report symptom inventory which measures current psychological symptoms and distress in terms of nine primary symptom dimensions. These are somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic-anxiety, paranoid ideation and psychoticism. The SCL-90-R takes 12-20 minutes to complete and respondents are asked to rate on a scale from 0 (not at all) to 4 (extremely) how much each item has distressed or bothered them in the last week.

The SCL-90-R manual reports high internal consistency (0.77 to 0.90) and test-retest reliability (0.78-0.90) for psychiatric outpatients (Derogatis, 1977). High internal consistency coefficients have also been reported for ‘symptomatic volunteers’ (Derogatis, Rickels, & Rock, 1976) and psychotherapy outpatients (Horowitz, Rosenberg, Baer, Ureno, & Villasenor, 1988). In terms of validity, both the Minnesota Multiphasic Personality Inventory and General Health Questionnaire measures have been found to converge and diverge with expected dimensions on the SCL-90-R (Derogatis, 1994; Schmitz, Kruse, Heckrath, Alberti, & Tress, 1999).

In the current study, the depression and anxiety dimensions of the SCL-90-R are utilized as measures of participants’ current levels of depressive and anxiety symptoms. Items contained within the depression dimension reflect a wide range of depressive symptoms such as, dysphoric affect and mood, withdrawal of interest in activities, lack of motivation, and loss of energy, as well as other cognitive and physiological correlates of depression. Several items concerning suicidal ideation are also included. The anxiety dimension of the SCL-90-R consists of a set of symptoms and behaviours usually associated with high manifest anxiety such as restlessness,

nervousness and tension, as well as somatic symptoms e.g., “heart pounding or racing”. There are also items touching on free floating anxiety and panic attacks.

Both the depression and anxiety dimensions of the SCL-90-R show good convergent and discriminant validity in relation to the General Health Questionnaire (Koeter, 1992). Further concurrent validity for the depression dimension of the SCL-90-R is demonstrated by its high correlation with other measures of depression such as the Beck Depression Inventory (0.8), and the Montgomery-Asberg Depression Rating Scale (0.81), (Peveler & Fairburn, 1990) and its ability to detect depression equally as effectively as the former (Choquette, 1994).

Statistical Analyses

Data were first entered into the Paradox relational database and then imported into the Statistical Package for the Social Sciences (SPSS) (17.0). All data analyses were performed using SPSS. A p value of <0.05 was used to infer statistical significance for all analyses in this study.

Descriptive Statistics were used to summarise the demographic characteristics of the sample. In view of the small sample sizes and indications that the normality assumption was violated for the demographic and self-report questionnaire data, Mann-Whitney U nonparametric tests were conducted to compare the AN and CT groups on these measures.

The Facial Expression Recognition Test (FERT) was analysed in terms of accuracy (percentage of total number of stimuli correctly identified for each emotion, and overall), reaction time (time in milliseconds to respond to the stimuli for each emotion, and overall), neutral face misclassification (percentage of neutral faces misclassified as each the other 6 emotions), overall misclassification (percentage of faces misclassified as each of the 6 emotions)

or as neutral) and intensity (percentage of total number of stimuli correctly identified at high and low intensities of anger stimuli).

Accuracy, and reaction time measures were analysed using a repeated measures ANOVA with group as a between subjects factor with 2 levels (AN and CT) and emotion as a within subjects factor with seven levels (anger, happy, sad, neutral, disgust, surprise, and fear). Reaction time data were found to be positively skewed and consequently a log transformation of the data was performed. The accuracy data was sufficiently normally distributed. Mauchley's test indicated that the assumption of sphericity was violated for both accuracy and reaction time measures. Consequently, degrees of freedom were adjusted using the Greenhouse-Geisser correction.

The misclassification measure was not normally distributed and log transformations failed to improve this. Consequently, this data was analysed using a series of Mann-Whitney *U* non-parametric tests comparing the AN and CT groups on % of errors (to neutral faces and overall) allocated to each emotion.

The intensity measure was analysed using a repeated measures ANOVA with group as a between subjects factor with 2 levels and intensity of angry expressions as a within subjects factor with 2 levels (high and low). Assumptions of normality, homogeneity of variance, and sphericity were all satisfied. The high and low intensity factors were created by collapsing the ten intensity levels into two variables, high (60-100%), and low (0-50%).

Results

Demographic Characteristics

Table 1 presents the means, standard deviations, and medians for both groups on demographic variables and BMI scores. Mann-Whitney U tests indicated that the AN and CT groups did not differ statistically on any of the demographic variables, although there was a trend toward significance for years of education. The majority of participants in both groups (41.7% AN group; 90.5% CT group) described themselves as New Zealand European. The remaining minority of the AN group comprised of one participant who identified as Maori and four who described themselves as ‘Other’ (Japanese, Malaysian-Chinese, Polish, and German). In the CT group, two individuals reported British ethnicity and one participant acknowledged Russian descent.

Table 1

Comparison of Demographic Information for the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)			CT (N=21)			U	p
	M	Mdn	SD	M	Mdn	SD		
Age	26.83	24.50	6.22	30.48	26.00	10.88	109.00	0.54
Years of Education	16.33	16.00	2.35	14.88	15.00	2.07	79.00	0.08
BMI	18.26	18.40	1.02	17.89	18.10	1.01	102.00	0.39

Anxiety and Depression Measures

Table 2 summarises the descriptive statistics for both groups on the SCL-90-R depression and anxiety subscales. The AN group scored significantly higher on the SCL-90-R depression scale ($z = 3.22$, $p = .001$) and the SCL-90-R anxiety scale ($z = 2.48$, $p = .013$), compared to the CT group. Due to these between group differences, SCL-90-R depression and anxiety subscales were originally included as covariates in the repeated measures ANOVAs. However, preliminary runs

of the ANOVAs revealed that these variables did not significantly predict any of the dependent variables, and therefore depression and anxiety were dropped from the analyses.

