Psychological and psychosomatic aspects of bariatric surgery for the treatment of obesity in adults

D I S S E R T A T I O N

zur Erlangung des akademischen Grades
Doctor rerum naturalium (Dr. rer. nat.)
im Fach Psychologie

eingereicht an der
Lebenswissenschaftlichen Fakultät der Humboldt-Universität zu Berlin

von
Diplom-Psychologin Andrea Figura

Prof. Dr.-Ing. Dr. Sabine Kunst
Präsidentin
der Humboldt-Universität zu Berlin

Prof. Dr. Bernhard Grimm
Dekan
der Lebenswissenschaftlichen Fakultät

Gutachter

1. Prof. Dr. Thomas Fydrich, Humboldt-Universität zu Berlin
2. Prof. Dr. Bernd Löwe, Universitätsklinikum Hamburg-Eppendorf
3. Prof. Dr. Matthias Rose, Charité–Universitätsmedizin Berlin

Tag der Verteidigung: 8. März 2018

Acknowledgements

This dissertation has been an invaluable journey and a time of intellectual and personal growth fostered by a wonderful learning and working environment at the Department of Psychosomatic Medicine at the Charité−Universitätsmedizin Berlin. Writing this dissertation would not have been possible (or only half as much fun) without the guidance of my supervisors and the continuous support I received from my colleagues, friends, and family over the past several intense years.

First, I would like to express my sincere gratitude to my supervisor, Prof. Matthias Rose, for his excellent guidance, sharp mind, caring, and patience. He provided me with a supportive atmosphere for conducting research in a clinical setting and gaining hands-on experience in both patient-reported research and the treatment of psychosomatic patients. I would also like to thank Prof. Thomas Fydrich for his supervision of my dissertation at the Humboldt-Universität zu Berlin, his kind cooperation and his helpful advice in the final phase.

In particular, I would like to thank Dr. Anne Ahnis. She gave me the opportunity to join her research team in the area of adiposity and bariatric surgery when I started as a student assistant in 2008 and later became a research assistant. During that time, she became a dear colleague and friend who was always willing to make time to give her best advice and constructive feedback. I would also like to thank my group of dedicated collaborators and co-authors: Prof. Andreas Stengel, Dr. Tobias Hofmann, Dr. Ulf Elbelt, and PD Dr. Jürgen Ordemann. Their immense knowledge and input and insightful comments helped me during all phases of research and publication. A special “thank you” goes to the late Prof. Burghard F. Klapp, who taught me to think critically from various perspectives. Naturally, many other people have accompanied me along the way and made an impact on me and my work. Thanks to all of you for your silent but meaningful contributions.

Last but not least, I would like to thank my family: my parents, my late grandparents and my brothers for their wise counsel, sympathetic ear, and unconditional love and their pride in me for pursuing a doctorate. I am grateful for my dear friends for their constant encouragement and moral support, but mostly for reminding me to put work aside and engage in social life and laughter. Malthe, you have shared this journey with me all along. You are a great source of motivation to me – thank you!

On the subject of my dissertation, I would like to acknowledge all patients who took the time to participate in my research.

Table of contents

List of figures and tables

List of abbreviations

BMI	Body mass index
CT	Conservatively treated
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, 4th Edition
EWL	Excess weight loss
HRQoL	Health-related quality of life
ICD-10	International Classification of Diseases, 10th Revision
kg	Kilogram
LSG	Laparoscopic sleeve gastrectomy
m²	Square meter
SES	Socio-economic status
ST	Surgically treated
T2DM	Type 2 diabetes mellitus
TWL	Total weight loss
U.S.	United States of America

List of academic publications

Study I

Ahnis, A., Figura, A., Hofmann, T., Stengel, A., Elbelt, U., & Klapp, B. F. (2015). Surgically and conservatively treated obese patients differ in psychological factors, regardless of body mass index or obesity-related co-morbidities: a comparison between groups and an analysis of predictors. *PLoS ONE, 10*(2), e0117460. doi:10.1371/journal.pone.0117460

[Full text]

Study II

Figura, A., Ahnis, A., Stengel, A., Hofmann, T., Elbelt, U., Ordemann, J., & Rose, M. (2015). Determinants of weight loss following laparoscopic sleeve gastrectomy: the role of psychological burden, coping style, and motivation to undergo surgery. *Journal of Obesity, 2015*, 626010. doi:10.1155/2015/626010

[Full text]

Study III

Figura, A., Rose, M., Ordemann, J., Klapp, B. F., & Ahnis, A. (2017a). Changes in self-reported eating patterns after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. *Surgery for Obesity and Related Diseases, 13*(2), 129-137. doi:10.1016/j.soard.2016.08.003

[Full text]

Study IV

Figura, A., Rose, M., Ordemann, J., Klapp, B. F., & Ahnis, A. (2017b). Improvement in self-reported eating-related psychopathology and physical health-related quality of life after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. *Eating Behaviors, 24*, 17-25. doi:10.1016/j.eatbeh.2016.11.006

[Full text]

Abstract

Obesity is a chronic malady that has become a striking global health problem of alarming proportions for both personal health and public health systems worldwide. Bariatric surgery for sustainable weight reduction has developed into an effective long-term treatment for the majority of adult patients with severe forms of obesity. However, while the number of operations performed continues to increase, the role of psychological factors throughout the bariatric surgery pathway remains uncertain. Empirical evidence regarding the effects of laparoscopic sleeve gastrectomy (LSG), a bariatric surgical procedure, is particularly scarce. This dissertation aims to examine the patient-reported health status as it impacts and results from bariatric surgery. Study I investigates whether obese patients who undergo surgical treatment differ from those who receive conservative treatment in terms of biological, psychological, and socio-demographic factors. Study II evaluates the role of the preoperative psychological burden, coping style, and motivation to undergo weight loss surgery in determining postoperative weight-related treatment success after LSG. Study III investigates changes in eating behaviors, and Study IV examines changes in eating-related psychopathology and health-related quality of life (HRQoL) in relation to weight loss in the second postoperative year after LSG compared with conservative treatment. The findings show that bariatric surgery is preferred by a vulnerable patient group with a lower socio-economic status and higher physical and psychological burdens compared with conservatively treated patients. LSG is shown to be a viable intervention that leads to a substantial and sustained weight reduction of 26% of the initial weight and promotes positive health-related outcomes. The determinants of treatment success after LSG include a lower preoperative body mass index, a higher education level and more active coping behavior. Further, body dissatisfaction and perfectionism in patients are positive indicators for favorable weight results after LSG. In the second year after weight loss treatment, LSG is associated with greater eating control and reduced feelings of hunger. This may contribute to the relatively higher postoperative weight loss after LSG, which in turn may result in LSG-patients being more satisfied with their physical appearance and less concerned with dieting and weight than before surgery compared with patients who undergo conservative treatment. Overall, LSG is an effective weight reduction treatment that has a generally positive effect on the HRQoL of patients. Still, these results are mean effects, and as not all patients equally benefit, close monitoring of physiological and psychological variables is warranted. The provision of routine psychological care of patients following bariatric surgery should be emphasized to secure and optimize long-term treatment success.

Zusammenfassung (Abstract in German language)

Die chirurgische Therapie der Adipositas, auch bariatrische Chirurgie genannt, hat sich für eine Vielzahl von Patienten mit morbider Adipositas zu einer wirksamen Behandlungsoption entwickelt. Während die Anzahl bariatrischer Operationen zunimmt, ist über den Einfluss psychologischer Faktoren und die psychischen Folgen jedoch noch wenig bekannt. Insbesondere in Zusammenhang mit dem operativen Eingriff der Schlauchmagenbildung (laparoskopische Sleeve-Gastrektomie, LSG) liegen bisher nur wenige empirische Daten vor. Das Ziel der vorliegenden Dissertation ist es, Einfluss und Veränderung patientenberichteter Gesundheitsmerkmale in der chirurgischen Adipositastherapie zu erfassen. Die Studie I untersucht zunächst bio-psycho-soziale Unterschiede zwischen Patienten, die sich entweder einer bariatrisch-chirurgischen Behandlung unterziehen oder an einem konservativen multimodalen Gewichtsreduktionsprogramm teilnehmen. Die Studie II beschäftigt sich mit dem Einfluss präoperativer Faktoren auf den gewichtsbezogenen Behandlungserfolg nach LSG. In Studie III und Studie IV werden Veränderungen im Essverhalten, in der essstörungsbezogenen Psychopathologie und gesundheitsbezogenen Lebensqualität von Patienten im zweiten Jahr nach LSG untersucht und mit der konservativ-behandelten Kontrollgruppe (KG) verglichen. Die Ergebnisse zeigen, dass eine bariatrische Operation von einer vulnerablen Patientengruppe präferiert wird, die im Vergleich zur KG einen niedrigeren sozioökonomischen Status hat und eine höhere körperliche sowie psychische Belastung berichtet. Die LSG bewährt sich als effektive Behandlungsmethode und führt zu einer nachhaltigen Gewichtsreduktion von 26%. Ein niedrigerer präoperativer Body-Maß-Index, ein höheres Bildungsniveau und aktiveres Bewältigungsverhalten wirken sich positiv auf den gewichtsbezogenen Behandlungserfolg aus. Zudem sind Unzufriedenheit mit dem Körper und Perfektionismusstreben bei Patienten Indikatoren für günstige Gewichtsergebnisse nach LSG. Im zweiten Jahr nach Intervention erreichen die LSG-Patienten im Vergleich mit den KG-Patienten einen höheren Gewichtsverlust (bei höherem Ausgangsgewicht) und eine Zunahme ihrer Lebensqualität. Die LSG-Patienten berichten mehr Kontrolle über ihr Essverhalten zu haben und weniger Hunger zu empfinden. Sie sind zufriedener mit ihrem äußeren Erscheinungsbild und weniger gedanklich auf Diäten und Gewicht fixiert als vor der Operation. Insgesamt weisen die Ergebnisse auf bedeutsame Verbesserungen in den selbstberichteten Gesundheitsmerkmalen nach LSG hin. Da die Ergebnisse auf Mittelwertseffekten basieren und nicht alle Patienten gleichermaßen profitieren, ist eine langfristige und routinemäßige postoperative Überwachung der körperlichen und psychischen Situation gerechtfertigt, um Behandlungserfolge optimal zu sichern.

Preface

In spring 2012, a young woman who was severely obese was struggling with a lump-in-the-throat feeling. The very next day, she was going to undergo a drastic and irreversible operation. Was she on the threshold of a new beginning or a terrible mistake? She was scheduled for bariatric surgery at the Charité−Universitätsmedizin Berlin, where a surgeon would cut away most of her healthy stomach. As a result of this surgery, she was almost certain to lose most of her excess weight. The woman's name was Sophia; she was a 27-year-old veterinary medicine student who lived with her grandmother, and worked part-time at a cinema. At 1.62 m and 125 kg, she had a difficult life. She was ashamed of her body. She somewhat hesitantly whispered that she was unable to find the fashionable clothes that she admired on models on their Instagram pictures and YouTube channels. She was having physical and medical problems: her joints hurt, moving around was effortful and caused shortness of breath, she could hardly bend down to tie her shoes, and she was unable to cross her legs. Moreover, she was prediabetic; she had high blood pressure and sleep apnea, which meant she woke up at night several times panting for air; and she had to take daily medication. At some point, a medical doctor told her something that petrified her: "You are only 27, but your body is much older than you are." For her, even worse were the constant struggles and indignities of being obese in today's society. She had never gone on a date, and no man ever seemed interested in her. Total strangers lectured her on what and how to eat, in addition to sending judgmental glances her way when she ate in public. Additionally, she suffered unexpected humiliations, such as when she wanted to go on vacation with her best friend and the flight attendant pulled her aside and asked her to try pulling the seatbelt over her stomach. It didn't fit, and she had to have a seatbelt extender installed while everyone else around her watched and laughed. "Every day of my life, I'm reminded of how heavy I am," she told me six months after we first met during the prebariatric psychological assessment. She was one of the first patients that I evaluated for bariatric surgery. She tried various diets and programs, such as Weight Watchers, but her urge to eat was as powerful as the urge to breathe when holding your breath, and it defeated her in her all-or-nothing mindset. "It's like a physical need I can't fight," Sophia said. In addition, the weight always came back. I felt her strain from being trapped in a vicious, self-perpetuating circle of obesity, physical immobility, and self-devaluation. "I've tried everything I can," she said, "and the surgery is a last resort for me." However, she had a hard time committing to the surgery. It was such a big step, and once it was done, there was no going back.

1. Introduction

This cumulative dissertation is based on four peer-reviewed publications concerning the psychological and psychosomatic aspects of bariatric surgery for the treatment of obesity in adults. The four articles will be referred to as Study I (Ahnis et al., 2015), Study II (Figura et al., 2015), Study III (Figura et al., 2017a), and Study IV (Figura et al., 2017b). The synopsis will begin by presenting a brief introduction to the disease of obesity, highlighting the role of psychopathology. Then, the concept of bariatric surgery for the treatment of obesity and particularly the surgical procedure of laparoscopic sleeve gastrectomy (LSG) will be presented. The routine clinical multidisciplinary evaluation of patients with obesity that is required before bariatric surgery will be explained, and an outline of the aims and research questions of the present dissertation will be presented. After the four studies of this dissertation project are presented and their main findings are integrated, the project's strengths and limitations will be outlined. The dissertation concludes with a discussion of the clinical implications and future research directions.

1.1. Definition and classification of obesity

According to the World Health Organization (WHO, 2000), obesity is an abnormal or excessive body fat accumulation that may impair health and quality of life. The body mass index (BMI) is a weight-for-height index that is commonly used to classify overweight and obesity in adults. It is calculated as body weight in kilograms divided by the square of body height in meters (kg/m²). Obesity is defined as a BMI ≥ 30 kg/m² and is classified further into degrees of severity (Table 1). The risk of obesity-related comorbidity increases as BMI increases. Morbid obesity is defined as a BMI ≥ 40 kg/m² or a BMI ≥ 35 kg/m² with obesity-related somatic comorbidity (National Institutes of Health [NIH], 1991).

Table 1. Body weight classification of adults according to body mass index (WHO, 2000)

Classification	BMI (kg/m²)	Risk of obesity-related comorbidity
Normal weight	18.5 – 24.9	Average
Overweight	≥ 25	
− Pre-obesity	25 – 29.9	Increased
− Obesity class 1	30 – 34.9	Moderate
− Obesity class 2	35 – 39.9	Severe
− Obesity class 3	≥ 40	Very severe
− Super-obesity	≥ 50	High-risk

Note. BMI, body mass index. BMI values for adults 20 years of age and older are age-independent and the same for both sexes. The association between BMI and risk of obesity-related comorbidity can be affected by a range of additional factors.

It is important to bear in mind that the relationship between BMI and percentage of body fat mass varies according to body build and proportion, sex, and age, and even across populations (WHO, 2000). Nonetheless, BMI is a robust, widely used, and internationally accepted standard for classifying overweight and obesity. Additional sex-specific measures of fat distribution include waist circumference and waist-to-hip ratio, which are used to identify individuals at increased risk of metabolic complications due to the accumulation of fat around the stomach and abdomen (WHO, 2000).

1.2. Prevalence and trends of obesity

The prevalence of obesity has increased dramatically in most parts of the world since 1980 (Finucane et al., 2011), and the current prevalence of morbid obesity in particular is at unprecedented levels. Globally, in 2014, more than 1.9 billion (39%) adults aged 18 years and older were overweight; of these, over 600 million (13%) were obese (WHO, 2016). Among high-income countries, the United States (U.S.) has the highest BMI (Finucane et al., 2011; Organisation for Economic Co-Operation and Development [OECD], 2014), with a marked increase in more severe forms of obesity (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). More than two-thirds of the adult U.S. population are overweight or obese (Flegal, Carroll, Kit, & Ogden, 2012); in 2013−2014, approximately 38% were obese, with a BMI of ≥ 30 kg/m², and 8% were severely obese, with a BMI of ≥ 40 kg/m² (Flegal et al., 2016). This positive linear trend of increases in the prevalence of obesity is not limited to the U.S. (OECD, 2014). The prevalence of obesity has also increased rapidly among both men and women in Germany. In 2008−2011, 23% of adult males and 24% of adult females in Germany were obese, with a BMI of ≥ 30 kg/m² (Mensink et al., 2013). The corresponding prevalence of morbid obesity (BMI ≥ 40 kg/m²) was 1% among men and 3% among woman (Mensink et al., 2013). Within the European Union, Germany is among the countries with the highest obesity prevalence (World Obesity Federation [WOF], 2017). Although the increase in obesity in Germany has not been as rapid as in the U.S., the proportion of obese adults has increased substantially, especially among younger age groups (i.e., 25−34 years) (Mensink et al., 2013). Furthermore, the results of health examination survey data have shown that the obesity prevalence varies by sex, age, race-ethnicity, education (Flegal et al., 2016), and socio-economic status (SES) (Ogden, Yanovski, Carroll, & Flegal, 2007; Mensink et al., 2013). While some evidence suggests that the prevalence of adult obesity might be leveling off (Flegal, Carroll, Ogden, & Curtin, 2010), forecasts estimate a 33% increase in the obesity prevalence and a 130% increase in the severe obesity prevalence through the year 2030 (Finkelstein et al., 2012).

1.3. Etiology and causes of obesity

Behind increases in weight lies a highly complex etiology of obesity that includes biological (e.g., genetic predisposition), physiological (e.g., endocrine disorders, such as hypothyroidism), medical (e.g., medication-induced weight gain due to pharmacological treatment for somatic or mental disorders), environmental (e.g., food environment), psychological (e.g., mental disorders and distress), behavioral (e.g., disordered eating behaviors), social (e.g., social network and support), socio-economic (e.g., education level, employment status, and income), and even political factors (e.g., farm subsidy policies) that interact in varying degrees to promote the development of obesity (Aronne, Nelinson, & Lillo, 2009; Wright & Aronne, 2012), suggesting a biopsychosocial model for obesity (Figure 1).

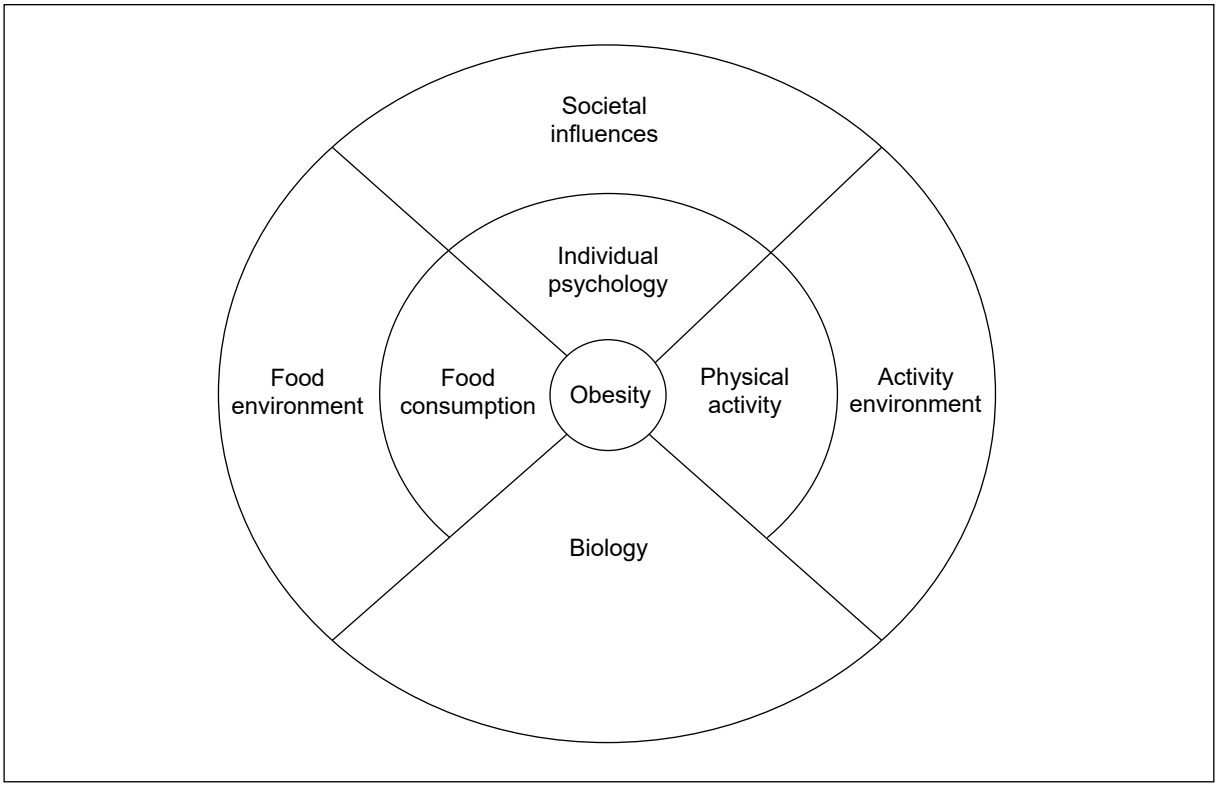

Figure 1. Obesity system map.

