Emotional Facial Expression Recognition and Emotion Regulation in Undergraduate Students with Disordered Eating

by

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Abstract

It is generally accepted that problematic emotional processing is central in anorexia nervosa. The current study explored emotional processing deficits in a non-clinical, restrictive disordered eating population by investigating emotional facial expression recognition accuracy in terms of basic emotions; level of emotion intensity; and perceptual and attentional processing through eye-tracking. Seventy-seven females were delineated into Average (n=46) and High (n=31) Body Mass Index (BMI) groups. BMI groups were split into high and low restricting groups via the Dieting subscale of the EAT-26. Participants viewed 96 images and were asked to identify the emotion. In restricting groups, results revealed no differences in recognition rates for the Average BMI group. For the High BMI group, results revealed greater recognition accuracy than the low restrictive group, regardless of emotion/intensity. Eye-tracking analyses revealed that the high restricting group spent more time viewing the face, specifically the eye/brow area at low intensities.

Keywords: Disordered eating, emotion, eye-tracking

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Table of Contents

List of Figures

Chapter 1: Introduction

Individuals with disordered eating as well as more severe eating pathology such as anorexia nervosa (AN) have been shown to experience emotional processing deficits, including in the domains of emotional facial expression recognition and emotional regulation (Harrison, Sullivan, Tchanturia, & Treasure, 2010a; Gilboa-Schechtman, Avnon, Zubery, & Jeczmien, 2006; Kucharska-Pietura, Nikolaou, Masiak, & Treasure, 2004; Zonnevylle-Bender et al., 2004). A relationship between both domains has been found within the AN population in that as emotional facial expression recognition deficits increase, so do emotion regulation difficulties (e.g. Harrison et al., 2010a). Although disordered eating symptom severity exists on a continuum, similar emotional processing deficits are thought to underlie these problematic behaviour patterns (Jones et al., 2008). Therefore, it is important to investigate whether this relationship between emotional facial expression recognition and emotional regulation exists among those with sub-threshold ED. Further, little is understood about specific mechanisms underlying the documented deficits in emotional facial expression recognition in those with high levels of non-clinical restrictive disordered eating behaviour in comparison to those with low levels of non-clinical restrictive disordered eating behaviour. As such, the purpose of the current study is to explore attentional processing using eye-tracking technology in order to interpret facial emotion processing via facial scanning patterns. Other factors of emotional facial expression recognition are also investigated in individuals with high restrictive disordered eating vs those with low restrictive disordered eating; namely accuracy differences between basic emotions and levels of emotional intensity.

1.1 Eating Pathology

Non-clinical disordered eating symptoms include cognitions such as fear of gaining weight, and concern or preoccupation with having an ideal weight and shape (Fairburn, Cooper,

& Shafran, 2003; Masuda, Boone, & Timko, 2011; Masuda, Price, Anderson, & Wendell, 2010) as well as maladaptive eating behaviours (Masuda et al., 2011). In adolescence, psychological risk factors such as high levels of body dissatisfaction, and depressive affect, are predictive of disordered eating symptomology (Graber, Brooks-Gunn, Paikoff, & Warren, 1994). Post-secondary students have also been found to have high rates of weight concerns, chronic dieting, body dissatisfaction, poor self-image, and problematic eating behaviours (Heatherton, Mahamedi, Striepe, Field, & Keel, 1997; Killen et al., 1996; Snelling, Schaeffer, & Lehrhoff, 2002; Vohs, Heatherton, & Herrin, 2001). Almost 80% of women diet during their first year at college (Striegel-Moore, Silberstein, Grunberg, & Rodin, 1990), and it has been suggested that college is an environmental risk factor for the development or exacerbation of disordered eating behaviours (Compas, Wagner, Slavin, & Vannatta, 1986).

Disordered eating can progress into clinical pathology (Cooper, Todd, & Wells, 2000; Stice, Mazotti, Krebs, & Martin, 1998). Restrictive behaviours and disordered cognitions such as chronic dieting, preoccupation with caloric intake, and body dissatisfaction are thought to be predisposing factors in the development of Anorexia Nervosa (AN; Gendall, Joyce, Sullivan, & Bulik, 1998; Vitousek & Ewald, 1993). Restrictive behaviours are also criteria for bulimia nervosa, avoidant/restrictive food intake disorder, as well as other specified feeding or eating disorder (including atypical anorexia nervosa; American Psychiatric Association, 2013). However, given that AN is considered the mental illness with the highest mortality rate (Reijonen, Pratt, Patel, & Greydanus, 2003), and much of the literature directly compares subclinical disordered eating to AN, the current study will focus on findings from AN research. In the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), AN is characterized by restricting, binging and/or purging behaviours, and significantly low body weight (American

Psychiatric Association, 2013). AN typically emerges during childhood and adolescence (Grange, 2011). A recent longitudinal study found a lifetime prevalence of 3.6% using DSM-5 criteria (Mustelin, Silén, Raevuori, Hoek, Kaprio, & Keski-Rahkonen, 2016). When compared to individuals with other psychiatric and physical health conditions, ED has marked reduction in quality of life (Jenkins, Rienecke Hoste, Meyer & Blissett, 2011).

1.2 The Role of Emotions in Disordered Eating

Although there are a variety of factors identified in the literature, it is generally accepted that problematic emotional processing is central in both disordered eating and eating disorders (Anestis, Selby, Fink, & Joiner, 2007; Davies, Swan, Schmidt, & Tchanturia, 2012; Fox, & Power, 2009; Gardner, Quinton, & Qualter, 2014; Kanakam, Krug, Raoult, Collier, & Treasure, 2013; Ridout, Thom, & Wallis, 2010). In essence, behaviours such as restrictive or excessive dieting, purging, and preoccupation with caloric intake, function to suppress or alleviate painful or overwhelming emotion (Cooper, Wells, & Todd, 2004; Corstorphine, 2006; Espeset, Gulliksen, Nordbø, Skårderud, & Holte, 2012; Schmidt & Treasure, 2006; Johnson, Stuckey, Lewis, & Schwartz, 1982).

Individuals with restrictive profiles, that is people who binge and/or purge, and have significantly low body weight, are known to experience difficulties in emotion recognition, that is in recognizing and labeling facial emotions expressed both with and without verbal cues (Kucharska-Pietura et al., 2004; Zonnevylle-Bender et al., 2004), and with emotion regulation (Gilboa-Schechtman et al., 2006; Harrison et al., 2010a). They have also been found to experience greater difficulty in facial recognition than people with other eating disorders (Harrison et al., 2010a), therefore, the current study will focus on restrictive disordered eating behaviours.

1.3 Emotion Recognition

In one of the earliest works on human emotion, Darwin (1872) concluded that emotional facial expressions provide integral cues about the motivations and intentions of others and therefore, can be considered fundamental in adaptive social functioning (Ridout, Wallis, Autwal, & Sellis, 2012). The normative population spend minimal cognitive resources to accurately and efficiently process facial expressions of emotion (Tracy & Robins, 2008). It is suggested that there are six basic and universal emotions; anger, disgust, fear, happiness sadness, and surprise (Ekman, 1999). Studies have shown that, of the six basic emotions, the expression of happiness has the highest rate of identification accuracy, followed by the identification of surprise and anger expressions (Beaudry, Roy-Charland, Perron, Cormier, & Tapp, 2014; Calvo, & Nummenmaa, 2009; Tracy & Robins, 2008). The identification of disgust, fear, and sadness have been found to be more difficult to recognize in a normative population (Beaudry, et al., 2014; Izard, 1994; Tracy & Robins, 2008)

1.4 Emotion Recognition and Eye-tracking

A facial feature is considered sufficient for emotion recognition if the information from that single feature is enough to glean an accurate response. Alternatively, if a feature is necessary for emotion recognition, then removal of that feature will result in diminished accuracy. Beaudry and colleagues (2014) identified which features (also known as zone) of the face - eye/brow area, mouth area - are sufficient and which are necessary in identifying basic emotional expressions in normal populations. In experiment one, in order to clarify the role of both facial zones, images of faces were displayed with only the eye/brow or mouth areas visible, and images with the eye/brow or mouth blocked. In experiment two, Beaudry and colleagues (2014) used images in a recognition task using eye-tracking technology, where all facial features were intact. This second experiment allowed exploration of the role of both zones when all information is available, therefore simulating a more naturalistic setting. The summary of results is further evidence of the complexity of visual processes associated with facial emotion recognition. Beaudry et al. (2014) determined that in order to accurately identify happiness, the scanning of the mouth zone was both sufficient and necessary. Furthermore, when all information is available, participants spent more time gazing at this zone than all other emotions. Alternatively to happiness, for accurate identification of sadness, the eye/brow zone was found to be both sufficient and necessary. Furthermore, attention was drawn more quickly and more time was spent gazing at the eye/brow zone, demonstrating the zone's importance in recognizing sadness (Beaudry et al., 2014). For these two basic emotions, results seem to suggest the reliance of featural processing for accurate recognition. However, for the other four basic emotions, patterns of results are not as clear. For instance, for disgust while in experiment one results seem to suggest the featural importance of the mouth with this zone being both necessary and sufficient in correctly identifying this emotion, results from eye-tracking do not show an importance of the mouth when all facial information is available (Beaudry et al., 2014). For surprise and anger, a clear pattern of the importance of either the mouth or eyes/brows was not observed, however, in experiment one, the eye/brow area was found to be necessary for accurate recognition for anger (Beaudry et al., 2014). Finally, for fear, both the mouth and eye/brow zones were necessary for its recognition, however neither area was found to be sufficient (Beaudry et al., 2014), indicating that in recognizing fear participants may be relying more on holistic processing. In addition, for all basic emotions, participants spent more time looking at the eyes/brows than the mouth zones (Beaudry et al., 2014; Sullivan, Ruffman, & Hutton, 2007), demonstrating the importance of this zone in facial emotion recognition, even in happiness that seemed to be relying on the featural processing of the mouth (Beaudry et al., 2014). These findings demonstrate that the role of facial feature zones in emotion recognition processing is complex and varies as a function of the emotion expressed. Moreover, results suggest that neither the featural or holistic account offer satisfactory explanation for the processing of emotional facial expressions.

In experiment two of their investigation of featural processing, Beaudry and colleagues (2014) utilized images of emotional facial expressions that were modified into four expression intensity levels. Results pertaining to intensity level were not discussed. Clinical studies have investigated facial expressions at varying emotional intensities, and found that the greater the intensity that is required to accurately identify an emotion (closer to 100%), the less sensitive to varying emotional expressions the individual is. Moreover, the less sensitive an individual is, the more they will experience difficulty in recognizing subtle emotional expressions (Ridout et al., 2012). Individuals with post-traumatic stress disorder (PTSD) have been found to have poorer sensitivity to facial emotion expressions than healthy controls, requiring higher levels of emotional intensity to accurately label certain expressions (Poljac, Montagne, & de Haan, 2011). The authors suggested that people with PTSD symptoms may have similar hypo-functioning in brain areas necessary for emotional recognition, (i.e. the amygdala) than those with depression (Poljac et al., 2011). Similar emotional sensitivity results were found in individuals with social anxiety disorder (Montagne et al., 2006), and those with clinical depression (Csukly, Czobor, Szily, Takács, & Simon, 2009).

The previously mentioned studies have focused mainly on recognition rate; others have explored the processing of emotional facial expressions in clinical populations. It has been determined that individuals with clinical pathology process emotional faces differently than the normative population. For example, patients with schizophrenia, show abnormal facial scanning patterns, particularly of facial areas necessary for emotion recognition (Mancuso et al., 2015). Individuals with autism spectrum disorder mislabel facial emotion expressions due to only attending to the mouth area of the face and not at the eye/brow area (Gross, 2008).