Table 2

Comparison of Symptom Checklist 90 Revised (SCL-90-R) Anxiety (A) and Depression (D) Subscale Scores for the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)			CT (N=21)			<i>U</i>	<i>p</i>
	M	Mdn	SD	M	Mdn	SD		
SCL-90 A	1.50	1.55	1.06	0.54	0.40	0.56	60.00	0.01
SCL-90 D	1.83	1.81	1.02	0.62	0.31	0.65	40.00	0.00

Note: ^b Numbers in bold are statistically significant differences ($p < .05$)

Accuracy of Emotion Recognition

Means and standard deviations for percentage recognition accuracy, for each emotion, for each group, are displayed in Table 3. A repeated measures ANOVA of recognition accuracy produced a significant main effect of emotion type, ($F(4.13, 128.16) = 22.09, p < .0001$), indicating differential performance in the seven emotion categories. As illustrated in Figure 1, participants were most accurate at happy face recognition, and least accurate at anger and fear recognition. No significant effect of group was found ($F(1, 31) = .75, p = .393$), nor did group interact significantly with emotion ($F(4.13, 128.16) = .920, p = .457$), indicating that AN and CT subjects did not differ significantly in overall accuracy averaged across emotion categories, or in accuracy for individual emotion categories.

Table 3

Recognition Accuracy (%) for each Emotion in the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)		CT (N=21)	
	M	SD	M	SD
Angry	34.23	14.41	32.74	15.20
Happy	65.83	12.81	65.83	8.23
Sad	51.25	21.60	51.90	17.23
Neutral	43.05	23.18	39.68	14.47
Disgusted	40.83	15.13	40.95	12.03
Surprised	40.83	14.16	45.24	10.63
Fearful	22.08	11.12	33.93	13.12
Total	42.59	7.90	44.32	3.64

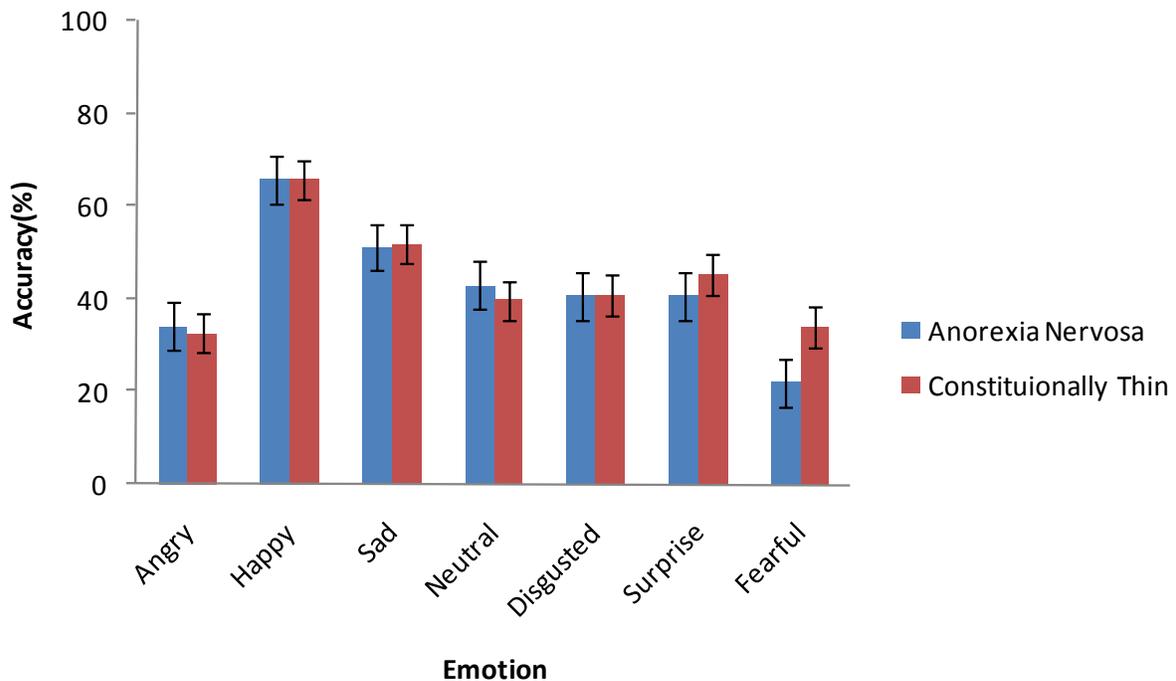


Figure 1. Mean (\pm s.e.m.) recognition accuracy for the six facial expressions of emotion, and neutral expressions on the Facial Expression Recognition Test in anorexia nervosa (n=12) and constitutionally thin (n=21) groups.