Developed for the Foresight Tackling Obesities project, an obesity system map was designed to provide systemic insight into the multiple factors contributing to the obesity epidemic. Figure 1 shows seven cross-cutting themes that range from societal and biological factors to individual psychology, the culture and economics of food production, food consumption, physical activity, and the structure of the activity environment (Vandenbroeck, Goossens, & Clemens, 2007).

Illustration retrieved from http://debategraph.org/Stream.aspx?nid=365986&vt=outline&dc=all. Public domain.

Most commonly, obesity is caused by a persistent imbalance between energy consumption (i.e., increased dietary food intake) and energy expenditure (i.e., decreased metabolic and physical activity). On one hand, the food environment has shifted in ways that promote overeating. Contributing to an increased daily calorie intake, fast foods and prepackaged and processed food items that are high in sugar, fat, and sodium are affordable, heavily marketed, and easily available, even in large portion sizes. On the other hand, due to the myriad advances in technology and transportation in recent decades, people spend more time engaging in sedentary behaviors, such as working on the computer or driving/riding in a car, which may result in the expenditure of fewer calories (Wright & Aronne, 2012).

1.3.1. Obesity and psychopathology

In light of the present work, psychological factors may play a fundamental role in the development and maintenance of overweight and obesity. Although life circumstances and individual habits represent challenges for many people, individuals who suffer from mental disorders (e.g., depression, anxiety, and eating disorders) may have more difficulty controlling their food consumption, engaging in adequate amounts of exercise, maintaining a normal weight, and adopting a healthy lifestyle.

Several representative epidemiological studies support a strong positive association between obesity and mental disorders. That is, obese people are 1.5 times more likely than normal-weight, physically healthy people to report lifetime mental disorders; severely obese people are twice as likely (Baumeister & Härter, 2007; Petry, Barry, Pietrzak, & Wagner, 2008). In Germany, both nontreatment-seeking obese people from the general population and treatment-seeking obese patients in clinical settings show a significantly increased risk of mental disorders (according to diagnostic criteria), with mood and anxiety disorders being most frequent; the prevalence rates increase with increasing severity of obesity (Baumeister & Härter, 2007), possibly due to greater health burdens and impairments. However, obesity itself is not systematically associated with psychopathological outcomes (Fabricatore & Wadden, 2004). The relationship between obesity and an increased risk of mental disorders is further moderated and mediated by different correlates, such as sex, marital status, and obesity-related somatic comorbidity (Baumeister & Härter, 2007). For example, the association between obesity and mood and anxiety disorders appears to be stronger in females than in males, which may be partly attributable to different societal expectations regarding thinness (Fabricatore & Wadden, 2004; Baumeister & Härter, 2007).

Causal pathways between obesity and mood and anxiety disorders are likely to be bidirectional and may be associated with disordered eating behaviors. Overweight and obesity often, but not always, begin at young ages, and mental disorders may precede or follow the onset of weight gain (Wardle & Cooke, 2005; Anderson, Cohen, Naumova, & Must, 2006). On one hand, negative early life experiences, such as being the target of weight-based discrimination and stigmatization, may cause depressive symptoms with feelings of worthlessness, a low sense of self-efficacy and low self-esteem, social anxiety and isolation, especially in extremely obese individuals (Kessler, Mickelson, & Williams, 1999; Carr & Friedman, 2005; Brewis, 2014). Additionally, health consequences related to obesity may lead to mood and anxiety disorders in otherwise mentally healthy individuals (Wimmelmann, Dela, & Mortensen, 2014). On the other hand, depression and anxiety disorders may contribute to weight gain or impede weight loss by interfering with a healthy lifestyle (Jones, O'Connor, Conner, McMillan, & Ferguson, 2007). In fact, an increased appetite leading to overeating as well as reduced energy and physical inactivity are symptoms of depression. Moreover, dysfunctional coping mechanisms, such as eating (and high calorie consumption) in response to negative emotions and distress, may have a temporary anxiolytic and comforting effect but can lead to overweight and obesity in the long run. Furthermore, psychosocial stress may play an important mediating role in the association between obesity and mental disorders. Under conditions of chronic stress, the activity of the hypothalamic-pituitary-adrenal axis, which responds to stress by releasing hormones such as cortisol that modulate sympathetic nervous system activity, becomes dysregulated due to the chronic elevation of stress-regulating hormones and activation of neurotransmitter pathways; this state has been implicated in depression and anxiety disorders as well as obesity (Bornstein, Schuppenies, Wong, & Licinio, 2006; Scott, Melhorn, & Sakai, 2012).

In particular, obesity is strongly associated with eating disorders, such as binge eating disorder, bulimia nervosa, and night eating syndrome, and with other problematic eating behaviors, such as hyperphagia (overeating), grazing, emotional eating, sweet eating, cravings and food addiction (Conceicao, Utzinger, & Pisetsky, 2015). The mechanisms underlying the association between obesity and psychopathology remain partly unknown; however, self-reinforcing cycles that can amplify both psychological burden and weight gain may be involved. Given that causes of obesity provide indications for therapy, the co-occurrence of obesity and mental conditions needs to be considered carefully in both the clinical assessment and treatment of obese patients (Petry et al., 2008).

1.4. Health burden and costs of obesity

The health burden and costs of overweight and obesity related to morbidity and mortality increased dramatically in Germany between the years 2002 and 2008 (Konnopka, Bödemann, & König, 2011; Lehnert, Streltchenia, Konnopka, Riedel-Heller, & König, 2015). Obesity is associated with a marked increase in premature mortality (Adams et al., 2006; Whitlock et al., 2009), often caused by frequent obesity-related comorbidities, such as type 2 diabetes mellitus (T2DM), cardiovascular disease, and cancer (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003; Bray, 2004; McGee, 2005), and with increased all-cause mortality (Flegal, Kit, Orpana, & Graubard, 2013). Critically, obesity is a risk factor for numerous disabling and life-threatening diseases, including arterial hypertension; coronary heart disease; dyslipidemia; hyperuricemia; gallbladder disease; respiratory disease, such as sleep apnea and hypoventilation syndrome; osteoarthritis and degenerative joint disease causing impaired mobility; gastroesophageal reflux disease; nonalcoholic hepatic steatosis; polycystic ovarian syndrome; and mental disorders (Must et al., 1999; Pi-Sunyer, 1999; Anonymous, 2000). The term “metabolic syndrome” is used when three or more of the following five medical conditions are present: abdominal obesity, high triglyceride level and low high-density lipoprotein (HDL) cholesterol level in the blood, hypertension, and insulin resistance. Patients with metabolic syndrome have an increased risk of developing T2DM and cardiovascular disease (American Heart Association [AHA], 2015). The evidence of the relationship between obesity and these comorbidities is strong; however, the causal mechanisms involved have not yet been clarified. The increased mass of fat tissue and the chronic inflammation induced by adipocytes (fat cells) are thought to play a central role in the pathogenesis of obesity-related diseases (Strissel, Denis, & Nikolajczyk, 2014).

As mentioned in paragraph 1.3., obese patients often suffer from not only somatic comorbidities but comorbid mental disorders. The covariation of obesity and mental disorders is suggested to have a high impact on health burden and costs. The presence of comorbid mental disorders in obese patients is associated with a nearly twofold increase in health care use and reductions in perceived health-related quality of life (HRQoL) compared with obesity without mental comorbidity (Baumeister & Härter, 2007). It seems that comorbid somatic diseases primarily aggravate physical aspects of quality of life, whereas mental comorbidities impair both psychosocial and physical aspects.

Being obese increases the probability of requiring primary care and diagnostic services (Bertakis & Azari, 2005). Notably, the marked increase in excess weight-related costs can largely be explained

by increases in the prevalence of overweight and obesity and, to a lesser extent, by increases in resource consumption (e.g., inpatient days, unit costs, and wages). Overweight and obesity caused €16,800 million in total costs in 2008 (+70% compared to 2002), of which €8,650 million were direct costs, corresponding to 3.3% of the total health care expenditures for all diseases in Germany in 2008 (Lehnert et al., 2015). The main drivers of direct costs were outpatient (€4,700 million) and inpatient care (€2,000 million), mostly for endocrinological diseases (44%; e.g., diabetes mellitus) and cardiovascular diseases (38%; e.g., hypertension, coronary heart disease). Indirect costs amounted to €8,150 million in 2008, of which approximately two-thirds (€5,300 million) were associated with unpaid work (e.g., sickness absence days, early retirement, and mortality) (Lehnert et al., 2015). Obesity reduces life expectancy, and the great majority of indirect costs were due to premature mortality. Excess weight-related deaths increased by 31% (from 36,653 in 2002 to 47,964 in 2008), driven by deaths resulting from cardiovascular diseases and neoplasms (80%). The associated years of potential life lost (YPLL) was 12.3 per deceased person, and the quality-adjusted life-years (QALY) lost was 10.5 per deceased person (Lehnert et al., 2015). In sum, obesity presents a significant burden in terms of both health economics and quality of life. Adequate diagnostics and treatment may decrease the health burden and costs.

1.5. Treatment of obesity

The treatment of obesity is based on indications for conservative (= nonsurgical) and surgical interventions and depends on BMI, obesity-related comorbidities, risk factors, and patient preference. However, the patient's individual psychosocial circumstances and resources and his/her access to specialized in- or outpatient obesity treatment play a crucial role. Generally, obesity treatment aims to produce a clinically significant and sustained reduction of weight; the remission of obesity-related comorbidity; a reduced risk of work inability, early retirement, and premature mortality; and improved HRQoL. The following remarks refer to the first revised version of the German Interdisciplinary Guideline of S3 Quality for the Prevention and Therapy of Obesity provided by the German Obesity Society (Hauner et al., 2014).

1.5.1. Conservative weight loss treatment

Conservative treatment for weight loss is recommended for patients with a BMI ≥ 30 kg/m² and for those with a BMI ≥ 25 kg/m² in the presence of obesity-related somatic comorbidities and psychosocial impairment. Conservative weight loss treatment is suitable for patients with good self-management ability and high motivation to undergo long-term behavioral lifestyle modification. Standard weight reduction programs include a combination of the following multimodal aspects: nutritional intervention (e.g., nutritional training and a calorie-reduced diet), increased physical activity (e.g., regular weight-adapted exercises if no barriers exist), and psychotherapy (e.g., cognitive behavioral therapy). These lifestyle interventions should be performed by trained specialists in conservative obesity management (i.e., dieticians, physiotherapists, psychotherapists) as structured group therapy programs to optimize psychosocial support and cost efficiency. Medical monitoring by a physician is also recommended. It has been demonstrated that multimodal programs that combine all these therapeutic strategies are more effective than diet, physical training or behavioral interventions alone (Södlerlund, Fischer, & Johansson, 2009; Wu, Gao, Chen, & van Dam, 2009). Detailed recommendations for therapeutic content and strategies can be found in the Interdisciplinary Guideline of S3 Quality for the Prevention and Therapy of Obesity (Hauner et al., 2014). Conservative weight loss treatment is associated with low risks; however, it is contraindicated in pregnant women and individuals with malignant or infectious diseases that cause morbid weight loss with general weakness and cachexia (e.g., malignant tumors, AIDS, and tuberculosis).

Pharmacologic obesity treatment can be considered an adjunct to lifestyle modifications. Weight loss medications approved for use in Germany include Orlistat and Liraglutide; it is also an off-label use of Metformin (Elbelt, Berger, & Hofmann, 2017). Orlistat (Xenical®, Alli®) is a potent selective inhibitor of pancreatic lipase that prevents the absorption of fats from the diet (Kim, 2016). Pharmacologic agents, such as Liraglutide and Metformin, have been developed for the treatment of T2DM. It is assumed that both of these agents target hunger control and satiety in the central nervous system and have an appetite suppressing effect. In 2015, Liraglutide (Saxenda®) was approved for the treatment of obesity. Metformin is not approved for the treatment of obesity, but it has shown beneficial weight loss effects in the prevention and treatment of T2DM (Kahn et al., 2006; Elbelt et al., 2017). Overall, the amount of weight reduction achievable with these medications varies from 3−10% of the initial weight beyond the

placebo effect, and they require continual drug usage to maintain weight loss effects (Kim, 2016). Each drug has a unique side effect profile that must be carefully considered.

Conservative weight reduction programs aim at a weight reduction of at least 5−10% of the initial weight within six to 12 months. They have shown good results for class 1 and 2 obesity (i.e., BMI = 30−34.9 and 35−39.9 kg/m², respectively) in completers (Wing & Phelan, 2005; Rademacher & Oberritter, 2008; Jebb et al., 2011; Walle & Becker, 2011; Bischoff et al., 2012; Lagerstrøm et al., 2013); however, they are usually less effective in the long-term treatment of morbid obesity, that is, class 3 obesity, with a BMI ≥ 40 kg/m² (Wadden, Sternberg, Letizia, Stunkard, & Foster, 1989; Björntorp, 1992; Mun, Blackburn, & Matthews, 2001). In fact, systematic reviews and meta-analyses have shown that conservative weight loss treatment has limited effectiveness due to high attrition rates of up to 90% (Moroshko, Brennan, & O'Brien, 2011); furthermore, after the conservative therapy programs end, a more or less rapid weight regain is likely given the chronic nature of obesity (Holzapfel & Hauner, 2011; Middleton, Patidar, & Perri, 2012). In addition to conservative weight loss treatment, surgical treatment has progressed in recent years. Most patients who present for bariatric surgery have already had multiple unsuccessful attempts to achieve sustained weight loss through nonsurgical weight reduction programs, and a surgical measure may seem like the last resort.

1.5.2. Surgical weight loss treatment

Bariatric (*bar-iatric*) means weight (*bar*) treatment (*iatric*). Bariatric surgery refers to weight loss surgery to treat morbidly obese patients and improve obesity-associated metabolic comorbidity. The related term “metabolic surgery” refers to the use of gastrointestinal surgery to primarily and purposely treat metabolic disorders (i.e., T2DM) rather than for body weight reduction alone.

1.5.2.1. Classification of bariatric surgical procedures

Bariatric surgery includes a variety of procedures. According to the traditional view, surgical strategies for weight loss have focused on restriction, malabsorption, or both. Predominantly restrictive surgical procedures reduce the amount of oral food intake by limiting the size/volume of the stomach and cause early satiety. Restrictive procedures include intragastric balloon, gastric banding, vertical banded gastroplasty, and sleeve gastrectomy surgery. Predominantly malabsorptive surgical procedures create a physiological condition of nutrient malabsorption. Malabsorptive procedures include biliopancreatic

diversion with duodenal switch surgery. Mixed procedures combine both techniques, and include Roux-en-Y gastric bypass surgery, for example. However, recent findings have questioned the “mechanical fix” and the isolated contribution of restrictive and malabsorptive mechanisms due to an increased understanding of the physiological mechanisms that may underlie the treatment success of bariatric surgery. Such potential underlying mechanisms include hormonal effects (e.g., altered concentration and signaling of the meal-stimulated gut hormones that regulate hunger and satiety) and metabolic effects (e.g., increased energy expenditure) (Stefater, Wilson-Pérez, Chambers, Sandoval, & Seeley, 2012; Lutz & Bueter, 2014). Still, these regulatory pathways and their interactions remain incompletely understood due to the complex and heterogeneous pathophysiology of obesity.

A complete introduction and explanation of all bariatric surgical procedures is beyond the scope of the present dissertation. Only the surgical procedure of laparoscopic sleeve gastrectomy (LSG) will be described in detail below due to its relevance to the present research projects. Kissler and Settmacher (2013) present a detailed overview of the different bariatric surgical procedures used to treat obesity, which vary substantially in terms of postoperative weight loss amount, BMI reduction, resolution of comorbidity, duration of hospitalization, nutritional requirements, nature and severity of complications, and rates of re-operation and mortality. Differences in effectiveness have been clearly demonstrated in large systematic reviews and meta-analyses (Buchwald et al., 2004; Buchwald, Estok, Fahrbach, Banel, & Sledge, 2007; Karlsson, Taft, Rydén, Sjöström, & Sullivan, 2007; Buchwald et al., 2009; Gloy et al., 2013; Chang et al., 2014). The choice of surgical procedure must be made by the surgeon based on the surgeon’s experience; patient factors, such as degree of obesity (BMI), age, sex, medical comorbidities, and surgical history; and patient preference and adherence (Kissler & Settmacher, 2013; Runkel & Brydniak, 2016).

1.5.2.2. Laparoscopic sleeve gastrectomy (LSG)

LSG was introduced as the first step in a multi-step bariatric operation concept for short-term weight loss in perioperative high-risk patients with very severe forms of obesity (BMI ≥ 50 kg/m²) and significant obesity-related comorbidity. However, LSG has since gained acceptance as an effective definitive and standalone surgical procedure when a restrictive mechanism is considered sufficient for adequate sustained weight reduction and the remission of comorbidities such as T2DM (Kissler & Settmacher, 2013; Runkel & Brydniak, 2016).

Weight loss following LSG is achieved by both restriction and hormonal modulation (Shi, Karmali, Sharma, & Birch, 2010). First, LSG reduces the size/volume of the stomach by 70−85% and thus restricts distention and increases the patient's sensation of fullness (thereby decreasing meal portion size). This restriction is further facilitated by the natural band effect of the intact pylorus, which is maintained during the LSG. Second, LSG alters the secretion patterns of gut hormones and the hormonal signaling from the gut to the brain, thus reducing appetite and hunger drive. This effect is believed to be related to decreased serum levels of ghrelin, a gastrointestinal orexigenic peptide hormone involved in the regulation of appetite/hunger that is mainly produced in the fundus of the stomach. Resection of the gastric fundus removes the majority of the ghrelin-producing cells, thereby reducing the hunger-regulating ghrelin levels and subsequently the appetite (Langer et al., 2005; Langer et al., 2008; Kissler & Settmacher, 2013).

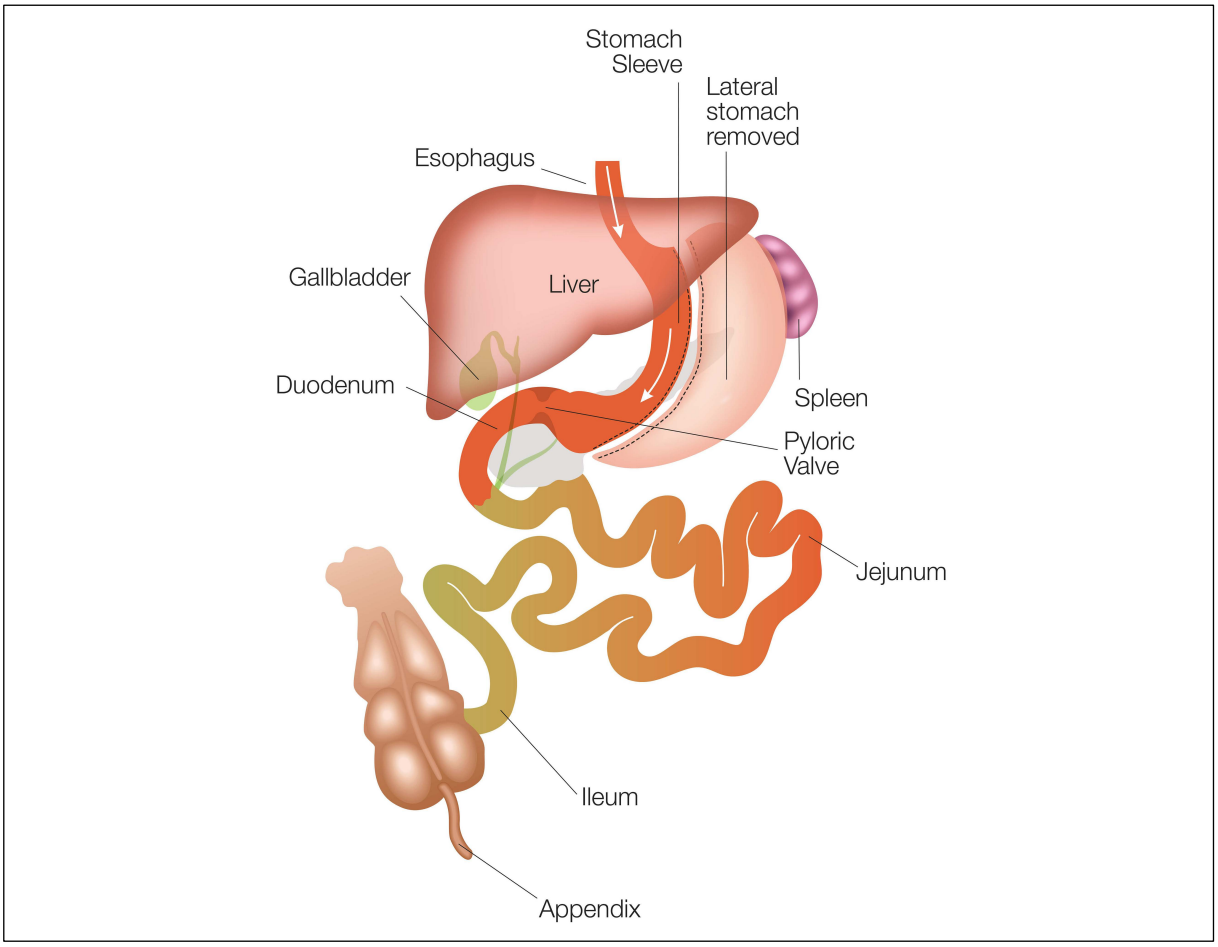

Figure 2. Illustration of sleeve gastrectomy.
Retrieved from http://www.avidscience.com/wp-content/uploads/2016/06/BS-16-01_June-23-2016.pdf.

