AN EXAMINATION OF THE INTEGRATED COGNITIVE AFFECTIVE MODEL AND WEIGHT REGAIN IN OBESITY: A PILOT STUDY

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Abstract

Obesity is a complex health issue that is widely considered to be an epidemic in North America. University-based weight loss programs produce weight loss in the short-term, but obesity tends to be a chronic condition that is difficult to treat due to long-term weight regain. The majority of obese people who lose weight tend to regain a large proportion, if not all, of the lost weight within one year. Among non-regainers, long-term adherence to reduced-calorie diets and high levels of exercise are associated with better outcomes. However, weight regain is the norm. Preliminary evidence suggests that psychological factors may play into why some people regain weight. The Integrative Cognitive Affective Therapy [ICAT] model provides a framework for understanding how certain psychological factors may be associated with weight regain including self-discrepancy, mood states (i.e., depression, anxiety, and stress), emotion regulation, and emotional eating.

The current study examined the application of the ICAT model to explain weight regain in obesity. A community sample of 71 obese adults who had recently lost at least 5% of their body weight were included in the analysis. At baseline, weight was measured, participants completed self-report questionnaires of psychological variables including: self-discrepancy, mood, difficulty in emotion regulation, emotional eating, and binge eating. Participants then provided self-reported weight at 3-month follow-up, and had their weight re-measured at 6-month follow-up.

Results provided evidence that higher baseline self-discrepancy and difficulty in emotion regulation were related to worse baseline depression and anxiety. Higher baseline emotional eating was related to higher body mass index (BMI) at baseline, 3-,

and 6-month follow-up. On average, BMI did not change significantly from baseline to 6-month follow-up. However, upon closer inspection, about one third of the sample regained weight (31.4%) while the remainder (68.6%) continued to lose weight between baseline and 6-months. Regression analyses revealed that none of the psychological variables measured at baseline significantly predicted BMI change from baseline to 6-months, and there were no significant differences between weight regainers and non-regainers on any of the baseline psychological variables including self-discrepancy, negative mood states, difficulties with emotion regulation, emotional eating, or binge eating.

This research contributed to the literature by exploring the role of psychological factors in explaining weight regain in obesity, and provided an initial exploration of the ICAT model as a framework for understanding weight regain. The implications of the findings, directions for future research as well as study strengths and limitations are discussed.

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1. CHAPTER ONE

Introduction

1.1 Obesity: A Complex Public Health Issue

Obesity is a complex medical condition that results from a long-term energy imbalance between calorie consumption and energy expenditure; excess energy is stored as body fat (Health Canada, 2006). Obesity is defined in terms of body mass index (BMI; kg/m^2), a ratio of weight to squared height designed to reflect degree of weight normality relative to large population samples (Keys, Fidanza, Karvonen, Kimura, & Taylor, 1972). Health Canada uses BMI to measure and classify obesity in adults according to the World Health Organization's [WHO] categorization guidelines (Health Canada, 2003). The latest WHO (2000) guidelines divide BMI scores into ranges that reflect weight category relative to health risk: underweight/increased risk (< 18.5), normal weight/least risk (18.5 - 24.9), overweight/increased risk (25 - 29.9), and obese/high risk (≥ 30). Obesity is divided into additional categories that reflect increasing health risk: Class 1/high risk (30.0 - 34.9), Class 2/very high risk (35.0 - 39.9), and Class 3/extremely high risk (≥ 40.0) (WHO, 2000).

The Public Health Agency of Canada [PHAC] and the Canadian Institute for Health Information [CIHI] issued a joint report that identified obesity as a major public health issue in Canada (PHAC, & CIHI, 2011). The report indicated that the prevalence of obesity in Canada more than doubled between 1981 and 2009; in 2009, approximately 25% of Canadian adults were considered obese (PHAC, & CIHI, 2011). Provincially,

Newfoundland and Labrador displayed the highest rate of obesity among the provinces at 25.4%, while British Columbia displayed the lowest rate at approximately 12.8% (PHAC, & CIHI, 2011).

Obesity is a chronic health problem that is often associated with serious health risks and high long-term economic costs (Institute of Medicine [IOM], 1995). The economic cost of obesity includes direct health care expenditures as well as associated costs such as lost economic output, premature death, and injury-related disability funds. According to PHAC and CIHI (2011), the economic cost of obesity in Canada increased from $3.9-$4.6 billion dollars between 2000 and 2008. The net increase in that period totaled approximately $735 million dollars (PHAC, & CIHI, 2011). Thus, developing effective treatments for obesity is an important research priority.

1.2 Obesity and Health Risks

Obesity is associated with serious physical health risks such as higher rates of all-cause mortality, Type II diabetes, cardiovascular disease, and various cancers (PHAC, & CIHI, 2011). The relationship between obesity and these health risks are well documented in a variety of large sample cohort studies. Berrington de Gonzalez, et al., (2010) conducted a large meta-analysis of 19 prospective research studies that evaluated the relationship between BMI and all-cause mortality rate. Based on data from 1.46 million U.S. adults, Cox regression and hazard ratio analysis indicated that high (>25) BMI is associated with significantly greater mortality rate at 10-year follow-up after controlling for age, smoking, pre-existing cancer or cardiovascular disease at baseline (Berrington de Gonzalez, et al., 2010). Consistent with these results, findings from a subsequent study by Katzmarzyk, et al., (2012) using a sample of 10, 725 Canadian adults found that 13 years

following the baseline assessment, hazard ratios for the relationship between BMI and all-cause mortality rate increased concurrently with BMI from 25.0 and above (Katzmarzyk, et al., 2012). These studies were limited in that they only collected BMI at baseline, meaning they were unable evaluate how change in BMI over time may affect mortality rate hazard ratios. However, they provide strong evidence of relationship between obesity and increased mortality rate in North America.

Furthermore, analysis of the data from the 2007-2009 Canadian Health Measures Surveys indicated that Canadians with obesity are at significantly higher risk of developing Type 2 diabetes and cardiovascular disease in comparison with those in the normal BMI category (Shields, Tremblay, Laviolette, Craig, Janssen, & Gorber, 2010). Pardo Silva, De Laet, Nussedler, Mamun, and Peters (2006) found that in a sample of 2, 551 adults from the Framingham Heart Cohort Study, those with a BMI >30 had a higher than average rate of cardiovascular diseases including hypertension, myocardial infarction, and stroke at age 45. In addition, participants in the obese category had been living with these illnesses significantly longer than age-matched participants with normal BMI (Pardo Silva, et al., 2006).

In addition to the economic costs and health risks associated with obesity, individuals with obesity are regularly subject to social stigmatization and weight bias that has been shown to have a detrimental effect on well-being. Social stigma against obesity is well documented throughout the lifespan; this literature is reviewed next.

1.3 Obesity and Weight Bias

There is considerable research evidence documenting western culture's tendency to value thinness, and exert pressure on people to achieve thinness; this trend has been

linked to the pathogenesis of eating disorders including anorexia nervosa and bulimia nervosa (Nasser, 1988). Furthermore, a review of the research suggests that there are both explicit and implicit biases against members of our society who are overweight or obese. In addition to the physical health risks associated with obesity, a systematic review of experimental research showed that individuals with obesity are frequently targets of social stigmatization and weight-related bias in a variety of settings including the employment process, health care system, and interpersonal relationships (Puhl, & Brownell, 2001). More recent experimental research has continued to support these earlier findings.

For example, Rooth (2009) found that obese individuals were less likely to be invited for interviews than normal weight individuals when credentials and other job requirements were controlled. In another study designed to evaluate hiring bias against overweight and obese individuals, a sample of 320 adults were asked to rate how likely they would be to hire the individual in a videotaped interview. The individual being interviewed had their apparent weight manipulated with prostheses to appear either average weight or obese. The tapes depicting the obese version of the same individual were less likely to be considered hirable than the thinner version of the applicant when gender and interview responses were controlled (Pingitoire, Dugoni, Tindale, & Spring, 1994). Furthermore, in a study evaluating wage parity between average weight and obese employees, obese women tended to receive approximately 6% lower wages, and obese men receive approximately 3% lower wages than their thinner counterparts when all other factors were controlled (Baum, & Ford, 2004).

A number of studies have used Implicit Attitudes Testing [IAT] to evaluate underlying weight bias in health professionals and trainees. Weight bias has been documented using IAT among health care trainees in psychology, nursing, medicine, and psychiatry who reported a significant amount of stereotypical negative attitudes towards obese patients including beliefs that obese patients were unmotivated and incompliant (Puhl, Luedicke, & Grilo, 2014). Within the health care system, obese individuals tend to be viewed more negatively than normal weight individuals by many health professionals including physicians, nurses, psychologists, and dieticians (Teachman, & Brownell, 2001). It has even been found that professionals who specialize in obesity also tend to hold more implicit and explicit negative attitudes towards obese patients than non-obese patients (Schwartz, Chambliss, Brownell, Blair, & Billington, 2003).

In terms of social influences, weight bias and stigma experienced by individuals with obesity has been documented from a very early age. In a sample of 821 children in grades 3-6 it was found that obese children were significantly more likely to report being bullied by their peers than average weight children. This finding remained significant when potential confounds such as socio-demographic variables and academic performances were controlled (Lumeng, et al., 2010). A study by Tiggemann and Anesbury (2000) showed that in a sample of 96 children in grades 4-6, children rated obese figures as significantly less attractive, happy, healthy, and confident than they rated normal weight figures when other factors were controlled and order of presentation was counterbalanced. Research has also demonstrated that obese women are more likely to pay for college themselves rather than receive parental financial support when parents

financial ability to pay for their daughter's college was controlled, suggesting a possible anti-obesity bias among parents against their own children (Crandall, 1995).

Overall, the research evidence suggests that the stigmatization experienced by obese individuals is rooted in the assumption that their inability or inaction in preventing or reversing obesity is indicative of character flaws including laziness, lack of intelligence, and lack of motivation (Teachman, et al., 2003). The well-documented stigmatization of obese individuals has been shown to have negative effects on mental health, body image and overall well-being among individuals with obesity. The research documenting these effects is reviewed in the following section.

1.4 Obesity, Mental Health, and Body Image

Given the widespread existence of weight stigmatization, it is important that researchers focus on mental health issues associated with obesity in addition to physical health risks. In their systematic review of the research on the relationship between obesity and mood disorders, Mansur, Brietzike, and McIntyre (2015) postulated that the relationship between obesity and mental health disorders is multidimensional and bidirectional; they theorize that a combination of physical, psychological, and environmental factors reciprocally impact each other over time to change or maintain weight. That is, social stigma and discrimination may compound or exacerbate psychological vulnerabilities such as predisposition to depressed mood, which may in turn impact behaviour such as reducing activity level, which could reciprocally influence physical health such as weight gain (Mansur, et al., 2015).

Illustrating this, Toups, et al. (2013) found that in a community sample of 2730 adults, obese individuals were twice as likely to experience a major depressive episode

within a five-year period than non-obese participants. Conversely, current or past incidence of depression did not predict the development of obesity within the same time frame. This suggests that obesity may be a significant risk factor for future development or onset of depression, but the inverse may not be true.

In a large community sample of over 17,000 adults, obese participants reported a significantly higher incidence of past and current diagnosed mood and anxiety disorders than their normal weight counterparts after controlling for gender, age, smoking, socioeconomic status, substance use, and use of psychotropic medication (Bodenlos, Lemon, Schnieder, August, & Pagoto, 2011). These results suggest that obesity may also be a risk factor for mood and anxiety disorders, though the directionality of this relationship was not specifically evaluated.

Obesity has also been linked to poor body image in that higher BMI is associated with less positive body image and higher reported body dissatisfaction. Annis, Cash, and Hrabosky (2004) found that in a community sample of 167 women who were currently overweight, never overweight, or formerly overweight, the currently overweight women scored significantly lower on measures of body image than did the other two groups, suggesting that current weight status may be linked to greater body image dissatisfaction, and that weight loss may moderately improve body image. Gingras, Fitzpatrick, and McCarger (2004) also found that in a community sample of chronic dieters, BMI was positively correlated with body image dissatisfaction, indicating that participants with higher BMI reported poorer body image.

In another study, a sample of 473 obese adults seeking weight loss treatment completed evaluations of BMI, body image, overall psychiatric distress, and self-esteem

at baseline and following weight loss treatment (Friedman, Reichmann, Costanzo, & Musante, 2002). Participants demonstrated significantly improved body image scores from baseline to six month follow up; however linear regression analysis indicated that change in BMI from baseline to 6-months was not a significant predictor of improvement in body image. Predictors of improved body image at follow up included lower pretreatment psychological distress, and reduction in binge eating behaviour (Friedman, et al., 2002). This means that the amount of weight lost may not be directly proportional to the amount of improvement in body image; other factors such as pre-existing psychological distress and binge eating may play a more significant role in contributing to body image improvements. These results suggest that interventions designed to improve body image may benefit from targeting factors related to psychological distress and binge eating behaviour rather than exclusively focusing on weight loss.

The findings of these studies indicate that body image dissatisfaction may not directly be related to actual body weight per se, but rather that body image may mediate the relationship between obesity and underlying psychosocial impairment. Reviews of this literature suggest that treatment approaches for obesity should include a psychosocial focus that addresses weight stigma and body image issues at the outset, rather than assuming body image disturbance will improve with weight loss. Unfortunately, the best practice guidelines for obesity treatment, which are detailed next, do not emphasize interventions for body image dissatisfaction.

1.5 Treatment of Obesity

Most interventions for obesity target the physical state of obesity by aiming to reduce body weight and body fat percentage. The three primary methods of treatment

include surgical procedures, pharmacological intervention, and behavioural treatment/lifestyle modification.

Surgical treatment of obesity is typically reserved for severe obesity (i.e., BMI of greater than or equal to 40) (Karmali, et al., 2010). This treatment consists of various types of bariatric surgery, during which the physical size of the stomach and/or intestines is altered to impact the amount of food an individual can consume before feeling full, or the degree to which intestines can absorb fat and other nutrients from their food.

Longitudinal, prospective research indicates that surgical treatment of obesity is effective at reducing obesity; however, amongst a sample of 782 obese adults who underwent bariatric surgery, participants regained an average of 18% of weight lost within the first two years post-surgery (Magro, et al., 2008).

The second option for obesity treatment is pharmacological intervention. A variety of weight loss medications have been studied, with varying degrees of clinical success. Pharmacological agents that have been used to treat obesity include drugs that suppress appetite, stimulate metabolic rate, interfere with nutrient utilization, or interfere with nutrient and fat absorption (Kordik, & Reitz, 1999). A meta-analysis of 14 double-blind randomized controlled trials of the only two Food and Drug Administration [FDA] approved pharmacological treatment agents for obesity was conducted to evaluate efficacy of these medications (Padwal, Li, & Lau, 2003). Participants in all of the clinical trials included in the analysis lost a clinically significant amount of weight (i.e., $\geq 5\%$) while taking the medication; however all studies suffered from high rates of attrition (i.e., 20-43%). Primary reasons for attrition included adverse side effects and treatment refusal.

The losses to attrition suggest that individuals may experience difficulty adhering to long-term medication for weight control (Padwal, et al., 2003).

According to the 2006 Clinical Practice Guidelines released by the Canadian Medical Association [CMA] (Canadian Medical Association Journal [CMAJ], 2007), surgical and pharmacological treatment options are to be considered only when behavioural/lifestyle modification treatment efforts have not been successful, or if long-term maintenance of weight loss has not been achieved. In their report, the CMA recommended that a combination of lifestyle modification strategies be utilized as the first line of treatment. Recommended strategies included reduced caloric intake by 500-1000kcal/day, increased moderate intensity physical activity to 30-60 minutes, 3-5 times/week, and cognitive behaviour therapy to support behavioural changes (CMAJ, 2007).

Cognitive behavioural therapy is often used as the medium to deliver dietary and exercise interventions effectively. For example, Kuller, et al. (2001) conducted a 5-year randomized control trial to evaluate the efficacy of cognitive behavioural therapy in facilitating weight loss and preventing weight-related cardiovascular risk factors in 535 overweight or obese women. At the baseline assessment, all participants received a pamphlet on reducing cardiovascular risk through lifestyle modification. Women assigned to the treatment condition received the baseline assessment, 6-months of intensive cognitive behaviour therapy [CBT] focused on reducing caloric intake, increasing physical activity, and using self-monitoring techniques to facilitate weight loss, as well as group and individual follow up booster sessions at 6, 18, 30, 42, and 54 months. Women in the control condition received the assessments only. The assessment group

demonstrated a 95% retention rate, and the intervention group demonstrated an 82% retention rate at 5-year follow-up. The results indicated that at each time point participants in the CBT intervention condition demonstrated significantly lower rates of cardiovascular risk factors, and significantly lower BMI over time than the assessment-only group. On average, the intervention group maintained weight loss achieved at the end of the 6-months, and the assessment-only group continued to gain weight. This study provided evidence for the effectiveness of CBT for lifestyle modification in the treatment of overweight and obesity. However, many research studies show that a large proportion of successful weight losers tend to regain weight; this trial may have benefited from the exceptionally long intervention of six months followed by 5 years of periodic booster sessions, which may not be feasible in clinical practice. The literature documenting the well-established problem of weight loss maintenance in obesity is discussed below.

1.6 Obesity and Weight Loss Maintenance

Despite evidence demonstrating the initial efficacy of lifestyle modification for weight loss in obesity, most research to date suggests that the weight loss is short-lived, and weight regain is the norm. In a telephone-based retrospective study of over 17,000 women, less than 2% of women who reported past weight loss attempts when they were between the ages of 18-30 had maintained their weight loss at age 50 (French, Jeffery, Folsom, McGovern, & Williamson, 1996). While these results are limited by possible recall bias, similar results have been demonstrated in many studies on long term weight maintenance outcome in obesity. Anderson, Konz, Frederich, and Wood (2001) conducted a meta-analysis of 29 studies to evaluate trends in weight loss maintenance over five years. The results indicated that 77% of participants across studies regained

approximately 80% of the weight they lost by five-year follow up, and maintained only approximately 20% of their initial weight loss. Furthermore, a subgroup of only approximately 15% of participants maintained losses of 10% or more of their original body weight at five year follow up, whereas on average people more successfully maintained losses of approximately 3% of their original body weight. This meta-analysis illustrates that weight regain is the norm, but a small subgroup of people are successful at maintaining weight losses that are associated with improved physical health (e.g., 5% or more).

In a prospective study, 152 overweight or obese adults completed a 15-week behavioural weight loss program and attended annual follow-up for four years following completion of the program (Kramer, Jeffery, Forster, & Snell, 1989). Statistically significant weight regain was demonstrated across the sample for the first two years, after which weight tended to stabilize within 4% of participant's pre-intervention weight; however, a subgroup of less than 3% of the sample maintained their entire initial weight loss at four year follow-up. Another study found that among 228 American adults who were either currently or formerly obese, 80% of the sample self-reported that after one year of successful weight loss maintenance they regained the weight they had lost. However, 20% of the sample self-reported that they had successfully maintained their weight loss of at least 10% of their former weight for longer than one year following their initial weight loss (McGuire, Wing, & Hill, 1999). Due to the self-report nature of this data, there is possible misrepresentation of the timeframe or amount of weight regain/maintenance due to recall bias.

These studies demonstrate the high rate of weight regain following weight loss in obesity; however, they also illustrate that a proportion of individuals who successfully lose weight are able to maintain weight loss long term. Not surprisingly, successful weight loss maintenance after one year has been shown to be associated with continued adherence to dietary modifications and exercise regimens (Befort, et al., 2008). This begs the question: what are the differences between weight loss maintainers and weight regainers? Identifying differences between these groups may inform the development of more effective weight loss programs. However, few studies to date have investigated factors that may explain why some individuals persist with these weight control behaviors over the longer term while others do not.

According to a biopsychosocial model, a complex interaction of biological, psychological and social factors likely contribute to weight regain in obesity. Biologically, there is evidence that our bodies do not adapt to weight loss in a way that facilitates weight loss maintenance (Cornier, 2011). In general, humans have evolved to prepare for famine when food intake decreases. That is, when caloric intake decreases, hormones act to increase hunger signals and decrease satiety. This biological response is an evolutionary adaption designed to help the body restore energy reserves (Cornier, 2011).

The influence of biological and hormonal factors on weight regain is irrefutably important, but findings from a systematic review conducted by Strohacker, McCaffery, MacLean, and Wing (2014) suggest that this explanation of weight regain is incomplete. These researchers emphasized the role of social, environmental, and psychological factors in order to better understand why some individuals are able to continue to adhere to

behaviour modifications that maintain weight loss following obesity treatments while others are not (Strohacker, et al., 2014). As detailed above, the fact that western culture tends to value thinness, and demonstrates weight bias against obese and overweight illustrates the potential role of social factors in the maintenance of obesity. Specifically, discrimination and weight bias may lead to or exacerbate mental health concerns including depression and anxiety, and may negatively impact or reinforce poor body image and self-esteem; as discussed above, these variables have been linked to obesity.

In terms of environmental factors, highly processed, high calorie, high sugar, and high fat foods are easily accessible in North America, and are often more affordable for low-income individuals and families than unprocessed foods. The accessibility and affordability of less healthy food choices is considered a contributing factor to the overall prevalence of obesity in North America (Cummins, & Macintyre, 2006). The current thesis will focus on the role of psychological factors in obesity and weight loss maintenance. The next section of this thesis will review the existing research on psychological factors associated with weight regain in obesity.

