Mindful Eating Behavior in Post Surgical Bariatric Patients

Megan Mabery Filer

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MINDFUL EATING BEHAVIOR IN POST SURGICAL BARIATRIC PATIENTS

by

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Thesis Proposal Presented in Partial Fulfillment of the Requirements for the Degree
Master of Science

SCHOOL OF HUMAN ECOLOGY
COLLEGE OF APPLIED AND NATURAL SCIENCES
LOUISIANA TECH UNIVERSITY

May 2020
LOUISIANA TECH UNIVERSITY
GRADUATE SCHOOL

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entitled Mindful Eating Behavior in Post Surgical Bariatric Patients
be accepted in partial fulfillment of the requirements for the degree of
Master of Science in Nutrition & Dietetics

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March 30, 2020
Date of thesis defense
ABSTRACT

Emotional eating and binge-eating behavior in obese individuals and post-surgical bariatric patients are both linked to decreased ability to identify and cope with stress (Mitchell et al., 2016; Urquhart & Mihalynuk, 2011). In turn, obese patients who exhibit greater rates of stress-eating behavior show reductions in levels of mindfulness (Ouwens et al., 2015). The purpose of the study was to investigate the association between mindful eating component scores and selected weight loss outcomes in post-surgical bariatric patients.

Patients from a private bariatric clinic in Shreveport, Louisiana who underwent gastric sleeve or gastric bypass were invited to participate based on specific inclusion/exclusion criteria. Patient eligibility included male and female patients, ages 20-65 years who underwent bariatric surgery (gastric sleeve or gastric bypass) between June 1, 2011 and June 1, 2018. Participants were asked to complete a mindful eating questionnaire (MEQ) component, a survey modified from a validated MEQ, administered via the online survey platform Survey Monkey™ to assess eating behavior. Weight, gender, bariatric surgery type and length of time since surgery were measured.

A total of N = 121 participants completed the MEQ component partially (108 completed the survey in entirety). The age range was 20 to 65 years. 81.5% of all participants were female, 78% were white, 54% reported having surgery in the past three to five years and 95.4% underwent gastric sleeve surgery.

Mean presurgical body mass index (BMI) was 46.72 and mean weight loss was 34.47% of presurgical weight. Bariatric surgery dates averaged 48.61 months prior to
study commencement. 88 (92%) of females and 19 (95%) of males experienced post-operative weight regain with a lowest post-surgical mean BMI of 30.93 for both genders.

The significant difference in mean total MEQ component score between males and females was not found. Females had MEQ component scores ($M = 2.53, SD = 0.37$) that were not statistically different than males ($M = 2.52, SD = 0.52$). Females scored higher in the survey domains addressing external cues, emotional response and distraction. In the awareness domain, males scored higher ($M = 3.00, SD = 0.44$) than females ($M = 2.66, SD = 0.67$) and this difference was statistically significant. The significant difference in average total MEQ component score between bariatric surgery types was not achievable due to low volume of gastric bypass surgery respondents (4.6%). The MEQ component score was higher in patients’ status-post gastric bypass ($M = 2.66, SD = 0.34$) when compared to the MEQ component score of patients’ status-post gastric sleeve ($M = 2.52, SD = 0.40$). A statistically significant difference between genders was found in the awareness domain with men scoring higher. No statistically significant association was observed between MEQ component scores and percent weight loss. A significant association was observed between MEQ component scores and patients who experienced post-surgical weight regain with a one-unit increase in MEQ component scores associated with every 6.03% increase in weight ($\beta = 6.03, t(88) = 2.78, p < 0.008$).

This study found that mindful eating component scores were not related to weight loss, bariatric surgery type or length of time since surgery. Men scored significantly higher in one domain of the mindful eating, however no further significance between
genders was identified. There was a significant association between mindful eating component scores and weight regain in this subgroup of patients.
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# TABLE OF CONTENTS

Abstract .............................................................................................................................. iii

Approval for Scholarly Dissemination .............................................................................. v

List of Tables ...................................................................................................................... viii

**CHAPTER 1: INTRODUCTION.................................................................................. 1**

Statement of the Problem ................................................................................................. 2

Purpose .............................................................................................................................. 3

Hypotheses ......................................................................................................................... 3

Justification ......................................................................................................................... 4

**CHAPTER 2: REVIEW OF LITERATURE.................................................................. 6**

Bariatric Surgery ................................................................................................................. 8

Bariatric Surgery Outcomes ............................................................................................... 10

Mindfulness Meditation ...................................................................................................... 12

Mindfulness and Obesity .................................................................................................... 13

Mindfulness and Binge-eating ........................................................................................... 16

Summary ............................................................................................................................. 18

**CHAPTER 3: METHODS.......................................................................................... 20**

Participants ......................................................................................................................... 20

Data Collection .................................................................................................................. 21

Data Collection Procedure ............................................................................................... 22

Data Analysis ........................................................................................................................ 23

**CHAPTER 4: RESULTS............................................................................................ 20**

**CHAPTER 5: DISCUSSION....................................................................................... 20**
CHAPTER 6: CONCLUSIONS AND FUTURE WORK ..........................................50

APPENDIX A ........................................................................................................51

A-1 HUC Approval Letter ....................................................................................52
A-2 Letter from Dr. Merriman ..............................................................................54

APPENDIX B ........................................................................................................55

B-1 Letter of Introduction ....................................................................................56
B-2 Mindful Eating Questionnaire .......................................................................57
B-3 Reminder Letter ............................................................................................60

REFERENCES .......................................................................................................61
LIST OF TABLES

Table 1: Demographic Characteristics of Participants ..........................................................27
Table 2: BMI differences by Gender ......................................................................................28
Table 3: BMI differences by Gender and Years Since Surgery .............................................30
Table 4: Months of Post-surgical Follow Up with Bariatric Team ........................................32
Table 5: MEQ Component Scores and Months of Follow-up with Bariatric Team ............33
Table 6: MEQ Component and Domain Scores by Gender ....................................................35
Table 7: MEQ Component Scores and Bariatric Surgery Type .............................................36
Table 8: Overall Weight Change & MEQ Component Scores ..............................................37
Table 9: BMI Change by Surgery Type ...................................................................................38
Table 10: Post-Surgical Weight Loss % and MEQ Component Scores ...............................40
Table 11: Post-Surgical Weight Regain % and MEQ Component Scores ............................41
CHAPTER 1

INTRODUCTION

Medical advancements of the 20th century have successfully increased longevity rates in the United States, yet the current health consequences of obesity are projected to decrease the lifespan of present and future generations (Hurt, Kulisek, Buchanan & McClave, 2010). The physical, emotional, and financial toll of obesity has become a powerful motivator for afflicted individuals to seek effective weight loss methods (Munoz et al., 2007; Wang, Sereika, Styn, & Burke, 2013). When traditional diet and exercise methods fail to produce desired results, pharmacological agents and bariatric surgery are often recommended by physicians to deliver clinically efficacious outcomes (Lenz, Burns, & Hilleman, 2013; Picot et al., 2009).

Bariatric surgery has been shown to decrease body mass index (BMI) and obesity-associated health conditions by considerably reducing intake (Sjöström et al., 2004). However, unintended outcomes often include nutrient deficiencies, digestive disorders, and initiation or perpetuation of eating disorders (Coupaye et al., 2009; Sheets et al., 2015). Eating behaviors and disordered eating patterns associated with obesity are not resolved via surgical intervention and often resurface or manifest post-operatively (Colles, Dixon, & O’Brien, 2008; Conceição et al., 2013; de Zwaan et al., 2010). The well-documented need for addressing the behavioral component of obesity is paramount to achieving sustainable weight loss in bariatric patients (Odom et al., 2010).

Eating behaviors associated with obesity, including binge-eating, night eating and grazing, are correlated with excessive emotional stress, and often intensify after bariatric
surgery (Colles et al., 2008; Sheets et al., 2015). Adequately attending to the emotional cues that prompt obesity-related eating behaviors with mindfulness techniques has been shown to decrease the desire to overeat (Kristeller & Wolever, 2011; Lillis, Hays, Bunting, & Masuda, 2009). Mindfulness-based techniques provide tools to overcome unconscious reactions to external stimuli by giving deliberate attentiveness to the current experience (Caldwell, Baime, & Wolever, 2012). Cultivating mental awareness to sensations of stress, anxiety and depression leads to behavior change, one of the foundations of sustainable weight loss and overcoming obesity (Caldwell et al., 2012; Hofmann, Sawyer, Witt, & Oh, 2010).

**Statement of the Problem**

Despite rapid post-surgical weight-loss, research has shown that approximately half of bariatric patients resume pre-surgical size within 2 years; subsequently, co-morbid health conditions have been shown to reappear approximately 3 years post-surgery (DiGiorgi et al., 2010; Magro et al., 2008). While pre-surgical care incorporates screening to exclude candidates who may have acute psychiatric disorders, post-surgical care for bariatric surgery patients is focused primarily on preventing immediate surgical complications and future nutritional deficiencies (Virji & Murr, 2006; Walfish, Vance, & Fabricatore, 2007).

Weight regain and nutritional deficiencies typically occur approximately one year post-surgery, when patient follow-up with medical professionals tends to decrease or cease (Moize et al., 2003; Yanos, Saules, Schuh, & Sogg, 2015). Studies have shown that less than 50% of patients attended nutrition consultations in the first post-operative year and of those who followed up, only 1/3 attended >1 meeting with a dietitian (Endevelt,
Ben-Assuli, Klain, & Zelber-Sagi, 2013; Kulick, Hark, & Deen, 2010). Patient participation in follow-up care has been shown to diminish to less than 10% in the post-operative decade (Higa, Ho, Tercero, Yunus, & Boone, 2011).

In addition, identified components of poor weight-loss outcomes in bariatric patients include suboptimal compliance regarding diet and exercise recommendations as well as the occurrence of emotional eating (Pérez-Pevida et al., 2018; Toussi, Fujioka & Coleman, 2009). Emotional eating and binge-eating behavior in obese individuals and post-surgical bariatric patients are both linked to decreased ability to identify and cope with stress (Mitchell et al., 2016; Urquhart & Mihalynuk, 2011).

**Purpose**

The purpose of the study was to investigate the association between mindful eating scores and selected weight loss outcomes in post-surgical bariatric patients. Patients completed a mindful eating survey electronically to assess eating behavior. Weight, gender, bariatric surgery type and length of time since surgery were measured and analyzed in relation to mindful eating behavior.

**Hypotheses**

The following null hypotheses were tested:

1. There will be no significant differences in mindful eating component scores between male and female post-surgical bariatric patients.