While eye-tracking has been used among disordered eating and ED populations to analyze attentional biases in body shape and size (eg. Blechert, Ansorge, & Tuschen-Caffier, 2010; Janelle, Hausenblas, Ellis, Coombes, & Duley, 2009; Jansen, Nederkoorn, & Mulkens, 2005; Pinhas et al., 2014), body-related word pairings (Gao et al., 2011), and food vs non-food stimuli (e.g. Giel et al., 2011; Schag et al., 2013), to the best of our knowledge, eye-tracking has not yet been utilized in the literature to assess scanning patterns in a facial emotion expressing recognition task in this population. Studies focusing on body shape and size found that participants in clinical groups experienced attentional avoidance when presented with images of larger, endomorphic bodies; favouring images of thinner bodies (Blechert, 2010; Pinhas et al., 2014). This suggests that individuals with disordered eating pathology avoid threatening or non-idealistic stimuli. However, others found attentional fixation on negative aspects, for example the abdomen area, of other women's and the participants own bodies (Janelle et al., 2009, Jansen et al., 2005). Therefore, a case may be made that individuals with disordered eating pathology may also fixate on negative, aversive aspects. Exploratory investigation of attentive processes for emotional facial expression recognition is included in the current study

1.5 Emotion Recognition and Disordered Eating

Several studies have provided evidence for impairment in recognizing all facial emotions in individuals with AN (Harrison et al., 2010a; Harrison et al., 2010b; Lang et al., 2015; Zonnevylle-Bender et al., 2004), in that those affected exhibit significantly less proficiency than healthy controls in the recognition of any emotion. More specifically, individuals with AN show a bias towards basic negative primary emotions, namely anger, disgust, fear, and sadness. For example, Kucharska-Pietura and colleagues (2004) found significant impairment in the recognition of the negative facial emotions of sadness and fear in individuals with AN versus healthy controls. Harrison and colleagues (2010a), also found differences among participants with AN and controls when identifying anger in a recognition task that provided images of only the eye area of the face. In other studies, participants with AN experienced a high rate of mistakes in identifying sad (Lang et al., 2015) and disgusted (Pollatos, Herbert, Schandry, & Gramann, 2008) facial expressions, as well as deficits in labeling happiness, neutral expressions, anger, and surprise (Jänsch, Harmer, & Cooper, 2009).

There is a paucity of research in facial emotion recognition in non-clinical population research, however, findings have been similar to those within the AN literature. In the few studies available, individuals with high disordered eating symptoms were also found to have an overall facial emotion recognition deficit (Ridout et al., 2010; Ridout et al., 2012; Wallis, Thom, & Ridout, 2008). Consistent with clinical findings, non-clinical disordered eating symptoms are related to decreased proficiency identifying negative emotions. For example, Jones and colleagues (2008), determined that women in the high disordered eating group were less proficient when identifying anger in a computerised facial emotion recognition task, and showed a bias for the interpretation of neutral faces as emotionally negative (angry and sad). Other non-clinical disordered eating studies examining facial emotion recognition, found a deficiency in identifying, in particular, angry (Ridout et al., 2010; Ridout et al., 2012; Wallis et al., 2008), sad (Wallis et al., 2008), and fearful faces (Ridout et al., 2012). It is suggested that these individuals may have a protective mechanism in which they avoid confrontation or other social situations;

therefore they may have a tendency to cognitively avoid processing social signals of anger, sadness or fear (Ridout et al., 2012).

Ridout and colleagues (2012) noted that the majority of the disordered eating facial recognition literature focuses solely on the accuracy of emotion identification. To address this gap, their study further investigated patterns of emotion recognition errors by being the first to analyze four differing emotional facial intensities in their recognition task (50%, 75%, 100%, and 125%) in a non-clinical disordered eating population (Ridout et al., 2012). They found that group differences emerged at the lowest emotion intensity level, suggesting that when compared with individuals with low eating psychopathology, participants with high levels of eating pathology may be less sensitive to subtle facial expressions (Ridout et al., 2012). As this is the first research investigating emotional intensity and emotional facial recognition accuracy in disordered eating, the current study will further explore intensity within this population.

1.6 Emotion Regulation

It has been demonstrated that not only do individuals with AN have emotional processing deficits, but that said deficits are interconnected and possibly mutually inclusive. Harrison, Sullivan, Tchanturia, and Treasure (2009), as well as Harrison and colleagues (2010a) determined that there is a significant negative correlation between emotional recognition accuracy and emotional regulation in individuals with AN versus healthy controls; emotion regulation difficulties increase, accuracy decreases.

Emotion regulation is the processing and moderating of the intensity, duration, and type of emotion experience (Gross, & Thompson, 2007). The two classes of emotion regulation are antecedent-focused; the changing of the internal or external environment that affects whether a given emotion occurs, and response-focused; a process of diminishing or augmenting an emotional response that has been activated (Gross, & John 2003). An individual with optimal emotional regulation has the ability to recognize their evoked emotions and respond to them in a flexible and adaptive manner (Paivio & Pascual-Leone, 2010). Optimal emotion regulation requires a set of strategies learned through socialization and experience that are systematically employed on a day-by-day basis (John, & Gross, 2004). Emotion regulation difficulties, or dysregulation, is characterized by a lack of acceptance of one's emotional responses, difficulties engaging in goal directed behaviour, problematic impulse control, a lack of emotional awareness in oneself and in others, limited access to adaptive regulation strategies, and an overall lack of emotional clarity, or understanding (Gratz & Roemer, 2004). It has been found that those with AN when compared to healthy controls experience difficulties across all six of these dimensions (Harrison et al., 2009; Harrison et al., 2010a)

Individuals with non-clinical disordered eating profiles also experience higher levels of emotion regulation difficulties than those who experience low disordered eating behaviours (Evers, Marijn Stok, & de Ridder, 2010; Lafrance Robinson, Kosmerly, Mansfield-Green, & Lafrance, 2014), suggesting that although the severity may be on a continuum, similar emotional processing deficits underlie the problematic behaviour patterns (Jones et al., 2008).

1.7 The Current Study

The current study seeks to clarify emotional processing deficits in a restrictive non-clinical disordered eating population by investigating emotional facial expression recognition accuracy in terms of: a) basic emotion; b) intensity of emotion; c) facial feature scanning; and d) emotional dysregulation. The primary objective is to determine differences in accurately identifying the six basic emotional facial expressions between the high disordered eating group and the low disordered eating group. Based on previous work conducted with clinical and non-clinical populations (Harrison et al., 2010a; Harrison et al., 2010b; Ridout et al., 2010; Ridout et al., 2012; Wallis et al., 2008), it was predicted that participants with high levels of restrictive disordered eating will exhibit a deficit in recognizing negative emotions of anger, sadness, disgust, and fear compared to the low disordered eating group. It is predicted that the current study's sample will have similar patterns of emotional processing deficits that were found in previous research.

In order to further investigate facial emotion recognition sensitivity, the second objective of the current study is to analyze accuracy in expression identification in four different levels of facial emotion intensity 20%, 30%, 50% and 100% as utilized in Beaudry et al. (2014). Consistent with the findings of Ridout et al. (2012), as well as clinical research among PTSD, social anxiety, and depressive populations (Csukly et al., 2009; Montagne et al., 2006; Poljac et al., 2011), it was predicted that facial recognition deficits would be found in the lower levels of emotional intensity (20% and 30%) in the high restrictive disordered eating group compared to the low disordered eating group. It is anticipated that the sample will have similar hypofunctioning in neurological areas sensitive to subtle emotional faces.

Full face stimuli were successfully utilized in non-clinical, disordered eating facial recognition tasks (Jones et al., 2008; Ridout, et al., 2012) and in experiment two of Beaudry et al., 2014; therefore, the current study utilized images of the entire face from the *Japanese and Caucasian Facial Expressions of Emotion* (JACFEE; Matsumoto & Ekman, 1989). This differs from several clinical studies that displayed solely the eye area of the face, for example, Harrison et al. (2009), and Harrison et al. (2010a). By using full face stimuli, the current study was able to address the gap in eye-tracking ED research; the third objective is to determine whether during a facial emotion recognition task, differences in scanning patterns towards areas of the face would emerge between high disordered eating and low disordered eating groups. It was predicted that individuals with high levels of restrictive disordered eating would avoid, or have shorter duration of time spent in the facial zones necessary for accurate identification of negative emotions, than those with low levels of disordered eating. This is in line with studies focusing on body shape and size that found attentional avoidance (Blechert, 2010; Pinhas et al., 2014), as well as those suggesting other patterns of avoidance, namely negative emotions (Ridout et al., 2010; Ridout et al., 2012; Wallis et al., 2008).

Finally, In order to determine whether it was possible to extend the findings of Harrison and colleagues' work (2009; 2010a) using a non-clinical population, the current study's fourth objective was to determine whether university students with high levels of restrictive disordered eating experience greater emotional regulation difficulties than those with low levels of disordered eating and whether an association exists between emotion regulation difficulties and facial emotion recognition accuracy in a restricting non-clinical population.

Chapter 2: Method

2.1 Participants

The current study included 77 female undergraduate students. Body Mass Index (BMI) was calculated and in order to be comparable to other samples within this research area, participants with a BMI of below 18 (n = 5) were removed as it may be an indication of undiagnosed AN. There were no age restrictions; the age range was 18-63 (M_{age} = 21.79, *SD* = 6.85). Participants were recruited from undergraduate psychology classes, with permission from the class instructor, following the delivery of a recruitment script.

2.2 Materials

2.2.1 Emotional Facial Expressions**.** The stimuli utilized for the eye-tracking portion of the study were 96 individually presented images of Caucasian emotional facial expressions from the *Japanese and Caucasian Facial Expressions of Emotion* (JACFEE; Matsumoto & Ekman, 1989). The six basic facial emotions of anger, disgust, fear, happiness, sadness, and surprise were represented twice for each gender. The images were modified using the Morpheus 7.0 program (Beaudry et al., 2014). The emotional expressions were altered in order to obtain four levels of varying intensities (20%, 30%, 50% and 100%) for each emotion. The order of images was randomized for each participant.

2.2.2 Questionnaires. Two self-report measures were utilized in the current study.

i. Difficulties in Emotional Regulation Scale (DERS). The DERS developed by Gratz and Roemer (2004), is a 36-item questionnaire that assesses multiple aspects of dysregulation utilizing a 5-point Likert scale. The measure obtains a total dysregulation score, with a possible range of 36-180, as well as six subscale scores. The DERS subscales are as follows: nonacceptance of emotional responses (Nonaccept), difficulties engaging in goal directed behaviour (Goals), impulse control difficulties (Impulse), lack of emotional awareness

(Awareness), limited access to emotion regulation strategies (Strategies), and lack of emotional clarity (Clarity). The DERS total score has been found to have high internal consistency ($\alpha = .93$) as well as significant construct validity when correlated to the Negative Mood Regulation scale (NMR) (Gratz & Roemer, 2004).

ii. The Eating Attitudes Test (EAT-26). The EAT-26 developed by Garner (1982), consists of 26 items measuring the presence of eating symptoms and concerns characteristic of eating disorders. It may also be used for a non-clinical population to assess disordered eating behaviours. The test consists of 22 items utilizing a 6-point Likert scale, and four open-ended questions. The EAT-26 obtains three subscale scores; Dieting, Bulimia and Food Preoccupation, and Oral Control. High internal consistency was found for the EAT-26 ($\alpha = .90$) (Koslowsky, 1992). Acceptable criterion-related validity was also found; the measure significantly predicted group membership between a normative sample and a sample of women with Anorexia Nervosa (Koslowsky, 1992). The current study utilizes the Dieting subscale only.

2.3 Apparatus for Eye Movement Monitoring

Participant eye movements were measured with an SR Research Ltd., EyeLink II system. This system has been found to have high accuracy ($<0.5^{\circ}$) as well as a high sampling rate (500 hz). The participants observed the visual stimuli on a 21-inch VIEW-Sonic CRT monitor. The EyeLink II apparatus includes two cameras (Single Reflex (SR) 520 monocular lens) that allow for simultaneous tracking of both eyes. The current study only tracked the saccades of the eye with the strongest calibration. The cameras are mounted to a padded headband, are fixed below the participants' eyes and measure the position of the eyes on the display screen in two millisecond intervals. The headband should not cause any physical discomfort to the participant. The headband also includes an infrared sensor that tracks the participants' point of gaze and tracks their precise head movements during the experimental session to compensate for head motion. The EyeLink II system uses an Ethernet link between the eye-tracker and the display computer for real-time saccade and gaze-position data transfer.

2.4 Procedure

Participants were tested individually in a private room for a single session lasting approximately 60 minutes. Following consent procedures, the first five minutes of the session were used to apply the apparatus, and to calibrate the eye-tracking system. The participants were seated approximately 60 centimetres from the screen. Each participant was exposed to 96 individually presented images of emotional facial expressions representing the six basic facial emotions of anger, disgust, fear, happiness, sadness, and surprise. Participants were required to verbally identify the emotion expressed and the experimenter marked an emotion checklist for each image. The checklist contained ten emotions from which to choose; anger, disgust, fear, happiness, sadness, surprise, guilt, contempt, shame, and interest. The participants also had the option of indicating an alternative emotion if they felt an image was not represented by the ten emotions provided in an effort to reduce the potential for forced attribution to the ten proposed emotions (Russell, 1993). Each image was presented on the screen one at a time manually by the experimenter. The participant would verbally indicate when they completed recording their response so that the experimenter could display the next image. Once all 96 images were presented, the experimenter took approximately five minutes to remove the eye-tracking apparatus. The participants were then given the self-report questionnaires to complete and were instructed to answer as honestly as possible without spending too long on each item. The order of the self-report questionnaires was randomized for each participant. After the participants completed the questionnaires they were provided with a debriefing form and rewarded with a bonus mark to contribute to their undergraduate psychology class credit.