1.7 Research on Psychological Predictors of Weight Maintenance and Weight Regain

To date, few studies have specifically explored psychological factors associated with weight regain in obesity. In an initial study, McGuire, Wing, Klem, Lang, and Hill (1999) used a sample of members of the National Weight Control Registry (NWCR) who had already successfully maintained their weight loss for 12 months. The results indicated that successful weight loss maintenance 24 months after weight loss was associated with lower ratings of depression at 12 months, and more stable ratings of depression between

12 and 24 months. In order to enter the NWCR, individuals must maintain their weight loss for one year; this inclusion criteria limits this study in that no comparisons can be made to people who regain weight within one year following weight loss. However, the results of this study indicated that people with low, stable levels of depression may be more successful weight loss maintainers in obesity, and started the exploration of psychological factors associated with weight loss regain.

There was no further research on psychological predictors of weight regain until Byrne, Cooper, and Fairburn (2003) conducted a qualitative study four years later. They recruited a community sample of 76 females who had been either formerly obese, lost weight and had successfully maintained their weight loss for over 1 year (*n*=28), were currently obese and had lost weight then regained it (*n*=28), and women with a stable weight who had never been obese (*n*=20). Using a qualitative methodology, 20 women from each group took part in individual semi-structured interviews; they were asked to discuss their weight loss experiences and ideas or beliefs they held about weight loss maintenance or weight regain. The interviews were coded to elicit themes and patterns that differentiated the groups. The themes that emerged were then introduced during subsequent group interviews to evaluate whether the themes were endorsed by a separate sample of weight maintainers and regainers.

Compared with maintainers, regainers were less likely to have met their initial weight loss goals, and retrospectively reported that they had been dissatisfied with their weight loss immediately after losing weight even when weight loss goals were met. Regainers also tended to endorse current weight and shape overvaluation, a more dichotomous thinking style, and higher rates of emotional eating. These themes were

supported in the group interviews. These findings suggest that participants who had regained weight tended to be more critical of their weight immediately after losing weight, tended to use food to regulate their emotions, tended to base their self-worth on their weight, and tended to have an "all-or-nothing" thinking style as compared with weight maintainers.

This study was limited by the inclusion of female participants only; as such, these results cannot be generalized to males who maintain or regain weight. Additionally, participants may have demonstrated recall bias given the retrospective nature of the interviews. Despite these limitations, this exploratory study pointed to several variables worthy of further study.

Building on their qualitative findings, Byrne, Cooper, and Fairburn (2004) subsequently conducted a prospective study to quantitatively examine the themes that had emerged in the previous interviews. Fifty-three Caucasian, obese women who had recently lost 10% of their body weight were recruited from a community weight loss class. Participants completed a face-to-face baseline assessment interview that consisted of a series of semi-structured interview protocols and self-report questions regarding demographics, weight history, eating behaviour, food intake, as well as specific interviews to target factors that emerged in the preceding qualitative study including questions about their thoughts, feelings, and behaviours about weight loss, and dichotomous thinking style. Dichotomous thinking style was defined as a tendency to see things as all good or all bad. This construct was measured using the Dichotomous Thinking Scale created by the authors. This measure was not previously used and the psychometrics had not been established. Participants then completed telephone follow-up

interviews every two months for one year. At one-year follow up, dichotomous thinking style was the only significant predictor of weight regain. That is, participants who had endorsed a dichotomous thinking style at baseline regained more weight than those who did not. Participants who regained weight also tended to report less satisfaction with their initial weight loss, and ranked weight control as a lower priority than did weight loss maintainers.

The results indicated that a dichotomous thinking style could be implicated in weight loss maintenance, and should be explored further in future research. However, a new, unvalidated measure of dichotomous thinking was used to measure this construct, which impacts the degree to which these findings can be interpreted as valid. In addition, a small, all-female sample was used, and self-reported weight rather than measured weight was collected at all time points. The homogenous sample limits the generalizability of these findings to males or ethnically diverse populations, and the validity of weight data may be biased, as participants may have under-reported weight or over-reported weight loss due to social desirability.

Following Byrne, et al.'s (2003) study, Linde et al., (2004) continued to examine the relationship between weight loss maintenance and initial weight loss (i.e., current weight loss target) and ideals (i.e., ideal weight). This study aimed to clarify the nature of this relationship by exploring whether depression, optimism, and self-esteem predicted weight loss maintenance. A community sample of 302 adult women had their height and weight measured, and completed questionnaires measuring their goal weight, ideal weight, weight history, binge eating behaviour, level of depressed mood, self-esteem, and body image satisfaction. Participants then completed an eight-week behavioural weight

loss program, and returned for follow-up assessment six and 18 months following the end of treatment.

Contrary to expectations, it was found that more unrealistic weight loss goals (i.e., amount intended to lose during current weight loss attempt) and ideals (i.e., ideal weight regardless of current weight loss goals) predicted greater weight loss and better weight loss maintenance outcomes at 18-month follow-up. Depression and binge eating were not significantly related to actual, goal, or ideal weight. Poor body image was associated with higher baseline BMI, less realistic weight goals and less realistic ideal weight.

Again this study was limited in that it only included females, the sample had relatively small weight losses compared to other treatment studies, and there was a high rate of attrition. In spite of these limitations, the results of this study call into question the validity of the common assumption that realistic weight loss goals predict better long-term weight maintenance.

Teixeiria, et al., (2004) conducted a study designed to identify pre-treatment psychological predictors of weight loss maintenance one-year post-completion of a four-month behavioural weight loss program. A community sample of 158 obese women completed a pre-treatment assessment including height and weight measurements and self-report questionnaires to evaluate exercise self-efficacy, body image, and quality of life. Thirty percent of participants either did not complete the four-month treatment or failed to return for follow up. Successful weight loss maintenance at one year was associated with pre-treatment higher quality of life, more positive body image, fewer previous dieting attempts, weight loss satisfaction, and higher ratings of exercise self-efficacy.

These results suggest that pre-treatment quality of life and body image satisfaction may play a significant role in adherence to weight loss programs and maintenance behaviour. However, this study used an all-female sample, there was a high rate of attrition, and the large number of statistical tests used in the analyses may have increased the likelihood of Type 1 error in the results. Replication of these results in future studies will strengthen their validity, and decrease the likelihood of Type 1 error.

Following this, Collings, Saules, and Saad (2008) explored the role of body image, depression, and self-esteem in a sample of 73 women who had lost 10 % of their pre-program body weight through a community based behavioural weight loss program. The authors evaluated the role of each of these factors in predicting weight loss maintenance three and 12 months following completion of the program. Participants completed self-report questionnaires and self-reported their weight upon recruitment, after three months, and again after 12 months.

Weight regainers reported greater body image dissatisfaction at baseline than those who successfully maintained weight loss at follow up. This seems inconsistent with the finding by Linde, et al. (2004) who found that more unrealistic weight loss goals predict better weight loss maintenance. It might be expected that those with greater body image dissatisfaction would also have less realistic weight loss goals and ideals. Colling, et al.'s (2008) results indicated that improvement in body image dissatisfaction between baseline and 12 month follow up significantly predicted weight maintenance, meaning that individuals who did not experience improvement in body image while maintaining weight loss were more likely to regain weight long term. The combinations of these findings suggest that weight loss goals/ideals are not necessarily consistent with body

image satisfaction. There may be other factors that influence body image satisfaction such as extra skin following weight loss (Gilmartin, 2013). However, Colling, et al. (2008)'s study used a relatively small sample size, and height and weight were derived from self-reports at all time points, which introduces the possibility of social desirability bias. These limitations constrain generalizability of these results, and highlight the need for replication using objective measurement.

Building on early findings, Wing et al., (2008) also evaluated whether baseline depressive symptoms, dietary disinhibition or treatment type predicted weight loss maintenance six and 12 months following either an in-person or online weight loss maintenance intervention among 261 overweight or obese adults in the northeastern United States who had recently lost 10% or more of their initial body weight. The sample was primarily made up of Caucasian women, but included approximately 18% males. Pre-intervention (i.e., baseline) scores on depression and dietary disinhibition were not significant predictors of weight loss maintenance. However, increases in depressive symptoms and dietary disinhibition between baseline and 6- and 12-month follow-ups significantly predicted weight regain. These findings suggest that addressing mood symptoms and mood stability over time may be important to improve long-term weight loss maintenance outcomes. This study was strengthened by the use of measured weight rather then self-report, and it was unique in that it specifically evaluated the impact of a weight loss maintenance program rather than a weight loss program. Limitations of this study are the inclusion of a primarily female sample, and the average pre-program weight loss for participants was high at 18% of their initial body weight; this may limit the generalizability of these results to those who have lost smaller proportions of weight.

No further research on psychological predictors of weight regain was conducted for several years until Delahanty, et al., (2013), using data from a multi-center study, examined whether depression, anxiety, stress, exercise self-efficacy, diet self-efficacy, and weight efficacy predicted weight loss maintenance 6-months following a 16-week behavioural treatment. A sample of 274 mixed-gender, mixed ethnicity, obese adults who had lost at least 7% of their body weight was assessed at baseline following the weight loss program, and again 6-months later. The only significant predictors of weight loss maintenance were increases in diet self-efficacy and dietary restraint throughout the follow-up period. This suggests that participants who felt capable of adhering to a diet, and whose dietary restraint increased from baseline to follow-up demonstrated better weight maintenance outcome. Like much of the research on this topic to date, this study was limited by reliance on self-reported weight.

In a recent study, Brantley, et al., (2014) explored psychological predictors of weight regain as part of a randomized control trial. A mixed-gender, mixed ethnicity sample of 1025 obese adults completed a six-month group-based weight loss intervention that targeted behaviour change and motivational enhancement. At the end of treatment participants completed a self-report measure of social support for eating and exercise habits and a composite self-report measure of mental health including ratings of quality of life, depression, and perceived stress. Participants were then randomly assigned to one of three weight loss maintenance interventions: self-directed/no intervention (i.e., control group), technology-based, or person-to-person contact interventions. The interventions consisted of social support and introduction to behavioural self-monitoring and relapse prevention strategies, and varied only in mode of delivery.

The results indicated that better overall mental health predicted better weight loss maintenance outcomes after controlling for intervention type. Contrary to expectations, greater perceived social support predicted higher weight regain. The authors speculate that this relationship might have been due to social support for weight loss being experienced by participants as judgment towards obesity or stigmatization. Participants who were part of the person-to-person contact intervention group tended to have better weight loss maintenance outcomes than participants in the technology-based intervention and control groups. These findings provide preliminary support for in-person relapse prevention weight maintenance programs and contribute to the evidence that depression may be related to weight regain in obesity. A limitation of this study is that it only included individuals who had lost at least four kilograms during the weight loss intervention; this limits the generalizability of the results to those who have lost moderate to large amounts of weight; these relationships may differ for those who have smaller amounts of weight (i.e., less than four kilograms).

In summary, the research on psychological factors associated with weight maintenance to date has been exploratory in nature, and few studies have been published on the topic. Specifically, nine studies have specifically explored the predictive role of psychological variables in weight regain. Included in these were one qualitative study (Byrne, et al., 2003), seven prospective longitudinal studies, and one randomized control trial (Brantley, et al., 2014). Of these, half included only female participants (Byrne, et al., 2003; 2004; Linde, et al., 2004; Teixeira, et al., 2004; Colling, et al., 2008), two included over 80% female participants (McGuire, et al., 1999; Wing, et al., 2008), and two included more evenly mixed gender samples (Delahanty, et al., 2013; Brantley, et al.,

2014). Additionally, all but two studies (McGuire, et al., 1999; Byrne, et al., 2003) were based on weight loss achieved through a specific weight loss intervention that was either controlled or offered by the researchers. This limited the generalizability of these findings to weight regain following the specific intervention offered.

Regarding the psychological predictors studied, a wide range of variables has been explored, but few have been examined in more than one study. The variables that have been identified as possible factors implicated in weight regain in obesity in single studies included: quality of life (Teixeria, et al., 2004), stress (Delahanty, et al., 2013), and diet self-efficacy (Delahanty, et al., 2013). These findings have yet to be supported through replication and are subject to the limitations of the individual studies as discussed above.

However, depression, emotional eating, and dissatisfaction with weight loss, are factors that have been shown to be related to or predictive of weight regain in obesity in multiple studies. Depressed mood symptoms were associated with weight regain in several studies (McGuire, et al., 1999; Wing, et al., 2008; Brantley, et al., 2014); however findings from Linde (2004) and Delahanty, et al., (2013) did not replicate this, suggesting that the nature of this relationship is still unclear and requires further replication and exploration.

Additionally, and perhaps predictably, emotional eating, binge eating, and eating to regulate mood were shown to predict weight regain following weight loss (Byrne, et al, 2003; Byrne et al., 2004; McGuire, et al, 1999). These results illustrate a behaviour pattern associated with weight regain, but also suggest that there may be a relationship between general difficulty with emotion regulation and weight loss maintenance in obesity. Satisfaction with weight loss was found to be an important predictor of weight

loss maintenance (Byrne, et al., 2003; Byrne, et al., 2004; Teixeira, et al., 2004). However, these findings showed that dissatisfaction with weight following weight loss was predictive of weight regain even when weight loss goals were met. This means that individuals who remained dissatisfied with their weight even after reaching their goal or ideal weight were more likely to regain weight long term. This suggests that dissatisfaction even after reaching weight loss goals may be indicative of dissatisfaction with the self in general, rather than specific dissatisfaction with a specific weight. This raises questions about the relationship between self-dissatisfaction and weight regain in obesity, which will be the focus of this thesis. Research to date has also been limited by almost exclusive use of self-reported weight and the inclusion of primarily all-female samples; these limitations will be addressed in the current thesis. In combination with the unexpected findings suggesting that unrealistic weight loss goals support successful weight loss maintenance (Linde, et al., 2004), these findings may imply that perhaps weight loss maintenance is more greatly impacted by satisfaction with weight loss achieved, rather than the realistic nature of weight loss goals or by the actual number of weight loss pounds achieved.

The following section introduces Self-Discrepancy Theory (SDT) as a framework to relate the general self-dissatisfaction discussed above, BMI changes (i.e., weight regain) over time following weight loss, and the psychological variables associated with weight regain including mood, difficulty in emotion regulation, emotional eating, and binge eating. SDT and past applications of this theory to weight related research is detailed next.

1.8 Self-Discrepancy Theory

Higgins, Klein, and Strauman (1985) developed SDT as a model to explain how individuals integrate beliefs and representations they hold of themselves. SDT states that individuals have a variety of representations of themselves including: a representation of themselves as they believe they are (*actual/own*), a representation of the person they wish or aspire to be (*ideal/own*), a representation of the person they feel they have a duty or obligation to be (*ought/own*), and representation of the person they do not want to be (*undesired/own*). Furthermore, SDT states that individuals also hold beliefs or representations about how they believe others view them including a representation of the person others believe they are (*actual/other*), a representation of the person others would wish or aspire them to be (*ideal/other*), a representation of the person others feel they have a duty or obligation to be (*ought/other*), and finally a representation of the person others would not want them to be (*undesired/other*) (Higgins, 1985). The *actual/own* representation is considered an individual's self-state, while all other representations of the self are referred to as self-guides (Strauman, & Higgins, 1988).

According to SDT, individuals can experience discrepancies between their self-state and any of the self-guides. For example, an individual could hold the view that they do not possess attributes or characteristics that they would ideally like to have; this would illustrate a discrepancy between the *actual/own* self-state and *ideal/own* self-guide. SDT also states that individuals can experience discrepancies between their self-state and the self-guides they perceive their close social group to hold about them (Higgins, 1987; Strauman, & Higgins 1987). For example, an individual could experience discrepancy between the personal characteristics they believe they do possess and the characteristics that they believe their parent or spouse would ideally like them to possess. This would

illustrate a discrepancy between the *actual/own* self-state and *ideal/other* self-guide. All "discrepancies" reference discrepancy between the stated self-guide (e.g. *ideal-own, ought-other,* etc.) and the self-state (i.e., *actual-own*).

The first application of SDT in clinical psychology research explored the relationship between self-discrepancy and negative mood states. Strauman and Higgins (1988) evaluated the role of self-discrepancy's relationship to depressed/dejected and anxious/irritable mood states in a sample of 72 university undergraduates; they found that certain types of discrepancies were significantly correlated with certain chronic negative mood states. Specifically, *ideal/own* discrepancy significantly positively correlated with chronic feelings of frustration and anger towards the self, as well as chronic feelings of dejection. Alternatively, *ought/other* discrepancy was positively related to chronic feelings of resentment, agitation, and anger directed towards others (Strauman, & Higgins, 1988). It was also found that an *ought/other* discrepancy was strongly associated with anxiety, and that an *ideal/own* discrepancy was strongly associated with depressed mood (Strauman, & Higgins, 1988).

Activation of specific types of self-discrepancy has been shown to cause corresponding negative mood states. Strauman and Higgins (1987) found that when participants in an undergraduate student sample were primed with information that activated thoughts of their perceived *ideal-own* discrepancies, feelings of dejection and sadness tended to be elicited. Furthermore, when the participants were primed with information that activated thoughts of their perceived *ought-own* discrepancies, feelings of anxiety were elicited (Strauman, & Higgins, 1987). This study illustrated that not only are negative mood states related to specific types of self-discrepancy, but provided

evidence to suggest that triggering awareness of self-discrepancy may actually cause negative mood states.

Following these initial findings, researchers began to explore how SDT might provide a framework for understanding the relationships between negative emotions, emotion regulation, body image, eating behaviour, disordered eating, and physical activity. These findings are detailed in the next section of this thesis.

1.9 Self-Discrepancy, Emotion Regulation, Eating, and Activity

Strauman, Vookles, Berenstein, Chaiken, & Higgins, (1991) found that in a sample of 138 female undergraduates, *ideal/own* self-discrepancy was significantly correlated with body dissatisfaction, irrespective of objective BMI. These results seemed to imply that self-discrepancy is related to negative body image satisfaction regardless of BMI category or medical need for weight loss. Furthermore, in a second sample of 91 male and female undergraduates, greater *ideal/own* self-discrepancy was significantly correlated with bulimic-type disordered eating behaviours; meanwhile, *ought/other* self-discrepancy was significantly correlated with food restriction and anorexic-type disordered eating behaviours. These significant correlations remained after appearance-based characteristics were controlled (Strauman, et al., 1991), suggesting that degree of body image dissatisfaction may not be proportionally dependent on objective BMI. One possible implication of these findings is that motivation to reduce self-discrepancy could impact eating behaviour related to weight control.

In a subsequent study, 490 female undergraduates were asked to complete separate measures of general self-discrepancy and appearance-based self-discrepancy (Strauman, & Glenberg, 1994). The researchers found that individuals with higher general

ideal/own self-discrepancies were significantly more likely to overestimate their body size than those with lower general self-discrepancy when presented with a spectrum of possible body size choices. Interestingly, the same pattern was not evident in those with only appearance-based self-discrepancy, implying that broader dissatisfaction with the self, rather than specific appearance-related discrepancies, may contribute to body image distortion.

These relationships were not explored further until Anton, Perri, and Riley (2000) explored the relationship between appearance-based self-discrepancy and body image dissatisfaction in a sample of 115 female college students. High degree of *ideal/own* body-specific self-discrepancy was positively correlated with body image dissatisfaction. Furthermore, body image dissatisfaction was related to low ratings of healthy lifestyle behaviours. Based on these findings, the authors suggest that an inverse relationship may exist between self-discrepancy and healthy lifestyle behaviours; that is, higher self-discrepancy may co-occur with limited healthy lifestyle behaviours (e.g., regular exercise, healthy dietary habits, etc.).

More recently, it was found that lower *ideal-own* self-discrepancy predicted more frequent physical activity among 205 female post-secondary students and higher *ideal-own* self- discrepancy was associated with lower physical activity levels (Brunet, Sabiston, Castonguay, Ferguson, & Bessette, 2012). Mediation analysis suggested that the relationship between low self-discrepancy and high physical activity was mediated by intrinsic motivation. These results suggest that interventions to increase physical activity should promote intrinsic, rather than extrinsic sources of motivation in order to promote exercise (Brunet, et al, 2012). For instance, encouraging obese individuals to pursue

weight loss for personal benefits (e.g. health benefits, increased energy, mood improvement, etc.), instead of in response to an external source of pressure (e.g. physician instruction, social pressure, etc.).

Heron and Smyth (2013) conducted a study designed to assess the relationship between body image self-discrepancy and real-time changes in mood using portable technology-based mood checks several times during the day. In the sample of 63 female undergraduate students, activation of *ideal-own* body image discrepancies uniquely predicted the onset of depressed mood symptoms, while activation of *ought/other* body image discrepancies predicted the onset of anxious mood symptoms (Heron & Smyth, 2013). This study was limited by the use of all female participants and the use of a relatively small sample size, but the results supported previous research suggesting that activation of self-discrepancy can elicit corresponding negative mood states.

In summary, these studies have provided evidence of a significant relationship between self-discrepancy, mood, body image, and lifestyle behaviours. This research paved the way for research examining the role of self-discrepancy in the development and maintenance of eating disorders.