Reaction Time

Means and standard deviations for reaction time, for each emotion, for each group are presented in Table 4. Repeated measures ANOVA of reaction time revealed a significant main effect of emotion type ($F(3.12,96.71) = 921.33, p < .05$), whereby participants were slowest to respond to happy, angry and sad faces and fastest to respond to neutral, disgusted, surprised and fearful faces. There was also a main effect of group ($F(1,31) = 8.88, p = .006$). As demonstrated in Figure 2, the AN subjects ($M = 1476.06$ ms, $SD = 172.81$ ms) responded significantly faster than the CT subjects ($M = 1759.90$ ms, $SD = 92.38$) to the facial stimuli, regardless of emotion type. No interaction effect of emotion and group was present ($F(3.12,96.71) = 1.89, p = .134$), showing that the AN group's response time was comparable across the individual emotion categories

Table 4

Reaction Time (ms) to each Emotion in the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)		CT (N=21)	
	M	SD	M	SD
Angry	1869.77	262.63	1932.17	95.61
Happy	1214.39	133.25	1484.56	84.31
Sad	1220.99	143.56	1689.83	154.46
Neutral	1470.58	199.21	1819.55	115.05
Disgusted	1622.47	242.46	1871.71	88.17
Surprised	1347.00	129.06	1620.64	111.13
Fearful	1587.23	159.78	1900.85	96.52
Total	1476.06	172.81	1759.90	92.38

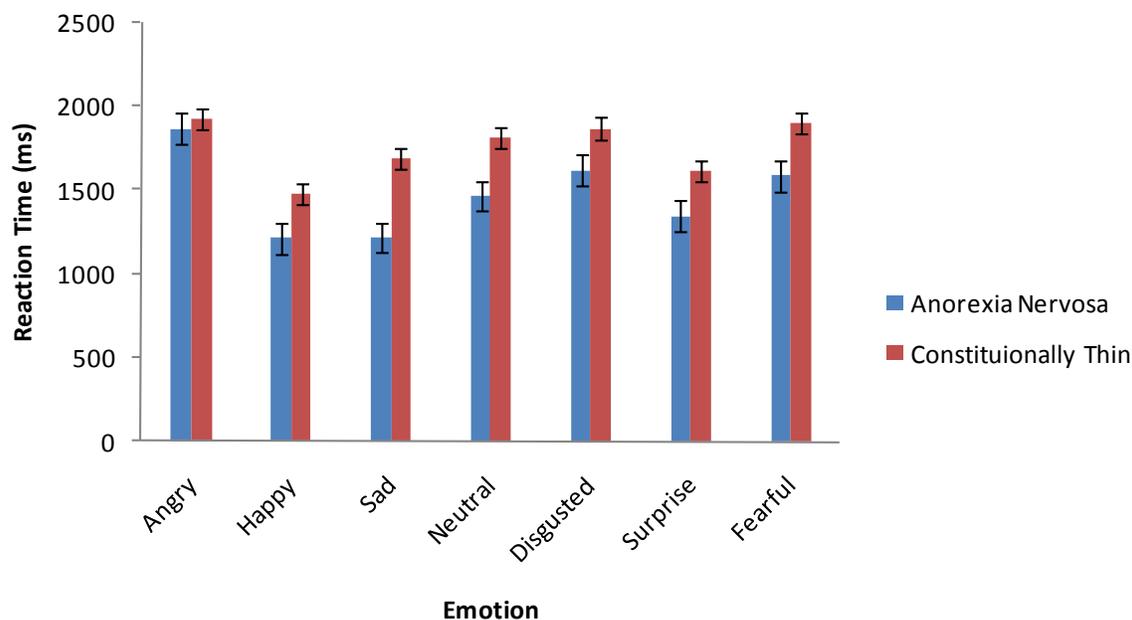


Figure 2. Mean (\pm s.e.m.) reaction time to the six facial expressions of emotion, and neutral expressions on the Facial Expression Recognition Test in anorexia nervosa (n=12) and constitutionally thin (n=21) groups.

Misclassification

Mann-Whitney U tests were used to compare between group differences in the emotion selected when neutral expressions were misclassified. Table 5 illustrates that AN and CT subjects did not differ significantly in the types of errors made when neutral faces were misclassified. The two groups were also compared on the emotion selected when any error was made; regardless of which emotional expression was displayed. As shown in Table 6, there were no significant differences between the AN and CT participants in the types of errors made overall.

Table 5

A Comparison of the Percentage of Neutral Face Errors Allocated to each Emotion in the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)			CT (N=21)			<i>U</i>	<i>p</i>
	M	Mdn	SD	M	Mdn	SD		
Angry	27.90	31.52	17.11	26.12	26.32	15.60	113.00	0.65
Happy	25.77	29.17	14.99	32.09	33.33	18.15	103.50	0.41
Sad	25.32	20.72	17.49	25.24	22.22	14.92	124.00	0.96
Disgusted	8.15	3.34	9.94	6.15	0.00	7.31	115.00	0.70
Surprised	3.85	0.00	5.18	2.75	0.00	4.02	112.50	0.62
Fearful	9.02	0.00	12.93	7.66	6.25	8.71	120.00	0.84

Table 6

A Comparison of the Overall Percentage of Errors Allocated to each Emotion in the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)			CT (N=21)			<i>U</i>	<i>p</i>
	M	Mdn	SD	M	Mdn	SD		
Angry	13.72	11.53	8.70	11.97	11.69	5.16	110.00	0.72
Happy	15.73	13.03	10.02	19.25	18.10	9.87	99.00	0.43
Sad	15.21	13.67	8.90	13.66	14.75	6.87	120.00	1.00
Neutral	32.79	30.34	19.63	29.86	32.39	10.34	119.00	0.99
Disgusted	7.15	6.64	3.43	8.46	7.77	4.19	98.00	0.41
Surprised	8.36	8.79	4.95	9.88	7.92	5.78	106.50	0.60
Fearful	7.04	5.47	4.52	6.91	5.94	4.53	104.00	0.55