LSG is performed laparoscopically, that is, as a minimally invasive surgical technique using trocars placed through the abdomen. The greater curvature (left side) of the stomach is dissolved through the dissection of the gastrocolic and gastrosplenic ligaments from the vasa gastricae breves using a sealing device. Then, gastric dissection along the greater curvature starts approximately 2−6 cm proximal to the pylorus and extends to the diaphragm. Using a calibrating bougie as a sizer (32−44 French), a narrow, tubular sleeve stomach with the size and shape of a banana is created (Figure 2). This residual gastric tube limits the gastric reservoir to 60−100 milliliters. Gastric resection is performed using linear staples to create a staple line. The gastric resect is removed through an extended trocar incision. The technical aspects of LSG (e.g., the size of the sleeve, the distance of the pylorus, and the size of the calibrating bougie) may vary. However, there is no clear evidence indicating the superiority of any particular technical approach (Shi et al., 2010; Kissler & Settmacher, 2013; Ordemann, Elbelt, & Menenakos, 2014; Runkel & Brydniak, 2016).

The minimally invasive technique reduces perioperative morbidity by reducing blood loss, hospital stays, and wound complication rates (Nguyen et al., 2001). For LSG, the rates of peri- and postoperative mortality (0.2−0.4%), early (≤ 30 days) and late (≥ 30 days) complications (5.5−7.7%), and re-operations (3.1%) are lower than those of other, more complex bariatric surgical procedures, such as Roux-en-Y gastric bypass and biliopancreatic diversion (Castagneto Gissey, Casella Mariolo, & Mingrone, 2016). However, LSG is irreversible; risks and complications after LSG include postoperative hemorrhage, staple line leakage (Shi et al., 2010), and reflux esophagitis (Runkel & Brydniak, 2016). Furthermore, surgically induced rapid weight loss can cause excess skin flaps, which may require plastic surgery. Care must be taken to adjust drug therapies for comorbidities (e.g., insulin, antihypertensive or psychiatric medication). Additionally, long-term nutritional deficiencies (e.g., anemia, bone demineralization, and hypoproteinemia) may occur after surgery, and patients may require lifelong vitamin/nutritional supplementation to prevent skin changes and hair loss, for example (Manzoni & Weber, 2015). Lifelong postoperative medical monitoring of bariatric surgery patients is strongly recommended to ensure ongoing treatment success (Kissler & Settmacher, 2013; Hauner et al., 2014; Runkel & Brydniak, 2016).

1.5.2.3. Indication and contraindication criteria for bariatric surgery

According to the current evidence-based German guidelines regulating eligibility for obesity-related surgery (Runkel et al., 2011; Hauner et al., 2014), bariatric surgery is generally indicated in patients with a BMI ≥ 40 kg/m² or for those with a BMI ≥ 35 kg/m² and significant obesity-related somatic comorbidity. Bariatric surgery is considered after appropriate multimodal conservative treatment has failed and/or when efforts appear futile due to the severity of the obesity (e.g., BMI ≥ 50 kg/m²) and related diseases (e.g., physical immobility or extremely high amounts of insulin required to treat T2DM). Conservative treatment options have failed when a substantial weight loss of > 10% of the initial weight and the control of obesity-related comorbidity have not been achieved within at least six cumulative months of treatment in the last two years. Bariatric surgery is usually recommended for adult patients ranging in age from 18−65 years; however, lower (< 18 years) or higher age (> 65 years) is not a contraindication per se. The indication for bariatric surgery should be individually justified based on the patient's medical condition in light of acceptable surgical risks and potential complications. The patient must be psychologically and socially stable, motivated, and fully informed about the surgical procedure and alternative treatment options, late effects, morbidity, and mortality; furthermore, he or she must be committed to lifestyle modification and must comply with long-term medical treatment and after-care, such as lifelong vitamin/nutritional supplementation and postbariatric plastic surgery. In the absence of contraindications, the preference of the informed patient should be considered during the treatment selection process. There are no absolute contraindications for bariatric surgery; however, the expected benefits must outweigh the risks. Relative contraindications include severe chronic somatic diseases that present a high perioperative risk and may worsen after bariatric surgery due to an altered catabolic metabolism. Additionally, bariatric surgery is often considered contraindicated in unstable or untreated patients with severe mental disorders, such as schizophrenia with active psychosis, emotionally unstable personality disorder, bulimia nervosa, drug or alcohol abuse/dependence, suicidality, and mental retardation, which potentially cause compliance problems; furthermore, bariatric surgery may not be appropriate for patients with impaired intellectual ability and a lack of comprehension of the risks and benefits, expected outcomes, and mandatory lifestyle changes associated with the procedure (de Zwaan, Wolf, & Herpertz, 2007; Müller, Herpertz, & de Zwaan, 2012). Female candidates for bariatric surgery must not be pregnant or lactating, and a pregnancy should not be planned within two years after bariatric surgery (Kissler & Settmacher, 2013). Screening of surgical candidates to ensure appropriate selection is a critical responsibility of the surgeon and the supporting multidisciplinary health care team.

These BMI-centered patient selection criteria for bariatric surgery were first established in 1991 by the U.S. National Institutes of Health Consensus Conference Panel on Gastrointestinal Surgery for Severe Obesity (NIH, 1991) and have subsequently been adopted by all major surgical societies. One must bear in mind that the great majority of surgical experience and scientific evidence acquired in past years relate to patients who were selected using these arbitrarily chosen criteria.

1.5.2.4. Effectiveness: conservative versus surgical weight loss treatment

The medical effectiveness of bariatric surgery has been confirmed beyond doubt. A recent systematic review of seven randomized controlled trials comparing surgical interventions with conservative management for obesity concluded that bariatric surgery results in superior weight loss outcomes and greater improvements in weight-associated comorbidities and HRQoL at one to two years of follow-up. No deaths occurred; however, the rate of serious adverse events ranged from 0−37% in the surgically treated (ST) groups and 0−25% in the conservatively treated (CT) groups. Between 2% and 13% of ST-patients required re-operation (Colquitt, Pickett, Loveman, & Frampton, 2014). The long-term results remain less clear and suggest decreasing benefits over time.

The Swedish Obese Subjects (SOS) study, which started in 1987, is one of the first and largest long-term, prospective, matched-pair trials to provide information on the effects of bariatric surgery for obesity, including overall mortality and control of comorbidities. Conservative standard treatment (2,037 participants) ranging from sophisticated lifestyle intervention to no specific weight loss treatment at all was compared with bariatric surgery (2,010 participants) of various types (19% gastric banding, 68% vertical banded gastroplasty, and 13% gastric bypass). In the three ST-subgroups, the maximum mean weight loss was achieved after one to two years and was between 20% and 32%, depending on the type of surgery. Weight regain was observed in all ST-subgroups in subsequent years, although the weight regain curves leveled off after eight to 10 years. After 15 years, weight losses were between 13% and 27% below the baseline weight, depending on the type of surgery. In the CT-group, the average weight change remained within ± 3% throughout the entire observation period. After bariatric surgery, the remission of T2DM was very high, with a rate of 72% at the 2-year follow-up; however, of these patients, 50% relapsed after 10 years. Compared with conservative standard treatment, bariatric surgery was associated with a long-term reduction in overall mortality of 30% and lower incidences of diabetes mellitus, myocardial infarction, stroke, and cancer. A maintained weight loss of 10−30% was required to

maintain the effects of surgery on risk factors. Over 10 years, HRQoL was significantly more improved in the ST-group than in the CT-group (Sjöström, 2013).

These findings indicate that bariatric surgery is the most effective option at present for treating morbid obesity. It offers sustained favorable effects on clinically significant weight loss outcomes of up to 80% of excess weight at two years or more after surgery, the remission of obesity-related comorbidity, reduced mortality and improved HRQoL compared with conservative interventions, regardless of the type of surgical procedure used (Maggard et al., 2005; Karlsson et al., 2007; Sjöström, 2008; Buchwald et al., 2009; Chang et al., 2014; Colquitt et al., 2014). However, bariatric surgery should be considered a “stepping stone”, and patients must be prepared to make comprehensive lifestyle changes.

1.5.2.5. Bariatric surgery in numbers

The rather young field of bariatric surgery has expanded exponentially as a consequence of the rapid increase of obesity. A recent report states that an estimated 468,609 bariatric surgical procedures were performed worldwide in 2013, compared with approximately 40,000 surgeries in 1997 (Angrisani et al., 2015). The U.S./Canada had the highest number of bariatric operations (154,276). The most commonly performed procedure throughout the world was Roux-en-Y gastric bypass (45%), followed by LSG (37%), and gastric banding (10%). Most significant was the increase in the number of LSG surgeries from 0% to 37% of all procedures performed between 2003 and 2013 (Angrisani et al., 2015).

In Germany, the number of bariatric operations has also increased rapidly in recent years (Stroh et al., 2013). In 2013, a total of 7,126 bariatric surgical procedures were performed in 124 bariatric centers in Germany, indicating that approximately 0.01% of the German population underwent bariatric surgery in 2013. This percentage appears extremely low given that 1−3% of the German population has morbid obesity (BMI ≥ 40 kg/m²) (Mensink et al., 2013) and would qualify for surgical weight loss treatment. This may be at least partly explained by the restricted access to bariatric surgery in the German health care system and by reservations on the patient side. While different bariatric surgical procedures are available, LSG is currently the most frequently performed in Germany, accounting for 46% of all bariatric surgical procedures (Angrisani et al., 2015).

1.6. Psychological evaluation before bariatric surgery

Given the multifactorial etiology of obesity, surgical weight loss treatment requires prior multidisciplinary evaluation and diagnostics, including medical and psychological assessments and nutritional consultation for patients seeking bariatric surgery. The clinical guidelines (Runkel et al., 2011; Hauner et al., 2014) recommend evaluation by a multidisciplinary team specialized and experienced in the management of obesity, that is, a dietician, surgeon, endocrinologist, and clinical psychologist, psychiatrist, or physician specialized in psychosomatic medicine who work together at a certified center for metabolic and bariatric surgery. Other disciplines should be involved depending on the patient's comorbidities (Runkel et al., 2011). The preoperative medical evaluation includes a physical examination; laboratory tests; assessments of current symptoms, medical history, comorbidities, and medication; and a differential diagnosis of secondary causes of obesity. In addition, a detailed history of nutrition and physical activity as well as weight gain and loss, including previous weight reduction attempts, is taken. Importantly, indications and contraindications for bariatric surgery are determined, and patients (and their relatives) are educated regarding the risks and benefits of the surgical intervention (Kissler & Settmacher, 2013; Hauner et al., 2014). A nutritional consultation includes the assessment of the patient's nutritional status, the preparation of a postoperative dietary plan, and education regarding good nutrition and potential nutritional complications after surgery.

The psychological evaluation is highly relevant due to the high prevalence rates of mental disorders among bariatric surgery candidates (LeMont, Moorehead, Parish, Reto, & Ritz, 2004; Müller et al., 2012). Studies employing diagnostic interviews have consistently demonstrated that among obese patients seeking bariatric surgery treatment, 20−60% have a current mental disorder (Sarwer et al., 2004; Kalarchian et al., 2007; Mühlhans, Horbach, & de Zwaan, 2009; de Zwaan et al., 2011), and up to 73% have a lifetime history of mental disorders (Glinski, Wetzler, & Goodman, 2001; Mühlhans et al., 2009), with depression and anxiety disorders and eating disorders being the most prevalent. The greatest risk of comorbid mental conditions has been found in patients with more severe obesity (Wadden et al., 2006; Kalarchian et al., 2007) as the prevalence of mental disorders increases with increasing BMI (Baumeister & Härter, 2007). To date, it remains unclear whether these findings primarily indicate that the more severe forms of obesity cause significant psychological distress or that individuals with severe distress are more likely to consider surgical treatment (Wimmelmann et al., 2014).

Recommendations for the psychological evaluation of patients with obesity who seek bariatric surgery are outlined by Herpertz and de Zwaan (2015) and include the assessment of the psychological and psychosocial status, mental disorders, eating behavior, weight and dieting history, coping behavior, social support, and resources as well as the patient's motivation, compliance, and expectations regarding the surgical outcomes. Additionally, the use of structured interviews and self-report measures has been encouraged (Peterson, Berg, & Mitchell, 2011). However, a number of studies have highlighted the lack of standardization and the wide variation in assessment methods, outcome decisions, and recommendations (Bauchowitz et al., 2005; Fabricatore, Crerand, Wadden, Sarwer, & Krasucki, 2006; Walfish, Vance, & Fabricatore, 2007). The current consensus is that the purpose of the preoperative psychological evaluation is to identify suitable (and unsuitable) bariatric surgery candidates based on indication and contraindication criteria and to address psychosocial challenges and psychological risk factors that may jeopardize the success of the surgical treatment (Sogg & Mori, 2009; Sogg, Lauretti, & West-Smith, 2016). The presence of a comorbid mental disorder is not a contraindication for surgery per se if the disorder is adequately treated, controlled, and well managed. However, in- or outpatient psychotherapy may be indicated prior to bariatric surgery or throughout the bariatric pathway if a relevant mental disorder, including eating disorders, is present and requires treatment. Furthermore, surgical candidates (and their relatives) are given information regarding the extent and consequences of the surgical intervention to ensure that they undertake the necessary lifestyle modifications to prepare for the intervention and that they form realistic expectations (e.g., that the surgery is not a simple "one-stop" solution or a "quick fix" for rapid weight loss) (Kissler & Settmacher, 2013).

Psychological difficulties across the bariatric surgery pathway can be categorized as either pre-existing difficulties, which are specifically related to the behavior changes required for bariatric surgery, or the postoperative development of new difficulties or reactivation of pre-existing difficulties (Ratcliffe et al., 2014). All of these may impair the success of surgical treatment and may lead to suboptimal weight loss and weight regain after bariatric surgery. Although a psychological evaluation is required by German health care insurance providers prior to surgical intervention, no consistent psychological predictors have been identified in systematic reviews and meta-analyses (Herpertz, Kielmann, Wolf, Hebebrand, & Senf, 2004; van Hout, Verschure, & van Heck, 2005; Adams, Salhab, Hussain, Miller, & Leveson, 2013; Wimmelmann et al., 2014). Thus, conclusive empirical evidence regarding the influence of psychological factors on postoperative outcomes is still lacking.

1.7. Aims of the dissertation and research questions

This dissertation aims to investigate the psychological factors that may impact and arise from bariatric surgery. The goal is to gauge how these factors might be identified and assessed to both optimize prebariatric screening and patient selection and improve the surgical treatment of obesity by identifying underlying psychopathological mechanisms. This in turn might facilitate the development of tailored psychotherapeutic interventions throughout the bariatric surgery pathway to secure and maintain treatment success. To date, research on the psychological and psychosomatic aspects of bariatric surgery for the treatment of obesity in adults has mainly focused on surgical procedures, such as gastric banding, vertical banded gastroplasty, and Roux-en-Y gastric bypass, while research on LSG is scarce. As outlined in paragraph 1.5.2., LSG is a restrictive, single-stage procedure that is relatively new in the field of bariatric surgery but has been gaining popularity due to its efficacy for weight reduction and its low surgical and nutritional risks (Zhang et al., 2015). However, although the number of LSG procedures performed has increased considerably (Stroh et al., 2013; Angrisani et al., 2015; American Society for Metabolic and Bariatric Surgery [ASMBS], 2016), reliable data on the effects of LSG on psychological and psychosomatic variables are still lacking. Therefore, the present research project focused mainly on the bariatric surgical procedure of LSG. Figure 3 depicts the research model and Figure 4 presents a comprehensive overview of the study population and the research questions of the four studies, which will be explained in detail in the following sections.

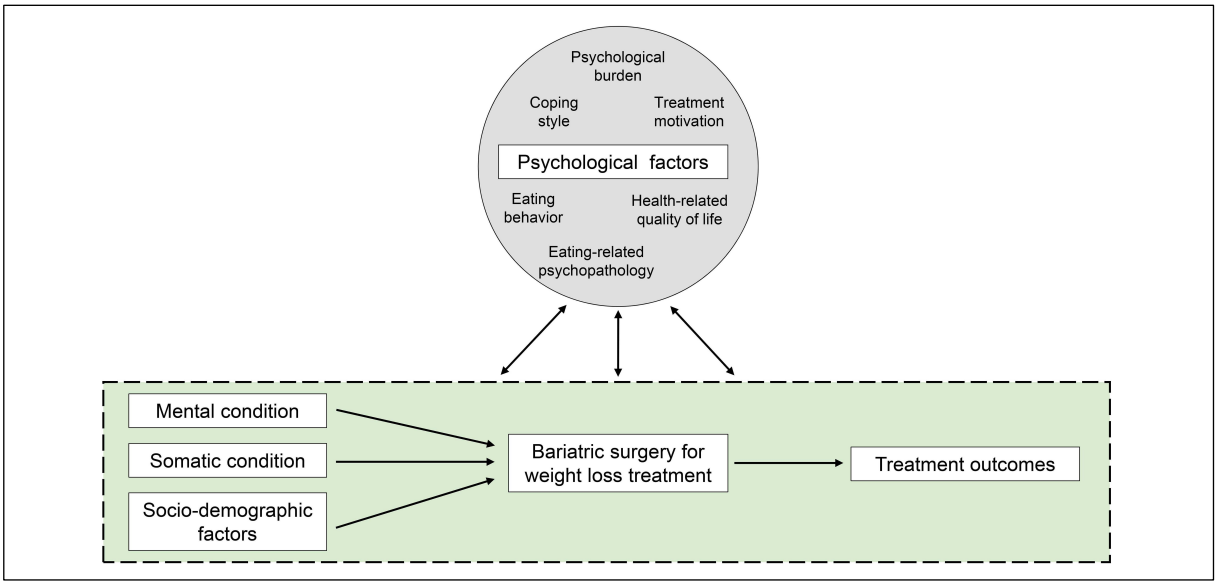

Figure 3. Illustration of the research model of the present dissertation.