2. There will be no significant differences in mindful eating component scores based on bariatric surgery type (RYGB vs. GS) in post-surgical bariatric patients.
3. There will be no significant differences in mindful eating component scores based on length of time since bariatric surgery.

4. There will be no significant differences in post-surgical percent weight loss post-surgery based on mindful eating component scores in bariatric patients.

5. There will be no significant differences in post-surgical weight regain based on mindful eating component scores in bariatric patients.

Justification

Bariatric surgery is frequently recommended as an effective resolution to obesity, but post-surgical weight gain is common and long-term follow-up of patients generally lasts between 12 to 24 months (Gourash et al., 2013; Magro et al., 2008). By itself, the surgical intervention does not prepare the patient for the lifestyle adjustment required to sustain long-term weight loss (Elkins et al., 2005; Kruseman, Leimgruber, Zumbach, & Golay, 2010).

Research indicates that mindful eating is inversely correlated with binge-eating and emotional eating behavior, but these data are less conclusive regarding the existence of mindful eating behavior in post-surgical bariatric patients, and the potential association between mindful eating behaviors and weight loss (Katterman, Kleinman, Hooda, Nackers, & Corsica, 2014; Levoya, Lazaridoua, Brewer, & Fulwiler, 2017). A study has yet to be conducted to assess the occurrence of mindful eating in post-surgical bariatric patients and the relationship with post-surgical weight gain, although mindfulness has been shown to have a positive effect in reducing obesity and binge-eating (Daubenmier et al., 2011; McIver, O’Halloran, & McGartland, 2009).
The current study investigated whether mindful eating was associated with successful weight loss efforts (e.g. initial weight loss and maintenance) in bariatric surgery patients. This study identified potential differences in mindful eating behaviors based on gender, surgery type, and years since surgery.

Mindful eating has been used as a tool to promote weight loss by expanding emotional awareness with obese and binge-eating populations. The benefit for addressing emotional eating behaviors with mindfulness in bariatric patients continues to be investigated. Assuming differences in mindful eating scores are identified, the results of this study may be used in the pre- and post-surgical care process of bariatric patients to: identify disordered eating behaviors; address depression and anxiety as it relates to mindless eating behavior; and support a fundamental lifestyle change that encourages long-term weight loss.
CHAPTER 2  
REVIEW OF LITERATURE

The National Institutes of Health (NIH) defines obesity by the Body Mass Index (BMI) (NIH, 2013). Calculated with a weight to height ratio, an obese BMI is in excess of 29.9 kilograms per meter squared (NIH, 2013). Obesity is further categorized into classes: class I ranges from 30.0-34.9 kg/m²; class II ranges from 35.0-39.9 kg/m²; and class III, also called morbid obesity, includes a BMI of 40 kg/m² and greater (NIH, 2013). Super obesity is defined as weighing nearly three times the ideal body weight for height, or having a BMI of 50 kg/m² or more (Centers for Disease Control and Prevention [CDC], 2016).

The pervasiveness of obesity in the United States has more than doubled over the past 50 years, with 39.8% of adults now qualifying as obese, and 18.5% of children qualifying as obese (Hales, Carroll, Fryar, & Ogden, 2017). Since 2000, morbid obesity rates in adults have risen at twice the rate of mild obesity rates, while super obesity rates have increased by 70% (Hales, Fryar, Carroll, Freedman, & Ogden, 2018; Sturm and Hattori, 2013). By 2030, the prevalence of obesity in the United States is anticipated to be 42% of the population, costing an additional $550 billion dollars in healthcare (Finkelstein et al., 2012).

The cause of obesity is multifactorial, stemming from excessive energy intake, sedentary behavior, genetics, lifestyle factors and cultural variables (NIH, 2013). The disparity between energy intake and expenditure is the most significant contributing
factor to obesity in the U.S. (NIH, 2013). The Department of Health and Human Services (USDHHS) currently endorses exercising for a minimum of 30 minutes per day at least five days per week, yet only one in five adults meets or exceeds these recommendations (DHHS, 2008; United States Department of Agriculture [USDA], 2018). The National Academy of Sciences (NAS) recommends a caloric intake for adult females fluctuating from 1,600 to 2,400 and males 2,600 to 3,000 calories per day, depending on weight, activity levels, height and age (NAS, 2002). Yet studies show adults’ average caloric consumption has increased significantly in the past 30 years and exceeds the recommendations (Johnston, Poti, Popkin, & Kenan, 2014; Wright, Wang, Kennedy-Stephenson, & Ervin, 2003). High calorie, inexpensive convenience foods account for half of the average individual’s daily diet, supplying excessively refined carbohydrates and processed fats that promote obesity (Drewnowski & Specter, 2004; Krebs-Smith, Guenther, Subar, Kirkpatrick & Dodd, 2010).

Obesity decreases life expectancy by a decade, while substantially contributing to the development and exacerbation of depression, infertility, arthritis, sleep apnea, hepatic steatosis, and cancer, as well as co-morbid conditions, including cardiovascular disease and diabetes (Greenberg, 2013; NIH, 1998). Cardiovascular disease, the most common cause of death in the United States, accounts for 25% of mortalities, totaling more than 600,000 people per year (CDC, 2017a). Approximately 30.3 million Americans have diabetes and by 2050, that number is expected to triple (CDC, 2017b). The present financial healthcare toll of obesity and associated co-morbid conditions is approximately 147 billion dollars annually; obesity-related healthcare is estimated to cost an additional
66 billion dollars annually over the next 15 years (Finkelstein, Trogdon, Cohen, & Dietz, 2009; Wang, McPherson, Marsh, Gortmaker, & Brown, 2011).

**Bariatric Surgery**

In the early 1990’s, bariatric surgery became the approved method for treating morbid obesity when diet and exercise failed to produce sufficient results (Colquitt, Pickett, Loveman, & Frampton, 2014; Robinson, 2009). By early 2001, surgical interventions to induce weight loss, by limiting volume capacity of the stomach and/or reducing absorption capability in the intestine, had increased sevenfold (Colquitt et al., 2014; Livingston, 2004). Buchwald et al. (2004) reviewed the characteristics of over 22,000 morbidly obese bariatric patients and found: 3 of 4 patients were female; average BMI was 47; average weight loss was 60% of original body weight; and co-morbid conditions improved or disappeared for 80% of patients 12-24 months after surgery.

Roux-en-Y gastric bypass (RYGB), the oldest and most highly regarded bariatric surgery in terms of outcomes, involves a partial gastrectomy and redirection of the stomach to the jejunum (American Society for Metabolic & Bariatric Surgery [ASMBS], 2018; Colquitt et al., 2014; Mason & Ito, 1947). Unintended consequences of RYGB include: nutritional deficiencies of iron, vitamin B-12 and calcium; postprandial diarrhea known as dumping syndrome; gastric hernias; chronic emesis; and life-threatening anastomotic leak of stomach contents into the peritoneal cavity (Colquitt et al., 2014). RYGB has been shown to be superior to gastric banding for weight loss but results in longer lengths of hospital stays and more significant health complications (Colquitt et al., 2014).
Laparoscopic gastric banding (LGB), a generally less invasive procedure, consists of a surgically wrapped device around the stomach to reduce volume; LGB has been approved by the Food and Drug Administration (FDA) for 20 years, providing an average of 50% weight loss for 2/3 of patients (Suter, Calmes, Paroz, & Guisti, 2006). In 40% of patients LGB has been shown to require additional surgical interventions to fix or withdraw the apparatus (Chiapaikeo et al., 2014; Himpens et al., 2011). However, as the LGB surgical techniques have been refined, reparative surgeries are down to less than 10%, but the preference for RYGB over LGB remains (O’Brien, MacDonald, Anderson, Brennan, & Brown, 2013).

The sleeve gastrectomy (SG) is the most popular bariatric surgery and often the initial phase of a RYGB in super-obese patients (ASMBS, 2018; Cottam et al., 2006). Successful weight loss and attenuation of comorbid conditions in SG patients were found to be comparable to RYGB patients at 2 years post-surgery (Cutolo et al., 2012). Along with nutritional deficiencies, a significant complication of SG includes acute gastro-esophageal reflux disease (GERD), a condition which occurs in approximately 20% of patients, and requires additional surgery or habitual medication use to relieve symptoms (Bohdjalian et al., 2010).

Many health insurance companies, including Medicare and Medicaid, will cover the cost of bariatric surgery if patients meet the criteria of being morbidly obese or obese with one or two comorbid conditions, depending on the provider (ASMBS, 2020). The average price of bariatric surgery costs approximately $15,000 out of pocket (Rozier et al., 2019). Psychiatric evaluations, recommended by the NIH and frequently required by insurance providers, are a component of preoperative care for bariatric patients to
eliminate objectionable candidates who may experience poor surgical outcomes (Rosales, Menzo, Szomstein, & Rosenthal, 2018; NIH, 1991). Roughly 15% of people seeking bariatric surgery are denied for mental health reasons or perceived inability to adhere to post-surgical lifestyle changes (Walfish et al., 2007).

**Bariatric Surgery Outcomes**

Bariatric patients are encouraged to anticipate a 60-80% reduction in superfluous body mass in the first 24 months post-surgery, although 50%-60% of patients eventually experience weight regain (Magro et al., 2008; Puzziferri et al., 2014; Rabner & Greenstein, 1991). Post-surgical weight gain is attributed to the recurrence of poor dietary habits: binge-eating; stress-related, emotional eating; eating while engaged in various pastimes (e.g., watching TV, using the computer, driving); severely limiting intake; frequently consuming high-fat, sugar-laden snacks; and mismanagement of emotional stress (Rusch & Andris, 2007). Food-related coping mechanisms often resurface or manifest after surgery as unhealthy dietary selections that promote weight regain (Rusch & Andris, 2007; Toussia et al., 2009).

Researchers have found that major depressive disorder (33%), binge-eating disorders (30%), night-eating syndromes (11%), and anxiety disorders (24%) plague potential bariatric patients; denial of bariatric surgery is not contingent upon the detection of any of these conditions (Abilés et al., 2010; Sarwer et al., 2004). Binge-eating disorder (BED) is defined by the American Psychiatric Association (APA) as ingesting abnormally large amounts of food in a short amount of time (twice a week for six months), resulting in sensations of guilt and shame (APA, 2017). BED is diagnosed in less than 2% of the public, but one in three bariatric patients present with this disorder
(Saunders, 2001). Initially, many patients with BED prior to surgery are evaluated six months after surgery, and because of the uncomfortable side effects (dumping syndrome, vomiting) associated with excessive consumption of high-fat, high-sugar foods, are found to be absolved of BED (Boan, Kolotkin, Westman, McMahon, & Grant, 2004). However, bariatric patients with a history of BED often become “grazers”, meaning they continuously consume small portions of food, with poor self-control and subsequently experience poor weight-loss outcomes and enhanced emotional suffering (Colles et al., 2008; Niego, Kofman, Weiss & Geliebter, 2007).