Chapter 3: Results

3.1 Facial Emotion Recognition Accuracy

Within the entire sample of participants, interactions between high (n = 38) and low (n = 39) EAT-26 Dieting group and emotion, $F(3, 375) = .77$, $p = .57$, EAT-26 Dieting group and intensity, $F(3, 225) = .49$, $p = .69$, and EAT-26 Dieting group, emotion, and intensity, $F(15, 1125) = 1.04$, $p = .41$, were not significant. Due to the number of participants who had a higher than average BMI, there was concern that this may have affected the results; therefore analyses were conducted in order to explore any differences between the BMI groups. Participants were delineated into two BMI categories; Average BMI of 18-24 (n=46, m = 21.78, SD = 1.92), and High BMI of ≥25 (n=31, m = 28.73, SD = 3.30).

3.1.1. Total Sample A mixed-design ANOVA was conducted to examine group differences between the Average BMI and the High BMI groups' facial emotion recognition accuracy as a function of the six basic emotions (anger, disgust, fear, happiness, sadness, surprise) and four levels of intensity (20%, 30%, 50%, 100%). A significant main effect of emotion, $F(5, 375) = 79.31$, $p < .001$, $\eta^2 = .51$, and a significant main effect of intensity, $F(3, 225) = 953.39$, $p < .001$, $\eta^2 = .93$ was found. No significance was found between the BMI groups, $F(1, 75) = 1.76$, $p = .19$. An interaction between emotion and intensity was also found (Figure 1), $F(15, 1125) = 15.85$, $p < .001$, $\eta^2 = .17$. Interactions between BMI group and emotion, $F(5, 375) = .89$, $p = .49$, BMI group and intensity, $F(3, 225) = .55$, $p = .65$, and BMI group, emotion and intensity, $F(15, 1125) = 1.24$, $p = .24$, were not significant.

Simple main effects tests were computed for the interaction between emotion and, intensity, using a Dunn's corrections ($p < .015$), in order to reduce the likelihood of committing type 1 error. For expressions of anger, $F(3, 228) = 165.60$, $p < .001$, $\eta^2 = .69$, disgust, $F(3, 228) = 106.75$, $p < .001$, $\eta^2 = .58$, fear, $F(3, 228) = 155.15$, $p < .001$, $\eta^2 = .67$, happiness $F(3, 228) =$

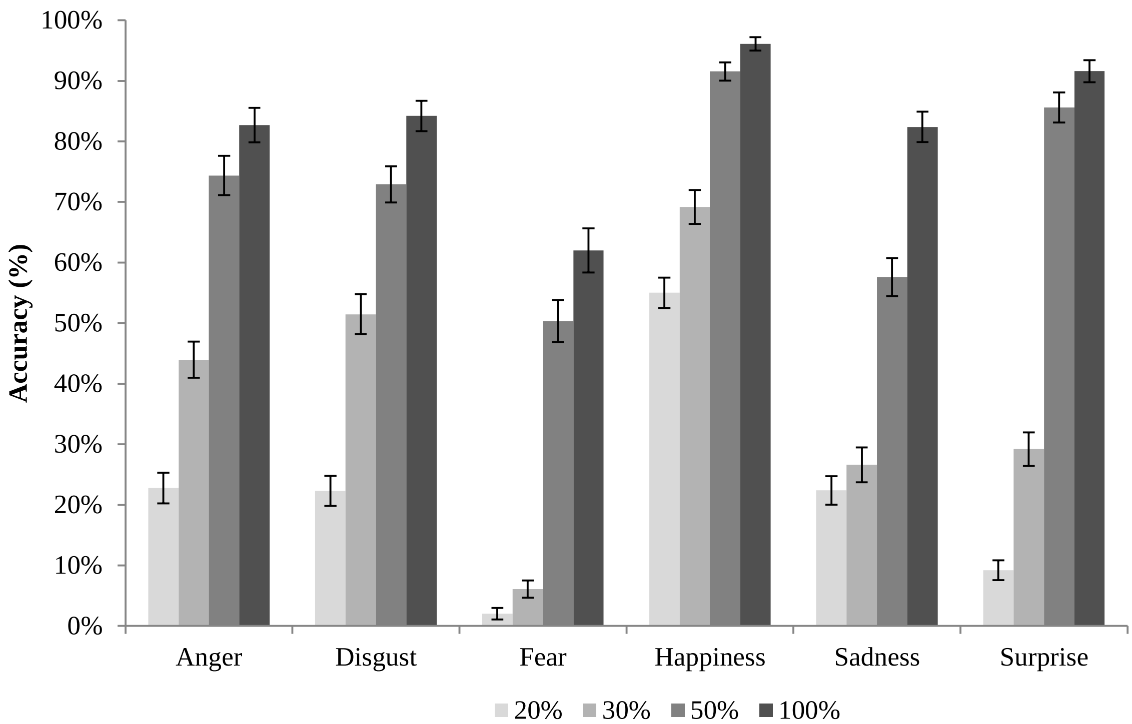

Figure 1. Mean accuracies (%) for the identification of the six basic emotions by intensity for the Total Sample

127.33, $p < .001$, $\eta^2 = .62$, sadness, $F(3, 228) = 171.49$, $p < .001$, $\eta^2 = .69$, and surprise, $F(3, 228) = 459.91$, $p < .001$, $\eta^2 = .86$, results revealed a significant effect of intensity. Post hoc tests (LSD) for all emotions found that all intensities significantly differed from one another in that accuracy significantly increased as intensities increased from 20% to 100%.

In terms of intensity, 20%, $F(5, 380) = 76.89$, $p < .001$, $\eta^2 = .50$, 30%, $F(5, 380) = 64.65$, $p < .001$, $\eta^2 = .54$, 50%, $F(5, 380) = 31.71$, $p < .001$, $\eta^2 = .29$, and 100%, $F(5, 380) = 23.58$, $p < .001$, $\eta^2 = .24$, revealed a significant effects of emotion. For 20%, post hoc tests (LSD) revealed that happiness had significantly greater accuracy than all other emotions. Fear had significantly lower accuracy than all other emotions. Anger, disgust, and sadness did not differ significantly but had higher accuracy than surprise. For 30%, post hoc tests (LSD) found that again, happiness had significantly greatest accuracy than all other emotions and fear had the lowest accuracy. Disgust and anger did not differ significantly but had greater accuracy than fear, sadness and surprise. Sadness and surprise did not differ in terms of accuracy at the 30% level. For 50% intensity, post hoc tests (LSD) revealed that all emotions significantly differed from one another except anger and disgust. From greatest accuracy to lowest the emotions are ordered as follows: happiness, surprise, anger/disgust, sadness, and fear. For 100% intensity, post hoc tests (LSD) found that again happiness had significantly greater accuracy than all emotions, and that fear had significantly lower accuracy than all emotions. Anger, disgust, sadness, and surprise were found to not be significantly different from each other and had significantly less accuracy than surprise.

3.1.2 Average BMI Group Those with an Average BMI were further grouped by high (n = 16) and low (n = 16) EAT-26 Dieting subscale scores. The EAT-26 Dieting scores were divided into three equal groups, the middle of which was removed. Due to the lack of variance within the EAT-26 Dieting scores it was felt to be more appropriate than split-half analysis. A 2 (High vs

Low EAT-26 Dieting group) x 6 (basic emotions) x 4 (level of emotion intensity) mixed-design ANOVA found a significant main effect of emotion, *F(*5, 150) = 47.96,$p < .001$ $\eta^2 = .62$, and a significant main effect of intensity, *F(*3, 90) = 468.38, $p < .001$, $\eta^2 = .94$. No between subjects effect was found for the Average BMI group in terms of facial emotion recognition accuracy, *F(*1, 30) = 1.45, $p = .24$. An interaction between emotion and intensity was also found (Figure 2), *F(*15, 450) = 8.22, $p < .001$, $\eta^2 = .22$. Interactions between EAT-26 Dieting group and emotion, *F*(5, 150) = .82, $p = .53$, EAT-26 Dieting group and intensity, *F*(3, 90) = .98, $p = .41$, and EAT-26 Dieting group, emotion and intensity, *F*(15, 450) = 1.28, $p = .21$, were not significant.

Simple main effects tests were computed for the interaction between emotion and intensity, using a Dunn's corrections ($p < .015$). For expressions of anger, *F(*3, 93) = 83.63, $p < .001$, $\eta^2 = .73$, disgust, *F(*3, 93) = 47.09, $p < .001$, $\eta^2 = .60$, fear, *F(*3, 93) = 48.35, $p < .001$, $\eta^2 = .61$, happiness, *F(*3, 93) = 56.69, $p < .001$, $\eta^2 = .65$, sadness, *F*(3, 93) = 80.66, $p < .001$, $\eta^2 = .72$, and surprise, *F*(3, 93) = 212.98, $p < .001$, $\eta^2 = .87$, results revealed a significant effect of intensity. Post hoc tests (LSD) for anger, disgust, and happiness, all found that all intensities were significantly different from one another, and that accuracy increased for all emotions as intensities increased from 20% to 100%. For fear, post hoc tests (LSD) found that participants' accuracy increased as intensities increased, however, the 20% and 30% intensities and the 50% and the 100% intensities were not significantly different from each other. For sadness and surprise, post hoc tests (LSD) also found that participants' accuracy increased as intensities increased, however the 20% and 30% intensities were not significantly different from each other for sadness, and the 50% and 100% intensities were not significantly different from each other for surprise.

In terms of intensity, 20%, *F*(5,155) = 35.73, $p < .001$, $\eta^2 = .54$, 30%, *F*(5,155) = 35.99,

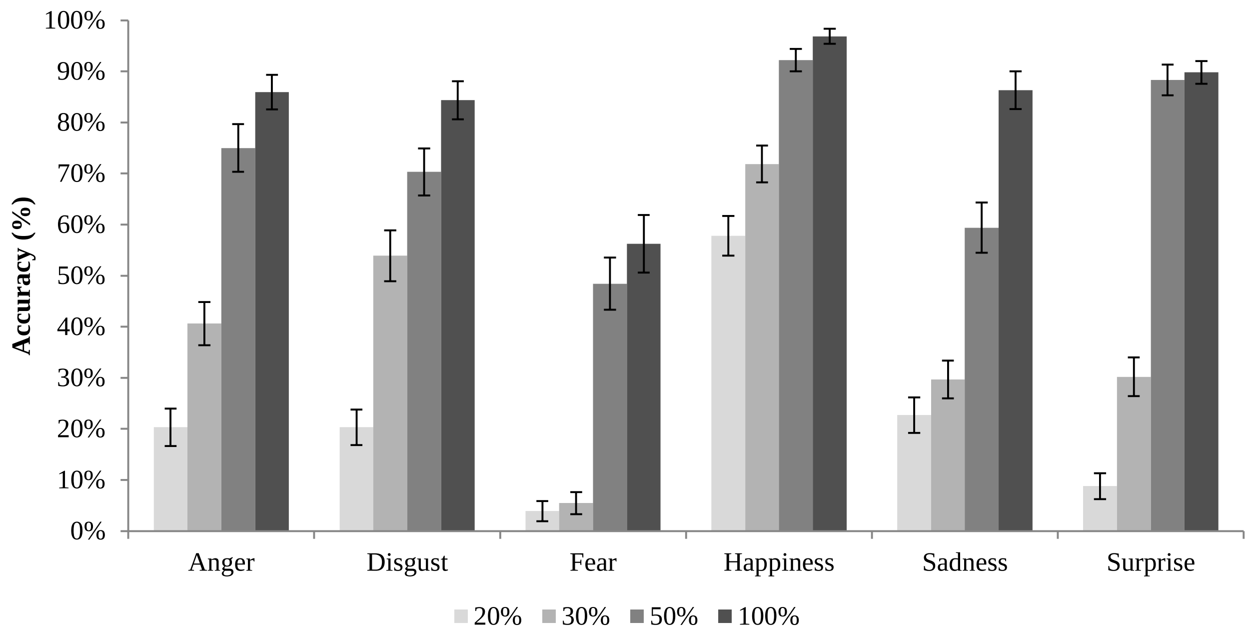

Figure 2. Mean accuracies (%) for the identification of the six basic emotions by intensity for the Average BMI Group

$p < .001$, $\eta^2 = .54$, 50%, $F(5,155) = 15.14$, $p < .001$, $\eta^2 = .33$, and 100%, $F(5,155) = 14.45$, $p < .001$, $\eta^2 = .32$, found significant effects of emotion. For 20%, post hoc tests (LSD) revealed that happiness had significantly greater accuracy than all other emotions. Fear had significantly lower accuracy than all other emotions except did not significantly differ with surprise. Surprise had significantly lower accuracy than anger and sadness. Anger, disgust, and sadness did not differ significantly. For 30%, post hoc tests (LSD) found that again, happiness had significantly greatest accuracy than all other emotions. Disgust had the second highest accuracy and significantly differed from all other emotions. Anger had the next significantly greatest level of accuracy. Fear had the lowest accuracy. Sadness and surprise did not differ significantly. For 50% intensity, post hoc tests (LSD) revealed that happiness had the greatest accuracy than all other emotions with the exception of surprise, and fear had the lowest accuracy than all with the exception of sadness. Surprise had greater accuracy than anger, disgust, and sadness. Anger and disgust did not differ significantly, but had greater accuracy than sadness. For 100% intensity, post hoc tests (LSD) found that happiness had significantly greater accuracy than all emotions, and that fear had significantly lower accuracy than all emotions. Anger, disgust, sadness, and surprise were found to not be significantly different from each other at the 100% level.