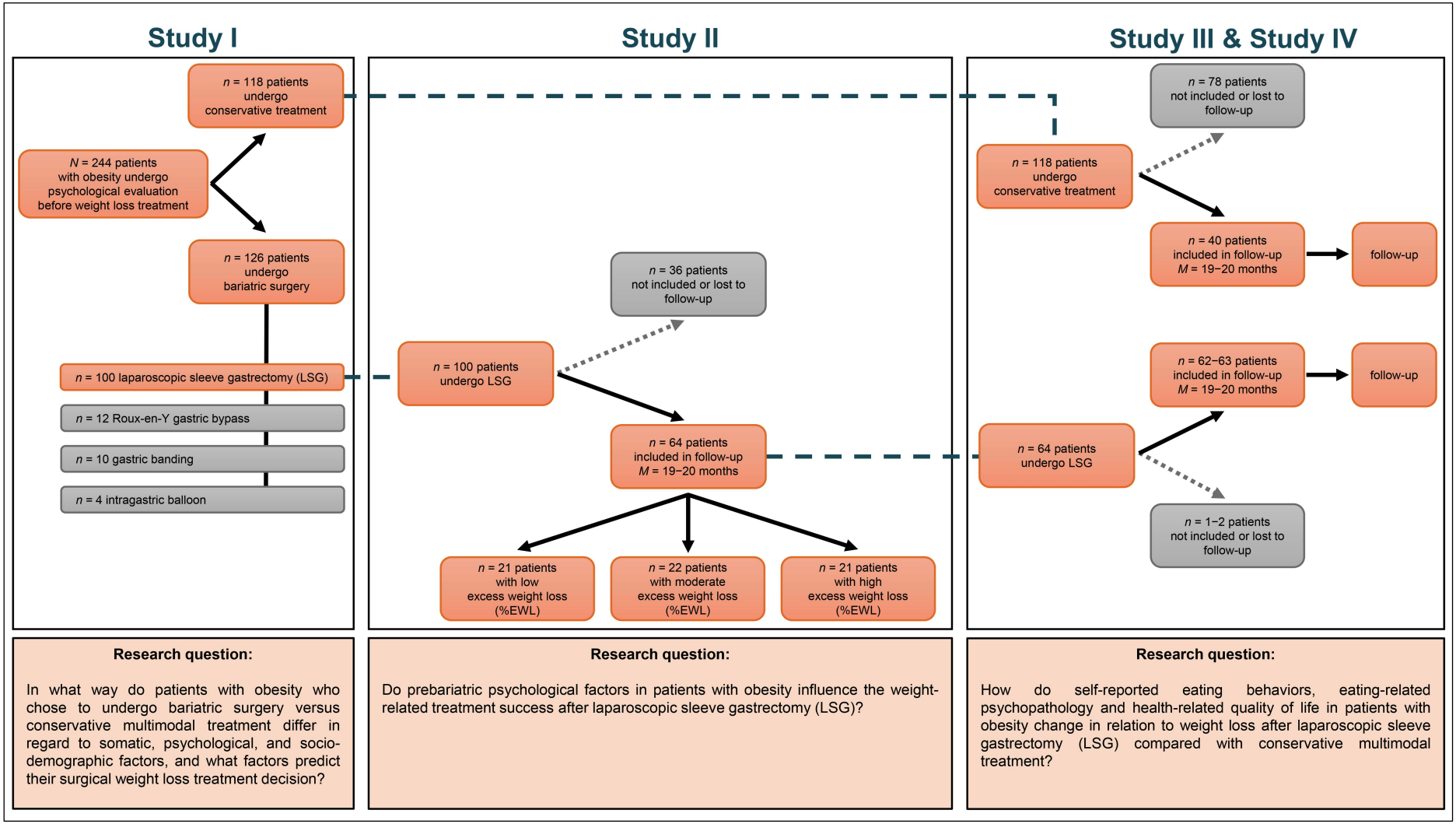

Figure 4. Comprehensive overview of the study population and the research questions of the four studies.

1.7.1. First research question: Study I

In what way do patients with obesity who chose to undergo bariatric surgery versus conservative multimodal treatment differ in regard to somatic, psychological, and socio-demographic factors, and what factors predict their surgical weight loss treatment decision?

Reversing or reducing obesity for the long-term once it has occurred has been a challenging and often frustrating medical endeavor, and bariatric surgery has offered the best results to date. Nevertheless, bariatric surgery is not without risks and is neither suitable for nor desired by all obese individuals; thus, the availability of effective noninvasive weight loss treatment may provide a vital alternative. In addition to somatic criteria (e.g., BMI and obesity-related comorbidity), psychological factors may affect the choice of treatment and influence the course of disease. Only few previous studies have analyzed psychological parameters in obese patients who underwent either conservative treatment or bariatric surgery, and identified that seeking surgical treatment was associated with, for example, higher BMI, younger age, higher levels of distress and general psychopathology, lower perceived health status, and greater psychosocial impairments as well as dysfunctional coping strategies (Karlsson, Sjöström, & Sullivan, 1998; Rydén et al., 2001; Rydén et al., 2004; Karlsson et al., 2007; de Man Lapidoth, Ghaderi, & Norring, 2008; Gradaschi et al., 2013). However, most of these studies did not control for BMI or obesity-related comorbidity, which may have played a causal role in the observed differences. Hence, the existing literature on the distinction between CT-patients and ST-patients with obesity and the predictive value of psychological, socio-demographic, and somatic factors for the choice of treatment is far from conclusive.

Study I aimed to 1) investigate whether obese patients who underwent a surgical treatment differed in a wide range of psychological factors from those who opted for a conservative treatment program, regardless of their somatic conditions; and 2) examine predictors of treatment choice.

1.7.2. Second research question: Study II

Do prebariatric psychological factors in patients with obesity influence the weight-related treatment success after LSG?

As stated earlier, bariatric surgery, including LSG, is considered the most effective long-term treatment for the majority of morbidly obese patients. However, the generally positive results of bariatric

surgical treatment have also been questioned. Previous research has shown that the amount of weight loss among patients after surgery varies greatly (Beck, Mehlsen, & Støving, 2012b; Ochner, Jochner, Caruso, Teixeira, & Pi-Sunyer, 2013), and a substantial minority of approximately 15−20% of all ST-patients fail to achieve adequate weight loss (Maggard et al., 2005; Snyder, Nguyen, Scarbourough, Yu, & Wilson, 2009). Surprisingly, little is known about the factors that promote or hinder postoperative weight loss, and reliable predictors are still lacking. Psychological factors may influence the success of surgical treatment. Obese patients with comorbid mental conditions may have difficulties adjusting to the lifestyle changes required to benefit from surgical intervention (Walfish et al., 2007). However, previous studies have shown controversial results regarding the predictive value of preoperative depression and anxiety disorder for postoperative weight loss outcomes (Averbukh et al., 2003; Dixon, Dixon, & O'Brien, 2003; Legenbauer et al., 2009). A more recent study that employed structured clinical interviews (de Zwaan et al., 2011) and a systematic review (Herpertz et al., 2004) both found evidence that the severity of psychological symptoms rather than the specific type of mental disorder influenced surgical treatment success; that is, a greater overall mental health burden was associated with less weight loss after bariatric surgery. Furthermore, the coping strategies used when confronting difficult situations in daily life and the motivation to undergo weight loss surgery may also be related to differences in weight loss outcomes (Claes, Vandereycken, Vandeputte, & Braet, 2013; Ahnis et al., 2015). Maladaptive coping behavior may complicate postbariatric weight loss; however, related research is scarce, and clear associations have not been established yet. To date, no studies have systematically assessed the relationship between postoperative weight loss and preoperative psychological burden (as a broader construct comprising the severity of perceived stress, depression, anxiety, and mental impairment), coping style and motivation to undergo weight loss surgery in a clinical sample of LSG-patients. Hence, assessing a broad range of preoperative patient characteristics appeared useful for identifying homogeneous subgroups of LSG-patients with different needs to tailor interventions and optimize postoperative weight loss outcomes and well-being.

Study II aimed to evaluate the role of preoperative psychological burden, coping style, and motivation to undergo weight loss surgery in determining postoperative weight-related treatment success after LSG. Therefore, the main aim of Study II was to characterize patients with low, moderate, and high postoperative weight loss outcomes retrospectively using between-group comparisons to examine whether LSG-patients with different levels of weight loss after surgery differed preoperatively in terms of their psychological burden, coping style, and treatment motivation.

1.7.3. Third research question: Study III

How do self-reported eating behaviors in patients with obesity change in relation to weight loss after LSG compared with conservative multimodal treatment?

Both physiological and psychological factors may be important to the success of bariatric surgery and may also contribute to postoperative differences in weight-related outcomes. Potential underlying mechanisms include a combination of gastrointestinal effects (e.g., altered concentration and signaling of meal-stimulated gut hormones), metabolic-systemic effects (e.g., increased energy expenditure), restrictive respective malabsorptive effects (e.g., reduced food intake and reduced absorption of calories and nutrients), and behavioral changes (e.g., altered eating behaviors) (Lutz & Bueter, 2014). Specifically, the extent of pathologic pre- and postoperative eating patterns is thought to be a predictor of the course of weight changes after surgery (Kalarchian et al., 2002; Colles, Dixon, & O'Brien, 2008; Sarwer et al., 2008; White, Kalarchian, Masheb, Marcus, & Grilo, 2010; Meany, Conceicao, & Mitchell, 2014). Few studies have investigated the effects of LSG on the three dimensions of eating behavior (i.e., cognitive restraint, disinhibition, and hunger) using the Three-Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985; Pudel & Westenhöfer, 1989). For example, Langer et al. (2008) and Rieber et al. (2013) found marked improvements in self-reported eating patterns after LSG accompanied by substantial weight reductions in small samples of 15 and 40 patients at six and 12 months of follow-up. However, reliable data on the longer-term benefits of LSG compared with conservative treatment options, such as lifestyle modification, on eating behavior and weight loss are still lacking.

Study III aimed to 1) investigate self-reported changes in three dimensions of eating behavior after LSG using the TFEQ by assessing and comparing preoperative data with postoperative data collected in the second follow-up year; 2) compare the self-reported eating behaviors of LSG-patients with data from a CT control group over the same follow-up period after the completion of a 1-year multimodal outpatient weight reduction group program; and 3) evaluate the extent to which potential changes in eating behaviors after LSG or conservative treatment were associated with weight loss outcomes. The main aims of Study III were to confirm previous findings (Langer et al., 2008; Rieber et al., 2013) and overcome previous shortcomings by using a controlled design, a larger sample size, and a longer follow-up period (during which weight loss tended to cease) than the aforementioned studies.

1.7.4. Fourth research question: Study IV

How do self-reported eating-related psychopathology and HRQoL in patients with obesity change in relation to weight loss after LSG compared with conservative multimodal treatment?

Although there is considerable agreement that obesity is associated with disordered eating habits (Malik, Mitchell, Engel, Crosby, & Wonderlich, 2014) and poor quality of life (Kolotkin, Meter, & Williams, 2001; Wadden et al., 2007), the differential effects of bariatric surgical procedures are not well studied. Very few studies have investigated the effects of vertical banded gastroplasty and Roux-en-Y gastric bypass on eating-related psychopathology using the Eating Disorder Inventory (EDI; Garner, Olmstead, & Polivy, 1983; Paul & Thiel, 2005) questionnaire. A cross-sectional study with a sample of 45 postbariatric patients found increased eating-related psychopathology that was negatively correlated with weight loss at approximately 24 months after Roux-en-Y gastric bypass in comparison with a nonmatched norm group (Beck et al., 2012b). In contrast, longitudinal studies with 6-month follow-up intervals (Leombruni et al., 2007; Matini, Ghanbari Jolfaei, Pazouki, Pishgahroudsari, & Ehtesham, 2014) have identified significant improvements in eating-related psychopathology in samples of 67 and 38 patients who underwent Roux-en-Y gastric bypass (Matini et al., 2014) and vertical banded gastroplasty (Leombruni et al., 2007), respectively. Furthermore, regarding HRQoL as assessed with the Short Form Health Survey (SF-36; Ware & Sherbourne, 1992; McHorney, Ware, & Raczek, 1993), the physical component of HRQoL improved after Roux-en-Y gastric bypass, whereas the mental component did not change (Matini et al., 2014). Nevertheless, reliable data on the longer-term beneficial effects of LSG on eating-related psychopathology and HRQoL are still lacking. In fact, not every patient with morbid obesity is motivated to undergo bariatric surgery, and given that recent studies have demonstrated post-LSG weight regains of up to 75% of the initial weight loss after five years of follow-up (Braghetto et al., 2012), further research comparing surgical and conservative treatment is needed to identify underlying psychopathological mechanisms and optimize the treatment of obesity to secure weight loss and improve health-related outcomes and well-being.

Study IV aimed to 1) investigate self-reported changes in eating-related psychopathology and HRQoL, using the EDI and SF-8 questionnaires, respectively, in patients who underwent LSG by assessing and comparing preoperative data with postoperative data collected in the second follow-up year; 2) compare the self-reported eating-related psychopathology and HRQoL of LSG-patients with data from a CT control group for the same follow-up interval after the termination of a 1-year multimodal

outpatient weight reduction group program; and 3) evaluate the extent to which potential changes in eating-related psychopathology and HRQoL after LSG or conservative treatment were associated with weight loss outcomes. Study IV is the first longitudinal study to examine the effect of LSG on these outcome measures using a control group design for the direct comparison of outcomes across different weight loss interventions.

1.7.5. Study setting and design

The following four original observational studies were conducted in a naturalistic clinical setting and employed prospective and retrospective study designs. As part of the routine comprehensive evaluation for bariatric surgery or conservative treatment at the multidisciplinary Obesity Center, which includes the Department of Bariatric Surgery, the Department of Endocrinology and Metabolic Diseases, and the Department of Psychosomatic Medicine of the university hospital Charité−Universitätsmedizin Berlin in Germany, patients with obesity who sought weight loss treatment were assessed by an experienced clinical psychologist or a physician specialized in psychosomatic medicine. A semi-structured diagnostic interview was performed for the psychosocial assessment, psychological evaluation, and diagnosis of mental disorders, including eating disorders, according to the International Classification of Diseases (ICD-10; WHO, 2010). Additionally, tablet PCs were used to administer psychometric measurements in the form of well-established standard self-rating questionnaires. Further medical evaluations were conducted by a surgeon and an endocrinologist.

1.7.6. Interventions

Treatment recommendations for bariatric surgery or a conservative 1-year multimodal outpatient weight reduction group program and the assignment of patients to one of the two intervention groups were based on inclusion and exclusion criteria established in accordance with the evidence-based German guidelines for the treatment of obesity (Hauner et al., 2007; Runkel et al., 2011; Hauner et al., 2014) and the advice of medical professionals. Additionally, patient preference was considered; that is, the patient could choose to either undergo bariatric surgery or enter the conservative treatment program. Please refer to chapter 1.5. for the general indication and contraindication criteria for surgical and conservative weight loss treatment for obesity and to the individual original studies' manuscripts for

detailed descriptions of the interventions applied in each study. All patients received regular medical follow-up examinations to monitor their health status.

1.7.7. Participants

For the present studies, a medical database was used to identify patients who underwent either bariatric surgery or the conservative 1-year multimodal outpatient weight reduction group program between February 2009 and August 2012 and who completed the psychological evaluation and psychometric assessment prior to the weight loss interventions. The patients were then contacted for a psychological follow-up assessment, which was conducted by two clinical psychologists (A. Ahnis and A. Figura for the CT-patients and A. Figura for the ST-patients). They were scheduled for an assessment at least one year after the termination of the weight loss intervention, when initial weight loss stabilization could be assumed, particularly for the bariatric surgery patients. In accordance with previous research, it was assumed that the impact of the surgery on weight loss could reduce the impact of psychological factors during the first postoperative months. The surgical effect usually began to abate one year postoperatively; therefore, the influence of psychological factors was expected to become more evident with longer-term follow-ups (Rutledge, Groesz, & Savu, 2011b; Wimmelmann et al., 2014). The sample sizes of the four studies were 244 (Study I), 64 (Study II), 102 (Study III), and 103 (Study IV) and comprised mostly female patients with obesity (BMI ≥ 30 kg/m²). The patients' ages ranged from 17−72 years. The two psychological assessment points occurred before (T0) and, on average, 19−20 months after the surgical or conservative weight loss intervention (T1). Regarding the longitudinal pre-post studies, Studies II−IV, there was an attrition rate of 29−30% among the patients who underwent LSG and of 34% among the patients who completed the conservative weight reduction program at the follow-up assessment; the reasons for attrition included incomplete data, declining to participate, and inability to be reached. Please refer to the original manuscripts for detailed attrition analyses. The studies were approved by the local Institutional Review Board, and written informed consent for the scientific use of the data was obtained from all participants included in the four studies. Study participation was independent of the medical care provided.

1.7.8. Measures

Table 2 presents a comprehensive overview of the measures that were used in the four studies. Please refer to the original manuscripts for more detailed descriptions of the applied measures.

Table 2. Overview and description of the central measures used in the four studies

Parameter	Assessment/ questionnaire	Description/ formula	Study	Point of assessment [a]
Socio-demographic factors	SOZ, Questionnaire on socio-demographic characteristics	Seventeen items assessing, e.g., age, sex, education level, marital status, occupational status	I–IV	T0
Weight, BMI	Extracted from the medical database, recorded by nursing staff, or patient-reported	Body weight (kg), height (cm), and BMI (kg/m²)	I–IV	T0, T1
Weight loss	Excess weight loss, percentage (%EWL) [b]	[(Weight loss between T0 and T1) / (excess weight at T0)] x 100	II–IV	T1
	Total weight loss, percentage (%TWL)	[(Weight loss between T0 and T1) / (weight at T0)] x 100	II–IV	T1
Comorbidities	Clinical diagnosis	Obesity-related somatic disorders and mental disorders, including eating disorders	I–III	T0
Health care	Ad hoc questionnaire	Health care utilization	I	T0
Psychotherapy	Ad hoc questionnaire	Use of psychotherapy	I, II	T0
Physical complaints	GBB-24, Giessen Subjective Complaints List (Brähler, Scheer, & Hinz, 2008) *German: Gießener Beschwerdebogen*	Twenty-four items assessing the degree of subjective physical complaints on four scales: exhaustion, upper abdominal, limb, and heart complaints	I	T0
Mood	BSF, Berlin Mood Questionnaire (Hörhold & Klapp, 1993) *German: Berliner Stimmungsfragebogen*	Thirty items on six scales assessing negative mood: tiredness, apathy, anxious-depressive mood, and anger; and positive mood: involvement and elated mood	I	T0
Resources	SWOP, Questionnaire for Self-Efficacy, Optimism, and Pessimism (Scholler, Fliege, & Klapp, 1999)	Nine items assessing the patient's self-efficacy, optimism, and pessimism on three independent scales	I	T0
	SOC-9, Sense of Coherence Scale (Schumacher, Wilz, Gunzelmann, & Brähler, 2000)	Nine items assessing the patient's sense of coherence	I	T0

(continued)

Table 2. Overview and description of the central measures used in the four studies (continued)

Parameter	Assessment/ questionnaire	Description/ formula	Study	Point of assessment [a]
Perceived stress	PSQ-20, Perceived Stress Questionnaire (Levenstein et al., 1993; Fliege et al., 2005)	Twenty items assessing the level of subjectively experienced stress reactions (worries, tension, and joy) and the perception of nonspecific external stressors (demands) on four scales and generating the overall index score of perceived stress	I, II	T0
Depression	PHQ-9, Patient Health Questionnaire Depression Scale (Spitzer, Kroenke, & Williams, 1999; Löwe, Spitzer, Zipfel, & Herzog, 2002)	Nine items assessing the symptom severity of depression according to the DSM-IV	I, II	T0
Anxiety	GAD-7, Generalized Anxiety Disorder 7-Item Scale (Spitzer, Kroenke, Williams, & Löwe, 2006; Löwe et al., 2008)	Seven items assessing the symptom severity of generalized anxiety disorder according to the DSM-IV	II	T0
Mental impairment	ISR, ICD-10-Symptom-Rating (Tritt et al., 2008)	Twenty-nine items assessing psychological symptoms/ syndromes according to the ICD-10 on five scales: depressive syndrome, anxiety syndrome, obsessive-compulsive syndrome, somatoform syndrome, and eating disorder syndrome, and indicating the overall severity of mental impairment	I, II	T0
Coping style	Brief COPE Questionnaire (Carver, 1997; Knoll, Rieckmann, & Schwarzer, 2005)	Twenty-eight items assessing coping behavior in difficult situations on four scales: seeking support, positive reframing, avoidant coping, and active coping	I, II	T0
Motivation to lose weight	Ad hoc questionnaire	Ten items assessing how strongly patients were self-motivated or motivated by their social or treatment environment to lose weight	II	T0
Eating behavior	TFEQ, Three-Factor Eating Questionnaire (Stunkard & Messick, 1985; Pudel & Westenhöfer, 1989) *German: Fragebogen zum Essverhalten*	Fifty-one items assessing self-reported psychological-behavioral components of eating on three scales: cognitive restraint, disinhibition, and hunger	III	T0, T1

(continued)

Table 2. Overview and description of the central measures used in the four studies (continued)

Parameter	Assessment/ questionnaire	Description/ formula	Study	Point of assessment [a]
Eating-related psychopathology	EDI, Eating Disorder Inventory (Garner et al., 1983; Paul & Thiel, 2005)	Sixty-four items assessing the severity of self-reported disordered eating attitudes and behaviors and personality traits on eight scales: drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, and maturity fears	IV	T0, T1
Health-related quality of life (HRQoL)	SF-8, Short Form Health Survey (Ware & Sherbourne, 1992; McHorney et al., 1993; Ware, Kosinski, Dewey, & Gandek, 2001)	Eight items assessing HRQoL in regard to perceived physical and mental health	IV	T0, T1

Note. T0, before weight loss intervention. T1, after weight loss intervention. BMI, body mass index. DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. ICD-10, International Classification of Diseases, 10th Revision.

[a] The first psychological assessment occurred, on average, eight months before the weight loss intervention. Weight and BMI were re-assessed on the day of surgery or on the day the conservative treatment program started.

[b] Excess weight is calculated in relation to a BMI of 25 kg/m² as this is recognized as the lowest limit of overweight (Deitel & Greenstein, 2003; Oria et al., 2005).

2. Research approaches and summaries of the four studies

In this chapter, a brief summary of the objectives, methods, and main findings, including interpretations, of each research study will be presented. A comprehensive discussion of the results of all studies will be provided in chapter 3.