1.10 Self-Discrepancy and the Integrated Cognitive Affective Therapy Model

As discussed previously, research that explored the utility of SDT in application to eating behaviour and body dissatisfaction provided evidence that activation of either general self-discrepancy or body image self-discrepancy elicits negative mood states including depression, anxiety, resentment, and body image dissatisfaction (Strauman, & Higgins, 1987; 1988; Anton, et al, 2000; Brunet, et al, 2012; Heron, & Smyth, 2013). Grounded in SDT and the research supporting a relationship between self-discrepancy

and eating behaviour, Wonderlich, et al, (2010) developed the Integrated Cognitive Affective Therapy [ICAT] model to depict the integrated roles of self-discrepancy, negative emotions, and emotion regulation styles in the development and maintenance of bulimia nervosa [BN].

The utility of the ICAT model for BN was evaluated in two initial studies (Wonderlich, et al, 2008). In the first, 50 women diagnosed with BN and 50 age-matched controls were asked to complete measures of self-discrepancy, self-directed coping style, and mood. Self-directed coping style was defined in terms of coping behaviours (e.g. eating disorder behaviours, binging, purging, etc.) and coping self-talk (e.g., positive/encouraging self-statements or negative/blaming/disparaging self-statements). The results indicated that the BN group had significantly greater *ideal-own* and *ought-own* self-discrepancies than the control group. The BN group also demonstrated significantly higher scores for negative coping styles and lower scores for positive coping styles than controls. In the second study, 25 women with BN and 25 controls completed measures of the same constructs (Wonderlich, et al, 2008). The results indicated that the BN group again endorsed higher self-discrepancy scores than controls, and mediation analyses indicated that negative mood mediated the relationship between self-discrepancy and self-directed coping style. These results suggest that self-discrepancy may play an important role in positive and negative self-regulation patterns, and this relationship may be mediated by mood.

The underlying core concepts that serve to maintain BN in the ICAT model have also been identified as predictors of weight regain in obesity (as reviewed in section 1.7); these include body image dissatisfaction, binge eating, emotional eating, and negative

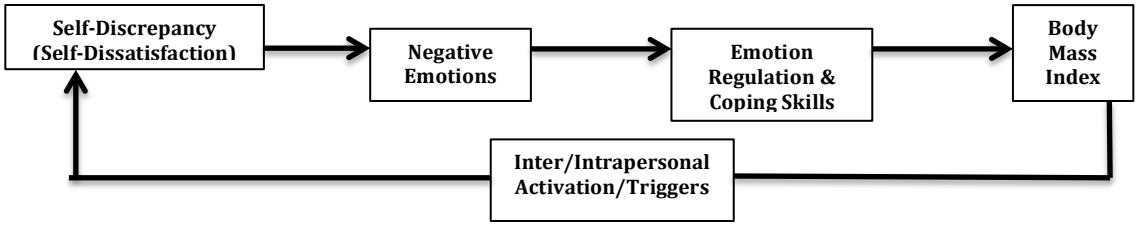
mood (Byrne, et al, 2004; Wonderlich, et al, 2010; Heron, & Smyth, 2013). Thus, in the current study, the ICAT model of Wonderlich et al (2010) has been adapted and applied to further understand weight regain in obesity.

The ICAT model postulates that interpersonal or intrapersonal experiences activate or trigger awareness of self-discrepancy, which in turn elicits negative emotions. The coping styles and emotion regulation adaptations of each individual will then influence their behavioural response to these negative emotions (Wonderlich, et al., 2010). In the case of BN, individuals may engage in binge eating and purging behaviours to cope with negative mood states that serve to further negatively impact their body dissatisfaction, mood, and emotion regulation style, and cycle back to increase the discrepancy between self-states and self-guides (Wonderlich, et al., 2010).

The model shown in Figure 1.1 depicts the proposed process involved in the maintenance of obesity and weight regain to be investigated in the current study. Self-discrepancy is activated through inter- or intra-personal triggers that stimulate negative emotional experiences. Individuals will vary regarding how well equipped they are to regulate those emotions; some may engage in adaptive emotion regulation strategies (e.g., utilizing social support, challenging unhelpful thoughts, physical activity), while others may engage in maladaptive strategies (e.g., emotional eating, social avoidance, binge eating). The strategy used will ultimately cycle back to influence each individual's self-state, and the degree of discrepancy between self-state and self-guides (e.g., more/less competent, more/less depressed, fatter/thinner, etc.).

Figure 1.1

Adapted ICAT Model



The model suggests that difficulty with emotion regulation may represent a third variable involved in the relationship between self-discrepancy and weight regain. Discrepancy in specific self-guides (i.e., *ideal/own* or *ought/own*) may also be uniquely related to the type of negative mood endorsed by individuals (i.e., depressed or anxious).

1.11 Overall Study Rationale and Aims

The current thesis had two primary objectives. The first was to examine BMI change over time in a community sample of obese or formerly obese adults who had recently lost weight. The second was to explore the utility of the ICAT model for understanding BMI change (i.e., weight maintenance versus weight regain) in obesity by examining the relationships between BMI change, self-discrepancy, difficulty in emotion regulation, mood, emotional eating, and binge eating. The value of the ICAT model has been established in understanding and treating eating disorders and may have applications for understanding and treating obesity. The following specific aims were addressed:

1. The first aim was to examine the relationships between baseline psychological variables, current BMI, and weight history. Based on the ICAT model and previous findings, it was hypothesized that:

a. *Ideal-own* self-discrepancy would demonstrate a positive relationship to depression and *ought-own* self-discrepancy would demonstrate a positive relationship to anxiety

b. *Ideal-own* and *ought-own* self-discrepancy would demonstrate a positive relationship with baseline, 3-month, and 6-month BMI.

c. Difficulty in emotion regulation would demonstrate a positive relationship with depression, anxiety, stress, and emotional eating.

2. The second aim of the current study was to assess change in BMI over time for the current sample. Based on previous findings, it was hypothesized that:

a. Average BMI would increase between baseline, 3-month, and 6-month follow-up, indicating a general trend of weight regain over time.

3. The third aim of the current study was to evaluate whether baseline psychological variables predicted BMI outcome at follow-up. It was hypothesized that higher ratings of *ideal-own* self-discrepancy, *ought-own* self-discrepancy, difficulties in emotion regulation, depression, anxiety, stress, and emotional eating would predict greater BMI increase at 6-month follow-up,

4. The fourth aim of this study was to compare weight regainers and non-regainers in terms of their mean scores on baseline psychological variables. It was hypothesized that:

a. Regainers would demonstrate higher ratings of *ideal-own* and *ought/own* self-discrepancy, difficulties in emotion regulation, emotional eating, depression, anxiety, and stress than non-regainers.

5. The fifth aim was to compare weight regainers and non-regainers on baseline binge-eating behaviour. It was hypothesized that:

a. A greater proportion of regainers would report binge eating in the last 28 days than maintainers.

2. CHAPTER TWO

Method

2.1 Design

The current study was part of a larger research project and it involved both cross-sectional and longitudinal components. The larger project was designed to evaluate psychological variables and biological variables (e.g., hormonal variables) in predicting weight regain in a community sample of obese individuals who had recently lost weight. The participants for the current study were a subset of those who took part in this larger study who also completed body scans and blood draws as a part of the larger project. The data and analyses for the biological component of the larger study are beyond the scope of the current thesis, and will not be discussed here.

Regarding the cross-sectional component, participants completed a series of interview and questionnaire measures of psychological variables at baseline. In addition, their height and weight were measured to ensure accurate calculation of BMI. As part of the larger project, participants also completed a blood draw and a DEXA (i.e., dual energy X-ray absorptiometry) body scan at that time. Only participant's scores on psychological measures and their BMI were used in the current analyses.

For the longitudinal component, participants provided weight data that was then used to calculate their BMI at 3- and 6-month follow-up. At 3-months the weight was self-reported via phone or email, and at 6-months weight was measured again. These measurements were used to examine the relationships between the baseline psychological

variables and weight regain over time. As part of the larger study, participants once again completed blood draws and body scans at 6-month follow-up.

2.2 Participant Recruitment

Participants were recruited from the community of St. John's, Newfoundland and Labrador and the surrounding area as part of a larger research project between October 2013 and July 2015. Participant recruitment was achieved through poster, brochure, and public media-based advertisements (see Appendix A). Poster advertisements were placed around the St. John's area including hospitals and health centres, family medical practices, fitness centres, community weight loss programs, community bulletin boards, and the Memorial University campus. Media-based advertisements were placed on a prominent local news website, a local radio station interviewed the principal investigator of the larger research study on air, and an article about the study was placed in the local newspaper. All advertisements stated that the study explored weight loss, and that researchers sought individuals who had recently lost weight. The advertisements invited those interested to visit a website and fill out the screening questionnaire by providing a link and a barcode scanner to direct them to the online survey.

Those interested completed the online screening questionnaire (See Appendix A), where they were asked to provide their email and/or phone number, and answer questions related to the inclusion and exclusion criteria. Everyone who filled out the screening questionnaire was notified of eligibility status by email. Those eligible were provided with more information about the study and were invited to participate; interested individuals were then scheduled for a baseline assessment. The inclusion and exclusion criteria are summarized in Table 2.1.

Table 2.1

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
BMI ≥ 30 prior to weight loss	Weight loss reached through non-behavioural methods (e.g. surgical, pharmacological)
≥ 5% Body Weight Loss	Self-reported current substance abuse
Current weight reached within 4 weeks prior to study	Self-reported anorexia or bulimia nervosa, self-induced vomiting, or laxative abuse
Age 18-60	

Inclusion criteria. Participants must have reported a BMI ≥ 30 prior to weight loss in order to be eligible to participate. Second, eligible participants must have reported weight loss of at least five percent of their original body weight through behavioural changes such as diet and exercise[1]. Participants were required to have reached their new lower weight within the past four weeks.

Exclusion criteria. Individuals were excluded if they had achieved weight loss through means other than behavioural change including: bariatric surgery, prescription diet pills, or liposuction. Individuals were also excluded if they reported currently receiving treatment for substance abuse, or current concerns about substance abuse. Finally, individuals who self-reported a current diagnosis of anorexia nervosa or bulimia

[1] A five percent weight loss minimum was chosen given that health benefits have been associated with weight loss of this magnitude (Wing, et al., 2011).

nervosa or specific symptoms of eating disorders including self-induced vomiting or laxative abuse were also excluded.

2.3 Assessment

Seventy-eight individuals attended individual baseline assessment appointments. A summary of interview questions, interview protocols, and self-report questionnaire measures administered at baseline, 3-month, and 6-month follow-up is shown in Table 2.2. All interview questions, interview protocols and self-report questionnaires are included in Appendix A.3.

Table 2.2

Assessment Measures

Time Point	Assessment Measures
Baseline	Demographic and Weight History Interview Selves Interview DERS EDE-Q: Binge Eating Questions DASS-21 EES Weight and Height Measurements
3-Month	Self-reported weight
6-Month	Weight Measurement

Note: DERS = Difficulties in Emotion Regulation Scale; EDE-Q = Eating Disorder Examination Questionnaire; DASS-21 = Depression, Anxiety, and Stress Scale -21; EES = Emotional Eating Scale;

Demographic and weight history interview. Detailed baseline demographic information was collected via interview including age, biological sex at birth, relationship status, ethnicity, education level, and vocational status. Participants were also asked to recall their highest and lowest lifetime adult weights, which were then used with their

measured height to calculate highest and lowest lifetime Body Mass Index (BMI). Additionally, participants were asked to recall how long they had maintained each weight, and how long it had been since they started their current weight loss attempt.

Selves Interview. Self-discrepancy was assessed using the Selves Interview (Higgins, Bond, Klein, & Strauman, 1986). This interview protocol is a free response measure, adapted from the original questionnaire version (Higgins, Klein, & Strauman, 1985). During the interview the researcher asks participants to describe their actual, ideal, and ought selves using one-word attributes. The interview uses identical instructions and scoring procedures as the questionnaire version (Higgins, et al., 1986; Wonderlich, et al., 2008). Higher scores reflect greater degree of self-discrepancy for each self-guide (i.e., *actual-ideal, actual-ought,* etc.).

The Selves Interview has demonstrated strong test-retest reliability with an intra-class correlation of r =.86 for the *total* self-discrepancy score, r =.88 for the *actual-ideal* self-discrepancy score, and r =.60 for the *actual-ought* self-discrepancy score (Wonderlich, et al., 2008). Higgins (1985) evaluated inter-rater reliability of the Selves scoring system; the Selves Interview demonstrated good inter-rater reliability(r=*.80*). Concurrent validity has been established for the Selves Questionnaire version; *actual/ideal* self-discrepancy scores were positively correlated with symptoms of depression, and *actual/ought* self-discrepancy scores were strongly associated with anxious/agitated symptoms (Higgins, et al., 1985).

Difficulty in Emotion Regulation Scale. The extent to which participants had difficulty regulating their emotions was evaluated using the Difficulty in Emotion Regulation Scale (DERS; Gratz, & Roemer, 2004). The DERS is a 36-item, 5-point

Likert-style questionnaire that includes six subscales derived from factor analysis: emotional non-acceptance, lack of emotional awareness, lack of emotional response clarity, limited access to emotion regulation strategies, difficulty controlling impulses in response to emotions, and difficulty with goal directed behaviour in the presence of negative emotions. The DERS does not specify a specific time frame for participants, but it designed to evaluate their emotion regulation difficulties in general. The overall score for the DERS can range from zero to 180, where higher scores reflect greater difficulty with emotion regulation. Norms for interpretation are provided using a sample of university students (Gratz, & Roemer, 2004).

Psychometric properties of the DERS were evaluated using a sample of 373 undergraduate students between 18-55 years old. The overall DERS score demonstrated strong internal consistency ($\alpha = .93$) (Gratz, & Roemer, 2004). In the current sample the DERS measure exhibited acceptable internal consistency comparable with norm data ($\alpha = .82$).

Test-retest reliability for the DERS was assessed after a retesting period of 4-8 weeks with a small sample (n=21); the subscales demonstrated adequate test-retest reliability ($r = .57$-$.89$, $p < .01$), and the test-retest reliability for the overall score was good ($r = .88$, $p < .01$) (Gratz, & Roemer, 2004).

The DERS demonstrated good construct validity with support for the factor structure when compared to existing measures hypothesized to correspond with DERS subscales (Gratz, & Roemer, 2004). The DERS utility for predicting behaviour associated with emotion dysregulation was evaluated in the same sample and the DERS was found to be a valid predictor of self-harm behaviour and intimate partner abuse among men and

women (Gratz, & Roemer, 2004). These results suggest that the DERS may be a valid predictor for other behaviours associated with emotion dysregulation, such as emotional eating and binge eating.

Depression, Anxiety, and Stress Scale – 21. The Depression, Anxiety and Stress Scale -21 (DASS-21; Lovibond, & Lovibond, 1995), is a 21-item self-report questionnaire that was developed to assess symptoms of depression, anxiety and stress over the past week. Higher scores on each subscale reflect greater endorsement of symptoms related to each scale. The DASS-21 is a compacted version of the longer, 42-item DASS that was modified for efficient administration. The original manual for the DASS-42 listed the items for the short version, but no psychometric data on the DASS-21 was provided until later publications (Antony, Bieling, Cox, Enns, & Swinson, 1998).

The DASS-21 has demonstrated strong internal consistency; Cronbach's alpha of α= .93 for the total score, α= .88-.94 for the Depression subscale, α= .80-.87 for the Anxiety subscale, and α= .84-.91 for the Stress scales (Antony, et al., 1998; Henry, & Crawford, 2005; Sinclair, et al., 2012). DASS-21 scores in the current sample exhibited strong internal consistency including Cronbach's alpha for the 1) total (α =.92), 2) depression subscale (α =.93), 3) anxiety subscale (α =.81), and 4) stress subscale (α =.84).

Antony, et al., (1998) suggested that the DASS-21 is preferable to the longer version given that inter-factor correlations were lower than those for the 42-item version. Brown, Chorpita, Korotitsch, and Barlow (1997) evaluated test-retest reliability for the DASS-42 in a clinical sample of 473 adults following a 2-week retesting period. Acceptable test-retest correlations were found for the three subscales (r=.71-.81), and no

significant differences were found between the subscale scores at each testing period (Brown, et al., 1997). Test-retest reliability has not been established for the DASS-21.

The DASS-21 subscales (depression, anxiety, and stress) achieved acceptable concurrent validity when compared to the Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), and the State-Trait Anxiety Inventory (STAI) respectively, with Pearson correlations between corresponding subscale scores ranging from r= .65-.88 (Antony, et al., 1998).

Eating Disorder Examination Questionnaire. Binge eating behaviour was assessed using the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Belgin, 1994). The 28-item EDE-Q is a self-report questionnaire version of the original Eating Disorder Examination (EDE) interview (Cooper & Fairburn, 1987), and has since been widely used to measure eating disorder attitudes and behaviours. The EDE-Q is comprised of four subscales including Restraint, Shape Concern, Weight Concern, and Eating Concern; the mean of subscale scores reflects an overall, global EDE-Q score. The EDE-Q also includes two specific questions to assess the frequency of binge eating over the previous four weeks (Berg, Peterson, Frazier, & Crow, 2012).

Acceptable internal consistency of the EDE-Q subscales has been determined with alpha coefficients ranging from .70 - .93 across studies (Berg, et al., 2012). All studies included only female samples from either undergraduate or community populations. Internal consistency of the EDE-Q subscales was lower but acceptable in the current sample (α=.55-.77). This could be because the current sample is a mixed-gender, non-eating disorder sample.

Test retest reliability has been evaluated in a mixed-gender sample seeking treatment for Binge Eating Disorder (BED). Test retest correlations for the EDE-Q subscales ranged from .66-.94, and from .51-.92 for the behavioural indicators. Acceptable test-retest reliability was also demonstrated for the total score (r =.76) (Reas, Grilo, & Masheb, 2006).

Criterion and construct validity for the EDE-Q has been established through a variety of studies that demonstrated the EDE-Q's utility for distinguishing between eating disorder and non-eating disorder groups (Berg, et al., 2012). Reports of binge-eating behaviour on the EDE-Q converge with other measures of binge eating, though there is variation in the degree of convergence found (Berg, et al., 2012). This could be in part due the complex definition of a binge episode including whether the amount of food consumed was objectively large, and feelings of loss of control.

An initial study using a community sample of 243 women evaluated the concordance rate between the EDE and EDE-Q; the results indicated that although overall concordance rate was good, higher rates of binge-eating are reported on the EDE-Q than the EDE (Fairburn, & Belgin, 1994). More recently, a study using a mixed-gender sample of 217 individuals seeking treatment for eating disorders found that a good overall concordance rate for eating disorder diagnosis between the EDE and EDE-Q for DSM-5 criteria. Discrepancy between the two measures on binge-eating behaviour was consistent with previous research, with estimates of the frequency of binge eating being higher on the EDE-Q (Berg, et al., 2013).

Emotional Eating Scale. Urge to eat in response to negative emotions was assessed using the Emotional Eating Scale (EES; Arnow, Kenardy, & Agras, 1995).

Participants are instructed to rate their urge to eat in response to 25 varied emotional experiences from *no urge to eat – an overwhelming urge to eat*. The listed emotions (e.g., sad, jittery, annoyed, etc.) correspond with three subscales based on factor analysis: (1) anger/frustration, (2) anxious, and (3) depressed. Higher scores on this questionnaire reflect more endorsement of emotional eating in response to emotions specified in each subscale.

In a sample of 51 obese females accepted into a treatment study on BED, the EES subscales demonstrated acceptable construct validity through strong correlations with the Binge Eating Scale (r= .46-.65, p< .01). Criterion validity was demonstrated by evaluating correlations between changes in EES subscale scores with changes in BES scores pre- and post- BED treatment (Arnow, et al., 1995). Adequate discriminant validity was also demonstrated with this sample through comparisons with related constructs such as cognitive restraint, self-esteem, psychological adjustment, and disinhibition (Arnow, et al., 1995).

In a sample of 217 overweight and obese participants seeking weight loss treatment, Goldbacher, et al., (2012) found that the EES subscales demonstrated good internal consistency (α=.78-.89), and strong internal consistency overall (α=.94). In the current sample, the EES total demonstrated comparable internal consistency for the overall scale (α=.93) and subscales (α=.76-.89). Acceptable test-retest reliability correlations were found following a two-week retesting period (Arnow, et al., 1995).

Weight and height. Participants were weighed at the baseline assessment by a trained technician using a medical grade weigh scale. Height was also measured at the baseline assessment to ensure accurate calculation of BMI. At three-month follow-up,

participants were asked to self-report their weight via email, and at six-month follow-up participants returned to have their weight measured again with the same scale.

2.4 Procedure

Ethics Approval. The Health Research Ethics Board (HREB) at Memorial University of Newfoundland approved this research project.

Informed Consent. Each participant was provided with an informed consent form (See Appendix A) outlining the study at the baseline assessment. The researcher reviewed the form verbally, and each participant was given as much time as needed to read it and ask questions. Each participant was provided with a photocopy of their signed consent form.

Baseline assessment. Baseline assessments took place at the Health Sciences Centre in St. John's, Newfoundland, where a research assistant met with participants individually. First, a trained technician measured their height and weight. Next, the participant was brought back to a private interview room where the research assistant completed the interview component of the assessment. The participant then completed the self-report questionnaires on a laptop computer. The research assistant remained in the room during the self-report component in order to answer questions as needed, but sat across the table from the participant to provide privacy while the questionnaires were completed. Once the questionnaires were complete, the researcher provided the participant with the date of their follow-up assessment, and the participant was free to leave.