The ASMBS recommends identifying potential barriers to successful weight loss prior to surgery, specifically to assess if the causative factor of the disordered eating arises due to: food fixation from severe calorie-restrictive induced starvation; overeating due to dysregulation of perceived hunger signals, attenuated by stress, boredom, loneliness and other emotions; small, frequent intake of meals and snacks out of routine, also called grazing and night eating syndrome (ASMBS, 2004). Night eating syndrome is identified by not consuming breakfast four or more days in a week, consuming half of total daily calories after seven at night and disordered sleep patterns four or more days in a week (ASMBS, 2004). The ASMBS (2004) concedes that post-surgical bariatric patients often have been found to substitute disordered eating behavior with other addictive behaviors, such as gambling, shopping, illicit drug abuse and high-risk sexual activity due to the inability of the patient to address their unresolved emotional concerns. The ASMBS (2013) recommendation to implement mindful eating behavior reaffirms the need for post-surgical care of bariatric patients with disordered eating behaviors to
adequately address the psychological component of weight-loss and medical compliance (Mechanick et al., 2013; Saunders, 2001).

The relationship between weight loss and attendance at post-surgical meetings with a registered dietitian is positively correlated, nearly tripling the amount of weight loss in bariatric patients and increasing physical activity rates, the greatest predictor of long-term weight loss in this population (Comppher, Hanlon, Kang, Elkin, & Williams, 2012; Kessler, Olmer, Raziel, Goiteir, & Dankner, 2017; Win, Ceresa, Schafer, Mak, & Stewart, 2014). After five years, post-surgical weight gain has been found to be as high as 84%, attributed to lack of attendance at nutritional management appointments and dietary non-compliance (Freire, Borges, Alvarez-Leite, Toulson, & Correia, 2012; Monaco-Ferreira & Leandro-Merhi, 2017).

**Mindfulness Meditation**

Mindfulness, is defined as the exercise of indiscriminately focusing on the present experience (Kabat-Zinn, 1994). This refined ability to keenly perceive thoughts while watching, without attaching or responding to, the ensuing emotions that arise is based upon Buddhist meditation philosophy (Kabat-Zinn, 1994). Mindfulness-based therapies use various techniques to deliver attention and acceptance to the individuals’ current situation, which then alters the activity of specific regions of the brain that left unregulated, generate cravings, nervousness and poor mood (Desbordes et al., 2012; Leung et al, 2013; Tang, Lu, Fan, Yang, & Posner, 2012). Skilled utilization of mindfulness has been shown to increase well-being by guiding positive decision-making regarding eating habits, health awareness and weight loss behavior (Forman et al., 2013; Wolever, Caldwell, Fikkan, Yeung, & Wakefield, 2010). Studies have shown the
widespread efficacy of mindfulness-based interventions and eating behavior in obese patients, specifically with regards to stress eating and binge-eating (O’Reilly, Cook, Spruijt-Metz, & Black, 2014; Wanden-Berghe, Sanz-Valero & Wanden-Berghe, 2011). In obese male and female patients seeking bariatric surgery, an inverse relationship exists between unrestrained eating behaviors and mindfulness (Opolski, Chur-Hansen, & Wittert, 2015). Research shows patients perceive bariatric surgery to be an effective intervention to resolve binge-eating behavior (Ouwens et al., 2015).

**Mindfulness and Obesity**

The positive correlation between emotional eating and obesity has been attributed to a diminished ability to identify, label and process feelings, with a subsequent abuse of food to manage sentiments in times of emotional distress (Rommel et al., 2012). Researchers theorize the physiological effects of stress hormones encourage frequent emotional eating by fortifying a feedback loop that is gratified by indulging food cravings that temporarily alleviate emotional discomfort, leading to obesity (Alberts, Mulkens, Smeets, & Thewissen, 2010; Dallman, 2010). In obese patients who exhibit greater rates of stress-eating behavior, there is a corresponding reduction in levels of mindfulness (Ouwens et al., 2015).

Researchers believe mindfulness-based interventions affect the physiological indicators of stress, such as elevated cortisol levels that lead to greater waist circumference and eating behaviors that contribute to obesity (Daubenmier et al., 2011). In a randomized controlled study, 47 overweight or obese women engaged in mindfulness-based stress reduction sessions. Researchers assessed the change in mindfulness, chronic stress, cortisol awakening response (CAR), eating behavior, weight,
and abdominal adiposity. The nine, weekly 150-minute classes included: breathing exercises; seated meditation practices; body scans; mindful eating exercises that cultivated awareness of hunger, satiety, and sensory perceptions of food; recognition of binge provoking stimulants; and personal astuteness. Participants had the ability to share their experiences of applying mindfulness techniques to their everyday lives as they were instructed to engage in 30 minutes of mindfulness meditation six days each week.

Behavioral questionnaires, salivary and serum cortisol levels, weight, and dual-energy x-ray absorptiometry (DEXA) scans were used to assess outcomes. In obese women who received the mindfulness-based stress reduction, CAR was significantly decreased, abdominal fat was decreased and stress levels improved (Daubenmier et al., 2011).

In another randomized controlled study, 84 obese participants enrolled in a six-month weight loss program were indiscriminately chosen to receive a day-long session of mindfulness-based therapy that addressed the emotional torment related to obesity (Lillis et al., 2009). After 12 weeks, participants were found to be less afflicted by the stigma of being obese and reported a greater sense of self-esteem and emotional stability. The study showed that mindfulness-based therapy benefited the psychological health of the participants and strengthened their self-efficacy regarding weight loss (Lillis et al., 2009).

The EMPOWER (Enhancing Mindfulness for the Prevention of Weight Regain) program, a mindfulness-based group weight loss method, applied mindfulness-based techniques to enhance adherence to nutrition recommendations, boost exercise commitment, support behavior modification, and develop stress control skills (Fikkan et al., 2010). Participants, who had recently lost 10% or more of their body weight without bariatric surgery, engaged in mindfulness-coaching via telephone as well as meeting as a
group weekly for two hours. The group meetings were held for 12 weeks with extra meetings 4, 5 and 6 months after the study began. The telephone calls, administered bi-weekly, began in week 9 and lasted until 15 months after the start of the program. Each session varied, yet applied previously learned skills to new areas as participants learned how to: establish a daily meditation practice; use breathing to interrupt stress responses; develop a relationship with themselves; and slowly consume three raisins over the course of 15 minutes. The sessions ended with assignments that strategically enforced mindfulness as a way to overcome barriers related to healthy consumption of food and consistently engage in adequate exercise. The participants stated they experienced improvements in weight loss behaviors that included exercise, eating, and managing stress (Fikkan et al., 2010).

Mindful meditation was successfully validated by a weight management study intended to promote weight-loss, personal accountability and emotional resilience regarding eating behaviors in middle-aged women (Timmerman & Brown, 2012). Study participants, women aged 40-59 years who reported dining out three or more days per week, were led through six weekly 120 minute meetings. The average age of study participants was 49 years of age, mostly white with an average BMI of 31.8 kg/m². These consultations incorporated meditations to stimulate mindful eating and then assessed for changes in anthropometrics, calorie and fat intake, and capacity to improve dietary and health-related decisions. The positive weight loss effects of the mindful meditation intervention in the study participants corresponded to significant improvement in nutritionally sound menu selections and decreased perceived challenges regarding eating behavior change (Timmerman & Brown, 2012).
The long-term success of weight-loss is attributed to a reduction in eating for stress relief and increased self-motivation for behavior change related to diet and exercise (Teixeira et al., 2010). Mindfulness-based meditation interventions have been shown to promote weight-loss in the obese population by increasing awareness of the physical sensations of psychological distress, i.e. the perception of suffering, by systematically attending to these sensations without the use of food as a coping mechanism (Dalen et al., 2010). Studies show that disordered eating behavior is mitigated with an intervention incorporating mindfulness, which has the potential to yield significant weight-loss results in the obese population (Alberts et al., 2010; Katterman et al., 2014).

**Mindfulness and Binge-eating**

Meditation-based therapy for the treatment of binge-eating was initiated in the same decade that bariatric surgery rates skyrocketed (Kristeller & Hallett, 1999; Robinson, 2009). In an early study assessing the therapeutic application of mindfulness, researchers found the 18 obese women who participated in mindfulness-based meditation substantially decreased the rate and intensity of their binge-eating episodes. After six weeks, the women reported a greater sense of control over their behavior and less feelings of depression and anxiety (Kristeller & Hallett, 1999).

The application of mindfulness as a legitimate therapy to assist the obese in weight loss has been repeatedly shown to effectively transform eating behavior and advance self-image (Hanson et al., 2019). Patients introduced to techniques in four sessions discovered that cultivating purposeful awareness to hunger cues, mindful consumption of meals and self-compassion for difficult emotions had significantly greater weight loss with corresponding improvements in confidence and self-control
regarding dietary intake compared to the control cohort. The researchers also noted that the group setting exhibited a positive effect on the patient’s sense of connection to a related community of similar people, thereby improving patient outcomes.

The ensuing application of mindfulness to address obesity has been shown to be effective by connecting awareness of emotional triggers to binge-eating impulses (Wolever & Best, 2009). The ability to recognize uncomfortable physical or mental sensations and resist reacting to those sensations with binge or stress eating behaviors fosters mastery of self-control (Kristeller & Wolever, 2011). Mindfulness-based eating awareness training (MB-EAT) enhances achievable, long-term weight loss by:

discouraging BED by reconditioning appetite and satiety signals to become more acute;

promoting sensible intake; and accentuating self-respect so that discouraging cycles of over-eating and depression are impeded (Kristeller & Wolever, 2011; Wolever & Best, 2009).

MB-EATs engage participants in various mindfulness-meditation exercises that develop physical and mental awareness of hunger, stress and sensations of chewing, swallowing and digesting food (Kristeller & Wolever, 2011).