3.1.3 High BMI Group The High BMI group was also grouped by high (n=12), and low (n=13) EAT-26 Dieting subscale score; The EAT-26 Dieting scores were divided into three groups, the middle of which was removed. Significant effects were found in a 2 (High vs Low EAT-26 Dieting group) x 6 (basic emotions) x 4 (level of emotion intensity) mixed-design ANOVA. The main effect of emotion, $F(5, 115) = 21.48$, $p < .001$ $\eta^2 = .48$, and the main effect of intensity, $F(3, 69) = 290.96$, $p < .001$, $\eta^2 = .93$ were significant. Also, a between groups difference was found significant; for those in the High BMI group, the High EAT-26 Dieting group was found to have higher facial emotion recognition accuracy rates across all emotions, than the Low EAT-26 Dieting group (Figure 3), $F(1, 25) = 4.34$, $p = .04$, $\eta^2 = .16$. An interaction between emotion and intensity was also found (Figure 4), $F(15, 450) = 7.10$, $p < .001$, $\eta^2 = .24$. Interactions between EAT-26 Dieting group and emotion, $F(5, 115) = 1.41$, $p = .23$, EAT-26 Dieting group and intensity, $F(3, 69) = .97$, $p = .41$, and EAT-26 Dieting group, emotion and intensity, $F(15, 345) = 1.28$, $p = .21$, were not significant.

Simple main effects tests were computed for the interaction between emotion and intensity, using a Dunn's corrections ($p < .015$). For expressions of anger, $F(3, 72) = 44.70$, $p < .001$, $\eta^2 = .65$, disgust, $F(3, 72) = 42.70$, $p < .001$, $\eta^2 = .64$, fear, $F(3, 72) = 69.61$, $p < .001$, $\eta^2 = .74$, happiness, $F(3, 72) = 44.40$, $p < .001$, $\eta^2 = .65$, sadness, $F(3, 72) = 66.12$, $p < .001$, $\eta^2 = .73$, and surprise, $F(3, 72) = 115.34$, $p < .001$, $\eta^2 = .83$, results revealed a significant effect of intensity, Post hoc tests (LSD) for happiness and surprise found that all intensities were significantly different from one another, and that accuracy increased for all emotions as intensities increased from 20% to 100%. For fear and sadness, post hoc tests (LSD) found that participants' accuracy increased as intensities increased; however, the 20% and 30% intensities were not significantly different from each other. For anger and disgust post hoc tests (LSD) also found that participants' accuracy increased as intensities increased, however the 50% and 100% intensities were not significantly different from each other.

For intensity, 20%, $F(5,120) = 29.80$, $p < .001$, $\eta^2 = .55$, 30%, $F(5, 120) = 25.10$, $p < .001$, $\eta^2 = .51$, 50%, $F(5,120) = 9.34$, $p < .001$, $\eta^2 = .28$, and 100%, $F(5,120) = 4.54$, $p < .01$, $\eta^2 = .16$, found significant effects of emotion. For 20%, post hoc tests (LSD) revealed that happiness had significantly greater accuracy than all other emotions. Fear had significantly lower accuracy than all other emotions. Anger, disgust, and sadness did not differ significantly;

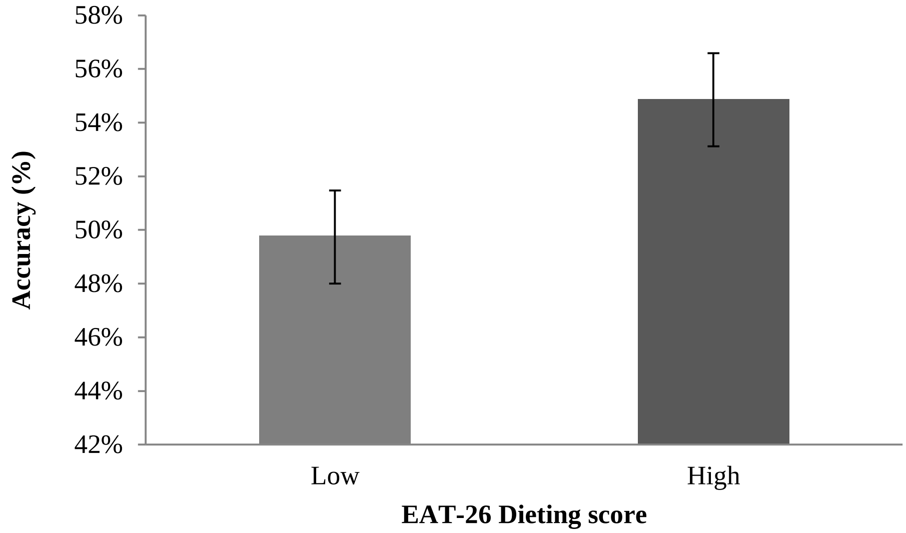

Figure 3. Mean accuracies (%) of Low and High EAT-26 Dieting group for the High BMI Group

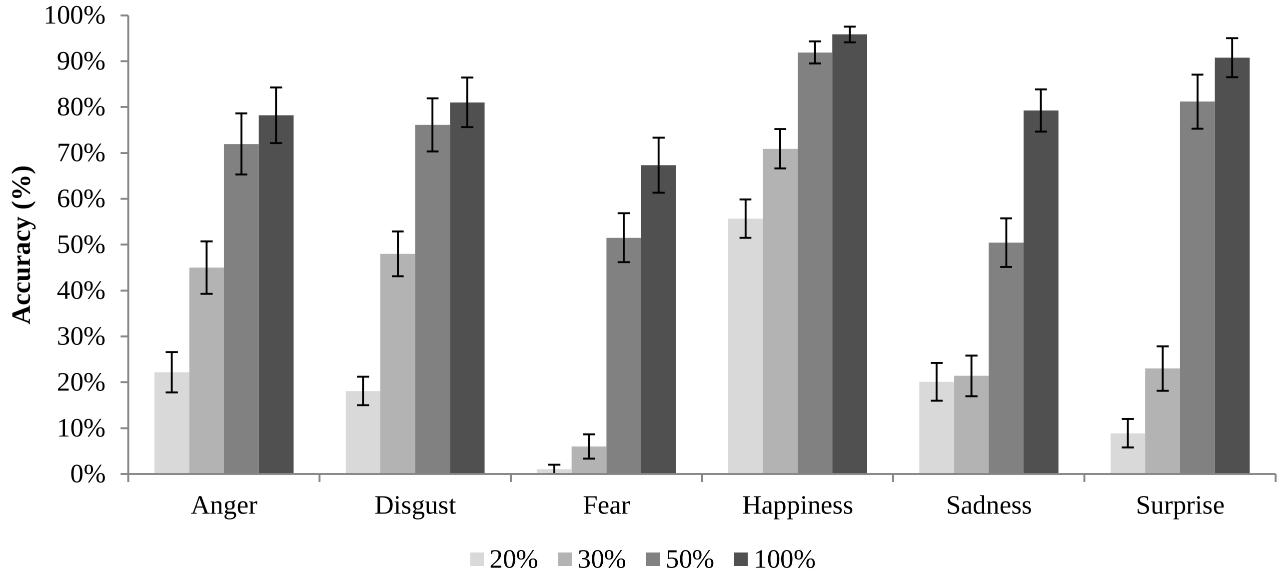

Figure 4. Mean accuracies (%) for the identification of the six basic emotions by intensity for the High BMI Group

however, both had higher accuracy than surprise. For 30%, post hoc tests (LSD) found that again, happiness had significantly greatest accuracy than all other emotions; fear had the lowest accuracy. Anger and disgust did not differ significantly; however had significantly higher accuracy than sadness and surprise which also did not differ significantly. For 50% intensity, post hoc tests (LSD) revealed that happiness had the greatest accuracy than all other emotions with the exception of surprise, and fear had the lowest accuracy than all with the exception of sadness. Surprise, anger and disgust did not differ significantly, but had greater accuracy than sadness. For 100% intensity, post hoc tests (LSD) found that happiness had significantly greater accuracy than all emotions with the exception of surprise. Fear had significantly lower accuracy than disgust and surprise. Anger, disgust, sadness, and surprise were found to not be significantly different from each other.

3.2 Proportion of Viewing Time (Eye-Tracking)

3.2.1 Total Sample A mixed-design ANOVA was conducted to examine group differences between the Average BMI (n = 46), and the High BMI (n = 31), groups' proportion of viewing time as a function of the six basic emotions (anger, disgust, fear, happiness, sadness, surprise), four levels of intensity (20%, 30%, 50%, 100%), and facial zone (eye/brow, mouth). A significant main effect of emotion, $F(5, 375) = 15.05$, $p < .001$, $\eta^2 = .17$, and a significant main effect of zone, $F(1, 75) = 159.24$, $p < .001$, $\eta^2 = .68$ were found. No significant difference was found between the BMI groups, $F(1, 75) = 2.29$, $p = .13$. An interaction between emotion and intensity was also found, $F(15, 1125) = 3.96$, $p < .001$, $\eta^2 = .05$, as well as an interaction between emotion and zone $F(5, 375) = 26.09$, $p < .001$, $\eta^2 = .26$, intensity and zone $F(3, 225) = 3.96$, $p < .001$, $\eta^2 = .19$, and between emotion, intensity, and zone (Figure 5) $F(15, 1125) = 6.74$, $p < .001$, $\eta^2 = .08$. Interactions between emotion and BMI group, $F(5, 375) = .78$, $p = .56$; intensity and