Anger Intensity

Repeated Measures ANOVA of anger accuracy produced a significant main effect of anger intensity ($F(1,31) = 135.89, p < .0001$). Angry faces were recognized more accurately at high intensity than at low intensity for both the AN and CT participants. There was no significant effect of group ($F(1,31) = .072, p = .79$), and intensity did not interact with group ($F(1,31) = .63, p = .43$), indicating that accuracy for the two groups was similar at both high and low intensities of

anger. Means and standard deviations for anger accuracy, at high and low intensity levels, by the AN and CT groups are presented in Table 7

Table 7

Recognition Accuracy (%) for Anger at High and Low Intensities in the Anorexia Nervosa (AN) and Constitutionally Thin (CT) Groups

	AN (N=12)		CT (N=21)	
	M	SD	M	SD
High Intensity	17.13	11.34	17.86	13.09
Low Intensity	51.25	19.44	47.62	20.47

Discussion

Summary of Findings

The present study compared the performance of women with anorexia nervosa to that of women who are constitutionally thin, on the Facial Expression Recognition Task (FERT), an established computerized test of facial emotion recognition.

In terms of accuracy, results showed no significant differences between the AN and CT groups on either overall accuracy, or accuracy for individual emotion categories. With regard to reaction time, the AN group were significantly faster overall at responding to facial emotion stimuli, regardless of emotion. The hypothesis that AN participants would respond significantly faster to angry faces, was not supported. There were no significant differences between the AN and CT participants for reaction time to individual emotion categories.

In relation to misclassifications, results were not consistent with the hypothesis that AN participants would misclassify more neutral faces as angry than CT participants. No significant differences between the two groups were found in the emotions selected when neutral faces were misclassified. Similarly, the prediction that AN participants would misclassify more faces as angry overall compared to CT participants was also not supported. No significant differences between the AN and CT groups were observed in the emotions chosen when participants made an error.

Concerning the effect of intensity on angry face recognition, the hypothesis that AN participants would be more accurate at recognising low-intensity angry faces than CT participants, was not confirmed. All subjects were less accurate at recognising low-intensity

angry faces than they were at recognising high-intensity angry faces and there was no significant difference in accuracy between the two groups at either intensity level.

Comparison to Past Research and Discussion of Relevant Theories

Accuracy.

The finding that AN subjects were not significantly different from controls in overall accuracy of emotion recognition or in accuracy for individual emotion categories, is in line with the results of Mendlewicz et al. (2005), Kessler et al. (2006), and Jansch et al. (2009). Drawing on recent neural models of face and emotion perception (Haxby, Hoffman, & Gobbini, 2002; O'Toole, Roark, & Abdi, 2002), Kessler et al suggested that their abovementioned results may be explained by the concept of two independent systems for the recognition of emotions: 1) a basic system, involving pattern recognition and matching of facial patterns with learned categories of emotions; and 2) a wider more complex system that draws on the basic facial emotion system but includes other sources of information (vocal, gesture, gaze, movement) to place the basic emotion information into a social context. Thus social-emotional difficulties in AN may be related to the interpretation and meaning given to others' emotions rather than a recognition deficit as assessed by experimental paradigms such as the FERT (Kessler, Schwarze, Filipic, Traue, & Wietersheim, 2006). Similarly, Ochsner's comprehensive model of socio-emotional functioning (Ochsner, 2008), which has previously been applied to AN (Oldershaw, Hambrook, Stahl, et al., 2010), differentiates high level mental state inference from the recognition of social-affective stimuli (e.g. faces) . High-level mental state inference refers to consideration of contextual/situational information in understanding the meaning of social stimuli and includes constructs such as mentalizing (Fonagy, Gergely, Jurist, & Target, 2002) and affective theory of mind (Shamay-Tsoory et al., 2007). Studies examining similar constructs in people with AN

suggest that these individuals have difficulty inferring cognitive and emotional states for both themselves and others (Oldershaw, Hambrook, Stahl, et al., 2010). This in itself could contribute to interpersonal difficulties, whether or not it is accompanied by a deficit in the recognition of facial emotion.

Other studies have found significant deficits in either overall accuracy (Kucharska-Pietura, et al., 2004; Pollatos, et al., 2008), accuracy for specific emotion categories (Jones, et al., 2008; Kucharska-Pietura, et al., 2004; Pollatos, et al., 2008), or both (Kucharska-Pietura, et al., 2004; Pollatos, et al., 2008), in participants with EDs compared to controls. It could be that the lenient weight criterion (BMI <19) used to diagnose AN in the present study contributed to the non-significant findings. As discussed in the introduction, research has shown that starvation results in emotional, social and personality changes, and that these changes are reversed upon refeeding (Keys, 1950; Keys, et al., 1950). While AN subjects in the current study were low in body weight (mean BMI = 18.26), it is possible that their weight was not low enough for emotion recognition to be affected. Other studies examining emotion recognition in AN have reported BMI in the range of 15.2-16.3 for their AN participants. However, it is noteworthy that studies have also reported emotion recognition deficits in individuals with 'sub-threshold' eating disorders and BMIs in the healthy range (Jones, et al., 2008; Ridout, et al., 2010). Furthermore, it has also been found that even intermittent dieting, without long-term weight-loss can lead to affective symptoms similar to those observed in individuals with eating disorders (Laessle, Platte, Schweiger, & Pirke, 1996). Consequently, it is unlikely that the higher BMI of the AN participants in the current study could account for the present findings.