MB-EAT interventions, redefined as MB-EAT for Diabetes (MB-EAT-D), have been applied to overweight and obese patients with diabetes to improve nutritional intake quality, blood sugar control, and reduction in body weight (Miller, Kristeller, Headings, Nagaraja, & Miser, 2012). For three months, participants attended group meetings of MB-EAT-D led by a registered dietitian and completed regular self-study work (Miller et al., 2012). The weekly sessions included generic health information regarding nutrition, exercise and blood sugar control recommendations, with directed introspections focused on diet, stress-related eating triggers and body awareness. The daily self-study work
included the use of recorded guided meditations that emphasized emotional awareness and subsequent behavioral choices regarding diet and exercise (Miller et al., 2012). Participants reported increased attentiveness to feelings that aroused impulses to eat that led to behavior change, such as increased vegetable and fruit consumption, and subsequent weight loss and improved blood sugar levels (Miller et al., 2012).

A mindfulness-based study, conducted on seven pre-surgical bariatric patients, found the desire to binge-eat was alleviated by utilizing mindfulness meditation techniques to counter stress responses (Leahey, Crowther, & Irwin, 2008). Patients engaged in a 10-week series of sessions, once per week for 75 minutes, which emphasized normalizing perceptions of mental tension, altering tortuous thinking patterns and expanding the ability to manage emotions found to be binge-eating catalysts. The researchers were able to show their intervention effectively reduced depression and binge-eating behavior in bariatric patients (Leahey et al., 2008).

**Summary**

The obesity rates in the United States have doubled since the 1970’s; subsequently health-care associated-costs have escalated by billions of dollars (Finkelstein et al., 2012; Hales et al., 2017). Bariatric surgery, gastric bypass specifically, continues to be most commonly recommended treatment for morbid obesity and other health-related complications due to significant initial reductions in weight and severity of comorbid conditions (Bestoun et al., 2018; Poirier et al., 2011). Post-surgical weight loss is often regained within 2 years due to poor stress-management related coping mechanisms that lead to emotional eating, a common condition in the bariatric population (Dallman, 2010; Toussi et al., 2009). Bariatric patients with mood disorders
and anxiety have shown diminished eating awareness, self-control and appropriate behavioral response to hunger, appetite and satiety cues that lead to poor dietary compliance and ensuing weight gain (Klatzkin, Gaffney, Cyrus, Bigus, & Brownley, 2016).

Mindfulness is defined as cognizance and reception of the existing moment to moment experience, enhancing the ability of the practitioner to maintain and grow non-judgmental, non-reactive awareness to the present (Bishop et al, 2004). Mindfulness as therapeutic application stimulates improvements in eating behavior by expanding coping techniques for stress management (Ouwens et al., 2015). In bariatric patients, successful diet-related behavior modification was most improved with the use of mindfulness to heighten the perception of various emotional states (Levin, Dalrymple, Himes, & Zimmerman, 2014).

Researchers are currently testing mindfulness-based interventions in post-surgical bariatric patients with increasingly positive results (Chako et al., 2016). Bariatric patients receiving mindfulness-based interventions report fewer incidences of stress-induced food consumption despite perceived escalating rates of anxiety, tension and distress. Patients have identified a noticeable response decline to common emotional eating triggers with an increased capability to adhere to exercise and dietary recommendations. Patient feedback includes enthusiasm for mindfulness-based counseling sessions, citing increased somatic awareness, reduced nervous tension and improved behavior regarding the consumption of food (Chako et al., 2016).
CHAPTER 3

METHODS

The objective of this study was to evaluate the differences in selected weight loss outcomes among post-surgical bariatric patients based on several factors including mindful eating scores, gender, type of bariatric surgery and length of time since surgery. The study design was a cross-sectional survey of post-surgical bariatric patients. Institutional review board approval was obtained from the Louisiana Tech University Human Use Committee prior data collection (Appendix A).

Participants

The participants of this study were post-bariatric surgery patients of Dr. George Merriman, II, FACS, FASMBS, a bariatric surgeon at the Freedom from Obesity Surgical Specialists, with surgical practice privileges at multiple hospitals in Northwestern Louisiana.

Written permission to conduct the study was obtained from Dr. Merriman prior to study commencement (Appendix A). Patient eligibility included male and female patients, ages 20-65 years who underwent bariatric surgery (gastric sleeve or gastric bypass) by Dr. Merriman between June 1, 2011 and June 1, 2018. The participants varied in gender, race, type of bariatric surgery and length of time since surgery. All eligible patients were identified by searching for the inclusion criteria variables within the electronic health record operated and obtained by the clinic manager. Approximately 1,000 individuals met eligibility requirements and received emails containing the link to the MEQ component. Patients were recruited via email and provided a detailed letter of
introduction with a hyperlink to the two-component survey administered by Survey Monkey™. One hundred and twenty-one survey responses were downloaded by the researcher. Survey responses were not included in data analysis if type of surgery, gender or weight gained and lost were not included in survey responses.

The survey contained two parts. The first part of the survey included basic demographic questions including age, gender, race, type of surgery, date of surgery, weight prior to surgery, lowest post-surgical weight and current weight. The second component of the survey, comprising the majority of the survey, included questions about mindful eating. The mindful eating questions were modified from the publicly available and validated Mindful Eating Questionnaire (MEQ). The MEQ is a 28-question survey created to evaluate the dynamic between eating behavior and mindfulness (Framson et al., 2009). The validated MEQ was developed by researchers who studied the association between mindful eating, exercise or yoga participation and BMI (Framson et al., 2009). The MEQ component, modified from the validated MEQ, had response categories which were a Likert scale regarding mindfulness. The mindful eating scale question responses ranged from 1 to 4 (least true to most true). The average of all question responses was the final MEQ component score. The higher the mindful eating score, the more engaged the participant was in mindful eating practices.

The MEQ component used for this study was divided into 5 domains that reflected eating behavior related to internal and external sensory stimulation: (1) disinhibition, (2) awareness, (3) external cues, (4) emotional response, and (5) distraction. Each domain reflected published research regarding eating behavior related to: (1) satiety; (2) emotional cognizance and behavioral regulation; (3) internal and external
environmental provocations; (4) consciousness regarding thoughts and feelings; (5) sensitivity to sensory impact of food; and unfocused consumption of food.

In the original research development of the validated MEQ, questions were retrieved from 7 validated eating behavior, emotional eating and mindfulness questionnaires: Three Factor Eating Scale, Dutch Eating Behavior Questionnaire, Emotional Eating Scale, Mindful Attention Awareness Scale, Freiburg Mindfulness Inventory, Kentucky Inventory of Mindfulness Skills, Cognitive and Affective Mindfulness Scale, and Mindfulness Questionnaire. The researchers surveyed approximately 300 study participants with the MEQ tool and assessed their responses using a mindful eating scale, a rating system based upon the degree of emotional awareness and related eating actions. Yoga participants were found to have the highest degree of mindful eating behavior, correlating negatively with BMI with a typical score of $2.92 \pm 0.37$. Low mindful eating behavior was consistently found to be correlated with higher BMIs. The MEQ was determined to be valid and reliable in evaluating mental and emotional responses.
Data Collection Instrument

Patients were recruited via an email, constructed by the researcher and distributed by the bariatric clinic. Eligible post-surgical bariatric patients were provided a detailed letter of introduction and instructions for participation from the researcher. The emailed letter contained a hyperlink to the survey administered by Survey Monkey™, which opened with a consent form (Appendix B). The consent form was considered to be electronically signed when the participant selected “agree”. Once the “agree” button was chosen, the study participant automatically progressed to the mindful eating survey.

Data Collection Procedure

Eligible patients were asked to participate in the study via email sent by clinic staff. The email opened with a letter of introduction from the researcher, providing basic information to the patients regarding purpose of the study, overview of participant expectations and privacy guarantees (Appendix B). From the email, patients were able to select a hyperlink to the consent form and mindful eating survey provided by Survey Monkey™.

The consent form was considered to be electronically signed when the participant selected “agree”. Once the “agree” button was chosen, the study participant automatically progressed to the mindful eating survey. Consent forms and survey responses were collected for the researcher to download from Survey Monkey™.

Data collection continued for 4 consecutive weeks; patients had online access to participate once in the survey during this time. A reminder email was sent by the bariatric clinic to eligible patients after week 1 and week 3 to encourage patient participation. To incentivize patient involvement in the study, a $100 gift card to Whole Foods or Amazon
was raffled at week 4; the winner was notified by the researcher at week 5. After the
survey had been completed by the participant, the participant was asked to text the words
“enter me” to the researcher’s phone number, placing the participant’s phone number in
the raffle; study participants were able to opt out of the raffle at their discretion by not
texting the researcher. The winner had the option to have the gift certificate mailed to
them or to pick it up from the Freedom from Obesity Clinic.

Data Analysis

The statistical software used to analyze the data was Stata: Release 16
(StataCorp., 2019). Descriptive statistics for categorical variable include frequencies and
percentages (%) for gender, race, and type of surgery. Continuous variables are described
with mean or median and their standard deviation: months since surgery, responses to
individual mindful eating questions, post-surgical weight changes (initial weight loss and
regain), average mindful eating scores (total) and subscale mindful eating scores (average
scores within each of 5 domains).

For the first 3 hypotheses, the dependent variable was mindful eating scores (a
continuous outcome), and the independent variables were (1) gender (dichotomous
variable), (2) type of surgery (dichotomous variable) and (3) time since surgery
(continuous variable in months). For hypotheses 4 and 5, (1) weight loss and (2) weight
regain were dependent variables and mindful eating score was the independent variable.
Means and standard deviations for the dependent variables were compared based on these
characteristics using linear regression analysis
A total $N = 121$ participants initiated the mindful eating questionnaire (MEQ) component but 13 (11%) responses were removed from the final analysis due to missing data required to test the 5 hypotheses of interest. The final sample size was $N_{final} = 108$.