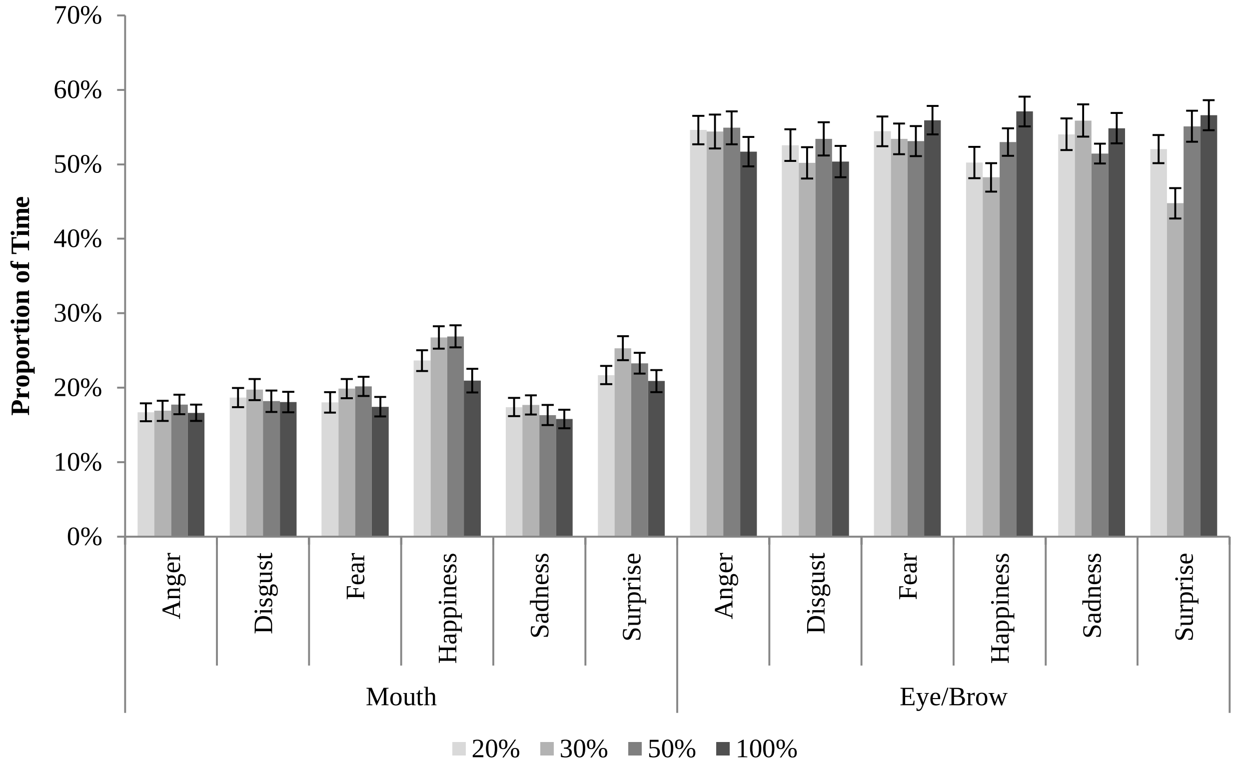

Figure 5. Mean proportions of time for the identification of the six basic emotions by zone and intensity for the total sample

BMI group, $F(3, 225) = .37$, $p = .78$; zone and BMI group, $F(1, 75) = 1.61$, $p = .21$; emotion, intensity, and BMI group, $F(15, 1125) = 1.15$, $p = .31$; emotion, zone, and BMI group, $F(5, 375) = .53$, $p = .75$; intensity, zone, and BMI group, $F(3, 225) = .85$, $p = .47$; and emotion, intensity, zone, and BMI group, $F(15, 1125) = 1.43$, $p = .12$, were not significant.

Simple main effects tests were computed for the interactions found. For the interaction between emotion and intensity, (Dunn's corrections $p < .015$), expressions of happiness, $F(3, 228) = 5.63$, $p < .001$, $\eta^2 = .07$, sadness, $F(3, 228) = 3.68$, $p < .01$, $\eta^2 = .05$ and surprise $F(3, 228) = 9.10$, $p < .001$, $\eta^2 = .11$, revealed a significant effect of intensity. No other expressions were significantly different in terms of intensity, all $F(3, 228) < 2.39$, $p > .07$. Post hoc tests (LSD) for happiness found that 100% and 50% intensities did not differ, however both had greater proportions of viewing time than the other intensities. There were no differences found between 20% and 30%. For sadness post hoc tests (LSD) found that 20% and 30% did not significantly differ, however both had greater viewing times than 50% intensity. 100% was not significantly different than the other intensities. For surprise post hoc tests revealed that the least proportion of time was spent in 30% than all other intensities. 50% had greater proportion of time than 20%. 100% did not significantly differ from 50% and 20%.

In terms of intensity, 50% $F(5, 380) = 16.19$, $p < .001$, $\eta^2 = .17$, and 100% $F(5, 380) = 10.31$, $p < .001$, $\eta^2 = .11$ found significant effects of emotion. No other intensities were significantly different in terms of emotion, all $F(5, 380) < 2.34$, $p > .04$. For 50% intensity, post hoc tests (LSD) revealed that happiness had the greatest proportion of viewing time than all other emotions with the exception of surprise. Surprise had greater proportions of viewing time than all other emotions with the exception of happiness. Sadness has significantly lesser viewing times than all other emotions. Anger, disgust, and fear did not differ significantly. For 100% post hoc tests (LSD) revealed that happiness had greater proportion of viewing time than all other emotions, but did not differ from surprise. Surprise had greater proportion of viewing time than anger, disgust, and sadness. Anger, disgust, and sadness did not differ significantly; however, anger and sadness had lesser viewing times than fear.

For the interaction between emotion and zone (Dunn's corrections $p < .019$), found that for expressions of anger, $F(1, 76) = 202.62$, $p < .001$, $\eta^2 = .72$, disgust, $F(1, 76) = 145.56$, $p < .001$, $\eta^2 = .65$, fear, $F(1, 76) = 192.51$, $p < .001$, $\eta^2 = .72$, happiness, $F(1, 76) = 104.66$, $p < .001$, $\eta^2 = .58$, sadness, $F(1, 76) = 199.70$, $p < .001$, $\eta^2 = .72$, and surprise, $F(1, 76) = 127.58$, $p < .001$, $\eta^2 = .63$, participants spent a higher proportion of time in the eye/brow zone than the mouth zone across all six emotions.

When analyzing zone, both the eyes/brow, $F(5, 380) = 4.10$, $p < .01$, $\eta^2 = .05$, and mouth zone, $F(5, 380) = 54.27$, $p < .001$, $\eta^2 = .42$, found a significant difference found for emotion. For the eye/brow zone, post hoc tests (LSD) found that fear and sadness had significantly greater proportion of time than disgust, happiness, and surprise (all of which did not differ from each other) but were not significantly different than anger. Anger had greater proportion of time than disgust and surprise. Post hoc tests (LSD) for the mouth zone found that happiness had the greatest proportions of time than all other emotions. Surprise had significantly greater proportions of time than all other emotions with the exception of happiness. Fear did not differ from disgust; however, both had significantly greater proportions of time than anger and sadness, which also did not differ.

Results of the simple main effects analyzed for the intensity and zone interaction (Dunn's corrections $p < .025$) found that participants spent a higher proportion of time in the eye/brow zone than the mouth zone across all four intensities: 20%, $F(1, 76) = 171.89$,: $p < .001$, $\eta^2 = .69$;

30%, $F(1, 76) = 130.16$, $p < .001$, $\eta^2 = .63$; 50%, $F(1, 76) = 157.79$, $p < .001$, $\eta^2 = .68$; 100%, $F(1, 76) = 205.55$, $p < .001$, $\eta^2 = .73$.

When analyzing zone, both eyes/brow, $F(3, 228) = 10.14$, $p < .001$, $\eta^2 = 12$, and mouth zone, $F(3, 228) = 14.02$, $p < .001$, $\eta^2 = 16$, found significant differences between intensities. For the eye/brow zone post hoc tests (LSD) found that intensity 30% had the lowest proportion of time than all other intensities. The 20% intensity did not differ from 50%, however was significantly lower than 100% intensity. 50% and 100% did not differ. For the mouth zone post hoc tests (LSD) found that 30% and 50% intensities did not differ significantly; however, both had greater proportions of times than 20% and 100%. 20% intensity had a greater proportion of viewing time than 100% intensity.

3.2.2 Average BMI Group The Average BMI group was further grouped by high (n = 16) and low (n = 16) EAT-26 Dieting subscale score. A 2 (High vs Low EAT-26 Dieting group) x 6 (basic emotions) x 4 (level of emotion intensity) x 2 (zone) mixed-design ANOVA found a significant main effect of emotion, $F(5, 150) = 6.57$, $p < .001$ $\eta^2 = .18$, and a significant main effect of zone, $F(1, 30) = 67.26$, $p < .001$, $\eta^2 = .69$. No between subjects effect was found for the Average BMI group in terms of proportion of viewing time, $F(1, 30) = 2.21$, $p = .14$. An interaction between emotion and intensity was found, $F(15, 450) = 2.40$, $p < .01$, $\eta^2 = .07$, as well as between emotion and zone, $F(5, 150) = 12.27$, $p < .001$, $\eta^2 = .29$, intensity and zone, $F(3, 90) = 6.64$, $p < .001$, $\eta^2 = .18$, emotion, intensity, and zone (Figure 6), $F(15, 450) = 2.81$, $p < .001$, $\eta^2 = .09$. Interactions between emotion and EAT-26 Dieting group, $F(5, 150) = .63$, $p = .68$; intensity and EAT-26 Dieting group, $F(3, 90) = .37$, $p = .78$; zone and EAT-26 Dieting group, $F(1, 30) = .04$, $p = .85$; emotion, intensity, and restrictive eating group, $F(15, 450) = 1.01$, $p = .44$; emotion, zone, and EAT-26 Dieting group, $F(5, 150) = 1.20$, $p = .31$; intensity, zone, and

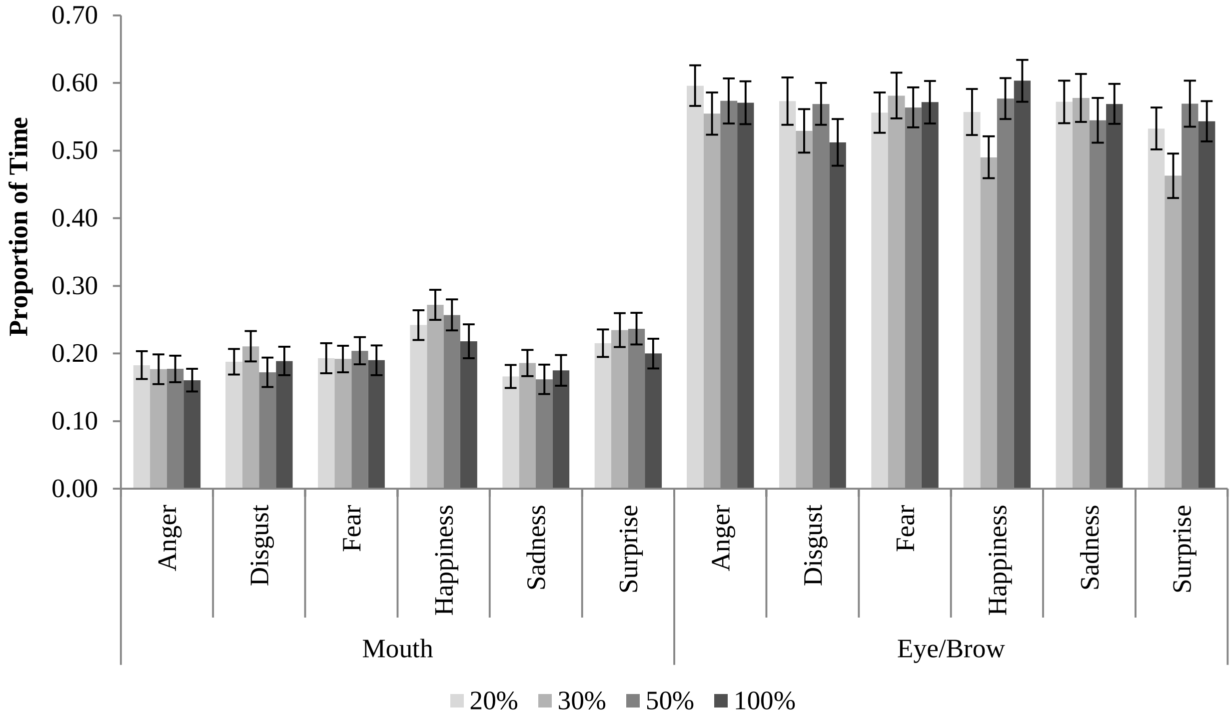

Figure 6. Mean proportions of time for the identification of the six basic emotions by zone and intensity for the Average BMI group

EAT-26 Dieting group, $F(3, 90) = .70$, $p = .56$; and emotion, intensity, zone, and EAT-26 Dieting group, $F(15, 450) = 1.54$, $p = .09$, were not significant.

Simple main effects tests were computed for the interactions found. For the interaction between emotion and intensity, (Dunn's corrections $p < .015$), expressions of happiness, $F(3, 93) = 4.16$, $p < .01$, $\eta^2 = .12$, and surprise, $F(3, 93) = 4.53$, $p < .01$, $\eta^2 = .13$ revealed a significant effect of intensity. No other expressions were significantly different in terms of intensity, all $F(3, 93) < 1.95$, $p > .13$. Post hoc tests (LSD) for happiness found that the 50% and 100% intensities were not significantly different from one another; however, both had greater portions of time than 30%. There were no differences were found between 20% and the other intensities. Post hoc tests (LSD) for surprise found that 50% had greater proportion of time than all other intensities. 20%, 30%, 100% did not significantly differ.