2.1. Study I: Surgically and conservatively treated obese patients differ in psychological factors, regardless of body mass index or obesity-related comorbidities: a comparison between groups and an analysis of predictors

Ahnis, A., Figura, A., Hofmann, T., Stengel, A., Elbelt, U., & Klapp, B. F. (2015). Surgically and conservatively treated obese patients differ in psychological factors, regardless of body mass index or obesity-related co-morbidities: a comparison between groups and an analysis of predictors. *PLoS ONE, 10*(2), e0117460.

2.1.1. Objective

To treat obesity, both conservative and surgical procedures are available (Hauner et al., 2014). Psychological factors are likely to influence the choice of treatment; however, few systematic studies have investigated these factors. The present study 1) investigated whether obese patients who underwent a surgical treatment differed in a wide range of psychological features from those who underwent a conservative treatment, regardless of their somatic conditions; and 2) examined the predictors of treatment choice.

2.1.2. Methods

In this study, a sample of 244 patients with obesity (mean age 44 years, 77.5% females) with a mean BMI of 45 ± 9 kg/m² underwent weight loss treatment. Of these patients, 126 underwent bariatric surgery (i.e., intragastric balloon, gastric banding, LSG, or Roux-en-Y gastric bypass), and 118 received conservative treatment, that is, a 1-year multimodal outpatient weight reduction group program that included dietary advice, physical exercise, psychoeducation, cognitive-behavioral therapy, training in Jacobson's progressive muscle relaxation, and social group support. The interventions occurred twice weekly for 2.5 hours during the first six months and once weekly for 2.5 hours during the second 6-month period. Data analysis was based on baseline data collected prior to the weight loss treatment. Statistical analyses included group comparisons using the independent-samples t-test, chi²-test, and ANCOVA to control for BMI and obesity-related comorbidities. Logistic regression models were calculated for the analysis of the predictors. Please refer to the original manuscript for a more detailed description of the methods.

2.1.3. Main results and interpretation

Study I generated the following main findings: First, ST-patients and CT-patients differed in socio-demographic, somatic, and psychological factors prior to their respective weight loss interventions. Patients who underwent bariatric surgery were significantly younger, were more often male, had a lower education level (i.e., nontertiary education) and were more often unemployed, possibly due to work-related disability caused by more severe obesity (Lehnert et al., 2015).

Regarding somatic factors, as expected, patients who underwent bariatric surgery had a higher baseline BMI (i.e., mean BMI of 50 ± 8 kg/m² in ST-patients versus mean BMI of 40 ± 7 kg/m² in

CT-patients), and a higher incidence of obesity-related comorbidities, such as T2DM, arterial hypertension, and coronary heart disease. Furthermore, the ST-patients reported higher health care utilization. The identified somatic differences between the ST-patients and CT-patients were in line with previous research (Rydén et al., 2004; Karlsson et al., 2007; de Man Lapidoth et al., 2008; Arnlöv, Ingelsson, Sundström, & Lind, 2010; Arnlöv, Sundström, Ingelsson, & Lind, 2011). These findings could be explained by the higher severity of obesity among the ST-patients and may reflect the medical eligibility criteria for bariatric surgery based on the clinical guidelines in place at the institution where this study was conducted.

Regarding psychological factors, the ST-patients reported a greater degree of psychopathology; that is, more physical complaints (GBB-24; Brähler et al., 2008; and ISR; Tritt et al., 2008), more negative and less positive mood (BSF; Hörhold & Klapp, 1993), greater perceived stress (PSQ-20; Levenstein et al., 1993; Fliege et al., 2005), higher scores for depression (PHQ-9; Spitzer et al., 1999; Löwe et al., 2002), and higher scores for anxiety and overall mental impairment (ISR; Tritt et al., 2008) compared with CT-patients. Furthermore, regarding resources and coping strategies, the ST-patients reported more pessimism (SWOP; Scholler et al., 1999), a lower sense of coherence (SOC-9; Schumacher et al., 2000), and more avoidant and active coping behavior (Brief COPE; Carver, 1997; Knoll et al., 2005) than the CT-patients. Notably, these psychological differences between the two treatment groups were independent of their somatic conditions; that is, the greater degree of psychopathology among the ST-patients was not attributable solely to the higher severity of obesity and related somatic diseases.

Second, in addition to medically assessed somatic factors, such as higher BMI and higher rates of T2DM, the self-reported health status (including physical complaints [GBB-24; Brähler et al., 2008], apathy [BSF; Hörhold & Klapp, 1993], sense of coherence [SOC-9; Schumacher et al., 2000], and active coping [Brief COPE; Carver, 1997; Knoll et al., 2005]), and the socio-demographic factor of younger age independently predicted the decision to undergo bariatric surgery.

In summary, obese patients who sought a surgical weight loss treatment presented with a lower SES and a higher physical and psychological burden compared with obese patients who chose a conservative treatment program. The psychological differences between the two treatment groups persisted even after BMI and obesity-related comorbidities were controlled. Somatic factors, psychological factors and younger age were associated with the decision to undergo bariatric surgery for the treatment of obesity.

On one hand, given this high physical burden, bariatric surgery for substantial weight loss and the remission of comorbidities may have been the best and only way to break the vicious, self-perpetuating circle of obesity and physical inactivity (Pietiläinen et al., 2008) and to improve life expectancy and prognosis in the presence of a severe somatic and psychological situation from which morbidly obese patients could not free themselves. On the other hand, however, given the high psychological burden of the obese patients who sought a surgical treatment, bariatric surgery alone may not have been sufficient. It should not be assumed that surgical weight loss would be sufficient to eradicate the high levels of psychopathology in these patients and return them to psychological health. In particular, patients with morbid obesity, low SES, and a high symptom burden who felt stressed and depressed and reported maladaptive coping strategies may have been at risk for postsurgical difficulties with implementing and adhering to the long-term lifestyle changes (e.g., following dietary advice and increasing physical activity) required to benefit from bariatric surgery. These challenges could leave these patients vulnerable to unsatisfactory weight loss and exacerbated psychopathology (Fabricatore & Wadden, 2004). However, the cross-sectional design of Study I did not allow an assessment of the predictive value of these somatic, socio-demographic, and psychological risk factors for treatment success after bariatric surgery. Therefore, interpretations remain speculative at this point. Study I highlighted the need for longitudinal studies to improve prebariatric screening and the treatment selection processes. Hence, Study II was conducted to investigate the determinants of weight loss outcomes following bariatric surgery.

2.2. Study II: Determinants of weight loss following laparoscopic sleeve gastrectomy: the role of psychological burden, coping style, and motivation to undergo surgery

Figura, A., Ahnis, A., Stengel, A., Hofmann, T., Elbelt, U., Ordemann, J., & Rose, M. (2015). Determinants of weight loss following laparoscopic sleeve gastrectomy: the role of psychological burden, coping style, and motivation to undergo surgery. *Journal of Obesity, 2015*, 626010.

2.2.1. Objective

The amount of weight loss among obese patients after bariatric surgery varies greatly (Beck et al., 2012b; Ochner et al., 2013), and approximately 15−20% of all ST-patients fail to achieve adequate weight loss (Maggard et al., 2005; Snyder et al., 2009). Psychological factors may influence treatment

success; however, reliable predictors have not been established to date. The present study evaluated the role of preoperative psychological burden, coping style, and motivation to undergo weight loss surgery in determining the postoperative weight-related treatment success after LSG.

2.2.2. Methods

The sample for this study included 64 morbidly obese patients (mean age 46 years, 71.9% females), with a mean preoperative BMI of 51 ± 8 kg/m² who had undergone LSG. The following questionnaires were administered before surgery to assess the psychological burden in terms of perceived stress (PSQ-20; Levenstein et al., 1993; Fliege et al., 2005), depression (PHQ-9; Spitzer et al., 1999; Löwe et al., 2002), anxiety (GAD-7; Spitzer et al., 2006; Löwe et al., 2008), mental impairment (ISR; Tritt et al., 2008) as well as coping style (Brief COPE; Carver, 1997; Knoll et al., 2005), and motivation to undergo weight loss surgery (ad hoc questionnaire). The percentage of excess weight loss (%EWL) was used as an indicator of treatment success and was assessed 20 months after surgery on average. To examine the impact of preoperative psychological factors on postoperative weight loss, the patients were classified according to their %EWL into three groups of nearly equal size based on the observed distribution: low (*n* = 21, %EWL range = 14−39%), moderate (*n* = 22, %EWL range = 40−59%), and high (*n* = 21, %EWL range = 60−115%). Additional patient characteristics, such as preoperative weight and BMI, socio-demographic status, diagnosed somatic and mental comorbidities (including eating disorders and the use of psychotherapy) were also assessed. Group comparisons using uni- and multivariate ANOVAs, chi²-tests and correlation analyses were performed. Please refer to the original manuscript for a more detailed description of the methods.

2.2.3. Main results and interpretation

Study II confirmed a considerable degree of variation in postoperative weight loss outcomes (i.e., 14−115% of EWL). Notably, all three weight loss groups showed significant decreases in body weight and BMI after LSG, including the group with comparatively low weight loss.

Study II generated the following main findings: First, the LSG-patients with high weight loss reported significantly more active coping behavior prior to surgery than the LSG-patients with moderate and low weight losses. This finding may indicate that the LSG-patients who dealt more actively with their obesity beforehand to find a solution and improve their health had a more successful postoperative

course of weight loss. This more-active coping behavior may have included preoperative searches for information regarding surgical treatment options on the internet, in support groups, in informational meetings, or during medical visits and examinations. This behavior may in turn have helped the patients develop a more informed and educated perspective on the possibilities and limitations of LSG and the lifestyle modifications it requires (e.g., following dietary advice and physical activity recommendations) to achieve greater and sustained weight loss after surgery. Other psychological factors assessed before surgery − that is, the patients' preoperative psychological burden and motivation to undergo weight loss surgery − were not associated with the amount of weight loss after LSG.

Second, regarding preoperative BMI, the patients who lost large amounts of weight after LSG had a lower BMI prior to surgery than the patients who lost moderate amounts of weight (i.e., a mean baseline BMI of 48 kg/m² in the high-EWL group versus a mean baseline BMI of 55 kg/m² in the moderate-EWL group), but there were no significant preoperative BMI differences compared with patients who lost low amounts of weight (i.e., a mean baseline BMI of 52 kg/m² in the low-EWL group). This initially counterintuitive finding was in line with previous gastric bypass studies reporting that preoperatively less-obese patients achieved a greater postoperative weight loss (Farkas et al., 2005; Tichansky et al., 2005; Ochner et al., 2013). This finding may indicate that patients with less-severe obesity benefit most from LSG in terms of postoperative weight loss. Another possible explanation is that the patients who were preoperatively more obese − that is, so-called super-obese patients with a BMI ≥ 50 kg/m² − may have tended to plateau earlier in their weight loss process and may have begun to regain weight as early as 12 months after surgery (Ochner et al., 2013). Early weight stagnation and weight regain might have played a role; however, the pre-post design of the present study masked a detailed time course of weight change, and therefore, explanations remain speculative at this point. In the present study, preoperative weight loss across all LSG-patients did not predict greater postoperative weight loss.

Lastly, the socio-demographic factor of education level (i.e., years of education) prior to the surgical intervention was associated with weight loss after LSG; that is, patients who reported a higher level of education had greater weight loss. While similar results have been found for patients who underwent Roux-en-Y gastric bypass (Hatoum, Stein, Merrifield, & Kaplan, 2009), the mechanism by which education levels might affect postoperative weight loss outcomes remains uncertain. Education level may serve as a proxy for SES, which may play a causal role in both the etiology (Ogden et al., 2007; Aronne et al., 2009; Wright & Aronne, 2012; Mensink et al., 2013) and persistence of obesity. For

example, a low SES has been found to be related to increased consumption of foods with high energy density but low nutritional value (Turrell, Hewitt, Patterson, Oldenburg, & Gould, 2002; Drewnowski & Specter, 2004) and to decreased physical activity (Gidlow, Johnston, Crone, Ellis, & James, 2006).

Taken together, the findings of the present study show that LSG is an effective surgical intervention for reducing weight. Self-reported more active coping behavior, a lower baseline BMI (i.e., BMI < 50 kg/m²) and higher education levels (i.e., tertiary education) may be markers of treatment success in terms of higher postoperative weight loss outcomes in the second year after LSG. Neither the other socio-demographic or somatic variables nor an extensive set of additional psychological factors that were assessed before surgery allow a clinically relevant prediction of weight loss.

The aim of this study was to identify psychological factors that could predict weight-related treatment success after LSG. However, the results demonstrated the difficulty of preoperatively identifying patients who were at risk for less-favorable postoperative weight loss outcomes. This result is in line with previous research. On one hand, obese patients who undergo LSG may constitute a highly selective group. These patients need to meet certain criteria and be free of contraindications to be eligible for bariatric surgery, which may have resulted in a homogenized sample of medically and psychologically similar patients. Consequently, both the variability within the whole sample of patients who underwent LSG and the variability between the three different weight loss groups may have been reduced. This may have undermined the impact of preoperative psychological factors on weight loss outcomes (Rutledge, Adler, & Friedman, 2011a). Therefore, the methodological approach used to answer the research question, including the weight loss classifications on which the group comparisons were based, may have played a role in the lack of identification of further differences among obese patients with low, moderate, and high weight loss after LSG. On the other hand, postbariatric psychological factors may have had a much stronger impact on weight loss outcomes than static prebariatric factors. Relevant postbariatric psychological factors may have included the development, persistence or re-emergence of depression and anxiety symptoms or loss of control over eating during the postoperative course and the patients' ability to cope with these mental conditions, implement and adhere to the required lifestyle modifications and adjust to the postoperative situation (Pessina, Andreoli, & Vassallo, 2001; Tolonen & Victorzon, 2003; Busetto et al., 2005; White et al., 2010; de Zwaan et al., 2011; Legenbauer, Petrak, de Zwaan, & Herpertz, 2011). Study II highlighted the need for further research on the psychological correlates of health outcomes after LSG. Hence, Study III and Study IV

were conducted to investigate the effects of LSG on patient-reported eating behavior and eating-related psychopathology as well as weight loss-related HRQoL.

2.3. Study III: Changes in self-reported eating patterns after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity

Figura, A., Rose, M., Ordemann, J., Klapp, B. F., & Ahnis, A. (2017a). Changes in self-reported eating patterns after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. *Surgery for Obesity and Related Diseases, 13*(2), 129-137.

2.3.1. Objective

Patients with severe obesity need to adapt to surgically induced changes in their eating behaviors to maintain treatment success. This study 1) investigated the effects of LSG on weight loss and on three dimensions of self-reported eating behavior − namely, cognitive restraint, disinhibition, and hunger − by assessing and comparing preoperative data with postoperative data collected in the second follow-up year; 2) compared the outcomes of LSG-patients with those of a CT control group over the same follow-up period after the completion of a 1-year multimodal outpatient weight reduction group program that included dietary advice, physical exercise, psychoeducation, cognitive-behavioral therapy, training in Jacobson's progressive muscle relaxation, and social group support; and 3) evaluated the extent to which potential changes in eating behaviors after LSG or conservative treatment were associated with weight loss outcomes.

2.3.2. Methods

In this study, a sample of 102 patients with obesity was investigated using the TFEQ (Stunkard & Messick, 1985; Pudel & Westenhöfer, 1989) before and an average of 19 (± 5) months after weight loss intervention. Of the 102 patients, 62 (mean age 46 years, 71% females) underwent LSG, and 40 (mean age 51 years, 77.5% females) underwent the conservative treatment program. The patients were assigned to either the surgical or the nonsurgical intervention group according to clinical guidelines and patient preference. Statistical analyses included within- and between-groups comparisons using paired- and independent-samples t-tests; ANCOVA was used to control for pre-existing group differences in

TFEQ pretest scores, age, and BMI. Additionally, correlation analyses were performed. Please refer to the original manuscript for a more detailed description of the methods.

2.3.3. Main results and interpretation

In the LSG-group, mean %TWL was 26 ± 11%, mean %EWL was 53 ± 24%, and the mean BMI decreased from 51 ± 8 to 38 ± 8 kg/m². In the CT-group, mean %TWL was 5 ± 11%, mean %EWL was 14 ± 27%, and the mean BMI decreased from 40 ± 7 to 38 ± 7 kg/m². The LSG-patients achieved a significantly higher weight loss and BMI reduction (starting from a higher baseline weight) compared with the CT-patients. Study III generated the following main findings: Significant improvements in self-reported eating behaviors were observed in both treatment groups; that is, both groups exhibited increased cognitive restraint of eating, decreased disinhibition of eating control, and a reduced degree of perceived hunger. First, this overall pattern of findings generally confirms those of previous bariatric surgery research that used the TFEQ to assess eating behaviors in obese patients six and 12 months after LSG (Langer et al., 2008; Rieber et al., 2013). Moreover, the observed improvements in maladaptive eating patterns were also consistent with previous studies that used the TFEQ over a similar follow-up period of 12−24 months after other surgical procedures, such as gastric banding, vertical banded gastroplasty, and Roux-en-Y gastric bypass (Karlsson et al., 1998; Burgmer et al., 2005; Bocchieri-Ricciardi et al., 2006). This may further support the premise that self-reported eating patterns improve in expected directions after bariatric surgery irrespective of the surgical procedure performed.

Second, in this study, the LSG-patients and CT-patients revealed similar patterns of changes in their self-reported eating behaviors after weight loss intervention. As the TFEQ scales assess three essential dimensions of maladaptive eating behaviors, it is reasonable to expect that any weight loss intervention that is effective over a relatively long follow-up period will have a significant effect on these target dimensions. However, the treatment effect of the surgical LSG intervention was more pronounced than that of the conservative intervention. Whereas the TFEQ scale scores measured before the interventions did not differ significantly between the groups, the LSG-patients reported substantially greater reductions in perceived hunger and disinhibition of eating control; that is, their eating was less affected by food cues and negative mood states, which may have led to fewer episodes of overeating and loss of control when eating after surgery. Compared with the CT-patients, LSG-patients were more strongly aligned with TFEQ scale values for hunger and disinhibition of a representative norm sample

from the German general population (Löffler et al., 2015). Thus, specific physiological effects could be assumed to be caused by the surgically modified anatomy of the gastrointestinal tract and subsequent hormonal effects that may have influenced eating behavior. Various neurotransmitters are involved in the altered gut-brain axis communication after bariatric surgery, which includes an earlier release and increased secretion of satiating gastrointestinal hormones and metabolites that may result in reduced eating and lower food intake (Lutz & Bueter, 2014). For example, Langer et al. (2008) found that reduced ghrelin levels six months after LSG were significantly correlated with decreased hunger scores as assessed with the TFEQ. Moreover, experimental functional magnetic resonance imaging studies (Ochner et al., 2011; Miras et al., 2012; Scholtz et al., 2014) have described a reduction in the reward value of high-caloric food (e.g., sweets and fat) after bariatric surgery, which may explain the greater reduction in the disinhibition of eating control after LSG compared with the conservative weight loss intervention in the present study. Interestingly, in this study, cognitive restraint of eating did not differ significantly between the LSG-patients and CT-patients. The increased control of eating and a conscious restriction of food intake may reflect a strong motivation to achieve weight loss and the need for more conscious dieting (e.g., considering the time, composition, amount, and frequency of eating when planning meals) after both weight loss interventions. On one hand, this finding may reflect the profound relationship with food that the obese patients may have had for many years, often since childhood and adolescence. On the other hand, it may suggest a sustained cognitive preoccupation with eating control, weight, and shape after both surgical and conservative weight loss treatment in light of a continuing abundance of food.

Lastly, in both treatment groups, higher weight loss was associated with decreased hunger sensations. After both weight loss interventions, the patients reported less hunger, which may have contributed to reduced overall eating and food intake and subsequent weight loss. This finding may indicate that the efficient reduction of perceived hunger and food cravings contributed significantly to treatment success, independent of the type of intervention.

To summarize this study, in the second follow-up year, LSG was associated with greater weight loss and greater improvements in self-reported eating behaviors compared with conservative treatment.

2.4. Study IV: Improvement in self-reported eating-related psychopathology and physical health-related quality of life after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity

Figura, A., Rose, M., Ordemann, J., Klapp, B. F., & Ahnis, A. (2017b). Improvement in self-reported eating-related psychopathology and physical health-related quality of life after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. *Eating Behaviors, 24*, 17-25.

2.4.1. Objective

This study employed a prospective approach similar to the one used in Study III. The present study 1) examined the effects of LSG on self-reported eating-related psychopathology and on HRQoL in the second follow-up year; 2) compared the outcomes after LSG with those after the conservative treatment program; and 3) evaluated the relationships between weight loss and eating-related psychopathology and HRQoL before and after the interventions.