Most survey participants were female ($n = 88, 81.5$%); the remaining respondents were male ($n = 20, 18.5$%). The majority of respondents were aged 51 to 65 years ($n = 50, 46$%); followed by 41 to 50 years ($n = 39, 36.1$%). The distribution of race/ethnicity was as follows: white ($n = 85, 78.7$%), African American/black ($n = 21, 19.4$%), Hispanic/Latino ($n = 1, 0.9$%), and other races/ethnicities ($n = 1, 0.9$%). A majority of participants reported having surgery in the past 2 to 5 years ($n = 50, 46.3$%). The most common bariatric surgery elected by participants was gastric sleeve surgery ($n = 103, 95.4$%) followed by gastric bypass surgery ($n = 5, 4.6$%). These results are summarized in Table 1.
Table 1

Demographic Characteristics of Participants (N = 108)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
<td>18.5%</td>
</tr>
<tr>
<td>Female</td>
<td>88</td>
<td>81.5%</td>
</tr>
<tr>
<td>Average Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>3</td>
<td>3.0%</td>
</tr>
<tr>
<td>31-40</td>
<td>16</td>
<td>14.8%</td>
</tr>
<tr>
<td>41-50</td>
<td>39</td>
<td>36.1%</td>
</tr>
<tr>
<td>51-65</td>
<td>50</td>
<td>46.3%</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>85</td>
<td>78.7%</td>
</tr>
<tr>
<td>African American</td>
<td>21</td>
<td>19.4%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Asian American</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Type of Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric Sleeve</td>
<td>103</td>
<td>95.4%</td>
</tr>
<tr>
<td>Gastric Bypass</td>
<td>5</td>
<td>4.6%</td>
</tr>
<tr>
<td>Years Since Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2</td>
<td>23</td>
<td>21.3%</td>
</tr>
<tr>
<td>≥2 to &lt;5</td>
<td>50</td>
<td>46.3%</td>
</tr>
<tr>
<td>≥5-10</td>
<td>35</td>
<td>32.4%</td>
</tr>
</tbody>
</table>
The pre-surgical mean BMI for all patients was 46.72 ($SD = 7.51$). Compared to the pre-surgical mean BMI, the lowest post-surgical mean BMI was 30.93 ($SD = 6.95$); this change represents a group mean decrease of 16 BMI units. The current mean BMI was 33.96 ($SD = 6.96$), representing an increase of 3.03 BMI units when compared to the lowest post-surgical mean BMI. The average length of time since surgery was 48.61 ($SD = 24.33$) months (Table 2).

Female patients reported a pre-surgical mean BMI of 45.86 ($SD = 7.64$) and an average lowest post-surgical mean BMI of 30.51 ($SD = 6.98$), while the current mean BMI was 33.19 ($SD = 6.74$). In contrast, male participants reported a pre-surgical mean BMI of 50.53 ($SD = 5.63$), lowest post-surgical mean BMI of 32.76 ($SD = 6.67$) and current mean BMI of 37.33 ($SD = 7.07$) (Table 2).

Table 2

<table>
<thead>
<tr>
<th>BMI differences by Gender ($N = 108$)</th>
<th>Total $N = 108$ (Mean ± SD)</th>
<th>Female $n = 88$ (Mean ± SD)</th>
<th>Male $n = 20$ (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-surgical BMI</td>
<td>46.72 ± 7.51</td>
<td>45.86 ± 7.64</td>
<td>50.53 ± 5.63</td>
</tr>
<tr>
<td>Lowest post-surgical BMI</td>
<td>30.93 ± 6.95</td>
<td>30.51 ± 6.98</td>
<td>32.76 ± 6.67</td>
</tr>
<tr>
<td>Current BMI</td>
<td>33.96 ± 6.96</td>
<td>33.19 ± 6.74</td>
<td>37.33 ± 7.07</td>
</tr>
</tbody>
</table>
Paired t-tests were completed to estimate the change in BMI at 3 different stages of post-operative time in years (<2 years, ≥2 to <5 years, ≥5 to 10) and by each gender. Significant change in presurgical BMI to current BMI was revealed for each gender in every post-operative time frame. The pre-surgical BMI ($M = 44.56, SD = 6.60$) of all patients with less than two post-operative years ($n = 23$) was significantly different, $t(22) = 10.30, p < 0.0001$, from the current BMI ($M = 32.67, SD = 6.24$). This difference in presurgical BMI ($M = 49.91, SD = 5.47$) and current BMI ($M = 36.59, SD = 3.94$) of males ($n = 5$) of the male subset was also statistically significant ($t(4) = 9.09, p < 0.0001$). Weight loss in the female bariatric patients ($n = 18$) less than two years from surgery was also significant $t(17) = 8.08, p < 0.0001$ when presurgical BMI ($M = 43.07, SD = 6.22$) and current BMI ($M = 31.57, SD = 6.40$) were analyzed (Table 3).

Male survey participants within the two to five-year post-operative window, reported a similar significant change $t(7) = 5.34, p < 0.0011$ in BMI from pre-surgical BMI ($M = 46.96, SD = 6.53$) to current BMI ($M = 33.94, SD = 6.45$). Females of the same post-operative time period were also determined to differ significantly in presurgical BMI ($M = 46.06, SD = 6.44$) and current BMI ($M = 33.01, SD = 6.08; t(41) = 15.19, p < 0.0001$). The patients who underwent bariatric surgery within the five to ten year time frame, also had significant weight loss $t(34) = 12.61, p < 0.0001$ determined by the comparison of presurgical BMI ($M = 47.80, SD = 9.13$) to current BMI ($M = 34.84, SD = 8.08$) (Table 3).
Table 3

*BMI differences by Gender and Years Since Surgery*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Presurgical BMI (Mean ± SD)</th>
<th>Current BMI (Mean ± SD)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 years post-surgery</td>
<td>23</td>
<td>44.56 ± 6.60</td>
<td>32.67 ± 6.24</td>
<td>10.30*</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Male</td>
<td>5</td>
<td>49.91 ± 5.47</td>
<td>36.59 ± 3.94</td>
<td>9.09*</td>
<td>0.0008</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>43.07 ± 6.22</td>
<td>31.57 ± 6.40</td>
<td>8.08*</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>≥2 to &lt;5 years post-surgery</td>
<td>50</td>
<td>46.96 ± 6.53</td>
<td>33.94 ± 6.45</td>
<td>16.13*</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
<td>51.70 ± 5.01</td>
<td>38.81 ± 6.53</td>
<td>5.34*</td>
<td>0.0011</td>
</tr>
<tr>
<td>Female</td>
<td>42</td>
<td>46.06 ± 6.44</td>
<td>33.01 ± 6.08</td>
<td>15.19*</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>≥5 to 10 years post-surgery</td>
<td>35</td>
<td>47.80 ± 9.13</td>
<td>34.84 ± 8.08</td>
<td>12.61*</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>49.62 ± 6.93</td>
<td>36.18 ± 9.70</td>
<td>7.35*</td>
<td>0.0003</td>
</tr>
<tr>
<td>Female</td>
<td>28</td>
<td>47.34 ± 9.65</td>
<td>34.50 ± 7.81</td>
<td>10.57*</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

*Note: *p* < 0.05

Female participants reported an average weight loss of 42.37 kilograms (SD = 17.21), representing a 33.2% reduction (SD = 11.59%) in their original body weight. Of those women who experienced post-surgical weight regain (n = 70, 92.11%), the mean regain was 7.53 kilograms (SD = 11.64), an increase of 5.97% (SD = 8.94%) of their pre-surgical weight. Female participants, with post-surgical weight regain, were at a mean of 4.34 years (SD = 1.93) from their bariatric surgery. Female participants without weight regain were at a mean of 2.96 years (SD = 2.25) post-operative bariatric surgery.

In contrast, male participants experienced an average weight loss of 56.89 kilograms (SD = 26.73), or a 34% decrease (SD = 13.47%), of their pre-surgical body
weight. Of those who experienced post-surgical weight regain ($n=20, 95\%$), they averaged 14.61 kilograms ($SD = 28.84$), an 8.26% increase ($SD = 13.23\%$) of their pre-surgical weight. Male participants with post-surgical weight regain were at a mean of 3.70 years ($SD = 1.89$) from their bariatric surgery. There was only one male participant without post-surgical weight regain with a timing of 2.29 years from the date of surgery to the time of survey completion.

Females reported follow-up visits with the bariatric surgeon over an average of 13 months ($SD = 12.11$) and registered dietitian for an average of and 8.56 months ($SD = 11.24$ months), while male patients reported follow-up visits with the bariatric surgeon over an average of 13 months ($SD = 8.48$ months) and registered dietitian over an average of 5.37 months ($SD = 5.07$ months). No significant difference was noted between genders in months of post-surgical follow-up visits with the bariatric surgeon or registered dietitian, ($t(105) = -0.06, p > 0.95$) and ($t(103) = 1.21, p > 0.23$) respectively.

The paired t-tests analysis, comparing the mean months of post-surgical follow-up with the bariatric surgeon and registered dietitian, was significant for all patients ($t(104) = 6.73, p < 0.0001$). Female patients’ follow-up between the bariatric surgeon and registered dietitian, was significantly different ($t(85) = 5.66, p < 0.0001$). Similarly, the comparison of male patients’ months of follow up between the bariatric surgeon and registered dietitian was also significantly different ($t(18) = 3.74, p < 0.0015$) (Table 4).
Table 4

*Months of Post-surgical Follow Up with Bariatric Team*

<table>
<thead>
<tr>
<th></th>
<th>Bariatric Surgeon (Mean ± SD)</th>
<th>Registered Dietitian (Mean ± SD)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>13.11 ± 11.55</td>
<td>7.98 ± 10.45</td>
<td>6.73*</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>N = 105</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13.08 ± 12.16</td>
<td>8.56 ± 11.24</td>
<td>5.66*</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>n = 88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13.26 ± 8.48</td>
<td>5.37 ± 5.07</td>
<td>3.74*</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>n = 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* *p* < 0.05

Table 5 displays the results of a linear regression analysis predicting change in MEQ component scores with regards to post-surgical follow-up in months with the bariatric surgeon and the registered dietitian. No significant difference in MEQ component scores, $\beta = -0.004$, $t(106) = -1.07$, $p < 0.287$, was predicted with a monthly increase in time spent following up with the bariatric surgeon. Change in follow-up with the surgeon did not account for the variance in MEQ component scores, $R^2 = 0.0117$, $F(1, 106) = 0.2875$, $p < 0.287$. Insignificant results, $\beta = -0.003$, $t(104) = 0.71$, $p < 0.482$, were similar regarding predicted change in total MEQ component scores and monthly change in follow-up with the registered dietitian. Change in follow-up with the registered dietitian did not account for the variance in MEQ component scores, $R^2 = 0.0043$, $F(1, 104) = 0.4821$, $p < 0.482$. 
Table 5

*MEQ Component Scores and Months of Follow-up with Bariatric Team (N=108)*

<table>
<thead>
<tr>
<th>Change in MEQ Score for every 1 month of follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total MEQ Component Score</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Bariatric Surgeon</strong></td>
</tr>
<tr>
<td>$\beta$</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>-0.004</td>
</tr>
<tr>
<td><strong>Disinhibition Score</strong></td>
</tr>
<tr>
<td>-0.004</td>
</tr>
<tr>
<td><strong>Awareness Score</strong></td>
</tr>
<tr>
<td>-0.003</td>
</tr>
<tr>
<td><strong>External Cues Score</strong></td>
</tr>
<tr>
<td>-0.006</td>
</tr>
<tr>
<td><strong>Emotional Response Score</strong></td>
</tr>
<tr>
<td>-0.004</td>
</tr>
<tr>
<td><strong>Distraction Score</strong></td>
</tr>
<tr>
<td>-0.002</td>
</tr>
</tbody>
</table>

*Note:* *p* < 0.05

The mean MEQ component score for all study participants was 2.53 (SD = 0.40).
The highest mean score was observed within the external cues domain ($M = 3.15$, $SD = 0.71$), followed by the awareness domain ($M = 2.73$, $SD = 0.64$), the emotional response
domain \( (M = 2.32, SD = 0.85) \), the disinhibition domain \( (M = 2.27, SD = 0.36) \) and lastly by the distraction domain \( (M = 2.17, SD = 0.79) \) (Table 6).