3 – month follow-up. 3-months after the baseline assessment participants received an email from the researcher confirming their future on site follow-up

appointment, and asking them to self-report their current weight. If a participant did not respond within one week of the initial email, they were sent a reminder email, and then the researcher contacted the participant by telephone to encourage retention.

6 – month follow up. One week prior to participant's scheduled six-month follow up appointment the research team contacted participants by email to confirm their appointments and reschedule if necessary. If a participant did not respond within one week of the initial email, they were sent a reminder email, and then the researcher contacted the participant by telephone to encourage retention. At the six-month follow up appointment participants had their weight measured by a trained technician using the same scale used at baseline. Follow up appointments were held at the same location as the baseline assessment.

2.5 Statistical Analyses

First, data were screened for missing values, outliers, and normality. Next, descriptive statistics for the sample's demographic characteristics weight history were run.

With respect to the first aim of this thesis, descriptive statistics for baseline psychological variables were calculated including mean, standard deviation, range, median, and interquartile range. Relationships among all baseline variables were examined using Pearson's correlations.

Regarding the second aim of this thesis, change in BMI over time was examined using a one-way repeated measures ANOVA followed by paired samples t-tests. To examine whether baseline psychological variables predicted BMI change over time, and

to address the third aim of this thesis, a series of univariate linear regressions were conducted.

To examine the fourth aim of this thesis, a series of independent samples t-tests were completed to evaluate the differences in mean scores on psychological variables between participants who regained weight and those who did not. Finally, in regards to the fifth and final aim of this thesis, a Fischer's Exact test was conducted to compare the percentage of binge eating frequency between weight regainers and non-regainers.

3. CHAPTER THREE

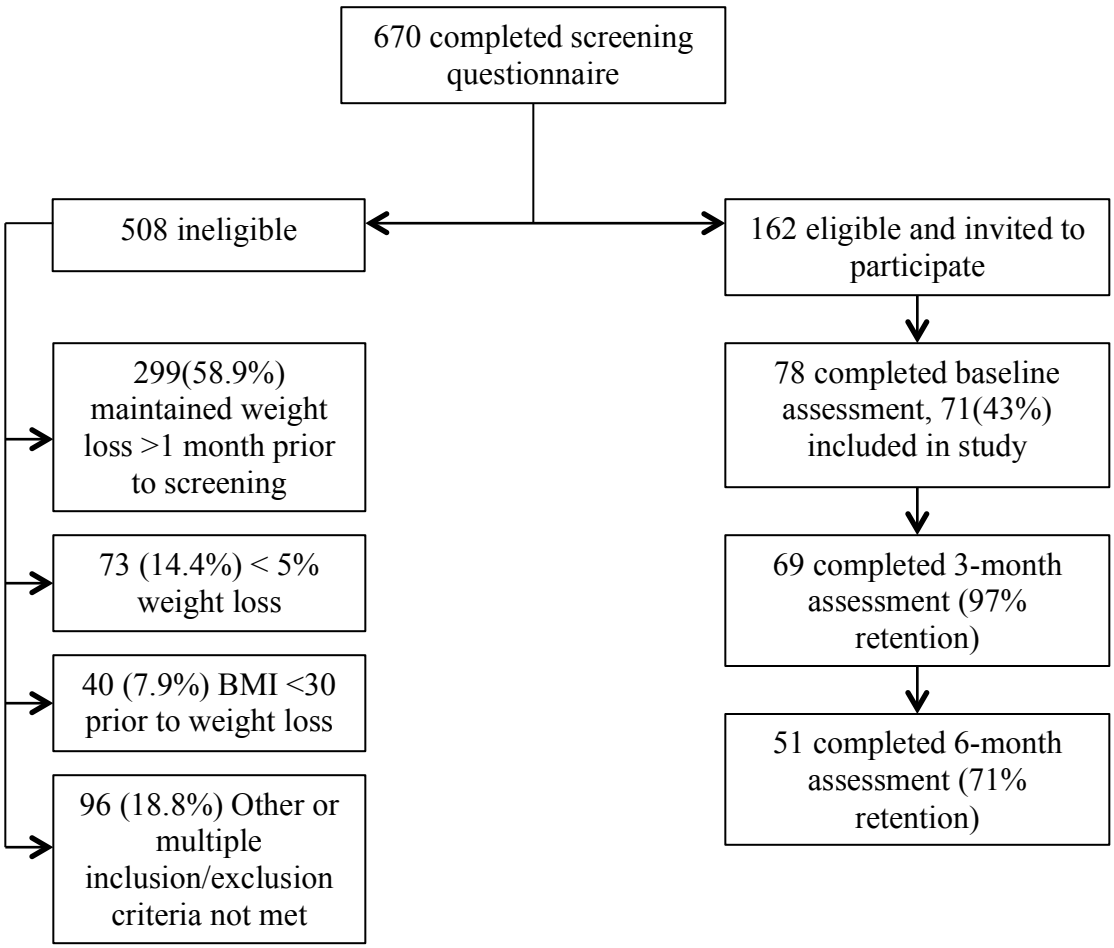
Results

3.1 Recruitment and Retention

A summary of participant recruitment and retention for the current study is presented in Figure 3.1.

Figure 3.1

Study Recruitment and Retention



Recruitment. Six hundred and sixty-three individuals completed the screening questionnaire. Of these, 162 were eligible to participate in the study. The primary reasons the remaining 501 were ineligible were: 1) maintenance of weight loss was for longer than 1 month prior to completing the screening questionnaire (59.6%); 2) weight loss amount was less than 5% (14.5%); and 3) BMI was less than 30 prior to weight loss (7.9%). Seventy-eight of those eligible chose to take part in the study and completed the baseline assessment. One participant withdrew from the study before the baseline assessment was completed, and four participants who were incorrectly screened as eligible were later found to be ineligible since their BMI prior to weight loss was not ≥ 30. Additionally, two participants did not complete the self-report questionnaires at the baseline assessment. The data from these participants were excluded, resulting in a final sample size of 71 participants.

Retention. Sixty-nine (97%) of participants who participated at baseline completed the 3-month follow-up assessment. Of these, 51 participants completed the 6-month follow-up assessment, resulting in an overall retention rate of 71%.

3.2 Data Screening

The data were first screened for missing values, outliers, normality, skewness, and kurtosis.

Missing Values. One participant did not complete the Selves Interview; therefore analyses for this measure were limited to 70 participants.

The EES was added to the study after data collection had begun. Therefore, the first six participants did not have the opportunity to complete this questionnaire at baseline. Additionally, one participant failed to complete the EES, and one participant

missed four questions on the EES. These participants were excluded from analyses of the EES, limiting the sample size for analyses of this measure to 63.

Regarding additional missing values on self-report measures, there were no missing values on the DASS-21; one question was missed by a single participant on the DERS, and 13 participants missed either one or two questions on the EES. To manage these missing data points, each participant's individual mean was calculated for the subscale on which the missing data point fell based on their responses to other items for that particular subscale. The missing item was imputed with the mean of the participant's other items on that subscale. This method of imputation was recommended given that only a very small number of missing cases were present; it allowed the data to be kept for analyses so as to not reduce the participant sample in an already small sample size, but does not reduce overall sample distribution as simple sample mean imputation would (Van, & Buuren, 2012)

Four participants did not complete 3-month follow-up, but did complete the 6-month follow-up. Using the method recommended by Engels and Diehr (2003) for imputing missing data in longitudinal studies, the average of each participant's baseline and 6-month weight was imputed for missing 3-month follow-up weight data.

Outliers. The data were screened for extreme data points by converting scores from psychological measures and baseline BMI values to z-scores and screening for values greater than 3.0 or less than -3.0 as suggested by Stevens (1996) for social sciences research. No significant outliers were detected on the EES or the ideal/own, ought/own, ideal/other, and undesired/other self-discrepancy scores.

One outlier was detected for baseline BMI. In addition, one outlier was detected for the DERS total score and for each of the undesired/own and ought/other self-discrepancy scores. For the DASS-21, one outlier on the Stress subscale and one outlier on the Anxiety subscale were detected, and the values were attributed to the same participant. Two outliers were detected for the Depression subscale. All outliers except those found for the DASS-21 anxiety subscale and the DASS-21 stress subscale were each attributed to different participants. All analyses were completed including the extreme data points, and then re-run excluding these outliers. No differences between the results with and without the outliers were found, and equal variances could be assumed based on Levene's test. Therefore, the results including all original data are reported below.

Normality. The data were assessed for normality, skewness, and kurtosis for each psychological measure and for BMI. First, histograms were evaluated which suggested that the data appeared approximately normal for most measures. Positive skewness was noticeable on the histograms for the DASS-21 Anxiety and Depression scales, and the Undesired/Own Selves Interview score. Table 3.1 presents the results of these screening procedures.

Table 3.1

Skewness, Kurtosis, and Z-scores

	Skewness			Kurtosis		
	Statistic	Error	Z-Score	Statistic	Error	Z-score
BMI Baseline	0.9	0.2	3.3	1.1	0.5	2.0
EES - A	0.8	0.3	2.7	-0.0	0.5	0.0

EES - AX	0.6	0.3	2.1	-0.2	0.5	-0.4
EES - D	0.1	0.3	0.3	-0.5	0.5	-0.9
EES-Total	0.6	0.3	2.1	0.0	0.5	0.0
DERS	0.6	0.2	2.4	1.8	0.6	3.2
DASS-21-D	1.5	0.2	5.3	1.7	0.5	3.2
DASS-21-A	2.3	0.2	8.2	5.1	0.5	10.2
DASS-21-S	0.7	0.2	2.7	.60	0.5	1.0
Selves-I/Own	-0.2	0.2	-0.7	-0.3	0.5	-0.6
Selves-O/Own	-0.4	0.2	-1.6	0.4	0.5	0.7
Selves-U/Own	1.0	0.2	3.8	2.5	0.5	4.5
Selves-I/Other	0.1	0.2	0.3	0.1	0.5	0.2
Selves-O/Other	-0.3	0.2	-1.3	1.3	0.5	2.3
Selves-U/Other	0.8	0.2	3.0	1.0	0.5	1.8

Note. Outliers included. EES-Total = Emotional Eating Scale Total Score; EES-A = Emotional Eating Scale Anger Subscale; EES-AX = Emotional Eating Scale Anxiety Subscale; EES-D= Emotional Eating Scale Depression Subscale; DERS = Difficulties in Emotion Regulation Scale; DASS-21-D = DASS-21 Depression Scale; DASS-21-A = DASS-21 Anxiety Scale; DASS-21-S = DASS-21 Stress Scale; EDE-Q Global = Eating Disorder Examination Global Score; Selves-I/Own = Selves Ideal-Own; Selves O/Own = Selves Ought-Own; Selves U/Own = Selves Undesired-Own; Selves I/Other = Selves Ideal-Other; Selves O/Other = Selves Ought-Other; Selves U/Other = Selves Undesired-Other.

As shown in the table above, the z-scores for skew and kurtosis were within the acceptable range of -3 .0 to 3.0 (Kim, 2013; Stevens, 1996) for the majority of measures. However, baseline BMI, the DERS total score, the Anxiety and Depression subscales of the DASS-21, and the undesired/own self-discrepancy score demonstrated significant skewness and/or kurtosis as illustrated by z-scores outside of this range. Given that the

current thesis focused on a high BMI population, it was expected that the mean BMI would be relatively high, and there would not be an evenly balanced distribution due to the inclusion criteria of a pre-weight loss BMI of 30 or more. Furthermore, a community sample was employed rather than a clinical sample, which means positive skewness would be expected on measures of mental health including depression and anxiety.

3.3 Sample Characteristics

Demographic characteristics. A summary of the demographic characteristics for the current sample is presented in Table 3.2. The mean age of the 73 participants was 38.7 (*SD*=10.1) years with a range from 18-58, and the mean baseline BMI of the sample was 31.7 (*SD*=5.0) with a range from 23.6-48.1. The sample included 45 (63.4%) females and 26 (36.6%) males. In terms of ethnicity, 66 (93.0%) participants were Caucasian, four participants indicated other ethnic backgrounds (5.6%), and one participant did not report ethnicity (1.4%).

In terms of relationship status, 48 (67.6%) participants reported being married or in a common-law relationship; 14 (19.7%) were single; five (7.0%) reported that they were in a relationship but not common law; one (1.4%) identified being divorced, and three (4.2%) selected “other”. With regard to educational attainment, 44 (62.0%) participants reported having completed either a college diploma or undergraduate university degree, 13 (18.3%) reported completion of some post-secondary education, 13 (18.3%) reported having completed graduate level education, and one participant (1.4%) reported having completed up to a high school diploma.

Table 3.2

Sample Baseline Demographic Characteristics

	Mean (SD)	Range
Age	38.7 (10.1)	18-58
Baseline BMI	31.7 (5.0)	23.6-48.1
	n	%
Sex		
Female	45	63.4
Male	26	36.6
Ethnicity		
Caucasian	66	93.0
Other	4	5.6
Missing	1	1.4
Relationship		
Married/common law	48	67.6
Single	14	19.7
In a relationship	5	7.0
Divorced	1	1.4
Other	3	4.2
Education Level Completed		
≤ High School	1	1.4
Some Post-Secondary	13	18.3
College or Undergraduate	44	62.0
Graduate Degree	13	18.3
Vocational Status		
Working (part- or full-time)	57	80.3
Not Working	14	19.7
Student Status		
Student (part- or full-time)	19	27.1
Non-student	51	71.8
Missing	1	1.4

In terms of employment status, 57 (80.3%) participants reported that they were currently employed either full- or part-time, and 14 (19.7%) reported that they did not work. Nineteen (27.1%) were currently enrolled as either a full or part-time student while 51 (71.8%) reported that they were not currently enrolled as a student, and one participant did not report this information.

Weight history. A summary of weight history statistics for the 73 participants is shown in Table 3.3.

Table 3.3

Weight History

	Mean (SD)	Range
High Lifetime BMI	39.4 (7.9)	30.2-65.9
Duration (months)	17.7 (22.4)	
Low Lifetime BMI	26.1 (4.3)	17.7-39.7
Duration (months)	30.0 (35.7)	
Duration of Current Weight Loss Attempt (months)	12.1(21.3)	

Participants reported a mean lowest lifetime BMI of 26.1 (*SD*=4.3), and had maintained their lowest weight for an average duration of 30.0 (*SD*=35.7) months. The mean highest lifetime BMI of the sample was 39.4 (*SD*=7.9), and participants reported maintaining their highest BMI for an average duration of 17.7 (*SD*=22.4) months. The mean duration of the current weight loss attempt was 12 months.

3.4 Baseline Descriptive Statistics.

A summary of all baseline descriptive statistics for the psychological measures is included in Table 3.4.

Table 3.4

Descriptive Statistics for Psychological Measures at Baseline Assessment

	N	Mean	SD	Range	Median	Interquartile Range
EES - Total	63	26.9	15.9	2-68	26.0	19.0
EES - A	63	10.7	7.7	1-30	9.0	11.0
EES - AX	63	7.7	5.9	0-22	7.0	9.0
EES - D	63	8.5	3.9	0-17	8.0	5.2
DERS	71	86.6	12.7	52-127	85.0	11.0
DASS-21-D	71	5.4	6.8	0-30	2.0	8.0
DASS-21-A	71	3.6	5.6	0-24	2.0	4.0
DASS-21-S	71	4.7	3.5	0-16	5.0	5.0
Selves-I/Own	70	-0.5	1.8	-5 – 3	-1.0	3.0
Selves-O/Own	70	-0.8	1.3	-4 – 2	-1.0	1.0
Selves-U/Own	70	1.3	1.6	-2 – 8	1.0	2.0
Selves-I/Other	70	-0.3	1.5	-4 – 4	0.0	2.5
Selves-O/Other	70	-0.6	1.3	-5 – 3	0.0	1.0
Selves-U/Other	70	1.1	1.7	-2 – 6	1.0	2.0

Note. EES-Total = Emotional Eating Scale Total Score; EES-A = Emotional Eating Scale Anger Subscale; EES-AX = Emotional Eating Scale Anxiety Subscale; EES-D= Emotional Eating Scale Depression Subscale; DERS = Difficulties in Emotion Regulation Scale; DASS-21-D = DASS-21 Depression Scale; DASS-21-A = DASS-21 Anxiety Scale; DASS-21-S = DASS-21 Stress Scale; Selves-I/Own = Selves Ideal-Own; Selves O/Own = Selves Ought-Own; Selves U/Own = Selves Undesired-Own; Selves I/Other =

Selves Ideal-Other; Selves O/Other = Selves Ought-Other; Selves U/Other = Selves Undesired-Other.

Emotional Eating Scale (EES). The EES has a maximum possible score of 100 with higher scores indicating more frequent urges to eat in response to emotions. The mean EES score for this sample is observed to be notably lower than the mean reported by Arnow, et al. (1995) in a clinic sample of obese women who had been accepted into a treatment program for weight loss and binge eating. This means that participants in the current study tended to report lower emotional eating behaviour than what may be expected in a clinical sample of obese adults. This is to be expected since the current study was based on a community sample.

Difficulty in Emotion Regulation Scale (DERS). The total DERS score can range from zero to 180 with higher scores indicating greater difficulty in emotion regulation. The mean score shown in Table 3.4 is observed to be higher than the norms reported by Gratz and Roemer (2004) using a university sample (women: M=77.9, SD=20.7; men: M=80.6, SD=18.7), but within one standard deviation. This indicates that the current sample endorsed somewhat greater difficulty with emotion regulation than a sample of university students.

Gianni, White, and Masheb (2013) measured difficulty in emotion regulation using the DERS in a clinical sample of obese adults who met criteria for Binge Eating Disorder [BED] (M=82.3, SD=24.0). The mean total DERS scores observed in the current sample appeared to be slightly higher than those in BED clinical sample.

Depression, Anxiety, and Stress Scale – 21 (DASS-21). The DASS-21 subscales are used to evaluate symptoms in each subscale domain with no total combined score.

The range for subscale scores are 0 – 42, with higher scores indicating greater symptom endorsement for that specific subscale. The current sample exhibited mean scores that were observed to be lower than published norms for a nonclinical community sample of non-obese adults on each of the DASS-21 subscales including Depression (*M*=5.70, *SD*=8.20), Anxiety (*M*=3.99, *SD*=6.27), and Stress (*M*=8.12, *SD*=7.62) (Sinclair, et al., 2012). Low scores and positive skewness are to be expected, given that the current sample is also non-clinical community sample.

Selves Interview. The scoring procedure for this interview results in each participant obtaining either a positive or negative score on each type of self-discrepancy. A negative score reflects relatively low self-discrepancy and a positive score reflects higher self-discrepancy. Higher self-discrepancy indicates a greater degree of difference between the type of person the participant believes they are, versus the type of person they would ideally like to be, ought to be, or do not feel they should be. As shown in Table 3.4, the current sample endorsed relatively low levels of self-discrepancy overall given that the mean scores were primarily negative. This indicates that overall participants endorsed only a small degree of discrepancy between how participants described themselves, versus how they described the characteristics of the type of person they and people close to them would ideally like them to be, or feel they ought to be.

The means for ideal-own and ought-own self-discrepancy for the current sample fall in between the means found for a sample of 25 individuals with bulimia nervosa (*ideal-own: M*=.16, *SD*=4.29; *ought-own: M*=-1.20, *SD*=2.71) and 25 controls (*ideal-own: M*=-2.24, *SD*=2.42; *ought-own: M*=-2.56, *SD*=1.96) (Wonderlich, et al., 2008). The means shown in Table 3.4 indicate that the means for the current sample were observed to

be higher than the control group in the sample used by Wonderlich, et al. (2008), but were observed to be lower self-discrepancy than the sample with bulimia nervosa.

The current sample demonstrated higher mean levels of self-discrepancy in terms of undesired scores compared with their other scores on this measure. This means that there was a higher degree of discrepancy between the type of person participants thought they actually were, versus the type of person they did not want to be. This is to be expected since the undesired scores represent the inverse of the other self-discrepancy scores. That is, someone with a low level of ideal/own or ought/own self-discrepancy is meeting or close to meeting their ideal or ought self-guide; therefore, it would be expected that there would be a higher degree of discrepancy between the person they do not want to be (undesired self-guide), and the person they believe they currently are (self-state).

Binge Eating. Binge eating was measured using the Eating Disorder Examination Questionnaire (EDE-Q). The prevalence of binge eating in the current sample is shown in Table 3.5. Participant's binge eating behaviour over the past four weeks was evaluated at the baseline assessment using two items on the EDE-Q.

Table 3.5

Number of Participants who Reported any Binge Eating over the past month at Baseline

	n	%
Binge Eating	47	64.4
No Binge Eating	26	35.6

Note: Binge eating was measured using questions 13 and 14 of the EDE-Q.

The first item assesses number of occasions when the participant felt that they had eaten an unusually large amount of food under the circumstances, and the second item assesses the number of times when these occasions were accompanied by a sense of loss of control. If a participant endorsed a number of one or higher on both questions, they were considered to have engaged in binge eating in the past month.

3.5 Correlations between Baseline Variables

To address the first aim of this thesis, zero-order Pearson's correlations were calculated to explore relationships between baseline psychological variables, current BMI, weight history, and demographic variables. The correlation matrix is shown in Table 3.6.