In terms of intensity, 50% $F(5, 155) = 8.06$, $p < .001$, $\eta^2 = .21$, and 100% $F(5, 155) = 4.00$, $p < .01$, $\eta^2 = .11$ found significant effects of emotion. No other intensities were significantly different in terms of emotion, all $F(5, 155) < 1.84$, $p > .11$. For 50% intensity, post hoc tests (LSD) revealed that happiness had the greatest proportion of viewing time than all other emotions with the exception of surprise. Surprise had greater proportions of viewing time than anger, disgust, and sadness. Anger, disgust, and fear did not differ significantly; however fear had greater proportions of viewing time than sadness. For 100% post hoc tests (LSD) revealed that happiness had greater proportion of time than all other emotions. Anger, disgust, fear, sadness, and surprise did not differ significantly.

For the interaction between emotion and zone (Dunn's corrections $p < .019$), found that for expressions of anger, $F(1, 31) = 86.22$, $p < .001$, $\eta^2 = .74$, disgust, $F(1, 31) = 63.34$, $p < .001$, $\eta^2 = .67$, fear, $F(1, 31) = 75.21$, $p < .001$, $\eta^2 = .71$, happiness, $F(1, 31) = 44.72$, $p < .001$, $\eta^2 = .59$, sadness, $F(1, 31) = 81.08$, $p < .001$, $\eta^2 = .72$, and surprise $F(1, 31) = 49.28$, $p < .001$, $\eta^2 = .61$ participants spent a higher proportion of time in the eye/brow zone than the mouth zone across all six emotions.

When analyzing zone, the eyes/brow zone, $F(5, 155) = 3.96$, $p < .01$, $\eta^2 = .11$ and the mouth zone $F(5, 155) = 20.94$, $p < .001$, $\eta^2 = 40$, found a significant difference for emotion. For the eye/brow zone, post hoc tests (LSD) found that surprise had the lowest proportions of time than all emotions, except was not significantly different than disgust. Disgust has greater proportions of time than fear. Anger, disgust, sadness, and happiness did not significantly differ. For the mouth zone, post hoc tests (LSD) found that happiness had the greatest proportion of time than all other emotions. Surprise had significantly greater proportions of time than all emotions with the exception of happiness. Fear had significantly greater proportions of time in the mouth than anger and sadness. Anger and disgust were not significantly different from each other.

Results of the simple main effects analyzed for the intensity and zone interaction (Dunn's corrections $p < .025$) found that participants spent a higher proportion of time in the eye/brow zone than the mouth zone across all four intensities: 20%, $F(1, 31) = 69.81$, $p < .001$, $\eta^2 = .69$; 30%, $F(1, 31) = 51.78$, $p < .001$, $\eta^2 = .63$; 50%, $F(1, 31) = 69.22$, $p < .001$, $\eta^2 = .69$; 100%, $F(1, 31) = 80.18$, $p < .001$, $\eta^2 = .72$.

When analyzing zone, both eyes/brow, $F(3, 93) = 4.57$, $p < .01$, $\eta^2 = 13$, and mouth zone, $F(3, 93) = 5.05$, $p < .01$, $\eta^2 = .14$, found significant differences between intensities. For the eye/brow zone post hoc tests (LSD) found that 30% intensity had significantly lower proportion of time than all other intensities. The 30%, 50%, and100% intensities did not significantly differ. For the mouth zone post hoc tests (LSD) found that participants had greater proportions of viewing times in the 30% than the 20% intensities than the 100% intensity. 20%, 50%, and 50% intensities did not differ significantly in the mouth zone.

3.2.3 High BMI Group The High BMI group was also further grouped via high (n=12), and low (n=13) EAT-26 Dieting subscale score. A mixed-methods ANOVA was conducted to examine group differences between the High EAT-26 Dieting group and Low EAT-26 Dieting group in the High BMI groups' proportion of viewing time as a function of emotion, intensity, and facial zone (eye/brow, mouth). The main effect of emotion, $F(5, 115) = 8.01$, $p < .001$, $\eta^2 = .26$, and the main effect of zone, $F(1, 23) = 45.23$, $p < .001$ $\eta^2 = .67$, were significant. In addition a between groups difference was found significant; for those in the High BMI group, the High EAT-26 Dieting group was found to spend a higher proportion of time viewing both facial zones, than those in the Low EAT-26 Dieting group (Figure 7), $F(1, 23) = 4.59$, $p = .04$, $\eta^2 = .17$. An interaction between emotion and intensity was also found, $F(15, 345) = 2.06$, $p < .01$, $\eta^2 = .08$, as well as between emotion and zone, $F(5, 115) = 8.24$, $p < .001$, $\eta^2 = .26$, intensity and zone, $F(3, 69) = 7.16$, $p < .001$, $\eta^2 = .24$, intensity and EAT-26 Dieting group, $F(3, 69) = 4.21$, $p < .01$, $\eta^2 = .15$ emotion, intensity, and zone (Figure 8), $F(15, 345) = 2.96$, $p < .001$, $\eta^2 = .11$, and intensity, zone, and EAT-26 Dieting group (Figure 9), $F(3, 69) = 2.70$, $p = .05$, $\eta^2 = .11$. Interactions between emotion and EAT-26 Dieting group, $F(5, 115) = .95$, $p = .45$; zone and EAT-26 Dieting group, $F(1, 23) = .3.21$, $p = .09$; emotion, intensity, and EAT-26 Dieting group, $F(15, 345) = .77$, $p = .71$; emotion, zone, and EAT-26 Dieting group, $F(5, 115) = 2.04$, $p = .08$; and emotion, intensity, zone, and EAT-26 Dieting group, $F(15, 345) = 1.01$, $p = .44$, were not significant.

Simple main effects tests were computed for the interactions found. For the interaction between emotion and intensity, (Dunn's corrections $p < .015$), expressions of happiness $F(3, 72) = 4.58$, $p < .01$, $\eta^2 = .16$, revealed a significant effect of intensity. No other expressions were

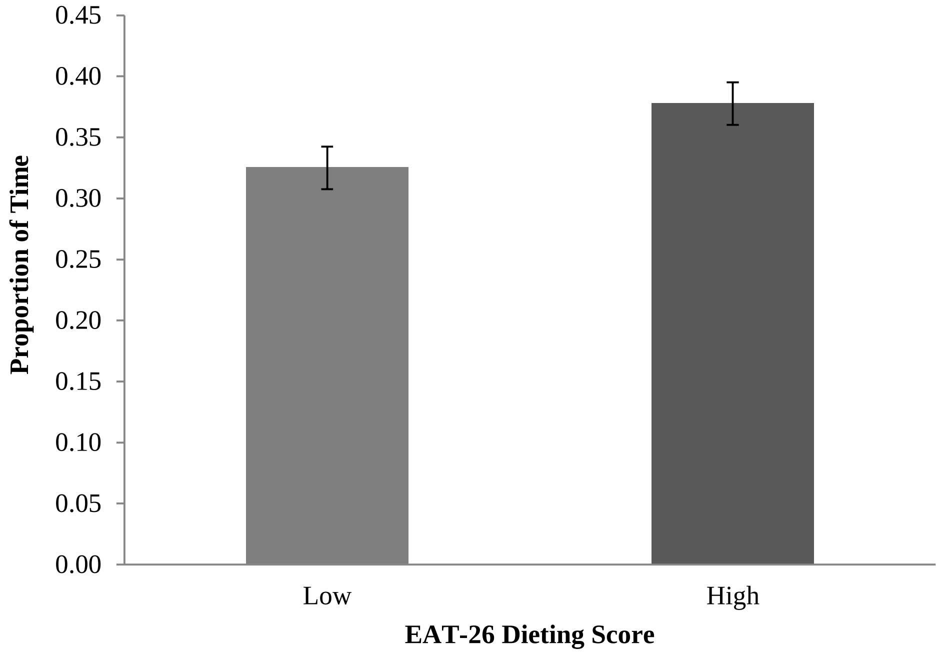

Figure 7. Mean proportions of time of Low and High EAT-26 Dieting scores for the High BMI Group

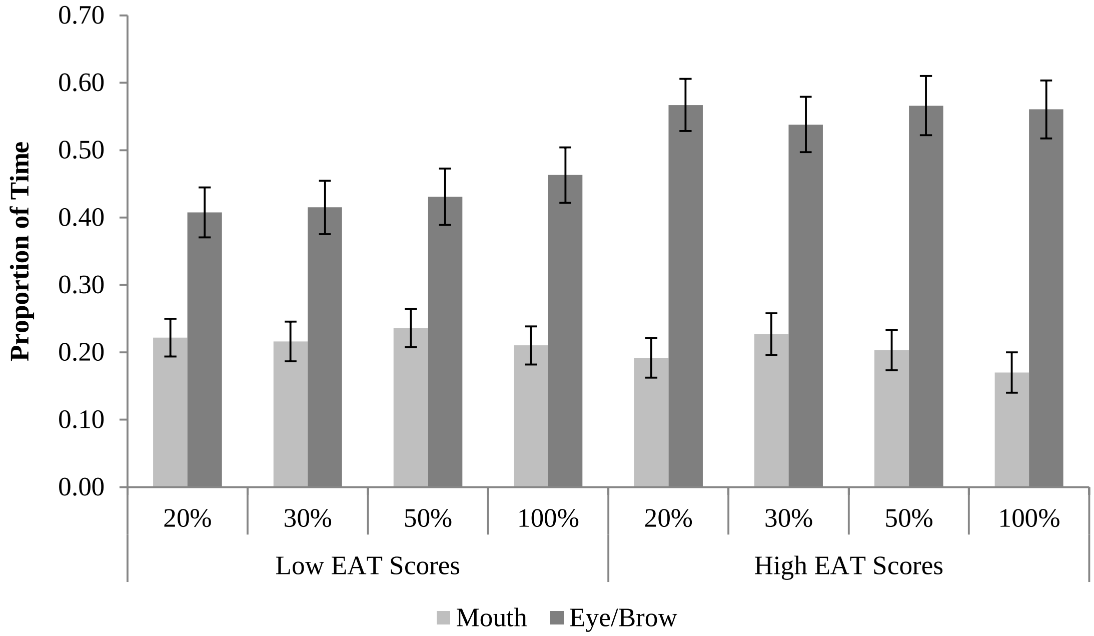

Figure 8. Mean proportions of time by intensity, zone, and EAT-26 Diet Scores for the High BMI Group

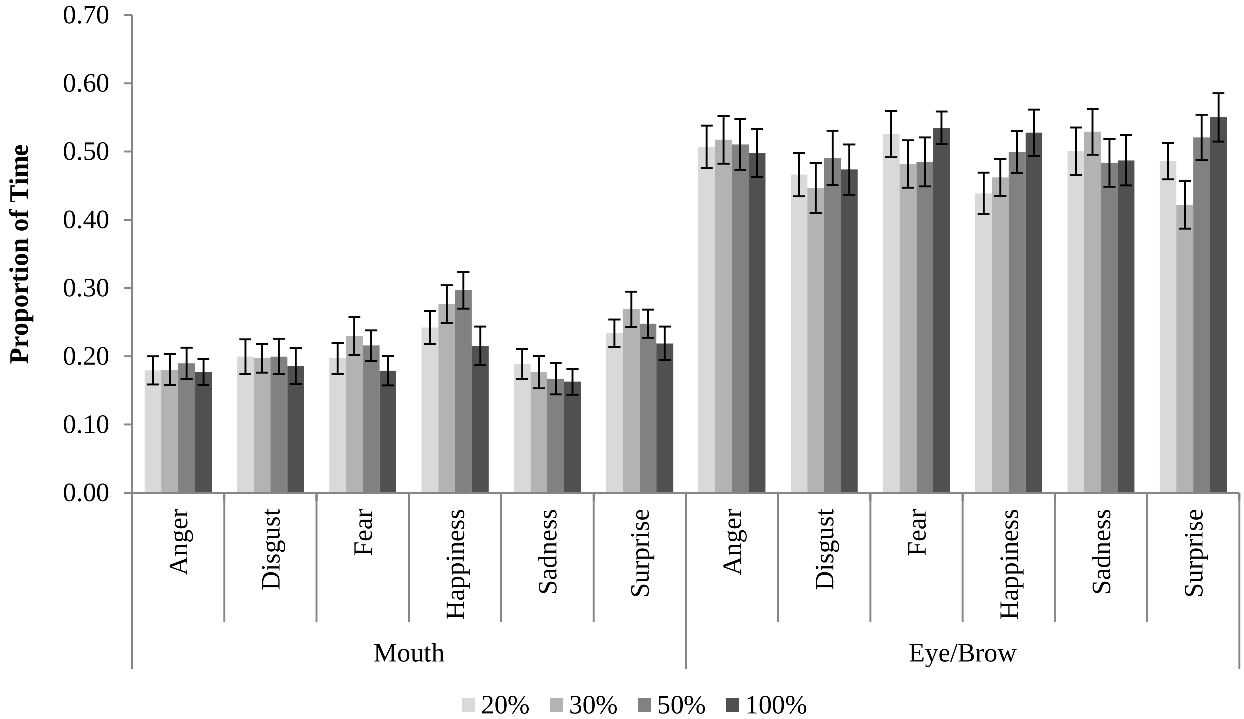

Figure 9. Mean proportions of time for the identification of the six basic emotions by zone and intensity for the High BMI group

significantly different in terms of intensity, all $F(3, 72) < 3.44$, $p > .02$. Post hoc tests (LSD) for happiness found that the 20% and 50% intensities were significantly different from one another in that participants spent higher proportions of time viewing 50%. There were no differences found between any other pairing of intensities. In terms of intensity, 50% $F(5, 120) = 6.48$, $p < .001$, $\eta^2 = .21$, and 100% $F(5, 120) = 5.13$, $p < .001$, $\eta^2 = .18$ found significant effects of emotion. No other intensities were significantly different in terms of emotion, all $F(5, 120) < 1.99$, $p > .09$.