2.4.2. Methods

In this study, a sample of 103 patients with obesity was investigated using the EDI (Garner et al., 1983; Paul & Thiel, 2005) and the SF-8 (Ware et al., 2001) before and, on average, 19 (± 5) months after weight loss intervention. Sixty-three patients (mean age 46 years, 71.4% females) underwent LSG, and 40 patients (mean age 51 years, 77.5% females) underwent the conservative treatment program. The patients were assigned to either the surgical or the nonsurgical intervention group according to clinical guidelines and patient preference. Statistical analyses included within- and between-groups comparisons using paired- and independent-samples t-tests; ANCOVA was used to control for pre-existing group differences in EDI and SF-8 pretest scores, age, and BMI. Additionally, a descriptive path analysis was performed using maximum-likelihood estimation to investigate the relationship between the psychological variables and weight loss based on the intervention (i.e., LSG and conservative treatment). Please refer to the original manuscript for a more detailed description of the methods.

2.4.3. Main results and interpretation

In the LSG-group, mean %TWL was 26 ± 11%, mean %EWL was 53 ± 24%, and the mean BMI decreased from 52 ± 8 to 38 ± 8 kg/m². In the CT-group, mean %TWL was 5 ± 11%, mean %EWL was 14 ± 27%, and the mean BMI decreased from 40 ± 7 to 38 ± 7 kg/m². The LSG-patients achieved a significantly higher weight loss and BMI reduction (starting from a higher baseline weight) compared with the CT-patients. Study IV generated the following main findings: Significant improvements in self-reported eating-related psychopathology were observed in both treatment groups. First, the LSG-patients reported significantly less drive for thinness (i.e., fewer concerns with dieting, less preoccupation with weight, and less fear of weight gain), less bulimia (i.e., fewer bulimic episodes of uncontrollable overeating, bingeing, and self-induced vomiting) and less body dissatisfaction (i.e., more satisfaction with their physical appearance) after surgery. The observed improvements were in line with previous bariatric surgery research that used the EDI to assess eating-related psychopathology in obese patients six months after other surgical procedures, such as vertical banded gastroplasty and Roux-en-Y gastric bypass (Leombruni et al., 2007; Matini et al., 2014). Additionally, consistent with the aforementioned studies, some, but not all, eating-related psychopathology improved after LSG, which may add further support to the premise that different restrictive and malabsorptive bariatric surgical procedures may be similarly associated with improvements in self-reported eating pathology.

Second, although both treatment groups had a similar BMI after the respective weight loss interventions and revealed similar patterns of changes in their self-reported eating-related psychopathology, the LSG-patients reported a significant reduction in their drive for thinness (starting from a higher baseline level) and significantly greater satisfaction with their physical appearance after surgery compared with the patients who underwent the conservative treatment. This finding may be attributable to the greater weight loss achieved by the LSG-patients after surgery (i.e., 53% of EWL after LSG versus 14% of EWL after conservative treatment). As the EDI scales address central motivations for seeking weight loss treatment, it is reasonable to expect that any weight loss intervention that is effective over a longer follow-up period will have a significant beneficial effect on EDI scores. However, compared with a normal-weight sample from the German general population (Paul & Thiel, 2005), scores for drive for thinness, body dissatisfaction, and bulimia were still elevated after both LSG and conservative treatment. This finding may reflect a sustained eating pathology that improved but was not

cured after the interventions, even though substantial weight loss was maintained in both treatment groups in the second follow-up year.

Regarding HRQoL, the LSG-patients reported substantial improvement in perceived physical HRQoL after surgery from a lower baseline level compared with CT-patients. One possible explanation may be that greater surgically induced weight loss (from a higher baseline weight) may be associated with a remission of obesity-related medical conditions and thus may contribute to a greater improvement in physical HRQoL. The lack of a corresponding effect of LSG on mental well-being was unexpected at first but has been described previously at 6- and 12-month follow-ups of patients with obesity who underwent other bariatric surgical procedures, such as gastric banding or Roux-en-Y gastric bypass (Faulconbridge et al., 2013; Matini et al., 2014; Omotosho, Mor, Shantavasinkul, Corsino, & Torquati, 2016). Notably, both before and after the interventions, the LSG-patients and CT-patients in the present study reported mental HRQoL comparable to the mean values of the general population, despite significant differences in baseline weight and the extent of weight loss between the two treatment groups. This finding may indicate that the morbidly obese patients who underwent LSG may have experienced a higher physical than mental burden with respect to HRQoL. Given the intensive nature of the conservative intervention in this study, it was surprising both that the resulting weight loss was quite limited and that no significant changes in perceived physical or mental HRQoL were observed. However, these findings were consistent with systematic reviews and meta-analyses showing that conservative weight loss interventions yield rather small reductions in body weight that are unlikely to be clinically significant and are often not sustainable after interventions end (Booth, Prevost, Wright, & Gulliford, 2014; Colquitt et al., 2014). Given the limited weight loss achieved by the CT-patients, considerable changes in HRQoL were not to be expected.

Lastly, for both the surgical and the nonsurgical intervention group, the magnitude of weight loss was related to considerable improvements in self-reported eating-related psychopathology, such as a decreased drive for thinness, increased satisfaction with the physical appearance, and improved physical HRQoL in the second follow-up year. However, the treatment effect of the surgical intervention was more pronounced; that is, the LSG-patients also reported fewer bulimic symptoms, decreased ineffectiveness (i.e., fewer feelings of inadequacy and insecurity and more feelings of self-control), less interpersonal distrust (i.e., a higher disposition to form close relationships), and improved interoceptive awareness (i.e., more confidence in recognizing and discriminating between emotions and sensations of hunger and satiety) related to their weight loss. Interestingly, for the LSG-patients, greater body

dissatisfaction and perfectionism (i.e., high personal expectations for superior achievement) before surgery proved to be predictive of higher postoperative weight loss and therefore may be used as positive indicators of favorable weight loss outcomes in patients seeking LSG. One possible explanation may be that obese patients who were more dissatisfied with their physical appearance and had high expectations regarding the surgical outcomes may also have been more motivated to implement and closely adhere to lifestyle modifications, which may have contributed to better weight loss results. However, previous studies on the associations among self-reported eating-related psychopathology, HRQoL, and weight loss after bariatric surgery have shown inconsistent results (Leombruni et al., 2007; Matini et al., 2014). This inconsistency in findings among studies may have been due to methodological discrepancies, such as different surgical procedures, sample sizes and characteristics, as well as varying follow-up periods.

Taken together, these findings indicate that in the second follow-up year, LSG was associated with greater weight loss from a higher baseline weight and greater improvements in self-reported eating-related psychopathology and physical HRQoL compared with conservative treatment.

3. General discussion

3.1. Integration of the findings

This dissertation aimed to examine the psychological factors that affect and arise from bariatric surgery in comparison with conservative treatment. Tables 3 and 4 present a comprehensive overview of the main results of the four studies. The central findings will be integrated and discussed in the following paragraphs.

3.1.1. Lower socio-economic status and higher physical and psychological burden in bariatric surgery candidates compared with patients seeking conservative treatment

Study I examined the pre-intervention differences between ST-patients and CT-patients with obesity that may have influenced their treatment choice. Patients who sought surgical weight loss treatment presented with a lower SES and generally higher physical and psychological burdens compared with patients who sought the conservative multimodal treatment program (Table 3). In particular, the bariatric

surgery candidates had a higher baseline BMI and a lower education level. However, they also reported more active coping behavior.

Table 3. Comprehensive overview of the main results of Study I and Study II

	Study I		Study II	
	Baseline characteristics of ST-patients compared with CT-patients before weight loss intervention *(Between-groups comparisons at T0)*		**Determinants of successful weight loss following LSG** *(Between-groups comparisons at T0)*	
Parameter	ST-patients [a]		LSG-patients with high %EWL [b]	
Socio-demographic factors	↓	Age *	→	Age
	↑	Male sex	→	Sex
	↓	Education level	↑	Education level
	↓	Occupational status/employment	→	Occupational status/employment
Weight, BMI	↑	Weight	↓	Weight
	↑	BMI *	↓	BMI
Comorbidities, clinical diagnosis	↑	T2DM *	→	T2DM
Physical complaints (GBB-24)	↑	Overall physical complaints *		*Not assessed*
Mood (BSF)	↑	Negative mood		*Not assessed*
	↑	- e.g., apathy *		
	↓	Positive mood		
Resources (SOC-9)	↓	Sense of coherence * [c]		*Not assessed*
Perceived stress (PSQ-20)	↑	Overall perceived stress	→	Overall perceived stress
Depression (PHQ-9)	↑	Depression	→	Depression
Mental impairment (ISR)	↑	Overall severity of mental impairment	→	Overall severity of mental impairment
Coping style (Brief COPE)	↑	Avoidant coping	→	Avoidant coping
	↑	Active coping *	↑	Active coping

Note. The arrows indicate group differences: ↑ higher/more; ↓ lower/less; → no group difference/inconclusive association based on statistical significance. T0, before weight loss intervention. BMI, body mass index. CT, conservatively treated. %EWL, percentage of excess weight loss. LSG, laparoscopic sleeve gastrectomy. ST, surgically treated. T2DM, Type 2 diabetes mellitus. Please refer to paragraph 1.7.8. for a description of the measures that were used.

[a] Results are displayed for ST-patients in comparison with CT-patients at T0 (reference group).

[b] Results are displayed for LSG-patients with high %EWL in comparison with LSG-patients with low and moderate %EWL after surgery (reference groups).

* Predictors of the decision for surgical weight loss treatment. [c] Inverted predictor effect. For more details, please refer to the original manuscript of Study I.

3.1.2. Determinants of weight-related treatment success of laparoscopic sleeve gastrectomy include lower baseline body mass index, higher education level and more active coping behavior

Study II investigated the determinants of successful weight loss among the surgical patients who underwent the bariatric procedure of LSG. This study showed that LSG was an effective intervention that led to a substantial and sustained weight reduction of approximately 26% of the initial weight in the second postoperative year. In fact, a lower preoperative baseline BMI, higher education level and self-reported more active coping behavior seemed to predict better weight loss outcomes after the LSG intervention (Table 3). No other biomedical markers (e.g., T2DM) or socio-demographic factors nor the identified mental health burdens of perceived stress, depression, mental impairment, or motivation to undergo surgery enabled a clinically relevant prediction (Table 3).

Bringing together the findings of Study I and Study II, in a vulnerable patient population that prefers bariatric surgery, because it may seem to be the last-resort weight loss intervention against the background of high physical and psychological burden, factors such as less-severe obesity, higher education level, and active coping skills contributed to successful weight loss.

3.1.3. Active coping style has predictive value for the treatment decision and weight loss outcome

As mentioned above, coping style played a central role in Study I and Study II. That is, the results of both studies indicated that self-reported more active coping behavior seemed to be associated not only with the decision to undergo bariatric surgery but also with surgical treatment success, leading to more favorable postoperative weight loss outcomes in patients who underwent LSG. Active coping behavior, as assessed with the Brief COPE questionnaire, is believed to reflect a problem-oriented approach to coping with difficult situations (Carver, 1997; Knoll et al., 2005).

In Study I, compared with CT-patients, the obese patients who sought bariatric surgery reported more active coping behavior combined with more avoidant coping behavior. This may reflect a “delegation of activity to the medical system” rather than direct behavioral attempts to reduce body weight, for example, by increasing physical activity or following a diet. Notably, the bariatric surgery pathway involved mandatory “activities” that were required to obtain medical approval for bariatric surgery from the multidisciplinary health care team and health insurance coverage. Those activities

included numerous preoperative physical examinations, participating in informational events regarding bariatric surgery, and dealing with barriers to accessing surgical treatment. Thus, it can be argued that surgical candidates perceived and described themselves as coping more actively with their situation because of those required mandatory activities. This view of partly delegating the task of weight management to the medical system (e.g., the health care team) is supported by a study by Elbelt et al. (2015), who found that a self-reported active coping style (which they also assessed with the Brief COPE) was associated with lower body weight-adjusted activity thermogenesis and reduced physical activity in patients with high-grade obesity who sought bariatric surgery. Interestingly, however, Study II demonstrated that among the obese patients who underwent LSG, a self-reported more active coping style determined their weight-related treatment success. Avoidant coping did not show any significant influence in this regard. Bringing together the findings of Study I and Study II, patients who perceived and described themselves as more actively coping during the prebariatric process may have not only developed an informed and educated perspective regarding the lifestyle modifications, which was a necessary prerequisite for bariatric surgery, but also stayed more active during the postoperative course. That is, the trait of “active coping” appeared to have facilitated more effective adherence to behavioral changes, effectively achieving higher and sustained weight loss.

One must bear in mind that the use of a single questionnaire did not allow a conclusive answer to the question of whether the observed high scores on the active coping scale were attributable to “delegated” problem solving, active lifestyle modifications, or both. Mixed-methods research approaches employing in-depth qualitative interviews in addition to quantitative assessments may have provided valuable information in this matter and should be integrated into subsequent studies.

3.1.4. Greater weight loss and body mass index reduction from a higher baseline weight after laparoscopic sleeve gastrectomy compared with conservative treatment

Concerning the course of weight and BMI after the surgical and conservative treatments examined in Study III and Study IV, both interventions reduced the BMI significantly; however, the patients who underwent LSG exhibited substantially higher weight loss and greater reduction in BMI (by approximately 20%) from a higher baseline weight. Notably, as described in Study I and before weight loss treatment, the patients with obesity who sought bariatric surgery were typically heavier than those who sought the conservative treatment program. In the second follow-up year, the BMI differences

between the LSG-patients and the CT-patients vanished, and both treatment groups had a similar BMI after the respective interventions as the amount of weight lost (i.e., 26% of TWL after LSG versus 5% of TWL after conservative treatment) differed significantly between the groups. Therefore, LSG was more effective than conservative treatment at allowing patients with morbid obesity to achieve substantial and sustained weight loss, thus promoting positive health-related outcomes.

3.1.5. Greater improvements in patient-reported eating behavior and eating-related psychopathology after laparoscopic sleeve gastrectomy compared with conservative treatment

Study III and Study IV focused on the effects of LSG on self-reported eating behavior and eating-related psychopathology in the second follow-up year and compared the outcomes after LSG with those after a conservative multimodal treatment program. In addition, the relationships between weight loss and both eating behavior and eating-related psychopathology before and after the respective interventions were examined. Please see Table 4 for a comprehensive overview of the main results.

Bringing together the findings of Study III and Study IV, both the surgical and the nonsurgical weight loss interventions led to positive treatment effects. However, along with the more favorable weight loss outcomes after LSG, the self-reported improvements in maladaptive eating patterns and eating-related pathological attitudes and behaviors prevalent among patients with obesity were more pronounced after LSG. As depicted on the right side of Table 4, between-groups comparisons revealed markedly greater reductions in disinhibition of eating control and feelings of hunger after LSG. This may have contributed to the relatively higher postoperative weight loss after LSG and in turn may have resulted in the finding that the LSG-patients were more satisfied with their physical appearance after surgery compared with the patients who underwent the conservative treatment. Furthermore, LSG was associated with a substantial improvement in drive for thinness from a higher baseline level compared with conservative treatment. That is, before intervention, the LSG-patients reported more concerns with dieting and weight than the CT-patients; however, in association with the high weight loss that was achieved after LSG, their drive for thinness decreased significantly. Regarding the impact of eating behavior and eating-related psychopathology on weight loss outcomes, body dissatisfaction and perfectionism in patients before LSG seemed to be motivational incentives for higher postoperative weight loss.

Table 4. Comprehensive overview of the main results of Study III and Study IV

		Study III & Study IV		
		Changes after LSG and conservative treatment before and after weight loss intervention *(Pre-post analysis using within-groups comparisons, T0−T1)*		**LSG-patients compared with CT-patients after weight loss intervention** *(Between-groups comparisons at T1)*
Parameter	Scale	LSG patients	CT patients	LSG patients [a]
BMI	BMI	↓	↓	→
Weight loss	%TWL			↑
	%EWL			↑
Eating behavior (TFEQ)	Cognitive restraint	↑	↑	→
	Disinhibition	↓	↓	↓
	Hunger	↓	↓	↓
Eating-related psychopathology (EDI)	Drive for thinness	↓	→	→
	Bulimia	↓	↓	→
	Body dissatisfaction	↓	↓	↓
	Ineffectiveness	→	→	→
	Perfectionism	→	→	→
	Interpersonal distrust	→	→	→
	Interoceptive awareness	→	→	→
	Maturity fears [b]	↓	→	→
HRQoL (SF-8)	Physical health	↑	→	→
	Mental health	→	→	→

Note. The arrows indicate changes or group differences: ↑ higher/more; ↓ lower/less; → no difference based on statistical significance. T0, before weight loss intervention. T1, after weight loss intervention. BMI, body mass index. CT, conservatively treated. %EWL, percentage of excess weight loss. HRQoL, health-related quality of life. LSG, laparoscopic sleeve gastrectomy. %TWL, percentage of total weight loss. Please refer to paragraph 1.7.8. for a description of the measures that were used.

[a] Results are displayed for LSG-patients in comparison with CT-patients at T1 (reference group).

[b] The EDI scale of maturity fears did not show an acceptable internal consistency. Therefore, there is no interpretation of the results. For more details, please refer to the original manuscript of Study IV.

The findings are consistent with previous research regarding both different biological outcomes between surgical and nonsurgical patients (Langer et al., 2008; Ochner et al., 2011; Lutz & Bueter, 2014) and the reported patterns of improvements in eating behavior and eating-related psychopathology after other restrictive (Karlsson et al., 1998; Burgmer et al., 2005; Leombruni et al., 2007), or restrictive-malabsorptive bariatric surgical procedures (Kalarchian, Wilson, Brolin, & Bradley, 1999; Dymek, le Grange, Neven, & Alverdy, 2001; Boan, Kolotkin, Westman, McMahon, & Grant, 2004; Bocchieri-Ricciardi et al., 2006; de Zwaan et al., 2010; Matini et al., 2014).

3.1.6. Improved physical health-related quality of life from a lower baseline level after laparoscopic sleeve gastrectomy compared with conservative treatment

Study IV examined the effect of LSG on self-reported HRQoL in the second follow-up year and compared the outcomes after LSG with those after a conservative multimodal treatment program. Additionally, the relationship between weight loss and HRQoL before and after the respective interventions was examined (Table 4). LSG was associated with substantial improvement in perceived physical HRQoL from a lower baseline level compared with conservative treatment. That is, morbidly obese LSG-patients reported lower physical HRQoL than the CT-patients before intervention. However, their physical HRQoL increased significantly after LSG, which was positively related to weight loss. This finding could have been linked to the remission of obesity-related medical conditions, such as immobility and impairments in physical functioning. Significant impairments or changes in perceived mental HRQoL were not observed in the surgical or the nonsurgical treatment groups.

3.2. Strengths and limitations

The aforementioned greater improvements in patient-reported psychological health outcomes after LSG compared with conservative treatment may be attributable to the greater weight loss resulting from the surgical intervention. However, whether the more pronounced treatment effects after LSG were attributable to weight loss alone or were moderated by other social, psychological, or physiological factors remains speculative at this point. Patients were assigned to either bariatric surgery, including LSG, or the conservative treatment program according to patient preference and medical recommendations based on widely accepted clinical guidelines rather than random assignment. Therefore, the treatment groups may have differed with respect to not only the intervention (as assumed in randomized controlled trials) but also additional patient factors that were not examined or controlled for in the present studies. For example, a significant number of patients who met medical eligibility criteria for bariatric surgery were not motivated to undergo surgery and opted for conservative treatment. This may point to important confounders, such as different personal and health-related characteristics (e.g., personality traits) and differences in available resources (e.g., the ability to be physically active), that could have influenced treatment preference and adherence and thus may have interfered with our main findings.

Nevertheless, for the present dissertation project, the research design was chosen according to the nature of the questions being asked. Additionally, the fact that the four presented studies were conducted in a naturalistic clinical setting could be considered a strength because it makes the results generalizable with high ecological validity within the German medical health care system.

Whereas the majority of previous longitudinal bariatric surgery research focused on Roux-en-Y gastric bypass, Studies II−IV examined homogeneous clinical samples of patients who underwent LSG. Though the sample sizes were comparable to those of the majority of studies in the field of bariatric surgery, they were still small, allowing for only few statistical tests driven by our hypotheses in addition to a large set of exploratory analyses. The attrition rates were comparatively small, and attrition analyses revealed no obvious systematic differences in baseline variables. However, the outcomes of the patients who were lost to follow-up are unknown, which may present the risk of a selection bias related to the attrition of patients who did not benefit from the interventions.