There were a number of statistically significant correlations including correlations between: 1) *ideal-own* self-discrepancy and depression, 2) *ideal-own* self-discrepancy and anxiety, 3) DERS and depression, 4) DERS and anxiety, 5) DERS and stress, 6) baseline BMI and emotional eating total score, 7) emotional eating-depression and baseline BMI 8) baseline BMI and emotional eating-anger and, 9) baseline BMI and emotional eating-anxiety subscales. This indicates that participants with higher ratings of *ideal-own* self-discrepancy tended to endorse higher ratings of depression and anxiety; and participants who endorsed greater difficulties in emotion regulation tended to endorse higher ratings of depression, anxiety, and stress. Higher baseline BMI was associated with higher ratings of emotional eating. There were also statistically significant negative correlations between 1) age and difficulties in emotion regulation, 2) age and depression, and 3) age and stress.

This suggests that younger participants tended to report more mood symptoms and more difficulties in emotion regulation.

Table 3.6

Correlation Matrix for Baseline Variables

	SD-I/O	SD-O/O	DERS	DASS-21 D	DASS-21 A	DASS-21 S	EES-T	EES-A	EES-AX	EES-D	B-BMI	3M-BMI	6M-BMI	H-BMI	L-BMI	Age
SD-I/O	1	.30**	.16	.33**	.29*	.04	.11	.15	.02	.13	-.03	-.13	-.25	-.16	-.19	-.02
SD-O/O		1	.07	.12	.19	.11	.13	.10	.17	.09	.16	.16	-.09	.06	-.06	-.00
DERS			1	.62**	.68**	.40**	-.05	-.03	-.03	-.08	-.05	.05	-.13	.09	-.04	-.29*
DASS-21 D				1	.70**	.43**	.13	.03	-.05	.07	-.14	-.14	-.19	-.06	.05	-.25*
DASS-21 A					1	.64**	-.04	-.02	-.04	-.06	-.00	.16	-.14	.22	.04	-.27*
DASS-21 S						1	.15	.11	.25*	.04	.21	.38**	.12	.29*	.06	-.22
EES-T							1	.95**	.90**	.83**	.37**	.31*	.31*	.15	-.08	.15
EES-A								1	.77**	.72**	.35**	.31**	.34*	.19	-.06	.19
EES-AX									1	.63**	.36**	.32**	.27	.13	-.15	.16
EES-D										1	.27*	.20	.14	.02	.02	-.02
B-BMI											1	.86**	.90**	.66**	.42**	.04
3M-BMI												1	.95**	.74**	.43**	.10
6M-BMI													1	.67**	.43**	.10
H-BMI														1	.54**	.08
L-BMI															1	-.21
Age																1

Note. SD-I/O= Selves *ideal-own* score; SD-O/O=Selves *ought/own* score; EES-T=Emotional Eating Scale Total score; EES-A=Emotional Eating Scale

3.6 BMI Change Over Time

Table 3.7 illustrates the mean BMI and weight for the sample at each time point.

Table 3.7
Summary of BMI and Weight at Baseline, 3-Month, and 6-Month Follow-up

	Mean	SD	Range	Median	Interquartile Range
Baseline					
BMI	31.7	5.0	23.6-48.1	30.8	5.4
Weight	91.8	16.2	60.2-154.3	91.6	21.1
3-month					
BMI	31.6	5.7	23.2-53.8	30.7	6.4
Weight	91.5	19.1	55.3-158.7	90.7	20.9
6-month					
BMI	30.9	5.2	21.2-51.6	29.7	5.1
Weight	89.0	18.3	52.3-165.5	87.3	19.0

Note. Weight measured in kilograms [kg].

To address the second aim of this thesis, mean BMI at baseline, 3-month follow-up, and 6-month follow-up were compared using a one-way repeated measures ANOVA. The results of the ANOVA are shown in Table 3.8.

Table 3.8

Results of One-way Repeated Measures ANOVA on BMI Across Time.

	F	df	p	Partial eta^2
Greenhouse-Geisser	1.37	2	.25	.02

Although there was a trend for BMI to decrease across time from baseline to 6-month follow-up, contrary to expectations, no statistically significant differences were found between the mean BMIs across the three time points. The benchmarks for

interpreting partial eta squared effect sizes outlined by Cohen (1969) indicate that the effect size (.02) falls in the low range.

To further explore BMI change, participants were divided into two groups based upon whether they had regained weight or not. Participants were classified as a "regainer" if they regained 2.5% of their original baseline weight at 6-month follow-up. This cut-off was chosen because 2.5% is half of the 5% weight loss that was required for study entry, and 6-month follow up was half of the total follow-up period for the larger study. Participants who maintained or lost weight over the follow-up period were classified as "non-regainers". The number and percent of "regainers" and "non-regainers" are presented in Table 3.9. Approximately one third of the sample was classified as regainers and the remainder as non-regainers.

Table 3.9

Number and Percent of Regainers and Non-regainers at 6-Month Follow-Up

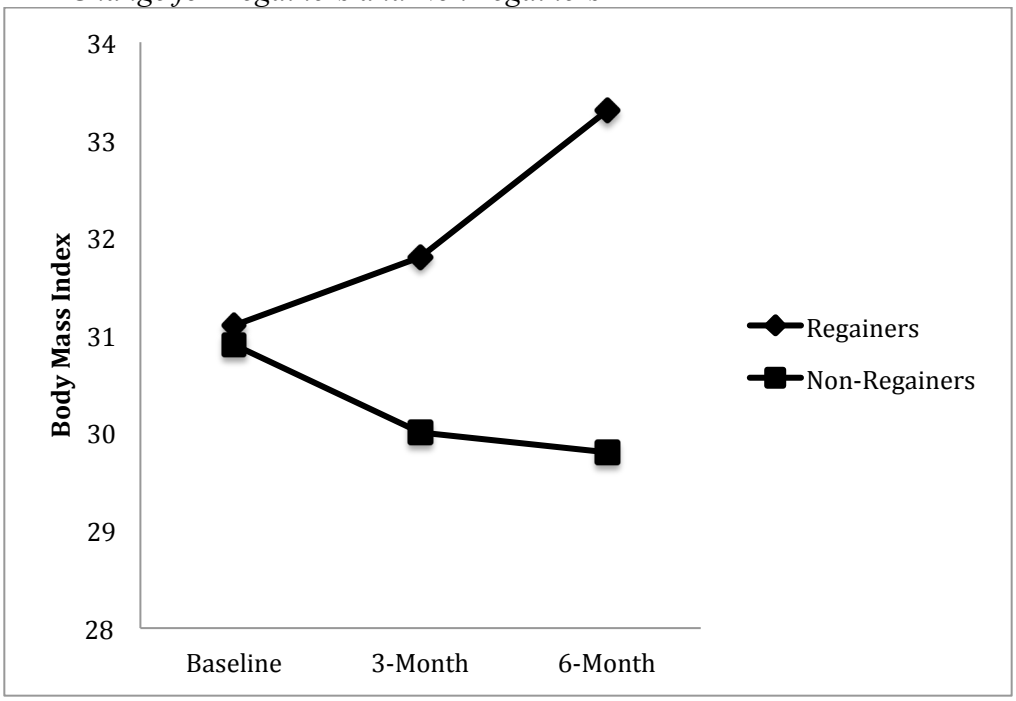
	N	%
Regainers	16	31.4
Non-Regainers	35	68.6

A 2x3 ANOVA was conducted to examine whether time and participant type (i.e., regainers or non-regainer) had a statistically significant effect on BMI. The analysis of variance indicated a statistically significant main effect of time on BMI irrespective of participant type, yielding an F ratio of $F(2, 98) = 5.60$, $p < .05$. This indicates that across the sample as a whole time did significantly affect Body Mass Index; specifically, this indicated a decrease in BMI over time in the sample as a whole. In addition, there was a statistically significant interaction between time and participant type (i.e., regainer or non-

regainer) $F(2, 98) = 30.71$, $p<.001$. This indicates that time had a significantly different effect on BMI for regainers and non-regainers. Body Mass Index for regainers and non-regainers at each time point is depicted in Figure 3.2. The graph indicates two different BMI trajectories for regainers and non-regainers between baseline, 3-month, and 6-month follow-up. The trajectory of regain appears to increase in speed and slope over time, while the trajectory of non-regainers appears to slow over follow-up. To explore these trajectories, a series of paired t-tests were conducted to compare mean BMIs over time for regainers and non-regainers. To control the Type 1 error rate, an alpha of $p<.01$ was employed.

Figure 3.2

BMI Change for Regainers and Non-regainers



Note. Regainers BMI: Baseline=31.1; 3-month=31.8; 6-month=33.3
Non-regainers BMI: Baseline=30.8; 3-month=29.9; 6-month=29.8

There was a statistically significant increase in BMI from baseline (*M*=31.1, *SD*=6.0) to 6-month follow-up [*M*=33.3, *SD*=6.2, *t*(15)=-6.46, *p*<.000] among regainers who gained 2.2 BMI points (i.e., 5.9 kilograms or 13 pounds) over the 6-month follow-up period. The eta-squared statistic (.73) indicated a large effect size.

A second paired t-test showed that there was also a statistically significant decrease in BMI from baseline (*M*=30.9, *SD*=4.1) to 6-month follow-up [*M*=29.8, *SD*=4.3, *t*(35)=3.82, *p*<.001] among non-regainers who lost on average 1.1 BMI points (i.e., 3.2 kilograms; 7.1 pounds) over the follow-up period. The eta-squared statistic (.21) indicated a large effect size.

3.7 Baseline Predictors of Weight Outcome.

To address the third aim of this thesis, a series of univariate linear regression analyses were conducted to evaluate whether baseline variables including self-discrepancy, difficulty in emotion regulation, mood, or emotional eating were predictive of overall BMI change for the sample as a whole from baseline to 6-month follow-up. Contrary to expectations, the results indicated that none of these variables significantly predicted BMI change. Given this and the two distinct BMI change trajectories indicated above in Figure 3.2, the remainder of the analyses focused on a comparison of the baseline characteristics of regainers (n=16) versus non-regainers (n=35).

3.8 Relationships between Weight Outcome Category and Psychological Variables.

To address the fourth aim of this thesis, differences between regainers and non-regainers on baseline psychological measures were evaluated. Specifically, a series of independent samples t-tests were conducted to evaluate baseline differences on the psychological measures between regainers and non-regainers.

Weight regain and self-discrepancy. A summary of the results of the independent samples t-tests for the Selves interview is shown in Table 3.10.

Table 3.10

Results of Independent Samples T-Tests Comparing "Weight Regainers" and "Weight Non-Regainers" on the Selves Interview at Baseline Assessment

	M	SD	t	df	p	eta^2
Selves-I/Own						
Regainers	-1.2	1.5	1.30	48	.19	.03
Non-regainer	-.4	1.9				
Selves-O/Own						
Regainer	-1.2	.9	1.32	48	.19	.03
Non-regainer	-.7	1.2				
Selves-U/Own						
Regainer	.8	1.5	1.39	48	.17	.03
Non-regainer	1.6	1.7				
Selves-I/Other						
Regainer	-.6	1.6	1.05	48	.29	.02
Non-regainer	-.1	1.5				
Selves-O/Other						
Regainer	-.8	1.0	.55	48	.58	.00
Non-regainer	-.5	1.4				
Selves-U/Other						
Regainer	1.3	1.8	-.18	48	.85	.00
Non-regainer	1.2	1.8				

As shown in the table, there were no statistically significant differences in scores on the Selves Interview between regainers and non-regainers at baseline. Eta squared

effect size calculations indicated that the magnitude of the differences ranged from very small to small.

Weight outcome and difficulty in emotion regulation. An independent samples t-test was conducted to compare the mean total DERS scores for regainers and non-regainers at baseline. Results indicated that there was no statistically significant difference between non-regainers (M=86.9, SD=14.8) and regainers (M=85.8, SD=8.0), t(48) = .28, p = .780, in terms of DERS at baseline. The effect size of the difference in means was very small (eta squared=.001).

Weight outcome and stress. An independent samples t-test was conducted to compare the mean baseline DASS-21 Stress scores for regainers and non-regainers. Again, there was no statistically significant differences in scores for non-regainers (M=8.1, SD=6.7), and regainers (M=7.8, SD=7.3), t(49)=.498, p=.62, in terms of baseline stress as measured by the DASS-21. The effect size of the difference in means was very small (eta squared=.005).

Weight outcome and anxiety. An independent samples t-test was conducted to compare the mean baseline DASS-21 Anxiety scores for regainers and non-regainers. There was no statistically significant difference in scores for non-regainers (M=3.8, SD=5.9), and regainers (M=2.0, SD=3.0), t(49)=1.18, p=.24, in terms of baseline level of anxiety as measured by the DASS-21. The effect size of the difference in means was small (eta squared=.02).

Weight outcome and depression. An independent samples t-test was conducted to compare the mean baseline DASS-21 Depression scores for regainers and non-regainers. There was no statistically significant difference in mean scores for non-

regainers (*M*=6.6, *SD*=7.7), and regainers (*M*=3.8, *SD*=5.4), t(49)=1.27, *p*=.20, in terms of baseline level of depression as measured by the DASS-21. The effect size of the difference in means was small (eta squared=.03).

Weight outcome and emotional eating. A series of independent samples t-tests were conducted to compare the mean baseline EES scores for regainers and non-regainers. The results of these analyses are shown in Table 3.11. Results indicated there was no statistically significant difference in EES scores between non-regainers and regainers in terms of emotional eating. The effect sizes of the differences in means ranged from very small to small.

Table 3.11

Results of Independent Samples T-Tests Comparing "Weight Regainers" and "Weight Non-Regainers" on Emotional Eating at Baseline Assessment

	M	SD	t	df	p	eta^2
EES-Total						
Regainers	23.2	15.8	.26	42	.79	.001
Non-regainer	24.6	14.9				
EES-Anger						
Regainer	10.5	8.5	-.48	43	.63	.005
Non-regainer	9.3	7.1				
EES-Anxiety						
Regainer	6.6	4.7	.57	42	.56	.007
Non-regainer	7.15	6.0				
EES-Depression						
Regainer	6.6	3.5	1.14	42	.25	.03
Non-regainer	7.9	3.5				

3.9 Weight Outcome and Binge Eating.

The mean number of binge eating episodes for participants who endorsed binging in the regainer and non-regainer groups is presented in Table 3.12. It appears that binge eating during the 28 days prior to the baseline assessment was not common in the current sample.

Table 3.12

Binge Episodes among Regainers and Non-Regainers

	Mean (SD)	Range
Regainers	1.0 (1.4)	0-5
Non-regainers	1.4 (3.65)	0-20

Regarding the fifth aim of this thesis, a Fischer's Exact test was conducted to compare proportions of regainers and non-regainers who reported any binge eating in the last 28 days on the EDE-Q. The purpose of this test was to evaluate the relationship between weight outcome (i.e., regainer or non-regainer) and binge eating status in the past 28 days (i.e., binge eating or no binge eating). There was no statistically significant difference between the proportion of regainers who reported binge eating (7/16; 43.8%) and the proportion of non-regainers who reported binge eating (11/35; 68.6%) (p=.52). That is, there was no statistically significant difference between the proportion of weight regainers who endorsed any binge eating in the last 28 days and the proportion of non-regainers who reported any binge eating in that timeframe.

4. CHAPTER 4

Discussion

4.1 Summary and Interpretation of Findings

The objective of this thesis was to examine the role of self-discrepancy, difficulties in emotion regulation, mood, and emotional eating in predicting BMI change following weight loss in an obese sample. The study was conceptualized using an adapted version of the Integrated Cognitive Affective Therapy (ICAT) model developed by Wonderlich, et al. (2008) to understand and treat eating disorders. According to the ICAT model, inter- or intrapersonal triggers of self-discrepancy negatively impact mood and thus activate any pre-existing difficulties in regulating those emotions. Consequently, unhelpful emotion regulation strategies such as emotional eating or binge eating are used to cope with negative emotions, and subsequently impact BMI. These coping methods are thought to then reinforce and maintain *ideal-own* and/or *ought/own* self-discrepancy. Based on this framework, in the current study it was predicted that higher *ideal-own* and *ought-own* self-discrepancy, worse mood symptoms, greater difficulties in emotion regulation, and more emotional eating at baseline would predict a BMI increase (i.e., weight regain) six months following weight loss of 5% or more in an obese sample.

Relationships among baseline variables. A number of significant correlations between the study variables at baseline emerged, and many of them were consistent with the ICAT model. It was found that higher *ideal-own* self-discrepancy was related to higher ratings of negative mood including depression and anxiety, but there was no significant relationship between self-discrepancy and stress. This suggests that a greater gap between the type of person participants believed they actually were and the type of

person they ideally want to be tends to be associated with lower mood. This finding is consistent with previous research by Strauman and Higgins (1987; 1988) who also found that depressed mood was associated with higher ratings of *ideal-own* self-discrepancy among university undergraduates. Strauman and Higgins (1988) also found that higher ratings of *ought-own* self-discrepancy were related to greater difficulties with anxiety. This finding was not replicated in the current study, as no significant relationship between anxiety and *ought-own* self-discrepancy was found. However, this relationship may have been difficult to detect in the current study given the relatively small sample size, and the low baseline anxiety ratings endorsed by the current sample compared to norm samples (Sinclair, et al., 2012). Strauman and Higgins (1987; 1988) found evidence of a positive relationship between negative mood states and self-discrepancy in an undergraduate sample and the results of the current study provide further evidence of this relationship in an obese community sample.

Regarding self-discrepancy and difficulties in emotion regulation, the results showed that there was no significant relationship between self-discrepancy and difficulty in emotion regulation in the current sample at baseline. Based upon the ICAT model, it was expected that greater difficulty in emotion regulation would be related to higher ratings of self-discrepancy, especially in the presence of a relationship between self-discrepancy and negative mood (i.e., depression and anxiety) and a relationship between difficulty with emotion regulation and negative mood. This was not found in the current sample, and no previous study has evaluated this relationship specifically. However, as predicted by the ICAT model, greater difficulties in emotion regulation were related to higher ratings of depression, anxiety, and stress. That is, participants who endorsed more

mood-related symptoms tended to also report greater difficulty with emotion regulation. The direction of the relationship between negative mood symptoms and difficulties in emotion regulation cannot be determined due to the cross-sectional nature of the data; it is also possible that the relationship is present due to an unknown third factor. Though causality cannot be inferred, this relationship is consistent with previous findings in a non-obese adult sample that indicated higher levels of anxiety and/or depression were related to greater difficulty regulating those emotions in adaptive ways (Liverant, Brown, Barlow, & Roemer, 2008). Depression, anxiety, and stress subscales were significantly correlated with each other at baseline, which is consistent with findings of Antony, et al. (1998) and consistent with the well-established high co-occurrence of depression and anxiety.

Regarding emotional eating, higher baseline emotional eating was associated with higher baseline BMI. This is consistent with previous research on emotional eating in obesity, which has established that emotional eating behavior is linked to higher BMI and greater mood difficulties (Mason, & Lewis, 2014). Of note, the positive correlation between baseline emotional eating and BMI diminished somewhat in strength over time but remained statistically significant at 3- and 6-month follow-up. This is consistent with previous qualitative research suggesting that, among obese adults, emotional eating is a significant barrier to achieving and maintaining weight loss (Byrne, et al., 2003). In the present study, emotional eating was also related to higher stress ratings on the DASS-21. Contrary to expectations, there was no significant relationship between emotional eating and depression or anxiety on the DASS-21; there was also no significant difference between regainers and non-regainers on emotional eating. The lack of expected findings

may have been due to the notably low overall ratings of emotional eating endorsed by the current sample at baseline. The expected relationship between eating to regulate mood and intensity of negative mood states may not have been detectable in a sample with a very low emotional eating level. However, it is possible that emotional eating behaviour emerged among regainers over a longer period of time than the 6-month follow-up in the current study could illustrate.

Interestingly, at baseline a number of variables demonstrated significant relationships with age that are consistent with past findings. First, age was related to difficulties with emotion regulation. Namely, younger participants tended to endorse greater difficulties in emotion regulation. This is consistent with previous research indicating that younger adults tend to demonstrate fewer adaptive emotion regulation strategies than middle-aged adults (Zimmermann, & Iwanski, 2014). Zimmerman and Iwanski (2014) suggest that the continuous development of adaptive emotion regulation skills across the lifespan may explain why younger adults tend to endorse fewer adaptive emotion regulation skills.

DASS-21 subscale scores were also significantly related to age, indicating that younger participants in the current sample tended to endorse higher ratings of depression, anxiety and stress. This is consistent with the findings of Balsis and Cully (2008) who also found that while overall endorsement of a single screening item for mood difficulties was the same in younger and middle-aged adults, younger adults more frequently endorsed specific depressive symptoms including anhedonia, suicidality, psychomotor retardation, and sleep change than middle aged adults. It may be that middle-aged adults tend to notice their general mood trends, but have developed more adaptive emotion

regulation skills that provide greater resilience against specific mood-related symptoms, lowering overall symptom distress with age.