Reaction time

Faster reaction time to emotional faces in AN subjects, compared with control subjects, has not been reported before. Past studies examining reaction time in relation to facial emotion stimuli have either found no difference between AN subjects and control subjects in their response time to facial emotion stimuli (Jones, et al., 2008; Kessler, Schwarze, Filipic, Traue, & von Wietersheim, 2006), or have reported slower overall reaction time in AN subjects, compared with controls (Jänsch, et al., 2009). Interestingly, in the study of Jänsch and colleagues there was some indication that reaction time was slower in participants that were taking centrally acting medication, and this may have contributed to the overall slower reaction in the AN group in comparison with the CT group. It is possible that the unmedicated participants in Jänsch et al.'s research displayed reaction times that were similar to AN participants in the current study, although this cannot be confirmed. Concerning the results of the other abovementioned studies, Kessler et al. did not report the medication status of their AN participants so it is not known if medication contributed to their non-significant findings, while Jones et al. excluded subjects who were taking centrally acting medication, and consequently their results cannot be attributed to the influence of medication.

Faster reaction time in AN individuals is surprising given reports of cognitive disturbances such as impaired attention, long term memory and working memory in AN (Laessle, Krieg, Fichter, & Pirke, 1989; Seed, McCue, Wesnes, Dahabra, & Young, 2002; Szmukler et al., 1992). The current finding also cannot be explained by a speed accuracy trade off, as AN participants performed comparably to control participants with respect to accuracy. Of relevance, some neuropsychological studies of AN subjects have found that people with AN perform well on 'effortful' tasks that require high cognitive effort and 'direct' the participant to

the information that will be tested, compared to tasks involving incidental or non-conscious learning (Galderisi et al., 2003; Southgate, Tchanturia, & Treasure, 2008; Strupp, Weingartner, Kaye, & Gwirtsman, 1986). This finding has been explained in terms of high arousal levels in AN subjects and associated attentional focusing (Braun & Chouinard, 1992; Strupp, et al., 1986). Heightened arousal (due to anxiety and preoccupations concerning food and body weight), is purported to narrow attentional focus and promote a focused processing style that allows AN subjects to perform well on effortful tasks. However, high levels of arousal may also reduce overall cognitive capacity, meaning any additional or non-conscious processing is impaired (Lauer, 2003). Similarly, researchers have also noted the distinct cognitive style of AN subjects, who appear to display a preference for local rather than global processing of information (Gillberg, Gillberg, Råstam, & Johansson, 1996; Gillberg, Råstam, Wentz, & Gillberg, 2007; Southgate, et al., 2008; Tokley & Kemps, 2007).

With respect to the FERT, it is possible this task could be approached in a way that would benefit a focused processing style, for example, scanning the face for distinctive features of each emotion (e.g., smile for happiness, wrinkled nose for disgust, raised eyebrows for surprise) rather than processing the face as a whole. This may lead to faster emotion recognition, although one would expect that it might also lead to increased accuracy, which was not the case in the current study.

Neuropsychological research has also suggested that there may be an interaction between task demands (e.g. emphasis on speed vs. accuracy) and the perfectionistic, compliant, and rule bound nature of people with AN (Southgate, Tchanturia, & Treasure, 2006). In the current study, it is possible that even though speed and accuracy were equally emphasised, AN subjects

perceived speed to be a more important factor than accuracy and performed accordingly, although again it is curious that this did not result in a significant decrease in accuracy.

Anger.

The results of the analyses examining reaction time, misclassifications and intensity did not support any of the hypotheses concerning anger. This is noteworthy considering the large number of studies implicating anger as a salient emotion in AN, and research that indicated that misclassification of faces as angry may be a feature of individuals with high levels of eating disorder symptoms. One possible explanation for this discrepancy is that anger could be associated with more internal than interpersonal threat for people with AN. Most research examining the relevance of anger for individuals with AN has focused on the intrapersonal aspects of anger, such as anger suppression and negative emotional schemas regarding the danger of expressing anger (Geller, et al., 2000; Ioannou & Fox, 2009; Waller, et al., 2003). Few studies have examined individuals with AN's perspectives on other people's anger and what this means for them. Thus interpersonal aspects of anger in AN are understudied. Even if anger is a salient emotion in the interpersonal relationships of individuals with AN, it could be that as discussed previously, any difficulties might lie further down the line in social-affective processing, in understanding and reacting to others' anger rather than at the level of recognition.

Limitations of the Current Study

Although this study improved upon some of the methodological issues of previous research in this area by considering the effects of depression and anxiety in the data-analysis, excluding participants on medication, and examining a wider range of outcome measures, it was not without its limitations. One limitation of the present study was the modest size of the AN

sample (n=12). While the intention of the study was to recruit a larger group of individuals with AN, this proved difficult, especially given the requirement that participants be free from medication. Difficulty in recruiting AN subjects has been reported in the literature before (Agras et al., 2004; McIntosh, et al., 2005), and may stem from the low base rate of the disorder and the ego-syntonic nature of its symptoms. A larger sample size would give more power to be able to detect any between-group differences, and it may well be that some analyses in the current study did not reach significance due to low power. For example, it was surprising that the emotion by group interaction for accuracy was non-significant as visual inspection of the means indicated that the AN group were markedly less accurate in fear recognition. It is possible that the small sample size in conjunction with the large number of variables in the repeated measures analysis contributed to the non-significant result. As discussed in the introduction, a difference in fear recognition between the AN and CT subjects would make theoretical sense in relation to purported serotonin dysregulation in AN and serotonergic modulation of the processing of fearful facial expressions (Harmer, et al., 2003a).