Differences in MEQ component and domain scores by gender were analyzed using two sample t-tests. Females had MEQ component scores \( (M = 2.53, SD = 0.37) \) that were not statistically different than males \( (M = 2.52, SD = 0.52; t(106) = 0.04, p < 0.97) \). Females scored higher in the survey domains addressing external cues \( (M = 3.16, SD = 0.66) \), emotional response \( (M = 2.36, SD = 0.86) \) and distraction \( (M = 2.20, SD = 0.78) \) but differences between genders were not statistically significant. In the awareness domain, males scored higher \( (M = 3.00, SD = 0.44) \) than females \( (M = 2.66, SD = 0.67) \) and this difference was statistically significant \( (t(106) = -2.15, p < 0.034) \) (Table 6).
Table 6

**MEQ Component and Domain Scores by Gender**

<table>
<thead>
<tr>
<th>Component</th>
<th>All Patients $\overline{M} \pm SD$ $\overline{(N = 108)}$</th>
<th>Male $\overline{M} \pm SD$ $\overline{(n = 20)}$</th>
<th>Female $\overline{M} \pm SD$ $\overline{(n = 88)}$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEQ Component Score</td>
<td>2.53 $\pm$ 0.40</td>
<td>2.52 $\pm$ 0.52</td>
<td>2.53 $\pm$ 0.37</td>
<td>0.04</td>
<td>0.97</td>
</tr>
<tr>
<td>Disinhibition Score</td>
<td>2.27 $\pm$ 0.36</td>
<td>2.34 $\pm$ 0.50</td>
<td>2.25 $\pm$ 0.32</td>
<td>-0.94</td>
<td>0.35</td>
</tr>
<tr>
<td>Awareness Score</td>
<td>2.73 $\pm$ 0.64</td>
<td>3.00 $\pm$ 0.44</td>
<td>2.66 $\pm$ 0.67</td>
<td>-2.15*</td>
<td>0.034</td>
</tr>
<tr>
<td>External Cues Score</td>
<td>3.15 $\pm$ 0.64</td>
<td>3.08 $\pm$ 0.89</td>
<td>3.16 $\pm$ 0.66</td>
<td>0.45</td>
<td>0.65</td>
</tr>
<tr>
<td>Emotional Response Score</td>
<td>2.32 $\pm$ 0.85</td>
<td>2.17 $\pm$ 0.84</td>
<td>2.36 $\pm$ 0.86</td>
<td>0.91</td>
<td>0.36</td>
</tr>
<tr>
<td>Distraction Score</td>
<td>2.17 $\pm$ 0.79</td>
<td>2.03 $\pm$ 0.82</td>
<td>2.20 $\pm$ 0.78</td>
<td>0.86</td>
<td>0.39</td>
</tr>
</tbody>
</table>

*Note: *$p < .05$.

None of the survey results, initially assessed using paired t-tests, varied in a statistically significant way by surgery type due to the low volume of gastric bypass patients. The MEQ component score ($M = 2.66$, $SD = 0.34$) was higher in patients’ status-post gastric bypass when compared to the MEQ component score ($M = 2.52$, $SD = 0.40$) of patients’ status-post gastric sleeve. Gastric bypass patients had greater scores in the domains of disinhibition ($M = 2.48$, $SD = 0.24$), emotional response ($M = 2.47$, $SD = 1.04$) and distraction ($M = 2.67$, $SD = 0.75$) (Table 7).
Table 7

*MEQ Component Scores and Bariatric Surgery Type (N = 108)*

<table>
<thead>
<tr>
<th></th>
<th>Gastric Bypass (Mean ± SD)</th>
<th>Gastric Sleeve (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>n=5</em></td>
<td><em>n=103</em></td>
</tr>
<tr>
<td>MEQ Score</td>
<td>2.66 ± 0.34</td>
<td>2.52 ± 0.40</td>
</tr>
<tr>
<td>Disinhibition Score</td>
<td>2.48 ± 0.24</td>
<td>2.26 ± 0.36</td>
</tr>
<tr>
<td>Awareness Score</td>
<td>2.54 ± 0.33</td>
<td>2.74 ± 0.65</td>
</tr>
<tr>
<td>External Cues Score</td>
<td>3.13 ± 0.30</td>
<td>3.15 ± 0.72</td>
</tr>
<tr>
<td>Emotional Response Score</td>
<td>2.47 ± 1.04</td>
<td>2.31 ± 0.85</td>
</tr>
<tr>
<td>Distraction Score</td>
<td>2.67 ± 0.75</td>
<td>2.15 ± 0.78</td>
</tr>
</tbody>
</table>

The results of the linear regression analysis used to assess the change in MEQ component scores (total and per domain) and weight change in relation to time since surgery are documented in Table 8. For every ten kilograms of weight loss, there was a non-significant change, $\beta = -0.020$, $t(21) = -0.60$, $p < 0.557$, in the MEQ component scores within the group of less than two years since bariatric surgery. As time since surgery progressed, the change in MEQ component scores remained non-significant for the two to five year time frame and the five to ten year time frame, $\beta = 0.018$, $t(48) = 0.45$, $p < 0.654$ and $\beta = 0.005$, $t(33) = 0.17$, $p < 0.862$, respectively. Significance was not achieved in the analysis of the domain scores in relation to weight loss and the three stages of times since surgery (Table 8).
Table 8

*Regression Analysis of Weight Change & MEQ Component Scores (N = 108)*

<table>
<thead>
<tr>
<th></th>
<th>&lt; 2 years since surgery</th>
<th>2 to 5 years since surgery</th>
<th>≥ 5 years since surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in score for every 10 kg of weight loss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>β</strong></td>
<td><strong>95% CI</strong></td>
<td><strong>p</strong></td>
<td><strong>β</strong></td>
</tr>
<tr>
<td>MEQ Component Score</td>
<td>-0.091</td>
<td>-0.063</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>to</td>
<td>0.050</td>
</tr>
<tr>
<td>Disinhibition Score</td>
<td>-0.081</td>
<td>-0.081</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>to</td>
<td>0.029</td>
</tr>
<tr>
<td>Awareness Score</td>
<td>-0.105</td>
<td>-0.075</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>to</td>
<td>0.117</td>
</tr>
<tr>
<td>External Cues Score</td>
<td>-0.008</td>
<td>-0.109</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>to</td>
<td>0.016</td>
</tr>
<tr>
<td>Emotional Response Score</td>
<td>-0.185</td>
<td>-0.142</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>to</td>
<td>0.195</td>
</tr>
<tr>
<td>Distraction Score</td>
<td>-0.219</td>
<td>-0.177</td>
<td>-0.038</td>
</tr>
<tr>
<td></td>
<td>to</td>
<td>to</td>
<td>0.064</td>
</tr>
</tbody>
</table>

*Note:* *p<0.05
The initial survey results regarding change in BMI by type of bariatric surgery outlined in table 9. Due to the low number of gastric bypass patients, the analysis was lacked statistical validity and was useful for descriptive analysis only. In this study, the average pre-surgical BMI was greater in gastric bypass patients ($M = 54.01, SD = 5.63$) compared to gastric sleeve patients ($M = 46.37, SD = 7.43$). The gastric bypass patients experienced a greater reduction in post-surgical BMI ($M = 34.13, SD = 6.75$) compared to gastric sleeve patients ($M = 30.77, SD = 6.96$). Gastric sleeve patients regained more weight than the gastric bypass patients, reflected in current mean BMIs of 33.94 ($SD = 7.05$) and 34.41 ($SD = 5.21$) respectively (Table 9).

Table 9

<table>
<thead>
<tr>
<th></th>
<th>Gastric Bypass</th>
<th>Gastric Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n=5$</td>
<td>$n=103$</td>
</tr>
<tr>
<td></td>
<td>(Mean ± SD)</td>
<td>(Mean ± SD)</td>
</tr>
<tr>
<td>BMI pre-surgery</td>
<td>54.01±5.63</td>
<td>46.37±7.43</td>
</tr>
<tr>
<td>Lowest BMI post-surgery</td>
<td>34.13±6.75</td>
<td>30.77±6.96</td>
</tr>
<tr>
<td>Current BMI</td>
<td>34.41±5.21</td>
<td>33.94±7.05</td>
</tr>
</tbody>
</table>
Regression analysis resulted in identical $\beta$ – coefficients for MEQ component scores and length of time since surgery $\beta = 0.02$, $t(106) = 1.07$, $p < 0.29$. The five domains in the MEQ component were not associated with the length of time since surgery. In terms of the individual domains, there were no significant associations in terms of length of time since surgery and disinhibition ($\beta = .027$, $t(106) = 1.53$, $p < 0.13$), awareness ($\beta = -0.01$, $t(106) = -0.19$, $p < 0.85$), external cues ($\beta = .003$, $t(106) = 0.08$, $p < 0.94$), emotional response ($\beta = .06$, $t(106) = 1.35$, $p < 0.18$), and distraction ($\beta = .02$, $t(106) = -0.60$, $p < 0.55$).