Consistent with the ICAT model, self-discrepancy was associated with negative mood states, and greater negative mood states were related to greater difficulty regulating emotions. Based on the ICAT model, it was expected that those with greater difficulty regulating emotions would turn to maladaptive coping strategies such as emotional eating. The current sample demonstrated relatively high ratings of difficulty with emotion regulation but low ratings of emotional eating relative to normative samples (Arnow, 1995; Gianni, et al., 2013). Previous findings from studies on emotional eating have indicated that emotional eating is associated with difficulties in emotion regulation, but this was not observed in the present study, possibly due to the low level of emotional eating reported at baseline. It is possible that, at the time of the baseline assessment, participants were using alternative methods to regulate negative emotions (instead of overeating) since this assessment occurred shortly after they had lost weight and while they may have still been employing active weight loss strategies.

BMI change. The second aim of this thesis was to examine BMI change over six months among obese individuals who had recently lost weight. Several previous studies (e.g., Anderson, et al., 2001; French, et al., 1996; McGuire, et al., 1999; Mehta, Smith, Muhammad, & Cassaza, 2014) have shown that weight regain is normative following weight loss in obesity. Focusing on those participants who completed all three assessments in the current study, no significant differences in mean BMI between the three time points were found, and the trend was that, on average across the sample, BMI continued to decrease between baseline and 6-month follow-up. This result was

unexpected and was inconsistent with the results of previous research by Kramer, et al., (1989) who showed that a large proportion of weight tends to be regained within the first year following weight loss, Tsai and Wadden (2005) who showed that most participants in a variety of commercial weight loss programs regained weight within two years, and McGuire, et al. (1999) who found that those who had recently achieved weight loss within a two year period were more prone to weight regain than those who had successfully maintained weight loss for longer than two years. Since the current sample was followed for six months after losing weight, more weight regain was anticipated than was observed. However, there are a few possible reasons why the expected result was not observed in the current study.

As previously stated, research suggests that a large proportion of weight tends to be regained within the first year following weight loss, but weight outcome at six months has not specifically been evaluated before. Linde (2004) and Wing (2008) followed up their participants at 6-months and at 12- or 18-months. However, only the findings from the final follow-up assessment were reported. Therefore, the weight status of their participants at 6-month follow-up is unknown. It is possible that the majority of weight regain that occurs in the first year following weight loss is regained in the latter six months, which could explain why the trend demonstrated in previous studies was not replicated in this study. If the follow-up period in the current study had been extended to one year, a greater degree of weight regain may have been observed.

Additionally, not all participants returned for the 6-month follow-up assessment and those who did may have been biased in some way. Twenty-nine percent of participants did not return for the 6-month follow up assessment. It is possible that they

may have been more likely to have experienced weight regain and elected not to return for follow-up possibly due to shame or embarrassment.

Although the results of the current study indicated that there was no significant change in BMI across time for the sample as a whole, a sizeable subgroup of participants maintained their weight loss or continued to lose weight, while another sizeable subgroup regained at least half the weight they had lost to get into the study. On average, participants classified as "non-regainers" continued to lose a significant amount of weight, as evidenced by the statistically significant decrease in BMI between baseline and 6-months in this subgroup. The mean BMI for regainers at 6-month follow-up was approximately two BMI points (on average, 5.9 kilograms) above their mean BMI at baseline. This is a sizable difference. Non-regainers tended to continue to lose a significant amount of weight. On the other hand, regainers demonstrated a significant increase in BMI from baseline to six-month follow-up. Thus, although the overall direction of BMI change in the sample as a whole was contrary to expectations based upon previous findings, the current results indicated that two subgroups emerged with two distinct weight trajectories. Additionally, the slope/speed of regain appears to increase between 3- and 6- month follow-up for regainers, while the slope/speed of BMI change for non-regainers appears to slow during this time frame. It is possible that non-regainers would begin the weight-regain trajectory during after six-months, and that the follow-up period of the current study was not sufficient to capture inevitable regain.

Predictors of BMI change and differences in weight outcome. Across the sample as a whole, none of the baseline psychological variables that were expected to predict BMI change from baseline to 6-month follow-up based on the ICAT model were

found to be statistically significant including *ideal-own* and *ought-own* self-discrepancy, negative mood (i.e., depression, anxiety, and stress), difficulty in emotion regulation, and emotional eating. One possible reason why the expected results were not observed could be because the sample contained a larger proportion of non-regainers who had decreasing BMI in 6-months.

As stated previously, attrition could have impacted these findings, as 29% of the baseline sample did not return for 6-month follow-up, and the BMI changes for those participants were unknown and could not be included in the analyses. Additionally, the length of the follow-up period may have influenced the findings, as previous studies that evaluated psychological predictors of weight regain tended to follow participants over a longer period of time such as 12 months (McGuire, et al., 1999; Byrne, et al., 2003; 2004; Teixeira, et al., 2004, Collings, et al., 2008, Wing, et al., 2008) or 18 months (Linde, et al., 2004). It is possible, as evident in previous research, that greater weight regain might have been observed in the present study with a longer period of follow-up. However, given the timeframe of the current author's doctoral program, a longer period of follow-up was not feasible for the present study.

Regarding the specific psychological variables included in the current study, baseline self-discrepancy did not predict BMI outcome at 6 months in the current study. The role of self-discrepancy in predicting weight loss outcome in obesity has not been studied previously. Due to the lack of significant BMI change between baseline and 6-month follow-up in the current sample, it is difficult to firmly conclude based on the present results that self-discrepancy is not a predictor of BMI change or weight regain in obesity. Interestingly, when completing the Selves Interview at the baseline assessment,

participants tended to spontaneously generate characteristics that were not appearance-related (e.g., honest, friendly, etc.) more consistently than appearance-related characteristics (e.g., thin, overweight, ugly, attractive, etc.) though both types of characteristics were admissible. However, participants in a bulimia nervosa sample, such as the one used by Wonderlich, et al., (2008), tend to spontaneously generate more appearance-related characteristics due to their extreme preoccupation with weight and shape. If the current sample was interviewed specifically regarding their appearance-based self-discrepancy, it is possible that a relationship between self-discrepancy and BMI change may have been observed.

The mean scores for regainers and non-regainers were compared for self-discrepancy. It was expected that regainers would demonstrate statistically significantly greater baseline *ideal-own* and *ought-own* self-discrepancy; however, no significant difference in self-discrepancy scores was found between regainers and non-regainers. This had not been evaluated in previous studies. There are a few possible explanations for why the expected result was not observed here.

First, based on the ICAT model, self-discrepancy is thought to have the potential to fluctuate and change over time by influence of inter/intrapersonal experiences, self-regulation, and mood (Wonderlich, et al., 2008). One factor that is thought to influence self-discrepancy is weight and/or BMI, as it is thought to cycle back to influence an individual's overall self-discrepancy through their intra/interpersonal experiences related to their weight (Brunet, et al., 2012; Heron & Smyth, 2013). Self-discrepancy was measured at baseline, this measurement was taken shortly following participant's initial weight loss; therefore self-discrepancy may have been relatively low at this time if

changes in weight indeed impacted participants self-discrepancy prior to the beginning of this study.

In addition, the current sample exhibited lower ideal-own and ought-own self-discrepancy means at baseline compared to previous data with community samples and clinical eating disorder samples (see section 3.4); specifically, the means were higher than a non-obese, non-eating disorder community sample, but lower than a clinical sample of adults with bulimia nervosa (Wonderlich, et al., 2008). This was expected given that this study employed a community, rather than a clinical sample. A clinical sample of adults with obesity who had recently lost 5% of their original body weight may have somewhat higher ratings of self-discrepancy than a community sample such as the one employed in the current study, as they may have been identified by physicians for inclusion in a clinical weight loss program which may indicate more severe obesity and more impact of obesity on their functioning.

With respect to the role of negative mood such as depression, the current study failed to provide evidence that baseline negative mood was associated with weight regain. There have been mixed findings in the literature regarding depression as a predictor of weight regain in obesity, and anxiety and stress have not been specifically studied before. Wing, et al., (2008) and Brantley, et al., (2008) found that baseline depression was a significant predictor of increased BMI over time following weight loss in obesity. However, both of these studies used a different measure of depression than the DASS-21, which was the measure employed in the current study. Brantley, et al. (2014) used the Patient Health Questionnaire - Depression Scale and Wing, et al., (2008) used the Beck Depression Inventory. This could explain differences in findings across studies as the

DASS-21 has not been specifically validated against the BDI. Furthermore, the DASS long form (42-item version) demonstrated only moderately strong correlation between the depression subscale and the BDI (Lovibond, & Lovibond, 1995). Studies by Linde (2004), Collings, et al. (2008), and Delahanty, et al., (2013), however, also evaluated whether depression predicts weight regain in obesity, and did not find a significant relationship.

Interestingly, the direction of the differences showed that regainers tended to have lower baseline levels of depression, anxiety and stress than non-regainers. This was unexpected and inconsistent with previous research showing that higher BMI in obesity is positively related to depression (Toups, et al., 2013). However, as mentioned, there are mixed findings as to whether negative mood is associated with weight regain (Linde, 2004; McGuire, et al., 1999; Wing, et al, 2008). Participants in the current sample exhibited lower levels of depression, anxiety, and stress at baseline than a normative non-obese community sample (Sinclair, et al., 2012). It is possible that the experience of weight regain could act as an intrapersonal trigger of self-discrepancy that may result in increased depression at follow up. However, since self-discrepancy and mood were not evaluated at follow-up in the present study it was not possible to examine the relationships between mood, self-discrepancy, and BMI over time and explore the nature of those relationships to weight outcome. Thus, further longitudinal research on the relationship between mood and weight regain in obesity is needed.

Difficulty with emotion regulation was not associated with weight regain in the current study. This relationship has not been investigated previously. Emotional eating was identified as a predictor of weight regain in obesity by Byrne, et al. (2004) and

Delahanty, et al. (2013). However, this finding was not replicated in the current study. It is possible that these results were not replicated here due to the general trend of the current sample to not regain weight as discussed above. Additionally, Byrne, et al. (2004) evaluated emotional eating using a different measure, an unstructured interview, rather than quantitative measure used in the current study. Delahanty et al. (2013) also evaluated emotional eating using a different measure, the Emotional Eating Questionnaire (EEQ). Participants in the current study reported low levels of baseline emotional eating which also made it difficult to detect difference between regainers and non-regainers.

Interestingly, in the current study the sample endorsed higher ratings of difficulty in emotion regulation than a clinical binge eating disorder sample (Gianni, et al., 2013) but lower emotional eating scores than a non-clinical sample of obese adults (Arnow, et al., 1995). Furthermore, over 60% of participants reported at least one episode of binge eating within the past 28 days at baseline. These findings are somewhat surprising as it seems logical that high DERS scores and the presence of binge eating would occur alongside high EES scores. However, DERS and EES were not significantly correlated and no differences were found between regainers and non-regainers on difficulties on emotion regulation, emotional eating, or binge eating. Difficulty in emotion regulation among regainers and non-regainers in obesity had not been evaluated previously, but based on findings related to binge and emotional eating it was expected that DERS would be different depending on weight outcome. A possible reason why high DERS scores could have present at baseline with low emotional eating scores is that participants may have had low emotional eating due to adherence to weight loss procedures used but did not feel equipped with alternative emotion regulation strategies. If, over a longer follow-up period

(e.g. 1-year, 18-months, etc.) alternative emotion regulation strategies were not found and utilized, it is possible that emotional eating behaviour could re-emerge. If this were to occur it is likely that emotional eating and DERS scores would be related.

Finally, it was predicted that regainers would report more frequent binge eating than non-regainers but no significant difference between the number of non-regainers and regainers who endorsed binge eating was found. This was inconsistent with previous studies that have established the relationship between obesity, weight regain, and binge eating (e.g. Gorin, et al., 2008; Masheb, et al, 2014).

In addition, it is possible that low statistical power due to the relatively small sample size, attrition, and small effect sizes may explain the lack of statistical significance. However, examination of the effect sizes for the differences observed in the current study suggests that a larger sample size likely would not have produced significant results. Nonetheless, it is possible that mean scores on the baseline psychological variables might have been higher in a sample of primarily weight regainers, rather than primarily non-regainers as in the current sample, which could have resulted in different findings.

Another potential reason why predicted findings were not demonstrated in the current study could be due to the inclusion of both male and female participants. The majority of previous research utilized all or mostly female participants; the current study included over 35% male participants. It is possible that the psychological predictors of weight regain differ for males and females. Though differences between males and females on predictors of weight regain has not been specifically evaluated, Kramer, et al. (1989) identified different patterns of weight loss maintenance between males and

females, suggesting that males are more successful at losing weight initially, but females tend to have better long term weight loss maintenance over four year follow-up. This suggests that there could be differences in the psychological factors involved in weight regain for males and females. However, given the small sample size and smaller sex-based subgroups, differences between sexes could not be reliably evaluated in the current study.

4.2 Methodological Considerations: Strengths and Limitations.

Strengths. This study had a number of strengths. First, the current study employed both cross-sectional and longitudinal components. The longitudinal component of the study design overcomes the possible recall bias that a retrospective design would have been subject to. The 3-month and 6-month follow-ups allowed for analysis of the relationship between baseline psychological variables and BMI change over time, allowing for examination of the utility of the ICAT model in predicting weight regain. This study was the first to examine self-discrepancy and difficulty with emotion regulation as predictors of weight regain in obesity, and it was the first study to conceptualize long-term weight regain in an existing clinical model (i.e., the ICAT model).

The cross-sectional component allowed for analysis of relationships among baseline psychological characteristics and certain demographic and historical information. Though these findings did not allow for causal or directional inferences, they provided additional support for relationships between psychological variables that have been identified in previous literature and broadened the support for these findings in the context of an obese sample. For example, past research has found relationships between

self-discrepancy and mood symptoms (Strauman, & Higgins, 1987; 1988), mood symptoms and emotion regulation difficulty (Liverant, et al., 2008), age and emotion regulation, and age and mood symptoms. The current study provided evidence of those relationships in an obese sample. The baseline relationships were also consistent with what would have been predicted by the ICAT, which bolstered the rationale for the longitudinal component of the study.

Second, the use of a community sample, rather than a clinic sample as in many previous studies, increased the generalizability of these results to a larger proportion of the obesity population. By broadening the inclusion criteria to individuals who lost weight through a variety of behavioural methods, the sample was not biased based on clinical program inclusion criteria (e.g., diabetes, severe obesity, etc.) or socioeconomic variables that may have limited individuals' ability to pay for a private weight loss clinic program.

Third, the current study included both male and female participants and the final sample included over 35% male participants. Much of the previous research on psychological factors involved in weight regain included only female participants, it could be that the psychological components of weight regain in obesity differ for males and females, and this may be why some of the results shown in studies with only female participants were not replicated here. However, sex differences would have been difficult to detect with the relatively small sample size and the even smaller sex-based subgroups of this sample.

Fourth, the current study utilized objectively measured weight to calculate BMI at two of the three time points; use of self-reported weight was one of the main limitations

of much of the past research on psychological predictors of weight regain in obesity. Research suggests that obese individuals tend to underreport their weight (e.g., Larsen, Ouwens, Rutger, Engels, Eisinga, & van Strien, 2008), so measuring actual body weight rather than relying on self-report increased the reliability of the weight data.

The final strength of this study was that in order to reduce the possibility of sampling bias due to study entry being based on self-reported weight loss, potential participants did not know the weight loss requirement or the duration of weight loss maintenance needed to be eligible for the study.

Limitations. This study also had some methodological limitations. First, the study involved a relatively small sample size, which limits statistical power and may have made true differences between regainers and non-regainers more difficult to detect, as the number of participants in each subgroup was fairly small. However, the small effect sizes observed for most of the analyses lends confidence to the non-significant findings.

A second possible study limitation is that 55% of those who were screened as eligible to take part during the recruitment phase elected not to participate in the study. This represents a fairly large proportion of the possible sample, and suggests the possibility of bias in the sample that was used. It is unknown why eligible individuals chose not to participate. It is possible that those who chose to take part in the study represented a subset of the population that were more motivated to maintain weight loss or to continue to lose weight.

Third, the current sample exhibited certain demographic characteristics that may limit the generalizability of these findings. A large proportion of participants (80.3%) had completed post-secondary education or higher. This suggests that the sample might have

been made up of those within a higher socioeconomic group who may have been more interested in research than those with lower levels of education. In addition, most participants were of Caucasian ethnicity (93%), which is similar to the demographic makeup of the province as indicated by Canadian census data (Statistics Canada, 2006). While this is acceptable in terms of the representation of the community in Newfoundland and Labrador where the study took place, it limits the generalizability of these findings to a non-Caucasian demographic.

Fourth, the 6-month follow-up period was relatively short. At six months, it was found that most participants had maintained their weight loss or continued to lose weight, while about one third had regained weight. It is possible that if the sample had been followed for a longer period of time, more weight regainers would have emerged, as seen in previous research.

Fifth, as to be expected in a longitudinal study, there was some attrition during the follow-up period. Approximately one-third of participants did not attend their follow-up assessment and therefore their weight outcome at six months is unknown. While the 71% retention is reasonably good for a community-based longitudinal study, this somewhat limits the conclusions that can be drawn about weight regain patterns in the whole sample. It is unknown why participants withdrew from the study, but it could be that these participants had different characteristics than study completers; for example, perhaps those who did not return for follow up experienced greater weight regain and were embarrassed to attend. This attrition rate is higher than that observed by Byrne, et al., (2004) and Brantley, et al., (2014) whose studies exhibited 94% and 93% retention rates, respectively. The retention rate for the current study was similar to in a study by

Teixeira (2004) who observed a 70% retention rate. The studies with higher retention rates tended to offer small monetary incentives at each follow up appointment to help aid retention; it could be that offering incentive for follow up was an important factor in retention.

Finally, baseline binge eating behaviours were assessed in the current study, but prior history of binge eating was not. While this provided information about binge eating behaviour that occurred in the past month at baseline, binge eating prior to one month ago was not assessed. Future studies should examine the impact of binge eating history on weight regain in obesity with a longer follow-up period. It is possible that eventually, after a prolonged period of weight loss or weight loss maintenance, binge eating re-emerges.

Additionally, weight loss method was not controlled or assessed in this study. Participants lost weight independently prior to study entry. Although individuals who lost weight through weight loss surgery were excluded, participants may have used a variety of methods to lose weight and some likely lost weight slowly while others may have lost weight very quickly. For instance, participants may have been at various stages of their weight loss attempt (i.e., reached weight loss goals, actively working towards weight loss goal), and this may have caused variation in whether participants were trying to lose or maintain weight during the follow-up period. It is also possible that individuals who lost weight rapidly may have been less likely to maintain their weight loss.

4.3 Clinical Implications

This study has a number of potential clinical implications. Obesity is a complex health issue with numerous treatment challenges including weight regain over time. The

sample demonstrated generally low baseline ratings of self-discrepancy and negative mood symptoms, and the general trend for the sample as a whole was to continue to lose weight over the 6-month follow-up period. Though causal inferences cannot be made based on the correlational nature of the findings, this might imply that obese patients who do not suffer from significant mood symptoms and who are generally satisfied with who they are as a person may be more likely to maintain weight loss over a 6-month period. It is not possible to know from the results of the current study whether mood symptoms precede or follow self-discrepancy activation, but previous studies on mood and self-discrepancy suggest that self-discrepancy tends to elicit negative mood (Strauman, & Higgins, 1987)

Interestingly, the current sample demonstrated relatively high baseline ratings of difficulty with emotion regulation. The mean baseline score on the DERS was higher than a non-obese university sample (Gratz, & Roemer, 2004) and also higher than a clinical sample of obese patients with binge eating disorder (Gianni, et al., 2013). Past research by Fereidouni, et al. (2015) found that obese adults who were bariatric surgery candidates exhibited greater emotion regulation difficulties than normal weight counterparts, suggesting that emotion regulation difficulties might play a role in weight outcome among severely obese clinical samples. The results of the current study imply that even in a community-based obese sample, difficulty with emotion regulation may be higher than in a non-obese population, and could play an important role in long-term weight regain. Furthermore, health care professionals working with obesity may consider assessing their patient's emotion regulation skills when considering treatment or weight maintenance options in order to support their patients most effectively in managing their obesity.

4.4 Directions for Future Research

The results of this study point to a number of interesting avenues for future research. First, the current study examined certain aspects of the ICAT model in a community sample of obese participants who had recently lost weight. It failed to find evidence to support this model within the current sample in terms of weight outcome at follow-up; however, this may have been in part due to the nature of the community sample including low ratings of mood difficulty, self-discrepancy, and emotional eating. Additionally, given the rate of attrition discussed above, it was not possible to truly evaluate the utility of this model since weight outcome for a proportion of the sample was unknown. Exploration of the ICAT model in a clinical sample would be an interesting area for future research, as a clinical sample may exhibit more severe mood symptoms, self-discrepancy, and emotional eating than a community sample.

Second, it may be valuable for future researchers to measure or control the method of weight loss used by participants. In the current study, the weight loss method was not controlled outside of excluding those who lost weight through surgical or pharmacological methods. Measuring the method of weight loss would provide insight into any differences in the methods used by regainers and non-regainers while preserving the valuable feature of using a sample that lost weight in a variety of ways. Alternatively, controlling the method of weight loss by either offering a specific weight loss intervention or recruiting from a specific existing weight loss program would decrease the potential for variation between participants in terms of their weight loss goals and objectives at the time of recruitment.

Third, though the results of this study failed to find evidence that difficulty with emotion regulation predicts weight outcome, the current findings do suggest that further exploration of emotion regulation in weight loss and weight loss maintenance for obesity is warranted. High ratings of difficulties with emotion regulation in the current sample despite low scores on other indicator of distress suggest that emotion regulation would be an interesting avenue for future studies.