Similarly, the heterogeneity of the AN sample was also a limitation. The AN group consisted of women with both binge-purge and restricting anorexia nervosa, and as discussed in the introduction, there is evidence that these variants of AN may be qualitatively different from one another. Unfortunately, the sample size of the present study did not allow for comparison between participants with restricting and binge-purge subtypes of AN, and examining both groups together could have obscured any significant emotion recognition deficits present in either group.

There are also some limitations of using the FERT to assess emotion recognition. Consistent with prior research investigating emotion recognition in AN, the FERT uses posed or

simulated expressions of emotions. However, posed and genuine facial expressions of emotion differ in a number of ways. Posed or simulated expressions are more asymmetric than those associated with a genuine emotions (Ekman, 1985), are characterized by less regular timing of muscle contractions (Hess, Kappas, McHugo, Kleck, & Lanzetta, 1989), and are exaggerated compared to genuine expressions (Naab & Russell, 2007; Tcherkassof, Bollon, Dubois, Pansu, & Adam, 2007). Furthermore, research has shown that perceivers are sensitive to the difference between posed and genuine expressions of affect (Frank, Ekman, & Friesen, 1993; Scherer & Ceschi, 2000) and respond differentially to them (Peace, Miles, & Johnston, 2006). This means that any findings regarding the accuracy of individuals at recognising posed expressions of emotion cannot necessarily be generalized to genuine naturally occurring expressions.

The FERT also utilizes morphing techniques to create a range of intensities for each emotion. This is achieved by computer software that combines in various proportions, the features of a neutral face and the ‘full’ emotion depicted by the target individual. In this way, a series of intermediate expressions are created. It has been noted that these intermediates may not exist as facial expressions in everyday life, and don’t necessary correspond to the way individuals actually display varying intensities of facial emotion (Adolphs, 2002).

Implications and Directions for Future Research

The current study is in line with others that have suggested that the social difficulties and alexithymia observed in AN are independent of basic facial emotion recognition, at least as assessed by the FERT and similar tasks (Kessler, Schwarze, Filipic, Traue, & von Wietersheim, 2006; Mendlewicz, et al., 2005). This implies that individuals with AN would not benefit from interventions that focus on teaching them to recognise others’ emotions at a basic level, as has been suggested by some researchers (Jones, et al.). However, all studies examining basic

emotion recognition in AN, including the present study, have suffered from methodological limitations related to ecological validity of stimuli. Consequently, a logical next step in research would be to examine emotion recognition in AN using stimuli consisting of genuine emotional expressions. Prior research has found that some groups of individual with social difficulties, such as children with autistic spectrum disorder, can recognise posed expressions of emotion, yet cannot differentiate between posed and genuine expressions (Blampied, 2008). This might also be the case for people with AN, and could contribute to some of the social difficulties experienced by these individuals. Future research should also focus on examining emotion recognition and similar skills under conditions and in contexts that more closely resemble those encountered in everyday life. For example, research has found that abused children are more likely to label ambiguous emotional expressions as “angry” when the expressions are produced by their own mother rather than a stranger (Shackman & Pollak, 2005). It may be that the proposed difficulties of AN subjects in emotion recognition are influenced by dispositional, situational, or emotional motivations that are not evoked by laboratory tasks. Similarly, in everyday, life facial expressions are highly dynamic and fleeting, and convey social signals through complex action patterns rather than static displays (Tcherkassof, et al., 2007). Differences in social information specified by static and dynamic expressions may be associated with distinct effects on facial emotion recognition. To date, only one study examining facial emotion processing in individuals with eating disorders has used dynamic emotional stimuli rather than the traditional static images (Ridout, et al., 2010), and this is certainly an area for further development. An additional challenge for future research is to examine differences between AN subtypes. Distinct patterns of emotional difficulties across restricting and binge-

purge variants of AN have the potential to inform the development of new therapeutic methods relating to emotional processing.

Summary and Conclusion

The results of the present study showed that individuals with AN were no different from healthy constitutionally thin women in their accuracy at recognising facial expressions of emotion, although they were faster to respond to facial emotion stimuli. However, both the present study and other research examining facial emotion recognition in EDs have been hampered by methodological inconsistencies and limitations relating to the ecological validity of stimuli. Therefore, future research in this area needs to move beyond experimental paradigms featuring posed expressions and static images, and develop new ecologically valid methods of assessing facial emotion recognition. A greater understanding of the types of social and affective difficulties experienced by individuals with AN has the potential to lead to new and innovative treatments.

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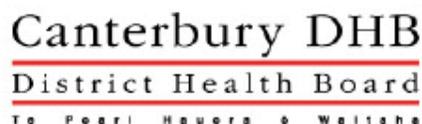
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Appendix B: Study Information Sheet



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Eating and Wellbeing in Women of Low Weight Study

Information Sheet

Introduction

You are invited to take part in a study of eating and wellbeing being conducted by Kathryn Taylor Virginia McIntosh, Jenny Jordan, Janet Carter, Andrea Bartram, Sarah Rowe, Julia Martin, Peter Joyce and Karin Muir. The major focus of the Eating and Wellbeing Study is to investigate nutritional, endocrine, cognitive and psychological functioning in women volunteers of low weight. This study is a companion study to the Binge Eating Psychotherapy Study which is a therapy trial designed to compare the effectiveness of three psychotherapies (talking therapies) for binge eating problems or bulimia nervosa.