Regression analysis was used to assess the relationship between percent post-surgical weight loss by MEQ component score. An inversely related association was observed between MEQ component score and percent weight loss but this difference was not statistically significant, $\beta = -1.90$, $t(107) = -0.65$, $p < .516$. The initial results included an outlier (a patient who did not initially lose weight after surgery but reported weight gain). The analysis was repeated with the removal of the outlier ($N = 107$) which did not affect statistical significance, $\beta = -1.16$, $t(106) = -0.43$, $p < 0.672$, or the inversely related association between MEQ component score and percent weight loss (Table 10).
Table 10

Post-Surgical Weight Loss % and MEQ Component Scores

<table>
<thead>
<tr>
<th># of Observations</th>
<th>β Coefficient</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Change in % weight loss for 1-unit change MEQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Patients</td>
<td>108</td>
<td>-1.90</td>
<td>-0.65</td>
</tr>
<tr>
<td>(AP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP-Minus</td>
<td>107</td>
<td>-1.16</td>
<td>-0.43</td>
</tr>
<tr>
<td>Outlier</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *p<0.05

Table 11 describes the results of the regression analysis used to assess the difference in MEQ component scores and post-surgical weight regain. Regression showed a significant, positive association between MEQ component score and increase in percent weight regain $\beta = 5.23, t(107) = 2.21, p < 0.05; R^2 = 0.04, F(1, 106) = 4.89, p < 0.029$. The outlier, who experienced only post-surgical weight gain, was removed from the initial analysis to assess if their inclusion resulted in a skewed average.

The positive relationship between MEQ component scores and post-surgical weight regain was strengthened by restricting the analysis only to the patients who gained weight and removing patients who continued to lose weight. Regression analysis showed MEQ component scores were significantly associated, $\beta = 6.03, t(88) = 2.78, p < 0.008,$
with post-surgical weight regain with a 1-unit increase in MEQ component score for every 6.03% increase in weight ($R^2 = 0.08$, $F(1,87) = 7.75$, $p < 0.008$) (Table 11).

Table 11

*Post-Surgical % Weight Regain and MEQ Component Scores*

<table>
<thead>
<tr>
<th></th>
<th>$N$</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in % weight loss for 1-unit change MEQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Regained in All Patients (AP)</td>
<td>108</td>
<td>5.23</td>
<td>2.21*</td>
<td>0.029</td>
</tr>
<tr>
<td>AP Minus Outlier</td>
<td>107</td>
<td>3.7</td>
<td>1.84</td>
<td>0.068</td>
</tr>
<tr>
<td>Patients with Weight Regain Only</td>
<td>89</td>
<td>6.03</td>
<td>2.78*</td>
<td>0.007</td>
</tr>
<tr>
<td>Patients with Weight Regain Only Minus Outlier</td>
<td>88</td>
<td>4.29</td>
<td>2.70*</td>
<td>0.008</td>
</tr>
</tbody>
</table>

*Note: *$p$*<0.05*
CHAPTER 5

DISCUSSION

This study investigated the association between mindful eating and weight change in a sample of bariatric surgery patients. In addition, initial and maintenance weight changes (whether patients lost or gained weight) were evaluated. The purpose of this study was to identify differences in mindful eating behaviors based on gender, surgery type, and years since surgery.

Approximately 1,000 individuals met eligibility requirements and received surveys. One hundred and twenty-one surveys were received, reflecting a response rate of 12%. This is similar to another study of bariatric patients where a response rate of 21.5% was observed, which was noted to have limited the researcher’s ability to obtain crucial information regarding sustained weight loss and post-operative behavior changes (Bradley et al., 2016). The patient population surveyed was predominately white female patients who received a gastric sleeve bariatric procedure. This is consistent with demographic data previously obtained by other researchers assessing trends in bariatric patients in the United States who determined that approximately ¾ of the patients receiving bariatric surgery are white women opting for the sleeve gastrectomy (ASMBS, 2018; Martin, Beekley, Kjorstad, & Sebesta, 2010).

The mean pre-surgical BMI in this sample was 46.72, which is consistent with a systematic review and meta-analysis that found the average bariatric patient’s BMI prior to surgery is 46 (Chang et al., 2014). Survey participants in this study experienced post-surgical weight loss, except for one female outlier who experienced only post-surgical
weight gain. The mean weight loss percentage was 33.47%, which is consistent with current research knowledge regarding successful weight outcomes in bariatric patients and mean percent weight loss in post-surgical bariatric patients to be 33.4% (SD = 11.4%) (Bradley et al, 2015; O’Brien et al., 2013).

The lowest mean post-surgical BMI reduction was 30.93 for all patients, reflecting a mean reduction of BMI by 16 BMI units. The paired t-test analyses revealed male and female patients, within each post-operative time frame, had significant reductions in BMI when preoperative and current BMI were analyzed. In this study, men experienced greater post-surgical weight loss compared to women, 56.89 kilograms and 42.37 kilograms respectively. The mean length of time since surgery was approximately four years, or 48.61 months. Other studies have also found bariatric patients may reduce their BMI by an average of 12–17 BMI units five years post-operatively (Chang et al., 2014).

The mean increase of post-surgical BMI was 3.03 units for all patients. Nineteen (95%) males experienced post-operative weight regain averaging 14.61 kilograms, having had bariatric surgery approximately four years prior to taking the survey. In this study, 88 (92%) females experienced a mean post-surgical weight regain of 5.97%; mean length of time since surgery was also approximately four years. The findings are congruent with other studies estimating 50-79% of all patients experience 8-15% weight regain after 24 months (Magro et al., 2008; Odom et al., 2010). Other researchers have suggested that male bariatric patients may experience weight fluctuations greater than that of females due to variations in lean body mass loss (Alba et al., 2019).
The results of the two-sample t-tests, comparing the post-operative follow-up in months between the bariatric team members, surgeon and registered dietitian, were significant. While male and female patients reported similar mean rates of follow-up with the bariatric surgeon, female patients interacted significantly longer with the registered dietitian than the male patients. This is important to note because researchers have concluded post-operative nutrition therapy is an effective tool for promoting continued weight loss and address eating behaviors yet post-operative care among bariatric surgery centers differs greatly (Sarwer et al., 2012). Patients report reoccurrence of emotional eating behavior due to stress regarding failure to maintain or continue post-surgical weight loss (Coulman, MacKichan, Blazeby & Owen-Smith, 2017). Researchers have found that patients with poor attendance do not achieve or sustain goal weight loss, citing professional obligations or personal issues as barriers to compliance with follow-up appointments (Vidal et al., 2013).

The null hypothesis that there would be no significant difference in mindful eating scores between male and female bariatric patients was not able to be adequately tested. The sample size of male patients \((n = 20)\) was too low to achieve statistically significant results. However, males scored higher than females in two domains: disinhibition and awareness. In the awareness domain, the males score was statistically significant. The mindful eating questions within the awareness domain reflected: appreciation for subtle flavors, textures, colors and aromas of foods; the bodily sensation derived from enjoyable foods; excessively sweet foods and beverages; and the ability to discern the effect food may have regarding emotional health. Research has indicated the awareness component of mindful eating is directly related to stress-eating behaviors such as binge-eating and
emotional eating (Levin, Dalrymple, Himes, & Zimmerman, 2014). Researchers have linked the association between decreased awareness and increased disinhibition by relating a higher degree of stress-eating behavior, triggered by perceived levels of tension, and the inability to refrain from returning to conditioned coping mechanisms that affect weight loss, such as the excessive consumption of comfort foods (Levoy, Lazaridoua, Brewer, & Fulwiler, 2017; Tomiyama, Dallman, & Epel, 2011).

The average score for female bariatric patients was greater than males in the external cues, emotional response, and distraction, with no statistical significance noted. The results are consistent with previous research that found rates of binge-eating in bariatric patients were equal between genders, with conclusions that female bariatric patients may experience more frequent and severe depression related to obesity than males, but the occurrence of subsequent behavioral coping mechanisms related to emotional eating are equal (Mazzeo, Saunders & Mitchell, 2006). The findings of our study reinforce the conclusion that gender may not predominantly influence mindful eating behavior in bariatric patients.

The ability to accurately test the hypothesis regarding bariatric surgery types and mindful eating scores was not achievable due to the low number (4.6%) of gastric bypass patients. The gastric bypass patients had higher scores in terms of total MEQ component, disinhibition, emotional response and distraction when compared to the gastric sleeve patients, but these differences were not statistically significant. These findings may resemble the conclusions of previous studies regarding emotional eating habits with varying surgery types that determined gastric bypass patients had less emotional eating rates within the first 2-years post-operative period compared to sleeve gastrectomy.
patients (Opozda, Chur- Hansen, & Wittert, 2016; Petereit, Jonaitis, Kupcinskas, & Maleckas, 2014).

The linear regression data analysis revealed no significant differences in length of time since surgery and mindful eating scores. There was an overall positive correlation between number of months since surgery and MEQ scores. Negative correlations were shown in the awareness and external cues domains in relation to post-surgical time lapse. While this study did not find a significant relationship between post-surgical time lapse and MEQ scores, the potential for post-operative eating behavior to shift toward emotional eating as post-surgical time commences has been identified by researchers assessing patients’ perceived loss of control related to eating (White, Kalarchian, Masheb, Marcus, & Grilo, 2010). In that study, the authors found 61% of pre-surgical patients reported a general loss of control; post-surgery, 31% reported loss of control at 6-month follow-up, 36% reported loss of control at 12-month follow-up, and 39% reported loss of control at 24-month follow-up. The apparent trend was an increase in emotional eating behavior as time progressed after surgery which correlated positively with weight regain. Patients with self-reported loss of control regarding eating after surgery lost significantly less weight at 12-month (34.6 vs. 37.2%) and 24-month (35.8 % vs. 39.1 %) follow-up appointments (White et al., 2010).

The linear regression data analysis showed no significant differences in average percent weight loss post-surgery based on mindful eating scores. A negative correlation was steadily observed between mindful eating scores and average percent weight loss post-surgery. Initially, all 108 patients were included in the regression analysis but no significant difference was observed. When the outlier, the only patient with initial post-
surgical weight gain, was dropped from the data analysis, the relationship between MEQ scores and percent weight loss post-surgery remained non-significant. Chacko et al (2016) found a similar inverse relationship between mindful eating behavior and weight loss in post-surgical bariatric patients. After a ten-week mindfulness-based intervention, post-surgical bariatric patients reported improved resistance to eating-related triggers but there was not a statistical difference in weight loss when compared to the non-treatment group. Patients reported feeling decreased stress and reduced emotional eating after the mindfulness-based intervention sessions despite the proof of weight loss efficacy. Researchers theorized more time may be needed to evaluate the measurable effects of behavior change as study outcomes were only assessed at baseline, 12 weeks, and 6 months. (Chacko et al., 2016).

Analysis rejected the final null hypothesis regarding post-surgical weight regain and mindful eating scores. The positively associated relationship between mindful eating scores and weight regain in bariatric patients was determined to be significant. The initial analysis revealed a significant difference in post-surgical weight regain and mindful eating scores. These results included every patient. An additional analysis further investigated the relationship between patients’ MEQ scores and only the patients who experienced weight regain ($N = 89$) and the difference became more significant.