For 50% intensity, post hoc tests (LSD) revealed that happiness had the greatest proportion of viewing time than all other emotions with the exception of surprise. Surprise had greater proportions of viewing time than all other emotions with the exception of happiness. Anger, disgust, fear, and sadness did not differ significantly. For 100% post hoc tests (LSD) revealed that surprise had greater proportion of viewing time than anger, disgust, and sadness and did not differ from happiness. Happiness had greater proportion of viewing time than disgust, and sadness. Anger, disgust, sadness, and fear did not differ significantly.

For the interaction between emotion and zone (Dunn's corrections $p < .019$), found that for expressions of anger, $F(1, 24) = 44.43$, $p < .001$, $\eta^2 = .65$, disgust, $F(1, 24) = 30.75$, $p < .001$, $\eta^2 = .56$, fear, $F(1, 24) = 46.21$, $p < .001$, $\eta^2 = .66$, happiness, $F(1, 24) = 22.58$, $p < .001$, $\eta^2 = .49$, sadness, $F(1, 24) = 48.11$, $p < .001$, $\eta^2 = .67$, and surprise $F(1, 24) = 35.38$, $p < .001$, $\eta^2 = .60$, participants spent a higher proportion of time in the eye/brow zone than the mouth zone across all six emotions.

When analyzing zone, the eyes/brow zone found no significant differences between any emotions, $F(5, 120) = 2.13$, $p = .06$. For the mouth zone, there was a significant difference found for emotion, $F(5, 120) = 17.00$, $p < .001$, $\eta^2 = 42$. Post hoc tests (LSD) found that happiness had the greatest proportions of time for the mouth zone, except was not significantly different than surprise. Surprise had significantly greater proportions of time than anger, disgust, fear, and sadness. Fear had significantly greater proportions of time in the mouth than sadness. Anger, disgust, and sadness were not significantly different from each other, with the least proportions of time in the mouth.

Results of the simple main effects analyzed for the intensity and zone interaction (Dunn's corrections $p < .025$) found that participants spent a higher proportion of time in the eye/brow zone than the mouth zone across all four intensities: 20%, $F(1, 24) = 41.35$,: $p < .001$, $\eta^2 = .63$; 30%, $F(1, 24) = 32.94$, $p < .001$, $\eta^2 = .58$; 50%, $F(1, 24) = 34.65$, $p < .001$, $\eta^2 = .59$; 100%, $F(1, 24) = 47.39$, $p < .001$, $\eta^2 = .66$.

When analyzing zone, both eyes/brow, $F(3, 72) = 4.47$, $p < .01$, $\eta^2 = 16$, and mouth zone, $F(3, 72) = 4.38$, $p < .01$, $\eta^2 = 15$, found significant differences between intensities. For the eye/brow zone post hoc tests (LSD) found that intensities 20% and 30% did not differ, however both had the lower proportion of time when compared to the 100% level. 50% intensity did not differ from 100%, however had greater proportion of viewing time than 30%. For the mouth zone post hoc tests (LSD) found that participants had greater proportions of viewing times in the 30% and 50% intensities than the 100% intensity. 20%, 30%, and 50% intensities did not differ significantly in the mouth zone.

For the zone by EAT-26 Dieting group as part of a 3-way interaction (Dunn's corrections $p < .038$), it was found that participants in the High EAT-26 Dieting group spent significantly greater proportions of time in the eye/brow zone than the Low EAT-26 Dieting group, $F(1, 1) = 5.16$, $p > .03$, $\eta^2 = 18$. The mouth zone did not find significant differences, $F(1, 1) = .33$, $p = .57$.

The interaction of intensity and EAT-26 Dieting group (Dunn's corrections $p < .025$) found that participants in the High EAT-26 Dieting group spent significantly greater proportions of time for the 20% intensity, $F(1, 1) = 5.83$, $p > .02$, $\eta^2 = 20$, and 30% intensity, $F(1, 1) = 6.63$, $p < .02$, $\eta^2 = 23$, than the Low EAT-26 Dieting group. Intensities of 50%, $F(1, 1) = 3.79$, $p = .06$, and 100%, $F(1, 1) = 1.42$, $p = .25$ found no significant differences in terms of EAT-26 Dieting group.

3.3 Emotion Regulation Correlations

In order to analyze the relationship between the DERS and the EAT-26 Dieting subscale within the Total Sample, bivariate correlations were conducted (n=77). The DERS Total was found to significantly correlate to the EAT-26 Dieting subscale ($r = .27$, $p = .02$). Of the six subscales, a significant relationship was found between the EAT-26 Dieting subscale and the Goals subscale ($r = .23$, $p = .04$), and the Impulse subscale ($r = .25$, $p = .03$). No further significance was found in the remaining four subscales (all $r < .19$, $p > .09$)

To investigate whether the relationship between the DERS and the EAT-26 Dieting subscale was effected by BMI, bivariate correlations were conducted on the Average BMI group (n = 46). The DERS Total was found to significantly correlate to the EAT-26 Dieting subscale ($r = .31$, $p = .04$). Of the six subscales, a significant relationship was found between the EAT-26 Dieting subscale and the Clarity subscale ($r = .30$, $p = .04$), and the Impulse subscale ($r = .29$, $p = .05$). No further significance was found in the remaining four subscales (all $r < .27$, $p > .07$)

Correlations were also conducted in order to investigate the relationship between the DERS and the EAT-26 Dieting subscale in the High BMI group (n = 31). The DERS Total did not have a significant correlation with the EAT-26 Dieting subscale. A significant, relationship was found between the Goals subscale and the EAT-26 Dieting subscale in the High BMI group ($r = .61$, $p < .001$). The other five DERS subscales were not found to be significantly correlated to the EAT-26 Dieting subscale (all $r < .36$, $p > .08$).

To investigate the relationship between total facial emotional expression recognition accuracy and emotion regulation, bivariate correlations were first conducted on the total sample. Participants were grouped by high and low EAT-26 Dieting scores (n = 38 and n = 39, respectively). No significant relationship was found between total accuracy score and total DERS score for either the High (r = .20, p = .23), or Low (r = .21, p = .21), EAT-26 Dieting group.

In order to determine whether BMI played a role in the relationship between total facial emotional expression recognition accuracy and emotion regulation, bivariate correlations were conducted for the Average and High BMI group. For the Average BMI group, no significant differences were found between total accuracy scores and DERS scores for either the High (n = 16; r = .29, p = .27), and Low (n = 16; r = .01, p = .98) EAT-26 Dieting groups. For the High BMI group, no significant differences were found between total accuracy scores and DERS scores for either the High (n = 12; r = .05, p = .88), and Low (n = 13; r = .32, p = .28) EAT-26 Dieting groups.

Chapter 4: Discussion

The current study investigated emotional processing deficits in a restrictive non-clinical disordered eating population. In order to gain a greater understanding of these processes in a non-clinical sample, emotional facial expression recognition accuracy was explored in terms of the six basic emotions, level of intensity, facial scanning, and emotional regulation. While facial scanning has been used in ED literature, this is the first to my knowledge that has included eye-tracking technology in facial recognition research within a disordered eating population.

4.1 Recognition Accuracy: Emotion and Intensity

Since no significant accuracy results were found for the total sample (n=77) in terms of high vs low disordered eating, emotion, and intensity, exploratory analyses on BMI were conducted. The Total Sample analysis group (that compared the Average BMI group vs High BMI group), and both the Average BMI group, and the High BMI group had similar accuracy patterns in terms of basic emotion and emotional intensity. Results revealed that, for all three groups, participants' accuracy increased as intensities increased meaning that individuals were more successful at recognizing more overt levels of emotional expression regardless of emotion. This finding was not surprising as the 20% and 30% intensity stimuli have very subtle emotional cues. When separated into Average and High BMI, some variance was found between emotions in terms of intensity. For both BMI groups, individuals were not sensitive to the subtle differences between lower intensities of sadness and fear. These emotions are more difficult for these individuals to identify at lower intensities than the other basic emotions. Women in the Average BMI group were successful in the higher intensities of both surprise and fear, and women in the High BMI group were successful in the higher intensities of both anger and disgust. These specific emotions did not require 100% intensity to be accurately identified. No significant differences were found for either BMI group in terms of restrictive eating behaviour and intensity of emotion. These results do not support discussed findings in PTSD, anxiety, depressive, nor non-clinical disordered eating populations that found that people with higher levels of pathology have greater difficulty identifying lower intensities of emotion than healthy controls or those with low levels of pathology (Csukly et al., 2009; Montagne et al., 2006; Poljac et al., 2011; Ridout et al., 2012). The current study's high disordered eating sample may not have had as salient of eating pathology than those in the studies mentioned, so difficulties in subtle emotions were not observed. This could suggest that the connection between high disordered eating behaviour and facial emotion deficits exist on a continuum; the more severe the restricting behaviour, the higher the level of deficit will be present. This may be significant in terms of timing of intervention further discussed within the implications.

In terms of specific emotion, individuals in all three analysis groups, across all levels of intensity, were more successful at accurately recognizing happiness than all other emotions. Overall, they also had high accuracy when identifying surprise (in higher intensities), and had the lowest success with accurately identifying fear. These findings are in line with emotional facial expression recognition literature (e.g. Beaudry et al., 2014; Calvo, & Nummenmaa, 2009; Tracy & Robins, 2008); therefore, for these three emotions, this sample's accuracy is comparable to the normative population. No expected differences were found in terms of restricting eating behaviour and the six basic emotions namely negative emotions of anger, disgust, fear, and sadness. Therefore, the hypothesis of cognitive and social avoidance of negative emotions, ventured by Ridout and collegues (2012), was not supported by the current study; significant differences in accuracy that were found between emotions are indicative of a normative population not one with varying eating pathology. Again this may suggest that the severity of disordered eating behaviour that must be present in order to have marked emotional deficits was not captured within the current study. However, given that happiness, surprise and anger have the highest rates of identification accuracy within a normative population (Beaudry et al., 2014; Calvo, & Nummenmaa, 2009; Tracy & Robins, 2008), perhaps the lack of expected findings (with regard to overall and negative emotion) indicates the strength of this phenomenon in that these emotion states are easily recognized across populations. Alternatively, it has been found that the construct of alexithymia is greatly predictive of emotional facial recognition accuracy deficits in the AN and DE populations (Brewer, Cook, Cardi, Treasure, & Bird, 2015; Ridout et al., 2010). Therefore, although high restrictive DE scores were reported, if these women had low levels of alexithymia, this may explain lack of accuracy results.