You will be part of a group of adult women of low weight who will carry out a series of similar assessments to the women with binge eating problems who are participating in the Binge Eating Psychotherapy Study. We will be comparing the results of the two groups' blood samples (particularly levels of hormones related to nutritional status), cognitive task results, self-report questionnaires and interview information.

More about this study

What are the aims of this study? The purpose of this study is to learn more about the similarities and differences between women with and without binge eating problems. A binge is eating a large amount of food in a short time and feeling out of control while doing so. In particular we will compare hormones levels (including insulin, glucagon, cholecystokinin, leptin and ghrelin) that are potentially related to the regulation of appetite and satiety, as well as cognitive, psychological and personality functioning. Some of these hormones are measured from a small sample of stored blood. With your permission, we may contact you regarding the use of this stored blood sample for additional future study.

Who can participate in this study? Any adult woman (over 16 years old) with a body mass index (weight (kgs)/height (m)²) of between 15 and 18 may participate in this study. Women who may currently have an eating disorder or have a history of an eating disorder can participate in this study. If you are on certain medications you may not be able to take part.

How many participants will be involved? We hope to study 50 women who do not have binge eating problems and around 200 with binge eating disorders.

Where will the study be held? This study will be held in the Clinical Research Unit, Terrace House, near Christchurch Hospital, Cnr. Antigua Street & Oxford Terrace. The Clinical Research Unit is jointly funded by the Canterbury District Health Board (CDHB) and the University of Otago's Christchurch School of Medicine and Health Sciences.

What is the time span for the study? The assessments for this study will occur between 8.30 and 5.00pm on a single day.

What will happen during the study?

If you are interested in taking part in this study a Research Assistant will first ask you some screening questions over the telephone to see if you are eligible to take part, and to give you detailed information

about the study. If you are eligible to take part in the study and you wish to do so, the researcher will obtain your written consent to participate in the study. After you have given consent to participate we will ask you to do some self-monitoring and organize the assessment day with you. These are explained in more detail below:

1) Self-monitoring task. We will ask you to record your eating for three days prior to the assessment day.

2) Assessment day (8.30am-5.00pm)

a) Neuroendocrine assessment. The neuroendocrine assessment examines aspects of your body's hormones (including insulin, glucagon, cholecystokinin, leptin and ghrelin) that are potentially related to the regulation of appetite and satiety. This assessment will involve coming to the clinical research unit at Terrace House at 8.30am, without having eaten breakfast. During this assessment we will take a series of blood samples while you will be resting comfortably with a needle inserted in a vein. After the first blood sample you will be given a glucose drink, to be drunk within a 5 minute period. We are also interested in your report of hunger, fullness, mood over this time and will ask you to complete self-report questionnaires about eating attitudes, current relationships, and aspects of your childhood and personality during this time. We will be taking about half as much blood as if you have had donated blood and your body will replace this very quickly. The blood sampling will finish at 12.30pm

b) Lunch break. There will be a half an hour lunch break (we will provide a light lunch).

c) Cognitive tasks. We will then ask you to do some cognitive tasks (planning, thinking and memory) on the computer. Most of these will involve trying to remember various patterns that have been shown to you on a computer screen, or finding where certain patterns are hidden on the screen. Other tasks will involve listening to information that is read to you, then recalling it after a time delay. The tasks take approximately 90 minutes - 2 hours.

e) Interview. Following a short break, you will be asked some questions regarding demographic information and the presence or absence of psychiatric disorders (This takes approximately 90 minutes).

Will my GP know I am in the study? If you would like your blood test results sent to your GP we will forward this on

What if I have an eating disorder? If you have an eating disorder such as anorexia nervosa or bulimia nervosa we will give you some information about how to access appropriate treatment and support. It is your decision what steps you may wish to take from there. If you would like this information sent to your GP we would also forward this on.

Risks and Benefits

What are the risks of participation?

Blood tests can sometimes cause minor discomfort and bruising around the area where the needle is inserted.

What are the benefits of participation?

We hope that this study will increase our understanding of the relationship between binge eating and different levels of nutrition-related hormones, and the relationship of these factors to cognitive function, personality and general psychological functioning in women with binge eating disorders and those with no eating disorders.

Reimbursement for time and expenses

In view of the time commitment involved in the assessments (approximately 7.5 hours in total for the baseline assessments, as well as the time taken to do the self-monitoring), we will also offer a payment

of \$100.00. If you are in receipt of a benefit from Work and Income New Zealand, this payment may result in a reduction of your benefit payment. You should contact Work and Income New Zealand to clarify whether your benefit will be affected by receiving payment for your participation in this research before you consent to participate. If you prefer, we can offer a \$100.00 gift voucher for Westfield Mall.

Participation

- Your participation in this study is entirely voluntary (your choice).
- You do not have to answer all questions and you may stop an interview or assessment at any time.
- If you agree to take part, you are free to withdraw from this study at any time, for any reason.
- You may bring a friend, family or whanau support to hear about the study, including the risk and/or benefits and any other explanations you require.

Disposal of blood samples

After the study is concluded, blood samples will be disposed of. There are two methods of disposal and participants may choose to have their remaining samples disposed of using standard disposal methods (disposal in accordance with NZS 4304:2002 'Healthcare Waste Management') or if preferred, disposed of with appropriate karakia, at the end of the study.

Confidentiality

We will take all precautions to maintain confidentiality. All forms and computer files will be marked with numbers only, not names. No material that could personally identify you will be used in any reports based on this study. The data from this study will be available only to the study investigators. All data will be stored in secure areas.

Results

How can I obtain results of this research? When this study is over, you may have a summary of the key results. Detailed results will be published in international scientific journals.