There was inconsistent evidence for significant reductions in emotional eating after gastric bypass, and no strong evidence for reductions in emotional eating behavior after sleeve gastrectomy. The study showed as weight loss increased, mindful eating scores decreased; as weight regain increased, mindful eating scores increased. In the patients who lost weight, the changed in mindful eating score did not predict weight loss
but did predict weight regain. The final hypothesis was a predictor of weight regain; as mindful eating scores increased, weight regain increased.

There were several limitations to this study. First, the survey questions were not provided to the participants in the same randomized order as the original validated MEQ provided. The MEQ component provided to participants in this study was derived from Table 1 of the published journal article concerning the development and validation of the MEQ (Framson et al, 2009). In the original MEQ, the survey questions were randomized and with the option to select “not applicable” to five survey questions. The MEQ component submitted to the participants of this study listed the survey questions per domain and did not provide a “not applicable” option in the response section for those five survey questions. Also, the original MEQ used responses titled, “never/rarely, sometimes, often, usually/always”. The MEQ component used the responses titled, “never, least true, often true, most true”. This may have affected the participants’ answers in multiple ways. The MEQ component, organized by each domain but not labeled, may have implied a negative or positive connotation to the subsequent questions, possibly creating predisposition within the participants’ responses. The absence of the “not applicable” option for survey question responses may have forced participants to select an answer that did not accurately reflect an appropriate answer for their personal experience. The change in participant response options between the original and the modified survey may have been different based on their understanding of how to apply the response to their situation.

An additional study limitation was every patient surveyed was from a private bariatric clinic in Northern Louisiana. The study would have been strengthened by
including additional patients from within a hospital setting, utilizing patients from a larger number of bariatric surgeons. Also, a limitation to the study occurred with the removal of 13 patients’ responses because the survey was not completed in its entirety. The sample size was predominately white females who received gastric sleeve procedures; male patients and gastric bypass procedures were not well represented in this patient population. The survey also did not capture the time frame depicting when the weight loss and weight regain occurred after surgery, instead identifying only weight prior to surgery, lowest post-surgical weight and current weight.

The strengths of this study were the convenient use of an online survey, where patient responses were anonymous. Research has shown that online surveys enhance data collections dynamics by increasing: rapidity of distribution and receiving results; convenience for administrating and participating; and ease of follow-up to promote involvement (Lefever & Ásrún Matthíasdóttir, 2007). Most importantly, the short 28 question survey instrument that provided the foundational questions used in the MEQ component was validated, having been determined to demonstrate good internal consistency and reliability in characterizing and measuring mindful eating.
CHAPTER 6:

CONCLUSIONS AND FUTURE WORK

This study found that mindful eating scores were not related to weight loss, gender, bariatric surgery type or length of time since surgery. There was a significant relationship between mindful eating scores and weight regain in the population of patients whose post-surgical weight loss was not lasting.

Future research should include an accurate utilization of the validated MEQ. Also, access to a more dynamic patient population, to include bariatric patients from more than one surgeon and bariatric surgery center. Studies should seek to identify the mindful eating scores of patients prior to surgery as well as after to further investigate the relationship between bariatric surgery, eating behavior change and weight changes. It would also be of benefit to document the time frame in which weight loss and potential weight regain occurs in post-surgical bariatric patients.
APPENDIX A

A-1 HUMAN SUBJECTS APPROVAL LETTER

A-2 LETTER FROM DR. MERRIMAN
TO: Ms. Megan M. Filer and Dr. Janet Pope
FROM: Dr. Richard Kordal, Director of Intellectual Property & Commercialization (OIPC)
rkordal@latech.edu
SUBJECT: HUMAN USE COMMITTEE REVIEW
DATE: May 6, 2019

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled: "Mindful Eating Behavior in Post Bariatric Patients".

HUC 19-104

The proposed study's revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. This approval was finalized on May 6, 2019 and this project will need to receive a continuation review by the IRB if the project continues beyond May 6, 2020. ANY CHANGES to your protocol procedures, including minor changes, should be reported immediately to the IRB for approval before implementation. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of Sponsored Projects.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent...
process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Sponsored Projects or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.
George R. Merriman II, MD, FACS, FASMBS
Freedom from Obesity
949 Olive Street Shreveport, LA 71104
318.222.3132

April 4, 2019

Graduate Program Louisiana Tech University 305 Wisteria Street Ruston, Louisiana 71272

To Whom It May Concern,

This letter is to inform you of my willingness to assist Megan M. Filer, a graduate student at Louisiana Tech University, in conducting the research for her thesis to assist her in her pursuit of a Master’s of Science in Nutrition and Dietetics.

Megan M. Filer requests my assistance in surveying my post-surgical bariatric patients for basic demographic information and mindful eating behaviors. I support her study and have determined her study in no way violates rules associated with human subject matter. The data derived from her study may serve to potentially benefit future patients.

I agree that IRB approval through Louisiana Tech is appropriate as I am a private physician with operating privileges at multiple facilities.

Sincerely,

George R. Merriman II, MD, FACS, FASMBS
APPENDIX B

B-1 LETTER OF INTRODUCTION

B-2 MINDFUL EATING QUESTIONNAIRE

B-3 REMINDER LETTER
Hello!

Nice to meet you. My name is Megan M. Filer. I am a graduate student at Louisiana Tech University and a dietitian in Shreveport, Louisiana. I am conducting research for my master’s degree in nutrition and would greatly appreciate your participation in my mindful eating survey.

I would like to know more about how to help assist weight loss surgery patients in achieving their weight loss goals. With this survey, I want to explore mindful eating behavior. The information you provide will remain anonymous and will be used only for this study. We hope to gain insight into providing more weight loss resources for patients. With respect for your time, this survey will take approximately 5 minutes.

Please click on the link at the bottom of this page and electronically sign the consent form. The mindful eating survey will follow.

Most importantly, thank you for your assistance with my research! As an incentive for completing this survey, your name will be entered into a raffle for a $100 gift card of your choosing to Amazon or Whole Foods. The winner of the raffle will be notified personally by me one week after the data collection for this study concludes (five weeks after you received this email initially). After completing the survey, a message will instruct you to text “enter me” to the phone number provided if you would like to be entered into the raffle. You may opt out of the raffle at your discretion.

Sincerely,
Megan M. Filer

************survey link************
B-2 MINDFUL EATING QUESTIONNAIRE

Age:

Gender:

Race:

Height:

Type of surgery (gastric sleeve or gastric bypass):

Date of surgery:

Weight prior to surgery (in pounds):

Lowest weight post-surgery (in pounds):

Current weight (in pounds):

Length of time (in months) of post-surgical follow up with bariatric surgeon:

Length of time (in months) of post-surgical follow-up with registered dietitian:

Please answer the following questions with a rating scale of 1-4, with 1 being the least representative statement to describe your eating behavior and 4 being the most representative statement to describe your eating behavior in general

1) I stop eating when I’m full even when eating something I love. 1 2 3 4

2) When a restaurant portion is too large, I stop eating when I’m full. 1 2 3 4

3) When I eat at “all you can eat” buffets, I tend to overeat. 1 2 3 4

4) If there are leftovers that I like, I take a second helping even though I’m full. 1 2 3 4

5) If there’s good food at a party, I’ll continue eating even after I’m full. 1 2 3 4
6) When I’m eating one of my favorite foods, I don’t recognize when I’ve had enough. 1 2 3 4

7) When I’m at a restaurant, I can tell when the portion I’ve been served is too large for me. 1 2 3 4

8) If it doesn’t cost much more, I get the larger size food or drink regardless of how hungry I feel. 1 2 3 4

9) I notice when there are subtle flavors in the foods I eat. 1 2 3 4

10) Before I eat I take a moment to appreciate the colors and smells of my food. 1 2 3 4

11) I appreciate the way my food looks on my plate. 1 2 3 4

12) When eating a pleasant meal, I notice if it makes me feel relaxed. 1 2 3 4

13) I taste every bite of food that I eat. 1 2 3 4

14) I notice when the food I eat affects my emotional state. 1 2 3 4

15) I notice when foods and drinks are too sweet. 1 2 3 4

16) I recognize when food advertisements make me want to eat. 1 2 3 4

17) I notice when I’m eating from a dish of candy just because it’s there. 1 2 3 4

18) I recognize when I’m eating and not hungry. 1 2 3 4

19) I notice when just going into a movie theater makes me want to eat candy or popcorn. 1 2 3 4

20) When I eat a big meal, I notice if it makes me feel heavy or sluggish. 1 2 3 4
21) At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should. 1 2 3 4

22) When I’m sad I eat to feel better. 1 2 3 4

23) When I’m feeling stressed at work I’ll go find something to eat. 1 2 3 4

24) I have trouble not eating ice cream, cookies, or chips if they’re around the house. 1 2 3 4

25) I snack without noticing that I am eating. 1 2 3 4

26) My thoughts tend to wander while I am eating. 1 2 3 4

27) I think about things I need to do while I am eating. 1 2 3 4

28) I eat so quickly that I don’t taste what I’m eating. 1 2 3 4
B-3 REMINDER LETTER

Hello!

This is a just a friendly reminder to complete the mindful eating survey. If you have completed the survey, please disregard this email and thank you so much for your time! If you have not completed the survey and are willing to participate, please read and proceed to the survey. If you are not interested in participating in the study, please disregard this email and the survey.

Nice to meet you. My name is Megan M. Filer. I am a graduate student at Louisiana Tech University and a dietitian in Shreveport, Louisiana. I am conducting research for my master’s degree in nutrition and would greatly appreciate your participation in my mindful eating survey.

I would like to know more about how to help assist weight loss surgery patients in achieving their weight loss goals. With this survey, I want to explore mindful eating behavior. The information you provide will remain anonymous and will be used only for this study. We hope to gain insight into providing more weight loss resources for patients. With respect for your time, this survey will take approximately 5 minutes.

Please click on the link at the bottom of this page and electronically sign the consent form. The mindful eating survey will follow.

Most importantly, thank you for your assistance with my research! As an incentive for completing this survey, your name will be entered into a raffle for a $100 gift card of your choosing to Amazon or Whole Foods. The winner of the raffle will be notified personally by me one week after the data collection for this study concludes (five weeks after you received this email initially). After completing the survey, a message will instruct you to text “enter me” to the phone number provided if you would like to be entered into the raffle. You may opt out of the raffle at your discretion.

Sincerely,
Megan M. Filer

***************survey link***************
REFERENCES


StataCorp. (2019). Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC.