Additionally, it is important to evaluate whether the variables in the ICAT model predict BMI increase or weight regain at 1-year follow-up or beyond. The current study evaluated the nature of these relationships at 6-months, but previous research has more firmly established the tendency towards weight regain after one year or more. It is possible that the hypothesized relationships might have emerged one or two years later.

Finally, it would be interesting for future researchers to evaluate the role of changes in the scores for psychological variables in the ICAT over time rather than just at baseline. Specifically, examination of past and current binge eating behaviour as well as changes in self-discrepancy, mood symptoms, difficulties with emotion regulation, and emotional eating across time during a longer follow-up period could provide insight into which psychological characteristics to target in obesity treatment programs or weight loss maintenance programs.

4.5 Conclusion

In summary, the main purpose of this thesis was to conduct a pilot study to explore the role of psychological variables related to the ICAT model in predicting weight loss outcome in an obese community sample. The current study did not produce evidence to suggest that self-discrepancy, mood symptoms, difficulty with emotion

regulation, or emotional eating significantly predicted weight regain. Although effect sizes were small, study limitations such as the relatively small sample size, the rate of attrition, the length of follow-up, and the possible variation in weight loss methods suggest that further research is needed to draw firm conclusions regarding the utility of the ICAT model for clinical use in obesity treatment.

The baseline cross-sectional analyses provided preliminary evidence of the predicted relationships between self-discrepancy, mood symptoms, and difficulties with emotion regulation. Comparisons of the level of difficulties in emotional regulation in the current sample with previous studies, suggested that individuals in the current sample had great difficulties with managing their emotions. However, this did not predict their weight outcome six months later; perhaps a longer follow-up period would have uncovered the predicted relationships. Thus, further research is needed on the role of difficulties in emotion regulation in predicting long-term weight outcome in obesity.

References

Anderson, J. W., Konz, E. C., Frederich, R. C., & Wood, C. L. (2001). Long-term weight-loss maintenance: A meta-analysis of US studies. *The American Journal of Clinical Nutrition, 74*(5), 579.

Annis, N. M., Cash, T. F., & Hrabosky, J. I. (2004). Body image and psychosocial differences among stable average weight, currently overweight, and formerly overweight women: The role of stigmatizing experiences. *Body Image, 1*(2), 155-167. doi:10.1016/j.bodyim.2003.12.001

Anton, S. D., Perri, M. G., & Riley, J R. (2000). Discrepancy between actual and ideal body images; impact on eating and exercise behaviours. *Eating Behaviours, 1*(2), 153.

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the depression anxiety stress scales in clinical groups and a community sample. *Psychological Assessment, 10*(2), 176-181. doi:10.1037/1040-3590.10.2.176

Arnow, B., Kenardy, J., & Agras, W. S. (1995). The emotional eating scale: The development of a measure to assess coping with negative affect by eating. *The International Journal of Eating Disorders, 18*(1), 79-90. doi:10.1002/1098-108X(199507)18:1<79::AID-EAT2260180109>3.0.CO;2-V

Balsis, S., & Cully, J. A. (2008). Comparing depression diagnostic symptoms across younger and older adults. *Aging & Mental Health, 12*(6), 800-806. doi: 10.1080/13607860802428000

Baum, C. L., & Ford, W. F. (2004). The wage effects of obesity: A longitudinal study. *Health Economics, 13*(9), 885-899. doi:10.1002/hec.881

Befort, C. A., Stewart, E. E., Smith, B. K., Gibson, C. A., Sullivan, D. K., & Donnelly, J. E. (2008). Weight maintenance, behaviours and barriers among previous participants of a university-based weight control program. *International Journal of Obesity, 32*(3), 519-526. doi:10.1038/sj.ijo.0803769

Berg, K. C., Peterson, C. B., Frazier, P., & Crow, S. J. (2012). Psychometric evaluation of the eating disorder examination and eating disorder examination‐questionnaire: A systematic review of the literature. *International Journal of Eating Disorders, 45*(3), 428-438. doi:10.1002/eat.20931

Berg, K. C., Swanson, S. A., Stiles-Shields, E. C., Eddy, K. T., Peterson, C. B., & Le Grange, D. (2013). Response patterns on interview and questionnaire versions of the eating disorder examination and their impact on latent structure analyses. *Comprehensive Psychiatry, 54*(5), 506-516. doi:10.1016/j.comppsych.2012.12.006

Berrington de Gonzalez, A., Hartge, P., Cerhan, J. R., Flint, A. J., Hannan, L., MacInnis, R. J., & Thun, M. J. (2010). Body-mass index and mortality among 1.46 million white adults. *The New England Journal of Medicine, 363*(23), 2211-2219. doi:10.1056/NEJMoa1000367

Binford, R. B., Le Grange, D., Jellar, C. C. (2005). Eating disorders examination versus eating disorders examination – questionnaire in adolescents with full and partial-syndrome bulimia nervosa and anorexia nervosa. *International Journal of Eating Disorders, 37*(1), 44-49. doi: 10.1002/eat.20062

Bodenlos, J. S., Lemon, S. C., Schneider, K. L., August, M. A., & Pagoto, S. L. (2011). Associations of mood and anxiety disorders with obesity: Comparisons by ethnicity. *Journal of Psychosomatic Research, 71*(5), 319-324. doi:10.1016/j.jpsychores.2011.03.004

Brantley, P. J., Stewart, D. W., Myers, V. H., Matthews-Ewald, M. R., Ard, J. D., Coughlin, J. W.. . Stevens, V. J. (2014). Psychosocial predictors of weight regain in the weight loss maintenance trial. *Journal of Behavioural Medicine, 37*(6), 1155-1168. doi:10.1007/s10865-014-9565-6

Brown, T. A., Chorpita, B. F., Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the depression anxiety stress scales (DASS) in clinical samples. *Behaviour Research and Therapy, 35*(1), 79-89. doi:10.1016/S0005-7967(96)00068-X

Brunet, J., Sabiston, C., Castonguay, A., Ferguson, L., & Bessette, N. (2012). The association between physical self-discrepancies and women's physical activity: The mediating role of motivation. *Journal of Sport & Exercise Psychology, 34*(1), 102.

Butryn, M. L., Phelan, S., Hill, J. O., & Wing, R. R. (2007). Consistent self-monitoring of weight: A key component of successful weight loss maintenance. *Obesity, 15*(12), 3091-3096. doi: 10.1038/oby.2007.368

Byrne, S., Cooper, Z., & Fairburn, C. (2003). Weight maintenance and relapse in obesity: A qualitative study. *International Journal of Obesity, 27*(8), 955-962. doi:10.1038/sj.ijo.0802305

Byrne, S. M., Cooper, Z., & Fairburn, C. G. (2004). Psychological predictors of weight regain in obesity. *Behaviour Research and Therapy, 42*(11), 1341-1356. doi:10.1016/j.brat.2003.09.004

Cohen, J. (1969). Statistical power analysis for the behavioural sciences. *Academic Press*, New York.

Collings, A. S., Saules, K. K., & Saad, L. R. (2008). A prospective study of predictors of successful weight maintenance by women enrolled in community-based weight-loss programs. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 13*(1), 38-47. doi:10.1007/BF03327783

Cooper, Z., & Fairburn, C. (1987). The Eating Disorder Examination: a semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International Journal of Eating Disorders*, 6, 1-8.

Cornier, M. (2011). Is your brain to blame for weight regain? *Physiology & Behaviour, 104*(4), 608-612. doi:10.1016/j.physbeh.2011.04.003

Cummins, S., & Macintyre, S. (2006). Food environments and obesity - neighborhood or nation? *International Journal of Epidemiology, 35*(1), 100-104. doi:10.1093/ije/dyi276

Crandall, C. S. (1995). Do parents discriminate against their heavyweight daughters? *Personality and Social Psychology Bulletin, 21*(7), 724.

Delahanty, L. M., Peyrot, M., Shrader, P. J., Williamson, D. A., Meigs, J. B., & Nathan, D. M.(2013). Pretreatment, psychological, and behavioural predictors of weight outcomes among lifestyle intervention participants in the diabetes prevention program (DPP). *Diabetes Care, 36*(1), 34-40. doi:10.2337/dc12-0733

Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *The International Journal of Eating Disorders, 16*(4), 363.

Fereidouni, F., Atef-Vahid, M. K., Fatalhi Lavansani, F., Jamshidi Orak, R., Klonsky, D. E., & Pazooki, A. (2015). Are Iranian obese women candidate for bariatric surgery different cognitively, emotionally, and behaviourally from their normal weight counterparts? *Eating and Weight Disorders, 20*(3), 397-403. doi: 10.1007/s40519-014-0168-6

Friedman, K. E., Reichmann, S. K., Costanzo, P. R., & Musante, G. J. (2002). Body image partially mediates the relationship between obesity and psychological distress. *Obesity Research, 10*(1), 33-41. doi:10.1038/oby.2002.5

Gianni, L. M., White, M. A., & Masheb, R.M. (2013). Eating pathology, emotion regulation, and emotional overeating in obese adults with binge eating disorder. *Eating Behaviours, 14*(3), 309-313. doi:10.1016/j.eatbeh.2013.05.008

Gilmartin, J. (2013). Body image concerns among massive weight loss patients. *Journal of Clinical Nursing, 22*(9-10), 1299-1309. doi: 10.1111/jocn.12031

Gingras, J., Fitzpatrick, J., & McCargar, L. (2004). Body image of chronic dieters: Lowered appearance evaluation and body satisfaction. *Journal of the American Dietetic Association, 104*(10), 1589-1592. doi:10.1016/j.jada.2004.07.025

Goldbacher, E. M., Grunwald, H. E., Lagrotte, C. A., Klotz, A. A., Oliver, T. L., Musliner, K. L., Foster, G. D. (2012). Factor structure of the emotional eating scale in overweight and obese adults seeking treatment. *Appetite, 59*(2), 610-615. doi:10.1016/j.appet.2012.04.005

Gorin, A. A., Niemeier, H. M., Hogan, P., Coday, M., Davis, C., DiLillo, V.G., Gluck, M.E., Wadden, T.A., West, D.S., Willimason, D., Yanovski, S.Z., Look AHEAD Research Group. (2008). Binge eating and weight loss outcomes in overweight and obese individuals with type 2 diabetes: Results from the Look AHEAD trial. *Archives of General Psychiatry, 65*(12), 1447-1455. doi: 10.1001/archpsyc.65.12.1447

Gratz, K. L., & Roemer, L. (2008). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioural Assessment, 30*(4), 315-315. doi:10.1007/s10862-008-9102-4

Health Canada. (2003). Canadian guidelines for body weight classification in adults: Quick reference tool for professionals. [Ottawa]: Government of Canada.

Health Canada. (2006). It's your health: Obesity. [Ottawa]: Government of Canada.

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the depression anxiety stress scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *The British Journal of Clinical Psychology / the British Psychological Society, 44*(2), 227.

Heron, K. E., & Smyth, J. M. (2013). Body image discrepancy and negative affect in women's everyday lives: An ecological momentary assessment evaluation of self-discrepancy theory. *Journal of Social and Clinical Psychology, 32*(3), 276.

Higgins, E. T., Klein, R., & Strauman, T. (1985). Self-concept discrepancy theory: A psychological model for distinguishing among different aspects of depression and anxiety. *Social Cognition, 3*(1), 51-76. doi:10.1521/soco.1985.3.1.51

Higgins, E. T., Bond, R. N., Klein, R., & Strauman, T. (1986). Self-discrepancies and emotional vulnerability: How magnitude, accessibility, and type of discrepancy influence affect. *Journal of Personality and Social Psychology, 51*(1), 5-15. doi:10.1037//0022-3514.51.1.5

Higgins, E. T. (1987). Self-discrepancy: A theory relating self and affect. *Psychological Review, 94*(3), 319-340. doi:10.1037/0033-295X.94.3.319

Institute of Medicine (IOM). (1995). Weighing the option: Criteria for evaluating weight-management programs. National Academy Press. Washington, DC.

Karmali, S., Stoklossa, C.J., Sharma, A., Stadnyk, J., Christiansen, S., Cottreau, D., & Birch, D.W. (2010). Bariatric surgery: A primer. *Canadian Family Physician, 56*(9), 873-879.

Katzmarzyk, P. T., Reeder, B. A., Elliott, S., Joffres, M. R., Pahwa, P., Raine, K. D., & Paradis, G. (2012). Body mass index and risk of cardiovascular disease, cancer and all-cause mortality. *Canadian Journal of Public Health / Revue Canadienne De Sante'e Publique, 103*(2), 147-151.

Keys, A., Fidanza, F., Karvonen, M. J., Kimura, N., & Taylor, H. L. (1972). Indices of relative weight and obesity. *International Journal of Epidemiology, 43*(3), 655-665. doi:10.1093/ije/dyu058

Kim, H. (2013). Statistical notes for clinical researchers: Assessing normal distribution using skew and kurtosis. *Restorative Dentistry and Orthodontics, 38*(1), 52-54. doi: http://dx.doi.org/10.5395/rde.2013.38.1.52

Kordik, C. P., & Reitz, A. B. (1999). Pharmacological treatment of obesity: Therapeutic strategies. *Journal of Medicinal Chemistry, 42*(2), 181-201. doi:10.1021/jm9805211

Kramer, F. M., Jeffery, R.W., Forster, J. L., & Snell, M. K. (1989). Long-term follow up of behavioural treatment for obesity: patterns of weight regain among men and women. *International Journal of Obesity, 13*, 123-136.

Kuller, L. H., Simkin-Silverman, L. R., Wing, R. R., Meilahn, E. N., & Ives, D. G. (2001). Women's healthy lifestyle project: A randomized clinical trial: Results at 54 months. *Circulation, 103*(1), 32-37. doi:10.1161/01.CIR.103.1.32

Larsen, J. K., Ouwens, M., Engels, R. C. M. E., Eisinga, R., & van Strien, T. (2008). Validity of self-reported weight and height and predictors of weight bias in female college students. *Appetite, 50*(2), 386-389. doi: 10.1016/j.appet.2007.09.002

Lau, D. C. W., Douketis, J. D., Morrison, K. M., Hramiak, I. M., Sharma, A. M., Ur, E. (2007). 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children [summary]. *CMAJ : Canadian Medical Association Journal, 176*(8), S1-S13. doi:10.1503/cmaj.061409

Linde, J. A., Jeffery, R. W., Finch, E. A., Ng, D. M., & Rothman, A. J. (2004). Are unrealistic weight loss goals associated with outcomes for overweight women? *Obesity, 12*(3), 569-576. doi:10.1038/oby.2004.65

Liverant, G. L., Brown, T. A., Barlow, D. H., and Roemer, L. (2008). Emotion regulation in unipolar depression: The effects of acceptance and suppression of subjective emotional experience on the intensity and duration of sadness and negative affect. *Behavior Research and Therapy, 46*, 1201-1209. doi: http://dx.doi.org/10.1016/j.brat.2008.08.001

Lovibond, S. H., & Lovibond, P. F. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the beck

depression and anxiety inventories. *Behaviour Research and Therapy, 33*(3), 335-343. doi:10.1016/0005-7967(94)00075-U

Lumeng, J. C., Forrest, P., Appugliese, D. P., Kaciroti, N., Corwyn, R. F., & Bradley, R. H. (2010). Weight status as a predictor of being bullied in third through sixth grades. *Pediatrics, 125*(6), e1301-e1307. doi:10.1542/peds.2009-0774

Magro, D. O., Geloneze, B., Delfini, R., Pareja, B. C., Callejas, F., & Pareja, J. C. (2008). Long-term weight regain after gastric bypass: A 5-year prospective study. *Obesity Surgery, 18*(6), 648-651. doi:10.1007/s11695-007-9265-1

Mansur, R. B., Brietzke, E., & McIntyre, R. S. (2015). Is there a "metabolic-mood syndrome"? A review of the relationship between obesity and mood disorders. *Neuroscience and Biobehavioural Reviews, 52*, 89-104. doi:10.1016/j.neubiorev.2014.12.017

Mason, T. B., & Lewis, R. J. (2014). Profiles of binge eating: the interaction of depressive symptoms, eating styles, and emotional eating. *Eating Disorders: The Journal of Treatment and Prevention, 22*(5), 450-460. doi:10.1080/10640266.2014.931766

McGuire, M. T., Wing, R. R., Klem, M. L., Lang, W., & Hill, J. O. (1999). What predicts weight regain in a group of successful weight losers? *Journal of Consulting and Clinical Psychology, 67*(2), 177-185. doi:10.1037/0022-006X.67.2.177

Mehta, T., Smith, D. L. Jr., Muhammad, J., & Casazza, K. (2014). Impact of weight cycling on risk of morbidity and mortality. *Obesity Reviews,* 15, 870-881. doi: 10.1111/obr.12222

Nasser, M. (1988). Culture and weight consciousness. *Journal of Psychosomatic Research, 32*(6), 573-577. doi:10.1016/0022-3999(88)90005-0

Padwal, R., Li, S. K., & Lau, D. C. W. (2003). Long-term pharmacotherapy for overweight and obesity: A systematic review and meta-analysis of randomized controlled trials. *International Journal of Obesity, 27*(12), 1437-1446. doi:10.1038/sj.ijo.0802475

Pardo Silva, M. C., De Laet, C., Nusselder, W. J., Mamun, A. A., & Peeters, A. (2006). Adult obesity and number of years lived with and without cardiovascular disease. *Obesity, 14*(7), 1264-1273. doi:10.1038/oby.2006.144

Pingitore, R., Dugoni, B. L., Tindale, R. S., & Spring, B. (1994). Bias against overweight job applicants in a simulated employment interview. *Journal of Applied Psychology, 79*(6), 909-917. doi:10.1037/0021-9010.79.6.909

Public Health Agency of Canada, & the Canadian Institute for Health Information. (2011). Obesity in Canada. [Ottawa]: Government of Canada.

Puhl, R., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research, 9*(12), 788-805. doi:10.1038/oby.2001.108

Puhl, R. M., Luedicke, J., & Grilo, C. M. (2014). Obesity bias in training: Attitudes, beliefs, and observations among advanced trainees in professional health disciplines. *Obesity, 22*(4), 1008-1015. doi:10.1002/oby.20637

Reas, D. L., Grilo, C. M., & Masheb, R. M. (2006). Reliability of the eating disorder examination-questionnaire in patients with binge eating disorder. *Behaviour Research and Therapy, 44*(1), 43-51. doi:10.1016/j.brat.2005.01.004

Rooth, D. (2009). Obesity, attractiveness, and differential treatment in hiring: A field experiment. *The Journal of Human Resources, 44*(3), 710-735. doi:10.1353/jhr.2009.0027

Schwartz, M. B., Chambliss, H. O., Brownell, K. D., Blair, S. N., & Billington, C. (2003). Weight bias among health professionals specializing in obesity. *Obesity Research, 11*(9), 1033-1039. doi:10.1038/oby.2003.142

Shields, M., Tremblay, M. S., Laviolette, M., Craig, C. L., Janssen, I., & Connor Gorber, S. (2010). Fitness of Canadian adults: Results from the 2007-2009 Canadian health measures survey. *Health Reports, 21*(1), 21.

Sinclair, S. J., Siefert, C. J., Slavin-Mulford, J. M., Stein, M. B., Renna, M., & Blais, M. A. (2012). Psychometric evaluation and normative data for the depression, anxiety, and stress scales-21 (DASS-21) in a nonclinical sample of U.S. adults. *Evaluation & the Health Professions, 35*(3), 259-279.

Stevens, J. P. (1996). *Applied multivariate statistics for the social sciences.* (3rd ed.). Lawrence Erlbaum Associates, Incorporated.

Strauman, T. J., & Higgins, E. T. (1987). Automatic activation of self-discrepancies and emotional syndromes: When cognitive structures influence affect. *Journal of Personality and Social Psychology, 53*(6), 1004-1014. doi:10.1037/0022-3514.53.6.1004

Strauman, T. J., & Higgins, E. T. (1988). Self-discrepancies as predictors of vulnerability to distinct syndromes of chronic emotional distress. *Journal of Personality, 56*(4), 685-707. doi:10.1111/j.1467-6494.1988.tb00472.x

Strauman, T. J., Vookles, J., Berenstein, V., & Chaiken, S. (1991). Self-discrepancies and vulnerability to body dissatisfaction and disordered eating. *Journal of Personality and Social Psychology, 61*(6), 946-956. doi:10.1037//0022-3514.61.6.946

Strauman, T. J., & Glenberg, A. M. (1994). Self-concept and body-image disturbance: Which self-beliefs predict body size overestimation? *Cognitive Therapy and Research, 18*(2), 105-125. doi:10.1007/BF02357219

Strohacker, K., McCaffery, J. M., MacLean, P. S., & Wing, R. R. (2014). Adaptations of leptin, ghrelin or insulin during weight loss as predictors of weight regain: A review of current literature. *International Journal of Obesity (2005), 38*(3), 388-396. doi:10.1038/ijo.2013.118

Teachman, B. A., & Brownell, K. D. (2001). Implicit anti-fat bias among health professionals: Is anyone immune? *International Journal of Obesity, 25*(10), 1525-1531. doi:10.1038/sj.ijo.0801745

Teachman, B. A., Gapinski, K. D., Brownell, K. D., Rawlins, M., & Jeyaram, S. (2003). Demonstrations of implicit anti-fat bias: The impact of providing causal information and evoking empathy. *Health Psychology, 22*(1), 68-78. doi:10.1037/0278-6133.22.1.68

Teixeira, P. J., Going, S. B., Houtkooper, L. B., Cussler, E. C., Metcalfe, L. L., Blew, R. M., & Lohman, T. G. (2004). Pretreatment predictors of attrition and successful weight management in women. *International Journal of Obesity, 28*(9), 1124-1133. doi:10.1038/sj.ijo.0802727

Tiggemann, M., & Anesbury, T. (2000). Negative stereotyping of obesity in children: The role of controllability beliefs. *Journal of Applied Social Psychology, 30*(9), 1977-1993. doi:10.1111/j.1559-1816.2000.tb02477.x

Toups, M. S. P., Myers, A. K., Wisniewski, S. R., Kurian, B., Morris, D. W., Rush, A. J., & Trivedi, M. H. (2013). Relationship between obesity and depression: Characteristics and treatment outcomes with antidepressant medication. *Psychosomatic Medicine, 75*(9), 863-872. doi:10.1097/PSY.0000000000000000

Tsai, A. G., & Wadden, T. A. (2005). Systematic review: An evaluation of major commercial weight loss programs in the United States. *Annals of Internal Medicine, 142*(1), 56-66. doi: 10.7326/0003-4819-142-1-200501040-00012

Van, Buuren, S. (2012). *Flexible imputation of missing data.* Boca Raton, FL: Taylor and Francis Group, LLC.