Compensation

In the unlikely event of a physical injury as a result of your participation in this study, you may be covered by ACC under the Injury Prevention, Rehabilitation and Compensation Act. ACC cover is not automatic and your case will need to be assessed by ACC according to the provisions of the 2002 Injury Prevention Rehabilitation and Compensation Act. If your claim is accepted by ACC, you still might not receive any compensation. This depends on a number of factors such as whether you are an earner or non-earner. ACC usually provides only partial reimbursement of costs and expenses and there may be no lump sum compensation payable. There is no cover for mental injury unless it is a result of physical injury. If you have ACC cover, generally this will affect your right to sue the investigators.

If you have any questions about ACC, contact your nearest ACC office or the investigator.

This study has received ethical approval from the Upper South A Regional Ethics Committee.

Where can I get more information about the study? Kathryn Taylor may be contacted by telephone or by letter: "Eating and Wellbeing Study", Clinical Research Unit, University Department of Psychological Medicine, Terrace House, 4 Oxford Terrace, Christchurch, 8140. Ph. 372 0400.

Appendix C: Study Consent Form



Canterbury DHB
District Health Board
Te Pori Hauora o Waitaha

The Christchurch School of Medicine & Health Sciences

DEPARTMENT OF PSYCHOLOGICAL MEDICINE

Clinical Research Unit
Terrace House
4 Oxford Tce
Christchurch

Telephone (03) 372 0400

Fax (03) 372 0407

Eating and Wellbeing in Women of Low Weight Study

You are invited to take part in a study of eating and wellbeing being conducted by Kathryn Taylor, Virginia McIntosh, Janet Carter, Jenny Jordan, Andrea Bartram, Sarah Rowe, Julia Martin, Peter Joyce and Karin Muir. The purpose of this study is to learn more about nutritional, endocrine, cognitive and psychological functioning in women volunteers of low weight.

I have read and I understand the information sheet dated 22nd July 2008 for those taking part in this study.

I have been given the opportunity to discuss this study. I am satisfied with the answers I have been given.

I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time.

I understand that my participation in this study is confidential and that no material that could identify me will be used in any report on this study.

I understand the compensation provisions for this study.

I have had time to consider whether to take part.

I know whom to contact if I have any questions about this study.

I consent to the researchers storing a specimen of my blood (or other tissue) for its later use as a part of this study or other research approved by the Regional Ethics Committee. YES/NO

I consent to any remaining samples being disposed of using standard disposal methods at the end of the study. YES/NO

I consent to being recontacted regarding the use of my stored blood for any additional study. YES/NO

I wish to have any remaining samples disposed of with appropriate karakia at the end of the study. YES/NO

I wish to receive a copy of the results of this study. YES / NO

I understand there will be a significant delay between the information I provide and receiving the results.

I agree to my GP being informed of my participation in this study YES / NO

GP's name _____ Address _____

I would be willing to be contacted to discuss participation in future research in this area YES / NO

I _____ (print full name) hereby consent to take part in this study.

Date: _____ Phone number: _____

Signature: _____

Project explained by: _____ Role: _____

Signature: _____ Date: _____

Appendix D: Ethical Approval**Upper South A Regional Ethics Committee**

Ministry of Health
4th Floor, 250 Oxford Tce
PO Box 3877
Christchurch
Phone (03) 372 3037
Fax (03) 372 1015

Email: uppersouth_ethicscommittee@moh.govt.nz

25 July 2008

Kathryn Taylor
Department of Psychological Medicine
Christchurch School of Medicine & Health Sciences
P O Box 4345
Christchurch

Dear Kathryn Taylor,

Ethics Ref: CTB/04/08/139
Enhancing Psychotherapy for Bulimia Nervosa and Binge Eating Disorder
Investigators: K Taylor, V McIntosh, J Jordan, J Carter, A Bartram, S Rowe, J Martin, P Joyce

Amendment
Request to recruit additional comparison group – women with low weight
Request for extension

Thank you for your response to the committee's queries. The above amendments are now approved.

The approved documents are the information sheet and consent form dated 22 July 2008.

Ethical approval is extended to 31 July 2009. We look forward to receiving a report from you at that time.

Yours sincerely



Alieke Dierckx
Upper South A Ethics Committee Administrator
Alieke_dierckx@moh.govt.nz



**Health
and
Disability
Ethics
Committees**

Upper South A Regional Ethics Committee

Ministry of Health
4th Floor, 250 Oxford Tce
PO Box 3877
Christchurch
Phone (03) 372 3037
Fax (03) 372 1015

Email: uppersouth_ethicscommittee@moh.govt.nz

8 February 2010

Professor Peter Joyce
Department of Psychological Medicine
Christchurch School of Medicine & Health Sciences
P O Box 4345
Christchurch

Attn: Kathryn Taylor

Dear Professor Joyce,

Enhancing Psychotherapy for Bulimia Nervosa and Binge Eating Disorder
Investigators: G McIntosh, J Carter, J Jordan, J McKenzie, K Taylor, M Kennedy, C Frampton, A Bartram, S Rowe, C Bray, K Light, P Joyce
Ethics ref: CTB/04/08/139

Additional documents

- [Anorexia nervosa poster version 01/02/2010](#)
- [Low weight poster version 29/01/2010](#)

Thank you for submitting the above documents, which have been considered by the Chairperson of the Upper South A Regional Ethics Committee, and approved under delegated authority.

Yours sincerely

Alieke Dierckx
Administrator
Upper South A Ethics Committee
Alieke_dierckx@moh.govt.nz