The weight loss levels were comparable to those reported in earlier research regarding surgical and nonsurgical weight loss outcomes (Colquitt et al., 2014), which indicates the representativeness of the presented studies' results. The patients' postoperative weight was partly self-reported, which may have resulted in an over- or underestimation of weight loss. However, self-reporting of weight is relatively common in obesity studies, and there is evidence that objectively measured and self-reported weights do not differ significantly in bariatric surgery patients (White et al., 2010). Furthermore, in the present analyses, obesity was evaluated based on BMI. This index was not grounded on physical or physiological considerations but on the empirical observation that, on average, body weight increased in proportion to body height squared (Eknoyan, 2008). It has been demonstrated that BMI correlates well with body fat mass (Flegal et al., 2009) but is not identical to it and does not take body fat distribution into account (Shah & Braverman, 2012). Therefore, the BMI changes observed in the presented studies may not completely parallel changes in body fatness or health risks. Nevertheless, BMI is advantageous because it can be measured relatively quickly and easily and is highly standardized compared with other anthropometric indicators of obesity, such as body circumference and subscapular measurements.

Study III used the TFEQ (Stunkard & Messick, 1985; Pudel & Westenhöfer, 1989), a well-validated and widely used self-report inventory that assesses cognitive, affective, and behavioral aspects of eating, to measure potentially disturbed eating behavior. However, while this instrument provides a general overview of changes in patients' self-observed eating behaviors and attitudes, it

cannot serve as a substitute for a measure of actual food and energy intake, that is, an analysis of the eating rate and the number, size, duration, and distribution of meals over repeated 24-hour recall periods (Laurenius et al., 2012). Previous studies by Stice, Sysko, Roberto, and Allison (2010) have indicated poor agreement between the TFEQ cognitive restraint scale and actual dietary restriction. However, both approaches, while not interchangeable, can provide succinct valuable information. The EDI (Garner et al., 1983; Paul & Thiel, 2005) and SF-8 questionnaires (Ware et al., 2001) employed in Study IV are not obesity-specific instruments; nevertheless, they proved useful for assessing self-reported changes in eating-related psychopathology and HRQoL after surgically and nonsurgically induced weight loss in obese patients.

Lastly, while the findings of this dissertation proved the importance of psychological factors that impact and arise from bariatric surgery, it is also necessary to consider potential physiological mechanisms. Bariatric surgery, including LSG, leads to profound changes in patients' gastrointestinal and whole-body physiology, including complex metabolic adaptations, anatomical variations, hormonal permutations, and other biological and mechanical effects (Lutz & Bueter, 2014). However, as the immediate surgically induced physiological effects wane over time, long-term treatment success may depend on the patients' ability to change and maintain appropriate health-related behaviors (Rutledge et al., 2011b; Wimmelmann et al., 2014). Future research should pursue a more comprehensive approach by combining both psychological and physiological aspects that contribute to health outcomes.

3.3. Conclusions

The overall objective of the present dissertation was to improve perceptions of obesity from a psychological and psychosomatic point of view and thus provide empirical data to inform evidence-based practice. The limitations notwithstanding, the preceding sections have demonstrated that:

- Bariatric surgical treatment for weight loss was preferred by a vulnerable population of patients with morbid obesity. They had a lower SES and a higher physical and psychological burden compared with the patients who underwent the conservative treatment. The likelihood of undergoing bariatric surgery increased with younger age, higher BMI, the presence of T2DM, and higher levels of patient-reported physical complaints, apathy, sense of coherence and active coping behavior.
- The bariatric surgical procedure of LSG was a viable intervention that led to a substantial and sustained weight reduction of approximately 26% of the initial weight and promoted positive health-

related outcomes. The determinants of weight-related treatment success after LSG included a lower baseline BMI (i.e., BMI < 50 kg/m²), a higher education level (i.e., tertiary education) and greater levels of patient-reported active coping behavior. Further, body dissatisfaction and perfectionism in patients were identified as positive indicators for favorable weight results after LSG. Therefore, it can be concluded that LSG-patients with a lower preoperative BMI and a higher education level who report more active coping behavior, greater dissatisfaction with their physical appearance, and a more perfectionistic attitude towards their personal expectations are more likely to achieve greater weight loss after surgery. The pre-existing mental health burden that was identified in bariatric surgery candidates before they underwent surgical treatment could not provide a clinical prediction of differential weight loss results after LSG.

- In the second year after weight loss treatment, LSG was associated with both greater weight loss and more pronounced improvements in patient-reported eating behavior and eating-related psychopathology compared with conservative treatment. Greater eating control and reduced feelings of hunger may have contributed to the approximately 20% higher postoperative weight loss after LSG (starting from a higher baseline weight) compared with conservative treatment. The combination of these factors may have increased LSG-patients' satisfaction with their physical appearance and made them less concerned with dieting and weight than before surgery compared with the CT-patients. Regarding HRQoL, LSG was associated with a substantial improvement in perceived physical HRQoL after surgery from a lower baseline level compared with conservative treatment. The conservative weight loss treatment program showed no significant effect on perceived HRQoL.

3.4. Clinical implications

We believe that the presented findings may shed light on the complex psychological mechanisms of obesity. The findings may have some important implications for clinical praxis and research.

The observational results suggest that LSG is an effective treatment for weight reduction, with a generally positive effect on HRQoL and on eating attitudes and behaviors. The psychological evaluation performed during the prebariatric screening process provides a valuable opportunity to identify obese patients at risk for less-favorable weight loss outcomes following LSG. Among LSG-patients, the potential risk markers identified in this dissertation project include a high preoperative BMI (i.e., BMI > 50 kg/m²), low education level, self-reported low active coping skills, little body dissatisfaction and

low levels of perfectionism, which may lead to nonadherence to the postoperative treatment regimen. Attention should be paid to these factors to identify patients who may benefit from more extensive preoperative education and support to enhance their readiness for surgery. However, further research using randomized controlled trials implemented in naturalistic clinical settings is needed to determine the reliability and validity of these risk markers. While all potential surgical patients should receive a thorough psychological evaluation before bariatric surgery, our findings suggest that there is no outright reason to exclude the possibility of LSG for patients with mental health conditions who are otherwise eligible and clinically stable surgical candidates.

3.5. Outlook

Regarding clinical praxis, the postoperative mental health status may prove to be a better indicator of different weight loss trajectories than the preoperative psychopathology, and adjustment to the behavioral demands imposed by LSG may play a key role. To attenuate the risk of suboptimal outcomes, it is essential to focus on both pre- and postbariatric psychological evaluation and intervention. Doing so may help to identify both patients with preoperative psychological vulnerabilities and those experiencing postoperative psychological difficulties resulting from the complex and dynamic changes in the patient's physiological system and his or her lifestyle, body shape, and identity. In fact, most psychological resources in bariatric surgery currently focus on the preoperative evaluation and intervention rather than postoperative input (Peacock & Zizzi, 2011, 2012; Ratcliffe et al., 2014). For example, given the potential postsurgical (re-)emergence of eating disturbances, which have been shown to affect weight loss and well-being (White et al., 2010; Conason et al., 2013; Conceicao et al., 2017), it can be argued that all postbariatric patients may benefit from routine psychological follow-up to quickly detect emerging difficulties and provide rapid intervention. Currently, the onus is on physicians, such as surgeons and general practitioners, to detect and address psychological problems as they see patients during the postoperative course. However, to date, there is no established clinical standard or routine for how and when to arrange psychological follow-up appointments after surgery.

Preliminary empirical evidence suggests that postoperative psychosocial care is associated with better bariatric surgery outcomes. A U.S. survey reported that while less than 50% of patients had psychological follow-up appointments in the first year after surgery, those who did access these appointments had greater weight loss (Peacock & Zizzi, 2012). Furthermore, a systematic review and

meta-analysis concluded that the provision of psychological interventions alongside bariatric surgery was associated with greater weight loss than surgery alone (Beck, Johannsen, Støving, Mehlsen, & Zachariae, 2012a). Thus, pre- and postoperative psychological care is critical and is likely to have a positive impact on the surgical treatment success. Consequently, there is a clinical need to adjust the imbalance between the increasing surgery volume and the psychological capacity, resources, and skills required for bariatric surgery. However, future research is needed to establish the optimal level of psychological input throughout the bariatric surgery pathway. Given the rising prevalence of severe obesity, bariatric surgery will continue to be of high public health relevance. Prospective studies should examine whether the provision of routine psychological follow-up and monitoring as well as postoperative supportive interventions through in-house behavioral and mental health services will prove valuable and beneficial for further optimizing medical after-care to secure long-term treatment success in terms of weight loss, HRQoL, and cost efficiency.

From a methodological point of view, avenues for future bariatric surgery research aimed at a better understanding of psychological aspects should consider both quantitative and qualitative empirical data using hierarchical and dimensional approaches (as opposed to categorical-polythetic classifications of psychopathology). Furthermore, the conceptualization of composite factor-based and higher-order latent constructs is encouraged. This includes the integration of personality traits and cognitive-behavioral, social and biological markers using adaptive longitudinal structural equation modeling. For example, rather than focusing on specific problematic eating or coping behaviors in isolation, examining underlying shared temperament features, such as impulsivity in relation to not only food but also other environmental contexts, may help to predict individual differences and pinpoint risk factors for suboptimal results following bariatric surgery. This integrative approach may facilitate communication across the disciplines involved in obesity treatment. The present dissertation may serve as a starting point for integrating multiple clinical measures, but further study is required.

Postface

Approximately one and a half years after Sophia underwent LSG surgery, I met with her again at the hospital while she waited for her follow-up appointment with the surgeon. She told me about her weight loss and her changing relationship with food in the months after LSG. Soon after the operation, her weight began to fall, and by now she had lost almost 40 kg. The operation forced her to eat less, making her cravings for greasy pizza and sweets simply vanish. "Food does not call out to me anymore. I still get hungry, but I am quickly satiated," Sophia said. She was not counting calories anymore or consciously trying to diet. The medical doctor told her that nearly all the weight loss she could expect had occurred and that she was now in the phase of weight stabilization. Still, she was hoping to lose more weight, even though the doctor said it was unlikely that she would ever be thin. "I am smaller, but I still think of myself as fat," she said. She showed me before-and-after pictures as if she had to prove the changes to herself. As the kilos dropped, Sophia experienced improvements in her health: her blood pressure decreased to normal, so she could stop taking medication to control it. Her sleep apnea was gone, her legs and knees had stopped hurting, and she felt more energetic. She had remained active in an online self-help forum since surgery, and she had started to bicycle every day. It showed; she moved with more confidence, and she met me wearing jeans that sat loose around her waist, bottom, and legs. She told me proudly that she had dropped four sizes. She has not bought new clothes yet as she is holding off until she loses more weight. Additionally, Sophia returned to university classes after taking a semester off for the surgery. She kept the operation a secret because she was afraid that people would judge her for having undergone such a radical treatment. "Even though I had hoped for more changes in my life, the weight loss improved my situation in a good way, and I don't regret having the operation. I think I would do it again."

The patient story (p.8 and p.61) is an adaptation from a 2016 The New York Times article by Gina Kolata called "After weight-loss surgery, a year of joys and disappointments." It reflects my own experience as a clinical psychologist working with bariatric surgery patients since 2011 at the Department of Psychosomatic Medicine at the Charité−Universitätsmedizin Berlin.

References

Adams, K. F., Schatzkin, A., Harris, T. B., Kipnis, V., Mouw, T., Ballard-Barbash, R., Hollenbeck, A., & Leitzmann, M. F. (2006). Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *New England Journal of Medicine, 355*(8), 763-778. doi:10.1056/NEJMoa055643

Adams, S. T., Salhab, M., Hussain, Z. I., Miller, G. V., & Leveson, S. H. (2013). Roux-en-Y gastric bypass for morbid obesity: what are the preoperative predictors of weight loss? *Postgraduate Medical Journal, 89*(1053), 411-416; quiz 415, 416. doi:10.1136/postgradmedj-2012-131310

AHA. (2015). *What is metabolic syndrome?* American Heart Association. Fact sheet retrieved from https://www.heart.org/idc/groups/heart-public/@wcm/@hcm/documents/downloadable/ucm_300322.pdf. Last accessed August 2017.

Ahnis, A., Figura, A., Hofmann, T., Stengel, A., Elbelt, U., & Klapp, B. F. (2015). Surgically and conservatively treated obese patients differ in psychological factors, regardless of body mass index or obesity-related co-morbidities: a comparison between groups and an analysis of predictors. *PLoS ONE, 10*(2), e0117460. doi:10.1371/journal.pone.0117460

Anderson, S. E., Cohen, P., Naumova, E. N., & Must, A. (2006). Association of depression and anxiety disorders with weight change in a prospective community-based study of children followed up into adulthood. *Archives of Pediatrics and Adolescent Medicine, 160*(3), 285-291. doi:10.1001/archpedi.160.3.285

Angrisani, L., Santonicola, A., Iovino, P., Formisano, G., Buchwald, H., & Scopinaro, N. (2015). Bariatric surgery worldwide 2013. *Obesity Surgery, 25*(10), 1822-1832. doi:10.1007/s11695-015-1657-z

Anonymous. (2000). Overweight, obesity, and health risk. National Task Force on the Prevention and Treatment of Obesity. *Archives of Internal Medicine, 160*(7), 898-904. doi:10.1001/archinte.160.7.898

Arnlöv, J., Ingelsson, E., Sundström, J., & Lind, L. (2010). Impact of body mass index and the metabolic syndrome on the risk of cardiovascular disease and death in middle-aged men. *Circulation, 121*(2), 230-236. doi:10.1161/CIRCULATIONAHA.109.887521

Arnlöv, J., Sundström, J., Ingelsson, E., & Lind, L. (2011). Impact of BMI and the metabolic syndrome on the risk of diabetes in middle-aged men. *Diabetes Care, 34*(1), 61-65. doi:10.2337/dc10-0955

Aronne, L. J., Nelinson, D. S., & Lillo, J. L. (2009). Obesity as a disease state: a new paradigm for diagnosis and treatment. *Clinical Cornerstone, 9*(4), 9-25; discussion 26-29. doi:10.1016/S1098-3597(09)80002-1

ASMBS. (2016). *Estimate of bariatric surgery numbers, 2011-2015.* American Society for Metabolic and Bariatric Surgery. Retrieved from https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers. Last accessed August 2017.

Averbukh, Y., Heshka, S., El-Shoreya, H., Flancbaum, L., Geliebter, A., Kamel, S., Pi-Sunyer, F. X., & Laferrère, B. (2003). Depression score predicts weight loss following Roux-en-Y gastric bypass. *Obesity Surgery, 13*(6), 833-836. doi:10.1381/096089203322618605

Bauchowitz, A. U., Gonder-Frederick, L. A., Olbrisch, M. E., Azarbad, L., Ryee, M. Y., Woodson, M., Miller, A., & Schirmer, B. (2005). Psychosocial evaluation of bariatric surgery candidates: a survey of present practices. *Psychosomatic Medicine, 67*(5), 825-832. doi:10.1097/01.psy.0000174173.32271.01

Baumeister, H., & Härter, M. (2007). Mental disorders in patients with obesity in comparison with healthy probands. *International Journal of Obesity, 31*(7), 1155-1164. doi:10.1038/sj.ijo.0803556

Beck, N. N., Johannsen, M., Støving, R. K., Mehlsen, M., & Zachariae, R. (2012a). Do postoperative psychotherapeutic interventions and support groups influence weight loss following bariatric surgery? A systematic review and meta-analysis of randomized and nonrandomized trials. *Obesity Surgery, 22*(11), 1790-1797. doi:10.1007/s11695-012-0739-4

Beck, N. N., Mehlsen, M., & Støving, R. K. (2012b). Psychological characteristics and associations with weight outcomes two years after gastric bypass surgery: postoperative eating disorder symptoms are associated with weight loss outcomes. *Eating Behaviors, 13*(4), 394-397. doi:10.1016/j.eatbeh.2012.06.001

Bertakis, K. D., & Azari, R. (2005). Obesity and the use of health care services. *Obesity Surgery, 13*(2), 372-379. doi:10.1038/oby.2005.49

Bischoff, S. C., Damms-Machado, A., Betz, C., Herpertz, S., Legenbauer, T., Löw, T., Wechsler, J. G., Bischoff, G., Austel, A., & Ellrott, T. (2012). Multicenter evaluation of an interdisciplinary 52-week weight loss program for obesity with regard to body weight, comorbidities and quality of life: a prospective study. *International Journal of Obesity, 36*(4), 614-624. doi:10.1038/ijo.2011.107

Björntorp, P. (1992). Treatment of obesity. *International Journal of Obesity, 16*(Suppl 3), S81-84. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/1338327

Boan, J., Kolotkin, R. L., Westman, E. C., McMahon, R. L., & Grant, J. P. (2004). Binge eating, quality of life and physical activity improve after Roux-en-Y gastric bypass for morbid obesity. *Obesity Surgery, 14*(3), 341-348. doi:10.1381/096089204322917864

Bocchieri-Ricciardi, L. E., Chen, E. Y., Munoz, D., Fischer, S., Dymek-Valentine, M., Alverdy, J. C., & le Grange, D. (2006). Pre-surgery binge eating status: effect on eating behavior and weight outcome after gastric bypass. *Obesity Surgery, 16*(9), 1198-1204. doi:10.1381/096089206778392194

Booth, H. P., Prevost, T. A., Wright, A. J., & Gulliford, M. C. (2014). Effectiveness of behavioural weight loss interventions delivered in a primary care setting: a systematic review and meta-analysis. *Family Practice, 31*(6), 643-653. doi:10.1093/fampra/cmu064

Bornstein, S. R., Schuppenies, A., Wong, M. L., & Licinio, J. (2006). Approaching the shared biology of obesity and depression: the stress axis as the locus of gene-environment interactions. *Molecular Psychiatry, 11*(10), 892-902. doi:10.1038/sj.mp.4001873

Braghetto, I., Csendes, A., Lanzarini, E., Papapietro, K., Cárcamo, C., & Molina, J. C. (2012). Is laparoscopic sleeve gastrectomy an acceptable primary bariatric procedure in obese patients? Early and 5-year postoperative results. *Surgical Laparoscopy Endoscopy and Percutaneous Techniques, 22*(6), 479-486. doi:10.1097/SLE.0b013e318262dc29

Brähler, E., Scheer, J. W., & Hinz, A. (2008). *Gießener Beschwerdebogen (GBB-24)*. Göttingen: Hogrefe.