4.2 Recognition Accuracy: Between Group Results

The Average BMI group results do not support the current body of literature as no significant facial emotion recognition accuracy differences were found between low and high levels of restrictive disordered eating in terms of specific emotion and level of intensity. Although some of the sample has relatively high levels of reported restrictive disordered eating symptoms, they do not experience the emotional hypo-functioning that has been found in previous research. Perhaps other factors, for example, body image dissatisfaction, may have contributed to the facial emotional recognition difficulties found in previous studies (e.g. Ridout et al., 2010; Ridout et al., 2012), suggesting that it is a more complex issue within the non-clinical population. Although an interaction between reported restrictive disordered eating, specific emotion, and level of intensity was not found within the High BMI group, a significant between group difference was found; women with high levels of restrictive disordered eating had greater success with accurately recognizing emotional faces than those with lower levels of restrictive disordered eating. This result is in stark contrast to the expected results based on the

AN, and restrictive disordered eating literature using average or low weight participants. If the higher body weight is due to a higher proportion of adipose tissue, similar findings are also found within the literature examining emotional processes of women who are obese; higher levels of maladaptive eating symptomology are associated with deficits in recognition accuracy (Cserjési Vermeulen, Lénárd, & Luminet, 2011; Koch & Pollatos, 2015). However, the current study's sample is unique in that individuals are above the average BMI and they are also endorsing high levels of dieting behaviours. One possibility is that this unique population could be experiencing a heightened sensitivity to emotional expressions on others' faces. It has been found in the AN literature that individuals are particularly sensitive to social comparison, especially when body dissatisfaction and/or early experiences of body shaming are present (Cardi, Di Matteo, Corfield, & Treasure, 2013; Cardi, Di Matteo, Gilbert, & Treasure, 2014). Therefore, they show attentional bias to cues of social evaluation, such as rejecting instead of accepting faces that may threaten their self-esteem, identity, or social status, (Cardi et al., 2013; Cardi et al., 2014). Increased ability to recognize emotional facial expressions may be part of this hypervigilance as understanding the experience of others could help these women navigate socio-emotional situations deemed threatening. Alternatively, if the high BMI in this group is due to a higher proportion of muscle, no research investigates differences in facial emotion recognition in people with differing level of muscle mass to the best of my knowledge. However, muscle mass may explain the contrasting result given that body builders have been found to have high levels of disordered eating behaviours and accompanying cognitions (Ravaldi et al., 2003; Walberg & Johnston, 1991). Perhaps a high amount of body muscle in this group affects the emotional deficits commonly associated with restrictive disordered eating.

4.3 Proportion of Viewing Times: Emotion, Intensity, and Zone

In terms of proportion of time spent viewing each emotion, the Total Sample analysis group, Average BMI group and the High BMI group significantly differed with regard to intensity for the emotions of happiness, sadness and surprise. When considering the Total Sample analysis group, individuals spent more time viewing both zones within lower intensities of sadness than higher intensities. This may suggest that to accurately identify more subtle cues of sadness, longer viewing times in each zone are required. The inverse is true of happiness and surprise. For happiness, the Average BMI group attended longer to the 50% intensity than the lowest intensity, and the High BMI group attended longer in both high intensities than 30%. The Average BMI group attended to the 50% intensity of surprise longer than all other intensities. As surprise and happiness are generally the easiest to identify in the general population, there is little cogent pattern in terms of proportion of time spent gazing at each intensity.

Further, when investigating zone and emotional intensity, clear patterns for the Total Sample analysis group and two BMI groups did not emerge. When it came to specific emotion, clear patterns for intensity also did not emerge. As in Beaudry and colleagues (2014), the complexity of the results is not suggestive of either feature processing or holistic processing for the six basic emotions and the four levels of intensity.

Overall, individuals in all three analysis groups spent greater proportions of time viewing pertinent zones in images depicting happiness and surprise (only at the higher intensities) than all other emotions. When considering that happiness followed by surprise were the most accurately recognized emotions, it appears that higher proportions of viewing time within both eye/brow and mouth zone leads to greater emotional facial recognition accuracy. This suggests that the sample's attentional processing behaviours are, again, indicative of a normative population.

All three analysis groups spent greater proportions of time in the eye/brow zone of the face than the mouth zone across all six emotions and four intensities. This means that the eye/brow area is important in identifying all six basic emotions, regardless of how subtle or overt the emotion is. This finding is in line with what was found by Beaudry and colleagues (2014), found in a normative sample. More specifically, when analyzing the eye/brow zone, those in the Total Sample group spent greater proportions of time viewing expressions of fear, surprise, and anger than disgust and happiness. For the Average BMI group, individuals viewed surprise for the lowest proportion of time, and viewed disgust for greater proportions of time than fear. In the High BMI group there were no significant differences found between emotions in the eye/brow zone. For the mouth zone, all three groups spent the greatest proportion of time viewing happiness, followed by surprise and then fear (as well as disgust in the total sample). Given these findings in the Total Sample and Average BMI group, as well as findings in the eye/brow zone, it can be concluded that for happiness, the mouth is necessary for accurate recognition. For surprise and fear, both the eye/brow area and mouth area appear to be necessary. Patterns are not clear for the remaining emotions in terms of the mouth zone; however, the eye/brow area was viewed more and therefore, is necessary for recognition. Further, since the eye/brow zone has been found to be necessary in the accurate recognition of the negative emotions of anger, fear, and sadness (Beaudry et al., 2014; Sullivan, Ruffman, & Hutton, 2007), and overall the sample spent higher proportions of time viewing this zone, perhaps this may explain the lack of expected results within those with higher levels of restrictive disordered eating. In other words, participants viewed the zone necessary for recognizing negative emotions longer than the mouth zone; therefore, they were successful at recognizing these emotions regardless of their level of disordered eating. This may be supportive of other eye-tracking findings suggesting that people with disordered eating pathology fixate on negative or aversive stimuli (Janelle et al., 2009, Jansen et al., 2005)

4.4 Proportion of Viewing Time: Between Groups Results

In terms of proportion of viewing time, the Total Sample as well as the Average BMI group did not find differences between Average/High BMI group and High/Low EAT-26 Dieting group, with respect to specific emotion, intensity of emotion, and facial zone. This is not surprising given that differences in emotional facial recognition accuracy did not emerge. Other findings of the current study, for example, the higher accuracy and proportions of viewing time in the emotions of happiness and surprise, appear to support the notion that higher proportions of viewing times in pertinent zones of the face lend to greater recognition accuracy rates.

Differences did emerge within the High BMI group; it was found that women with higher levels of restrictive disordered eating behaviours spent a greater proportion of time attending to pertinent zones of the face, irrespective of emotion, than women with low levels of restrictive disordered eating. When further eye-tracking results were analyzed, it was found that not only did women with higher levels of restrictive disordered eating spend longer proportions of time viewing the eye/brow zone than did women with low levels of restrictive disordered eating; they also spent more time viewing both zones within the lower levels of emotional intensity. It stands to reason that those with higher than average body mass and high levels of restricting behaviour have greater success at accurately recognizing emotional faces because they are spending more time in necessary zones of the face, and spending greater amounts of time trying to decipher subtle emotional cues. The heightened viewing times lend support to the findings that those with high eating pathology display heightened sensitivity to facial emotional expressions (Cardi, Matteo, Gilbert, & Treasure, 2014).

4.5 Emotion Regulation

As predicted, the findings of the Total Sample analysis group as well as the Average BMI group were in line with findings of Harrison and colleagues (2009; 2010a); as individuals' restrictive disordered eating behaviours increased, so did their level of overall emotional regulation difficulty. More specifically, women with average BMIs and high levels of restrictive disordered eating, have difficulty understanding their emotional experience as well as difficulties controlling impulses when experiencing negative emotions (Gratz & Roemer, 2004). This also begins to replicate research that found significant correlations between all six DERS subscales and restrictive disordered eating in an undergraduate and AN population (Harrison et al., 2009; Lafrance Robinson et al., 2014). With a larger sample, perhaps significance within all six subscales would emerge. Given these findings, although differences in emotional facial recognition accuracy were not observed, in terms of emotion regulation, similar emotional deficits underlie AN, and non-clinical disordered eating populations (among those with an average body weight). Perhaps emotion regulation difficulties emerge with less severe or not yet chronic cases of disordered eating, whereas emotional facial recognition inaccuracy may emerge when behaviours become more severe, bordering on clinical. This is further supported by the lack of relationship found between recognition accuracy and level of emotion regulation in this population, regardless of high or low disordered eating. However, Harrison and colleagues (2009) findings that demonstrated such a relationship in individuals with AN versus healthy controls, are not extended to the current study's non-clinical population.

Contrary to the Average BMI group, emotion regulation and restrictive disordered eating did not appear to be related among those participants in the High BMI group. Therefore, the significant relationship found within the Total Sample was driven by the Average BMI group not by women with higher BMIs. However, those with higher levels of restrictive disordered eating have greater difficulty engaging in goal-directed behaviour when emotionally evoked (Gratz & Roemer, 2004). Perhaps these results also point to a potential weight related effect on emotional deficits in this group. When considering the lack of significant relationship between accuracy and emotion regulation in women with high disordered eating, however, it cannot be assumed that there is a causal link between strong facial recognition and adaptive emotional strategies.

4.6 Implications

Emotional facial expression recognition is imperative for adaptive social functioning as they provide cues about the motivations and intentions of others (Ridout et al., 2012). Therefore, those who experience inaccuracy with recognizing the emotions of others may experience social difficulties in addition to what difficulty influenced such a deficiency. It is well documented that those who experience disordered eating behaviours also experience interpersonal difficulties, which in turn may act as a developmental or maintaining factor in more serious eating pathology (Ridout et al., 2012). The current study's findings, primarily those concerning attentional processing differences found with eye-tracking technology, could inform psychologists with emotional psychoeducation in those with subclinical levels of restrictive eating and perhaps even those with AN. Unexpectedly, it was found that the unique group of restrictive eaters were more accurate at recognizing facial emotions regardless of emotion or intensity therefore; we can apply the strategies that led to their success to people who do experience emotional deficits. For example, individuals could be coached to look specifically in the eye/brow zone and to look for greater proportions of time, especially in the more difficult, subtle presentations of emotion. Further, it has been purported that the connection between restrictive eating behaviours and emotional facial recognition exist on a continuum; therefore, early intervention (e.g. emotion workshops/therapy) may be useful in order to abate the behaviours before the severity reaches a point where facial recognition is compromised. Additionally, early detection and intervention of high levels of disordered eating is also imperative in people with an average body weight as they have been found to struggle with overall emotion regulation difficulties that can further complicate and exacerbate symptoms. Further research and possible workshop pilot-testing, for example an emotion-focused therapy skill-building seminar, could be conducted in order to determine the best possible delivery of emotion regulation education to the subclinical population; particularly targeted to undergraduate students.

4.7 Limitations and Future Directions

In any study utilizing self-report measures, such as the EAT-26 and the DERS, there is the risk for under or over reporting of behaviour. Although participants were recruited using similar methods to other studies using undergraduate females (Ridout et al., 2010; Ridout et al., 2012), this may have affected the results of the current study. This could be solved in future investigations by having a third party, such as a parent or roommate, provide collateral information to verify reported behaviour. Time of testing may have had an effect on reported eating behaviours and/or emotion regulation; therefore all data could be collected at the same time of day in future studies. As previously stated, the construct of alexithymia was not measured. Future replications of the current study could administer the Toronto Alexithymia scale (Bagby, Parker, & Taylor, 1994). Information such as body image and body cognition were also not measured and could potentially affect the analyses. For example, those who rate high on both body satisfaction and restricting behaviours may perform differently than those who rate low on body satisfaction and high on restricting behaviours. Future research should include self-report measures on such variables. In addition, a larger sample of each BMI category may increase variability and produce more significant results; specifically, interactions between restrictive eating behaviours, specific emotion, and intensity, and within DERS correlations. Lack of findings may also mean that there simply was not enough variability among participants. Future studies may also directly recruit those with self-identified non-clinical restrictive disordered eating behaviours and compare against those with average eating behaviours; this way greater disordered eating scores may be gleaned and group differences can emerge.

Research pertaining to emotional facial expression recognition in women with high BMIs that experience high restricting behaviours is scarce; therefore replication of the current study as well as future investigation in this unique population would be valuable. Specifically, the biological and social mechanisms behind high BMI, level of restriction, and the ability to recognize facial emotion should be explored.

4.8 Conclusion

Findings of previous studies were not supported in terms of differences in specific emotion and intensity, related to high or low restrictive disordered eating behaviours. However, it was found that those with a higher than average BMI and higher levels of restrictive eating pathology have greater facial emotion recognition accuracy regardless of emotion and intensity. It is suggested that this proficiency is influenced by the finding that these individuals spent greater time viewing pertinent areas of the face, specifically the eye/brow zone that is sufficient in identifying most of the six basic emotions. They also spent more time viewing the more difficult do decipher, lower emotional intensities in order to determine the emotion present. Further, those with higher than average BMI did not have a correlation between overall emotional dysregulation and reported restrictive disordered eating, whereas those with an average BMI found a positive correlation between the variables; as the level of emotional dysregulation increased as did the level of eating pathology. Findings suggest that this unique population may have a great degree of sensitivity to perceived socio-emotional threat and therefore, are more accurate at the recognition of others’ emotional expression.

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