Wing, R. R., Papandonatos, G., Fava, J. L., Gorin, A. A., Phelan, S., McCaffery, J., & Tate, D. F. (2008). Maintaining large weight losses: The role of behavioural and psychological factors. *Journal of Consulting and Clinical Psychology, 76*(6), 1015-1021. doi:10.1037/a0014159

Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., & Bertoni, A. G. (2011). Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care, 34*(7), 1481-1486. doi:10.2337/dc10-2415

Wold, P. N. (1983). Anorexic syndromes and affective disorder. *Journal of Psychiatry & Neuroscience, 8*(3), 116-119.

Wonderlich, S. A., Engel, S. G., Peterson, C. B., Robinson, M. D., Crosby, R. D., Mitchell, J. E.. . Simonich, H. K. (2008). Examining the conceptual model of integrative cognitive‐affective therapy for BN: Two assessment studies. *International Journal of Eating Disorders, 41*(8), 748-754. doi:10.1002/eat.20551

Wonderlich, S. A., Peterson, C. B., Smith, T. L., Klein, M., Mitchell, J. E., Crow, S. J., & Engel, S. G. (2010). Integrative cognitive-affective therapy for bulimia nervosa. *The Treatment of Eating Disorders: A Clinical Handbook.* Grilo, C.M., & Mitchell, J.E. (Eds.). Guilford Press. New York, NY. 317-338.

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation difficulties from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion specific developmental variations. *International journal of Behavioral Development, 38*(2), 182-194. doi:10.1177/0165025413515405

Appendix A

A.1 Study Advertisement

Department of Psychology
&
Faculty of Medicine

MEMORIAL UNIVERSITY

Have you recently lost weight?

Or are you currently trying to lose weight?

Researchers at MUN are looking for adults ages 18 and over who have recently lost weight to take part in a study of factors that affect body weight.

As part of this study, you will get valuable health information about your body composition, including bone density and body fat percentage.

For more information, or to find out if you are eligible to take part, scan the barcode above, go to http://fluidsurveys.com/s/munweightloss, telephone 864-2219 or email munweightloss@gmail.com

The proposal for this research has been reviewed by the Heath Research Ethics Board and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the HREB at info@hrea.ca or by telephone at 709-777-6967.

Body Weight Study
http://fluidsurveys.com/s/munweightloss
Email: munweightloss@gmail.com
Phone: 864-2219

A.2 Informed Consent

How Biological and Psychological Factors Influence Eating Behavior and Weight Loss

Consent to Take Part in Research

INVESTIGATORS: Dr. Jacqueline Carter, Psychology Department, MUN
Email: jacqueline.carter@mun.ca Tel: 864-8118

Dr. Guang Sun, Faculty of Medicine, MUN
Email: gsun@mun.ca Tel: 777-8661

Research Assistant: Katharine Stabb, Psychology Department, MUN
Email: kps418@mun.ca Tel: 769-3049

You are invited to take part in a research project, and this form is part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any other information given to you by the researcher.

It is entirely up to you to decide whether to take part in this research. If you choose not to take part or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

Introduction and Purpose:
We are conducting a research study to explore how psychological and biological factors affect eating behavior and body weight over time among people who have recently lost at least 10% of their body weight through diet and exercise. We are studying how different factors such as mood, personality, and the level of certain hormones affect weight loss maintenance.

We will measure weight-related hormones (e.g., leptin and ghrelin) secreted by various organs and tissues that affect appetite. In addition, we will examine if DNA sequences (i.e., genetics) affect weight loss maintenance. We are trying to understand how these biological factors work together with psychological factors to affect weight loss maintenance over time among people who have intentionally lost weight.

What you will do in this study:
This study will involve meeting with a research assistant at the Health Sciences Centre 3 times over the course of one year - an initial assessment and follow up

appointments 6 and 12 months later. Each meeting will last about 1.5 hours. At the first visit, we will schedule your second and third follow-up appointments to take place 6 and 12 months later. Three months after your initial visit we will send you a very brief survey via e-mail to complete at home.

At the first appointment, you will be asked to provide a blood sample (approximately 3 tablespoons) so that we can measure the level of weight-related hormones and extract DNA from your blood. Next, you will be asked to fill out a few short questionnaires asking about your mood, personality, and eating behavior, and then complete a brief behavioral task on the computer. You will have your body weight and height, as well as body composition, measured by a certified staff member.

At the 6- and 12-month follow-up appointments, you will fill in a brief subset of the questionnaires, have your body composition measured again, and be asked to provide a blood sample.

Before each follow-up appointment, the researcher will contact you approximately one week prior to the scheduled meeting to confirm the time and date.

PARTICIPANTS ARE REQUIRED TO FAST FOR 12 HOURS (OVERNIGHT) PRIOR TO BLOOD SAMPLE This is necessary for the accurate measurement of weight-related hormones. If you do not wish to provide a blood sample and/or have your percent body fat measured, you may still participate in the other components of the study.

The results of this study are expected to contribute to the development of better weight loss treatments.

Possible benefits and risks: There are no known personal benefits guaranteed for participating in this study. However, it is possible that participation could assist your efforts to maintain weight loss over time. Possible risks associated with participation in this study are minimal, but may include some discomfort about revealing sensitive information about mood, eating behavior or weight history. There is little risk when sampling blood. There is a possibility of bruising at the site and a slight chance of infection. There will be a very low dose of X-ray exposure when you receive measurement of body fat.

<u>You should not participate in body composition measurement if you think you might be pregnant.</u>

Withdrawal from the study: You can withdraw from participation in this study at any point without giving any reason. There are no consequences for withdrawal. If you decide to withdraw, you will be given the opportunity to remove previously collected data from the study. Data cannot be withdrawn once the study has been completed and the results are aggregated.

Confidentiality and Anonymity: Your participation in this study will be kept strictly anonymous and confidential. The information gathered will be seen solely by the researchers involved in this study, and will be used solely for research purposes. Questionnaire data and blood samples will be identified only by ID number, and will not

have any identifying information on them. Contact information and associated ID numbers will be kept in a separate secure digital file. This will allow the researchers to contact you to schedule follow up appointments, while keeping your information confidential and anonymous.

Confidentiality and Storage of Data: We will be collecting and storing questionnaire data via the online survey company FluidSurveys. As such, it is subject to Canadian privacy laws. If you choose to participate in this study, you understand that your responses will be stored in Canada. FluidSurveys ensures that they will not use the collected data, and that we, the researchers, retain ownership of it. The questionnaire data will be stored as a password protected digital file. The blood samples will be securely stored in Dr. Sun's laboratory. The blood samples will be identified only by ID number. Only Drs. Carter and Sun or researchers who signed the oath of confidentiality can access the data.

The security and privacy policies of FluidSurveys can be accessed at the following links:
http://fluidsurveys.com/about/privacy/
http://cdn1.fluidsurveys.com/wp-content/uploads/2013/02/FluidSurveys_Security2.pdf

Memorial University requires that the data be stored for a minimum of 5 years after publication of the study findings. The blood samples will be stored for at least 10 years because new hormones related to obesity might be available in the near future.

Reporting of Results: The findings from this study will be submitted for publication in academic journals and for presentation at scientific meetings. The data will be reported in group format only.

Sharing of Results with Participants: We would be happy to provide you with a summary of the research findings after this study is completed if you provide us with your e-mail address. Since this is a long-term project, this may be up to 5 years from now. Please indicate below if you would like to receive a summary of the research findings.

☐ I would like a summary of the research findings. E-mail:_____

Questions: You are welcome to ask any questions at any time during your participation in this research study. If you would like more information about this study, please contact Dr. Jacqueline Carter (contact information at the beginning of this form.)

Compensation: In the event that you suffer injury as a direct result of taking part in this study, necessary treatment will be available at no additional cost to you.

If you feel distressed after your participation in this study, you can contact one of the following resources:

For MUN Students: University Counselling Centre

5th Floor University Centre, UC-5000
Memorial University of Newfoundland
St. John's, NL
A1C 5S7
Tel: (709) 864-8874

For Non-MUN students: Canadian Mental Health Association Crisis Line
Tel: (709) 737-4668
Toll Free: 1-888-737-4668

The protocol for this research study has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Consent:
Your signature on this form means that:

- You have read the information about the research.
- You have been given the opportunity to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.
- If you decide to withdraw, you will be given the opportunity to remove any previously collected data (including blood samples) from the study. Data cannot be removed once the study has been completed and the results are aggregated.
- For females – you are not pregnant.

If you sign this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Your signature:
I have read and understood what this study is about and appreciate any risks and benefits. I have had adequate time to think about this and have had the opportunity to ask questions and my questions have been answered.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

A copy of this Informed Consent Form has been given to me for my records.

_____ _____

Signature of participant Date

Researcher's or Research Assistant's Signature:
I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study, and he or she has freely chosen to be in the study.

_____ _____

Signature of Research Assistant Date

_____ _____

Signature of Researcher Date

A.3 Interview Protocols and Questionnaires

Demographic Interview

DEMOGRAPHIC INTERVIEW QUESTIONS

[PARTICIPANT ID:_____]

Age:_____

Biological Sex: M F I

Relationship Status: _____

What is your ethnic background? _____

School/Vocational Functioning:

Do you work? Yes No

If yes, FULL TIME or PART TIME

What is your occupation? _____

Are you a student?: Yes No

If yes, FULL TIME or PART TIME

What is your highest level of education?

High School _____

College _____

University (undergraduate) _____

University (graduate) _____

WEIGHT HISTORY INTERVIEW QUESTIONS

Current Height: _____

Current Weight: _____

Are the above reports from measurements taken, or self-report? M__ SR___

If M, how much did you weigh last time you weighed yourself (SR)? _____

When was that?_____

When did you start trying to lose weight?_____

What was your weight when you started to lose weight this time? _____

Since you reached your current height:

What was your highest weight? (excluding pregnancy) _____

When was that?_____

How long were you at this weight? _____
What was your lowest weight?_____
When was that? _____
How long were you at this weight?_____

Selves Interview **Higgins, et al., (1986)**

SELVES INTERVIEW PROTOCOL

Introduction: I'd like to ask you some questions concerning how you describe yourself and how other people in your life would describe you. I will be asking several different but related questions, about the type of person that you actually are, ideally would like to be, believe you ought to be, and do not want to be. As I ask the questions I'll be writing down your responses, and I may ask you to elaborate on them from time to time. Please do your best to limit your responses to one word attributes. These attributes may be positive or negative. If you're not sure of anything I ask you, just let me know and I'll try to clarify the question.

Please take your time and consider each question thoughtfully. There are no right or wrong answers. In general, the first things that come to mind are the best answers. We will maintain the confidentiality of your answers.

ACTUAL/OWN: **What are the attributes that you believe you actually possess?**

(Clarification: What kind of person do you believe you are?)

If only positive attributes are given, ask "Are there any attributes that you possess that might not be as positive as the ones you've mentioned already?".

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?" Only write down the first ten if more than ten are given.

ACTUAL/OTHER: **What are the attributes that your parents or other important people in your life believe you actually possess?**

(Clarification: What kind of person do important people in your life believe you are?)

If only positive attributes are given, ask "Are there any attributes that others believe you possess that might not be as positive as the ones you've mentioned already?".

If one or both parents are not currently a significant part of the subject's life, say "What kind of person did (he/she/they) believe you were back when they were a significant part of your life?"

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?" Only write down the first ten if more than ten are given.

IDEAL/OWN: **Now I'd like to ask a slightly different question. What are the attributes of the kind of person that you would ideally like to be?**

(Clarification: What kind of person is it your ultimate wish or aspiration to be?)

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?"

If the participant generates an inadequate number of trait like words for entry into the palm pilot say "Could you give me some more words describing how you would like to be as a person in terms of personality traits/values/physical characteristics."

Only write down the first ten if more than ten are given.

IDEAL/OTHER: **What are the attributes of the kind of person that your parents or other important people in your life would ideally like you to be?**

(Clarification: What kind of person would important people in your life wish for you to be?)

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?" Only write down the first ten if more than ten are given.

OUGHT/OWN: **Now here's another slightly different question: What are the attributes of the kind of person you believe you ought to be?**

(Clarification: What kind of person is it your duty or responsibility to be?)

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?"

If the participant generates an inadequate number of trait like words for entry into the palm pilot say "Could you give me some more words describing how you ought to be as a person in terms of personality traits/values/physical characteristics."

Only write down the first ten if more than ten are given.

OUGHT OTHER: **What are the attributes of the kind of person that other important people in your life believe you ought to be?**

(Clarification: What kind of person do important people in your life believe it is your duty or responsibility to be?)

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?" Only write down the first ten if more than ten are given.

UNDESIRED/OWN: **Here is the final question. What are the attributes that you do not want to possess?**

(Clarification: What kind of person do you believe it would be extremely undesirable to be?)

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?" Only write down the first ten if more than ten are given.

UNDESIRED/OTHER: **What are the attributes that your parents or other important people in your life do not want you to possess?**

(Clarification: What kind of person do important people in your life believe it would be extremely undesirable for you to be?)

Be sure to get at least SIX attributes. If less than six are produced spontaneously, ask "Are there any others you can think of?" Only write down the first ten if more than ten are given.

CONCLUSION: **Are there any other attributes or traits that you forgot to mention for any of these questions?**

Participant # _____

SELVES INTERVIEW

Date _____
Interviewer # _____

Actual/Own

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Actual/Other (Attribute)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Participant # _____

Ideal/Own	**Ideal/Other** (Attribute)
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____
6. _____	6. _____
7. _____	7. _____
8. _____	8. _____
9. _____	9. _____
10. _____	10._____

Participant # _____

Ought/Own

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Ought/Other (Attribute)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Participant # _____

Undesired/Own

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Undesired/Other (Attribute)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Difficulties in Emotion Regulation Scale **Gratz & Roemer, (2004)**

Difficulties in Emotion Regulation Scale (DERS)

Please indicate how often the following statements apply to you by writing the appropriate number from the scale below on the line beside each item:

1	2	3	4	5
almost never (0-10%)	sometimes (11-35%)	about half the time (36-65%)	most of the time (66-90%)	almost always (91-100%)

_____ 1) I am clear about my feelings.

_____ 2) I pay attention to how I feel.

_____ 3) I experience my emotions as overwhelming and out of control.

_____ 4) I have no idea how I am feeling.

_____ 5) I have difficulty making sense out of my feelings.

_____ 6) I am attentive to my feelings.

_____ 7) I know exactly how I am feeling.

_____ 8) I care about what I am feeling.

_____ 9) I am confused about how I feel.

_____ 10) When I'm upset, I acknowledge my emotions.

_____ 11) When I'm upset, I become angry with myself for feeling that way.

_____ 12) When I'm upset, I become embarrassed for feeling that way.

_____ 13) When I'm upset, I have difficulty getting work done.

_____ 14) When I'm upset, I become out of control.

_____ 15) When I'm upset, I believe that I will remain that way for a long time.

_____ 16) When I'm upset, I believe that I'll end up feeling very depressed.

_____ 17) When I'm upset, I believe that my feelings are valid and important.

_____ 18) When I'm upset, I have difficulty focusing on other things.

_____ 19) When I'm upset, I feel out of control.

_____ 20) When I'm upset, I can still get things done.

_____ 21) When I'm upset, I feel ashamed with myself for feeling that way.

1	2	3	4	5
almost never (0-10%)	sometimes (11-35%)	about half the time (36-65%)	most of the time (66-90%)	almost always (91-100%)

_____ 22) When I'm upset, I know that I can find a way to eventually feel better.

_____ 23) When I'm upset, I feel like I am weak.

_____ 24) When I'm upset, I feel like I can remain in control of my behaviors.

_____ 25) When I'm upset, I feel guilty for feeling that way.

_____ 26) When I'm upset, I have difficulty concentrating.

_____ 27) When I'm upset, I have difficulty controlling my behaviors.

_____ 28) When I'm upset, I believe that there is nothing I can do to make myself feel better.

_____ 29) When I'm upset, I become irritated with myself for feeling that way.

_____ 30) When I'm upset, I start to feel very bad about myself.

_____ 31) When I'm upset, I believe that wallowing in it is all I can do.

_____ 32) When I'm upset, I lose control over my behaviors.

_____ 33) When I'm upset, I have difficulty thinking about anything else.

_____ 34) When I'm upset, I take time to figure out what I'm really feeling.

_____ 35) When I'm upset, it takes me a long time to feel better.

_____ 36) When I'm upset, my emotions feel overwhelming.

Depression Anxiety and Stress Scale – 21 **Lovibond, & Lovibond, (1995)**

DASS 21 NAME _____ DATE _____

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all - NEVER

1 Applied to me to some degree, or some of the time - SOMETIMES

2 Applied to me to a considerable degree, or a good part of time - OFTEN

3 Applied to me very much, or most of the time - ALMOST ALWAYS

		N	S	O	AA	FOR OFFICE USE D	A	S
1	I found it hard to wind down	0	1	2	3			
2	I was aware of dryness of my mouth	0	1	2	3			
3	I couldn't seem to experience any positive feeling at all	0	1	2	3			
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3			
5	I found it difficult to work up the initiative to do things	0	1	2	3			
6	I tended to over-react to situations	0	1	2	3			
7	I experienced trembling (eg, in the hands)	0	1	2	3			
8	I felt that I was using a lot of nervous energy	0	1	2	3			
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3			
10	I felt that I had nothing to look forward to	0	1	2	3			
11	I found myself getting agitated	0	1	2	3			
12	I found it difficult to relax	0	1	2	3			
13	I felt down-hearted and blue	0	1	2	3			
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3			
15	I felt I was close to panic	0	1	2	3			
16	I was unable to become enthusiastic about anything	0	1	2	3			
17	I felt I wasn't worth much as a person	0	1	2	3			
18	I felt that I was rather touchy	0	1	2	3			
19	I was aware of the action of my heart in the absence of physicalexertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3			
20	I felt scared without any good reason	0	1	2	3			
21	I felt that life was meaningless	0	1	2	3			
					TOTALS			

Emotional Eating Scale **Arnow, et al., (1995)**

Emotional Eating Scale

We all respond to different emotions in different ways. Some types of feelings lead people to experience an urge to eat. Please indicate the extent to which the following feelings lead you to feel an urge to eat by checking the appropriate box.

	No Desire to Eat	A Small Desire to Eat	A Moderate Desire to Eat	A Strong Urge to Eat	An Overwhelming Urge to Eat
Resentful					
Discouraged					
Shaky					
Worn Out					
Inadequate					
Excited					
Rebellious					
Blue					
Jittery					
Sad					
Uneasy					
Irritated					
Jealous					
Worried					
Frustrated					
Lonely					
Furious					
On edge					
Confused					
Nervous					
Angry					
Guilty					
Bored					
Helpless					
Upset					

Eating Disorder Examination Questionnaire **Fairburn & Belgin, (1994)**

EATING QUESTIONNAIRE

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

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

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

Questions 13-18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days).....

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

Questions 19-21: Please circle the appropriate number. Please note that for these questions the term "binge eating" means eating what others would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

19	Over the past 28 days, on how many days have you eaten in secret (ie, furtively)?.....Do not count episodes of binge eating	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
		0	1	2	3	4	5	6
20	On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? .....Do not count episodes of binge eating	None of the times	A few of the times	Less than half	Half of the times	More than half	Most of the time	Every time
		0	1	2	3	4	5	6
21	Over the past 28 days, how concerned have you been about other people seeing you eat? .....Do not count episodes of binge eating	Not at all		Slightly	Moderately			Markedly
		0	1	2	3	4	5	6

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

	On how many of the past 28 days	Not at all		Slightly		Moderately		Markedly
22	Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23	Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24	How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?	0	1	2	3	4	5	6
25	How dissatisfied have you been with your weight?	0	1	2	3	4	5	6
26	How dissatisfied have you been with your shape?	0	1	2	3	4	5	6
27	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6