Bray, G. A. (2004). Obesity is a chronic, relapsing neurochemical disease. *International Journal of Obesity, 28*(1), 34-38. doi:10.1038/sj.ijo.0802479

Brewis, A. A. (2014). Stigma and the perpetuation of obesity. *Social Science and Medicine, 118*, 152-158. doi:10.1016/j.socscimed.2014.08.003

Buchwald, H., Avidor, Y., Braunwald, E., Jensen, M. D., Pories, W., Fahrbach, K., & Schoelles, K. (2004). Bariatric surgery: a systematic review and meta-analysis. *JAMA, 292*(14), 1724-1737. doi:10.1001/jama.292.14.1724

Buchwald, H., Estok, R., Fahrbach, K., Banel, D., & Sledge, I. (2007). Trends in mortality in bariatric surgery: a systematic review and meta-analysis. *Surgery, 142*(4), 621-632; discussion 632-635. doi:10.1016/j.surg.2007.07.018

Buchwald, H., Estok, R., Fahrbach, K., Banel, D., Jensen, M. D., Pories, W. J., Bantle, J. P., & Sledge, I. (2009). Weight and type 2 diabetes after bariatric surgery: systematic review and meta-analysis. *The American Journal of Medicine, 122*(3), 248-256. doi:10.1016/j.amjmed.2008.09.041

Burgmer, R., Grigutsch, K., Zipfel, S., Wolf, A. M., de Zwaan, M., Husemann, B., Albus, C., Senf, W., & Herpertz, S. (2005). The influence of eating behavior and eating pathology on weight loss after gastric restriction operations. *Obesity Surgery, 15*(5), 684-691. doi:10.1381/0960892053923798

Busetto, L., Segato, G., de Luca, M., de Marchi, F., Foletto, M., Vianello, M., Valeri, M., Favretti, F., & Enzi, G. (2005). Weight loss and postoperative complications in morbidly obese patients with binge eating disorder treated by laparoscopic adjustable gastric banding. *Obesity Surgery, 15*(2), 195-201. doi:10.1381/0960892053268327

Calle, E. E., Rodriguez, C., Walker-Thurmond, K., & Thun, M. J. (2003). Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *New England Journal of Medicine, 348*(17), 1625-1638. doi:10.1056/NEJMoa021423

Carr, D., & Friedman, M. A. (2005). Is obesity stigmatizing? Body weight, perceived discrimination, and psychological well-being in the United States. *Journal of Health and Social Behavior, 46*(3), 244-259. doi:10.1177/002214650504600303

Carver, C. S. (1997). You want to measure coping but your protocol's too long: consider the brief COPE. *International Journal of Behavioral Medicine, 4*(1), 92-100. doi:10.1207/s15327558ijbm0401_6

Castagneto Gissey, L., Casella Mariolo, J. R., & Mingrone, G. (2016). How to choose the best metabolic procedure? *Current Atherosclerosis Reports, 18*(7), 43. doi:10.1007/s11883-016-0590-5

Chang, S. H., Stoll, C. R., Song, J., Varela, J. E., Eagon, C. J., & Colditz, G. A. (2014). The effectiveness and risks of bariatric surgery: an updated systematic review and meta-analysis, 2003-2012. *JAMA Surgery, 149*(3), 275-287. doi:10.1001/jamasurg.2013.3654

Claes, L., Vandereycken, W., Vandeputte, A., & Braet, C. (2013). Personality subtypes in female pre-bariatric obese patients: do they differ in eating disorder symptoms, psychological complaints and coping behaviour? *European Eating Disorders Review, 21*(1), 72-77. doi:10.1002/erv.2188

Colles, S. L., Dixon, J. B., & O'Brien, P. E. (2008). Grazing and loss of control related to eating: two high-risk factors following bariatric surgery. *Obesity, 16*(3), 615-622. doi:10.1038/oby.2007.101

Colquitt, J. L., Pickett, K., Loveman, E., & Frampton, G. K. (2014). Surgery for weight loss in adults. *Cochrane Database of Systematic Reviews*(8), CD003641. doi:10.1002/14651858.CD003641.pub4

Conason, A., Teixeira, J., Hsu, C. H., Puma, L., Knafo, D., & Geliebter, A. (2013). Substance use following bariatric weight loss surgery. *JAMA Surgery, 148*(2), 145-150. doi:10.1001/2013.jamasurg.265

Conceicao, E. M., Utzinger, L. M., & Pisetsky, E. M. (2015). Eating disorders and problematic eating behaviours before and after bariatric surgery: characterization, assessment and association with treatment outcomes. *European Eating Disorders Review, 23*(6), 417-425. doi:10.1002/erv.2397

Conceicao, E. M., Mitchell, J. E., Pinto-Bastos, A., Arrojado, F., Brandao, I., & Machado, P. P. P. (2017). Stability of problematic eating behaviors and weight loss trajectories after bariatric surgery: a longitudinal observational study. *Surgery for Obesity and Related Diseases, 13*(6), 1063-1070. doi:10.1016/j.soard.2016.12.006

de Man Lapidoth, J., Ghaderi, A., & Norring, C. (2008). A comparison of eating disorders among patients receiving surgical vs non-surgical weight-loss treatments. *Obesity Surgery, 18*(6), 715-720. doi:10.1007/s11695-007-9250-8

de Zwaan, M., Wolf, A. M., & Herpertz, S. (2007). Psychosomatische Aspekte der Adipositaschirurgie: Was ist empirisch gesichert? *Deutsches Ärzteblatt, 6*(10), 470. Retrieved from http://www.aerzteblatt.de/int/article.asp?id=57187

de Zwaan, M., Hilbert, A., Swan-Kremeier, L., Simonich, H., Lancaster, K., Howell, L. M., Monson, T., Crosby, R. D., & Mitchell, J. E. (2010). Comprehensive interview assessment of eating behavior 18-35 months after gastric bypass surgery for morbid obesity. *Surgery for Obesity and Related Diseases, 6*(1), 79-85. doi:10.1016/j.soard.2009.08.011

de Zwaan, M., Enderle, J., Wagner, S., Mühlhans, B., Ditzen, B., Gefeller, O., Mitchell, J. E., & Müller, A. (2011). Anxiety and depression in bariatric surgery patients: a prospective, follow-up study using structured clinical interviews. *Journal of Affective Disorders, 133*(1-2), 61-68. doi:10.1016/j.jad.2011.03.025

Deitel, M., & Greenstein, R. J. (2003). Recommendations for reporting weight loss. *Obesity Surgery, 13*(2), 159-160. doi:10.1381/096089203764467117

Dixon, J. B., Dixon, M. E., & O'Brien, P. E. (2003). Depression in association with severe obesity: changes with weight loss. *Archives of Internal Medicine, 163*(17), 2058-2065. doi:10.1001/archinte.163.17.2058

Drewnowski, A., & Specter, S. E. (2004). Poverty and obesity: the role of energy density and energy costs. *American Journal of Clinical Nutrition, 79*(1), 6-16. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/14684391

Dymek, M. P., le Grange, D., Neven, K., & Alverdy, J. (2001). Quality of life and psychosocial adjustment in patients after Roux-en-Y gastric bypass: a brief report. *Obesity Surgery, 11*(1), 32-39. doi:10.1381/096089201321454088

Eknoyan, G. (2008). Adolphe Quetelet (1796-1874) − the average man and indices of obesity. *Nephrology Dialysis Transplantation, 23*(1), 47-51. doi:10.1093/ndt/gfm517

Elbelt, U., Ahnis, A., Riedl, A., Burkert, S., Schuetz, T., Ordemann, J., Strasburger, C. J., & Klapp, B. F. (2015). Associations of physical activity with depressiveness and coping in subjects with high-grade obesity aiming at bariatric surgery: a cross-sectional study. *BioPsychoSocial Medicine, 9*, 16. doi:10.1186/s13030-015-0042-4

Elbelt, U., Berger, H., & Hofmann, T. (2017). Konservative Therapie der Adipositas. In J. Ordemann & U. Elbelt (Eds.), *Adipositas- und metabolische Chirurgie* (pp. 23-30). Berlin Heidelberg: Springer.

Fabricatore, A. N., & Wadden, T. A. (2004). Psychological aspects of obesity. *Clinics in Dermatology, 22*(4), 332-337. doi:10.1016/j.clindermatol.2004.01.006

Fabricatore, A. N., Crerand, C. E., Wadden, T. A., Sarwer, D. B., & Krasucki, J. L. (2006). How do mental health professionals evaluate candidates for bariatric surgery? Survey results. *Obesity Surgery, 16*(5), 567-573. doi:10.1381/096089206776944986

Farkas, D. T., Vemulapalli, P., Haider, A., Lopes, J. M., Gibbs, K. E., & Teixeira, J. A. (2005). Laparoscopic Roux-en-Y gastric bypass is safe and effective in patients with a BMI ≥ 60. *Obesity Surgery, 15*(4), 486-493. doi:10.1381/0960892053723466

Faulconbridge, L. F., Wadden, T. A., Thomas, J. G., Jones-Corneille, L. R., Sarwer, D. B., & Fabricatore, A. N. (2013). Changes in depression and quality of life in obese individuals with binge eating disorder: bariatric surgery versus lifestyle modification. *Surgery for Obesity and Related Diseases, 9*(5), 790-796. doi:10.1016/j.soard.2012.10.010

Figura, A., Ahnis, A., Stengel, A., Hofmann, T., Elbelt, U., Ordemann, J., & Rose, M. (2015). Determinants of weight loss following laparoscopic sleeve gastrectomy: the role of psychological burden, coping style, and motivation to undergo surgery. *Journal of Obesity, 2015*, 626010. doi:10.1155/2015/626010

Figura, A., Rose, M., Ordemann, J., Klapp, B. F., & Ahnis, A. (2017a). Changes in self-reported eating patterns after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. *Surgery for Obesity and Related Diseases, 13*(2), 129-137. doi:10.1016/j.soard.2016.08.003

Figura, A., Rose, M., Ordemann, J., Klapp, B. F., & Ahnis, A. (2017b). Improvement in self-reported eating-related psychopathology and physical health-related quality of life after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. *Eating Behaviors, 24*, 17-25. doi:10.1016/j.eatbeh.2016.11.006

Finkelstein, E. A., Khavjou, O. A., Thompson, H., Trogdon, J. G., Pan, L., Sherry, B., & Dietz, W. (2012). Obesity and severe obesity forecasts through 2030. *American Journal of Preventive Medicine, 42*(6), 563-570. doi:10.1016/j.amepre.2011.10.026

Finucane, M. M., Stevens, G. A., Cowan, M. J., Danaei, G., Lin, J. K., Paciorek, C. J., Singh, G. M., Gutierrez, H. R., Lu, Y., Bahalim, A. N., Farzadfar, F., Riley, L. M., & Ezzati, M. (2011). National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet, 377*(9765), 557-567. doi:10.1016/S0140-6736(10)62037-5

Flegal, K. M., Shepherd, J. A., Looker, A. C., Graubard, B. I., Borrud, L. G., Ogden, C. L., Harris, T. B., Everhart, J. E., & Schenker, N. (2009). Comparisons of percentage body fat, body mass index, waist circumference, and waist-stature ratio in adults. *American Journal of Clinical Nutrition, 89*(2), 500-508. doi:10.3945/ajcn.2008.26847

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Curtin, L. R. (2010). Prevalence and trends in obesity among US adults, 1999-2008. *JAMA, 303*(3), 235-241. doi:10.1001/jama.2009.2014

Flegal, K. M., Carroll, M. D., Kit, B. K., & Ogden, C. L. (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA, 307*(5), 491-497. doi:10.1001/jama.2012.39

Flegal, K. M., Kit, B. K., Orpana, H., & Graubard, B. I. (2013). Association of all-cause mortality with overweight and obesity using standard body mass index categories: a systematic review and meta-analysis. *JAMA, 309*(1), 71-82. doi:10.1001/jama.2012.113905

Flegal, K. M., Kruszon-Moran, D., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2016). Trends in obesity among adults in the United States, 2005 to 2014. *JAMA, 315*(21), 2284-2291. doi:10.1001/jama.2016.6458

Fliege, H., Rose, M., Arck, P., Walter, O. B., Kocalevent, R. D., Weber, C., & Klapp, B. F. (2005). The Perceived Stress Questionnaire (PSQ) reconsidered: validation and reference values from different clinical and healthy adult samples. *Psychosomatic Medicine, 67*(1), 78-88. doi:10.1097/01.psy.0000151491.80178.78

Garner, D. M., Olmstead, M. P., & Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *International Journal of Eating Disorders, 2*(2), 15-34. doi:10.1002/1098-108x(198321)2:2<15::Aid-Eat2260020203>3.0.Co;2-6

Gidlow, C., Johnston, L. H., Crone, D., Ellis, N., & James, D. (2006). A systematic review of the relationship between socio-economic position and physical activity. *Health Education Journal, 65*(4), 338–367. doi:https://doi.org/10.1177/0017896906069378

Glinski, J., Wetzler, S., & Goodman, E. (2001). The psychology of gastric bypass surgery. *Obesity Surgery, 11*(5), 581-588. doi:10.1381/09608920160557057

Gloy, V. L., Briel, M., Bhatt, D. L., Kashyap, S. R., Schauer, P. R., Mingrone, G., Bucher, H. C., & Nordmann, A. J. (2013). Bariatric surgery versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomised controlled trials. *British Medical Journal, 347*, f5934. doi:10.1136/bmj.f5934

Gradaschi, R., Noli, G., Cornicelli, M., Camerini, G., Scopinaro, N., & Adami, G. F. (2013). Do clinical and behavioural correlates of obese patients seeking bariatric surgery differ from those of individuals involved in conservative weight loss programme? *Journal of Human Nutrition and Dietetics, 26*(Suppl 1), 34-38. doi:10.1111/jhn.12080

Hatoum, I. J., Stein, H. K., Merrifield, B. F., & Kaplan, L. M. (2009). Capacity for physical activity predicts weight loss after Roux-en-Y gastric bypass. *Obesity, 17*(1), 92-99. doi:10.1038/oby.2008.507

Hauner, H., Buchholz, G., Hamann, A., Husemann, B., Koletzko, B., Liebermeister, H., Wabitsch, M., Westenhöfer, J., Wirth, A., & Wolfram, G. (2007). *Evidence-based German guideline for the prevention and treatment of obesity*. German Obesity Society, German Diabetes Association, German Nutrition Society, and German Society for Nutritional Medicine. Retrieved from http://www.deutsche-diabetes-gesellschaft.de/fileadmin/Redakteur/Leitlinien/Englische_Leitlinien/EBLL_ADIPOSITAS_Update_05_2007_ENGL.pdf. Last accessed August 2017.

Hauner, H., Berg, A., Bischoff, S. C., Colombo-Benkmann, M., Ellrott, T., Heintze, C., Kanthak, U., Kunze, D., Stephan, N., Teufel, M., Wabitsch, M., & Wirth, A. (2014). *Interdisziplinäre Leitlinie der Qualität S3 zur Prävention und Therapie der Adipositas.* Version 2.0, April 2014. Deutsche Adipositas Gesellschaft, Deutsche Diabetes Gesellschaft, Deutsche Gesellschaft für Ernährung e.V. und Deutsche Gesellschaft für Ernährungsmedizin e.V. Retrieved from http://www.adipositas-gesellschaft.de/fileadmin/PDF/Leitlinien/050-001l_S3_Adipositas_Praevention_Therapie_2014-11.pdf. Last accessed August 2017.

Herpertz, S., Kielmann, R., Wolf, A. M., Hebebrand, J., & Senf, W. (2004). Do psychosocial variables predict weight loss or mental health after obesity surgery? A systematic review. *Obesity Research, 12*(10), 1554-1569. doi:10.1038/oby.2004.195

Herpertz, S., & de Zwaan, M. (2015). Psychosomatische Aspekte der Adipositaschirurgie. In S. Herpertz, M. de Zwaan, & S. Zipfel (Eds.), *Handbuch Essstörungen und Adipositas* (pp. 559-565). Berlin Heidelberg: Springer.

Holzapfel, C., & Hauner, H. (2011). [Weight maintenance after weight loss − how the body defends its weight]. *Deutsche Medizinische Wochenschrift, 136*(3), 89-94. doi:10.1055/s-0030-1269445

Hörhold, M., & Klapp, B. F. (1993). Testungen der Invarianz und der Hierarchie eines mehrdimensionalen Stimmungsmodells auf der Basis von Zweipunkterhebungen an Patienten- und Studentenstichproben. *Zeitschrift für Medizinische Psychologie, 1*, 27-35.

Jebb, S. A., Ahern, A. L., Olson, A. D., Aston, L. M., Holzapfel, C., Stoll, J., Amann-Gassner, U., Simpson, A. E., Fuller, N. R., Pearson, S., Lau, N. S., Mander, A. P., Hauner, H., & Caterson, I. D. (2011). Primary care referral to a commercial provider for weight loss treatment versus standard care: a randomised controlled trial. *Lancet, 378*(9801), 1485-1492. doi:10.1016/S0140-6736(11)61344-5

Jones, F., O'Connor, D. B., Conner, M., McMillan, B., & Ferguson, E. (2007). Impact of daily mood, work hours, and iso-strain variables on self-reported health behaviors. *Journal of Applied Psychology, 92*(6), 1731-1740. doi:10.1037/0021-9010.92.6.1731

Kahn, S. E., Haffner, S. M., Heise, M. A., Herman, W. H., Holman, R. R., Jones, N. P., Kravitz, B. G., Lachin, J. M., O'Neill, M. C., Zinman, B., & Viberti, G. (2006). Glycemic durability of rosiglitazone, metformin, or glyburide monotherapy. *New England Journal of Medicine, 355*(23), 2427-2443. doi:10.1056/NEJMoa066224

Kalarchian, M. A., Wilson, G. T., Brolin, R. E., & Bradley, L. (1999). Effects of bariatric surgery on binge eating and related psychopathology. *Eating and Weight Disorders, 4*(1), 1-5. doi:10.1007/bf03376581

Kalarchian, M. A., Marcus, M. D., Wilson, G. T., Labouvie, E. W., Brolin, R. E., & LaMarca, L. B. (2002). Binge eating among gastric bypass patients at long-term follow-up. *Obesity Surgery, 12*(2), 270-275. doi:10.1381/096089202762552494

Kalarchian, M. A., Marcus, M. D., Levine, M. D., Courcoulas, A. P., Pilkonis, P. A., Ringham, R. M., Soulakova, J. N., Weissfeld, L. A., & Rofey, D. L. (2007). Psychiatric disorders among bariatric surgery candidates: relationship to obesity and functional health status. *American Journal of Psychiatry, 164*(2), 328-334; quiz 374. doi:10.1176/ajp.2007.164.2.328

Karlsson, J., Sjöström, L., & Sullivan, M. (1998). Swedish obese subjects (SOS): an intervention study of obesity. Two-year follow-up of health-related quality of life (HRQL) and eating behavior after gastric surgery for severe obesity. *International Journal of Obesity, 22*(2), 113-126. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9504319

Karlsson, J., Taft, C., Rydén, A., Sjöström, L., & Sullivan, M. (2007). Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. *International Journal of Obesity, 31*(8), 1248-1261. doi:10.1038/sj.ijo.0803573

Keshishian, A. (2016). Illustration of sleeve gastrectomy [Digital image]. Retrieved from http://www.avidscience.com/wp-content/uploads/2016/06/BS-16-01_June-23-2016.pdf. Last accessed August 2017.

Kessler, R. C., Mickelson, K. D., & Williams, D. R. (1999). The prevalence, distribution, and mental health correlates of perceived discrimination in the United States. *Journal of Health and Social Behavior, 40*(3), 208-230. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/10513145

Kim, S. (2016). Drugs to treat obesity: do they work? *Postgraduate Medical Journal, 92*(1089), 401-406. doi:10.1136/postgradmedj-2015-133388

Kissler, H. J., & Settmacher, U. (2013). Bariatric surgery to treat obesity. *Seminars in Nephrology, 33*(1), 75-89. doi:10.1016/j.semnephrol.2012.12.004

Knoll, N., Rieckmann, N., & Schwarzer, R. (2005). Coping as a mediator between personality and stress outcomes: a longitudinal study with cataract surgery patients. *European Journal of Personality, 19*(3), 229-247. doi:10.1002/per.546

Kolata, G. (2016, December 27). After weight-loss surgery, a year of joys and disappointments. *The New York Times*. Retrieved from https://www.nytimes.com/2016/12/27/health/bariatric-surgery.html. Last accessed August 2017.

Kolotkin, R. L., Meter, K., & Williams, G. R. (2001). Quality of life and obesity. *Obesity Reviews, 2*(4), 219-229. doi:10.1046/j.1467-789X.2001.00040.x

Konnopka, A., Bödemann, M., & König, H. H. (2011). Health burden and costs of obesity and overweight in Germany. *European Journal of Health Economics, 12*(4), 345-352. doi:10.1007/s10198-010-0242-6

Lagerstrøm, D., Berg, A., Haas, U., Hamm, M., Göhner, W., Fuchs, R., Predel, H. G., & Berg, A. (2013). Das M.O.B.I.L.I.S.-Schulungsprogramm – Bewegungstherapie und Lebensstilintervention bei Adipositas und Diabetes. *Diabetes aktuell, 11*(1), 10-16. doi:10.1055/s-0033-1338142

Langer, F. B., Reza Hoda, M. A., Bohdjalian, A., Felberbauer, F. X., Zacherl, J., Wenzl, E., Schindler, K., Luger, A., Ludvik, B., & Prager, G. (2005). Sleeve gastrectomy and gastric banding: effects on plasma ghrelin levels. *Obesity Surgery, 15*(7), 1024-1029. doi:10.1381/0960892054621125

Langer, F. B., Bohdjalian, A., Shakeri-Manesch, S., Zacherl, J., Riener, R., Schindler, K., Ludvik, B., & Prager, G. (2008). Eating behavior in laparoscopic sleeve gastrectomy: correlation between plasma ghrelin levels and hunger. *European Surgery, 40*(3), 120-124. doi:10.1007/s10353-008-0406-0

Laurenius, A., Larsson, I., Bueter, M., Melanson, K. J., Bosaeus, I., Forslund, H. B., Lönroth, H., Fändriks, L., & Olbers, T. (2012). Changes in eating behaviour and meal pattern following Roux-en-Y gastric bypass. *International Journal of Obesity, 36*(3), 348-355. doi:10.1038/ijo.2011.217

Legenbauer, T., de Zwaan, M., Benecke, A., Mühlhans, B., Petrak, F., & Herpertz, S. (2009). Depression and anxiety: their predictive function for weight loss in obese individuals. *Obesity Facts, 2*(4), 227-234. doi:10.1159/000226278

Legenbauer, T., Petrak, F., de Zwaan, M., & Herpertz, S. (2011). Influence of depressive and eating disorders on short- and long-term course of weight after surgical and nonsurgical weight loss treatment. *Comprehensive Psychiatry, 52*(3), 301-311. doi:10.1016/j.comppsych.2010.06.012

Lehnert, T., Streltchenia, P., Konnopka, A., Riedel-Heller, S. G., & König, H. H. (2015). Health burden and costs of obesity and overweight in Germany: an update. *European Journal of Health Economics, 16*(9), 957-967. doi:10.1007/s10198-014-0645-x

LeMont, D., Moorehead, M. K., Parish, M. S., Reto, C. S., & Ritz, S. J. (2004). *Suggestions for the pre-surgical psychological assessment of bariatric surgery candidates*. American Society for Metabolic and Bariatric Surgery. Retrieved from https://asmbs.org/wp/uploads/2014/05/PsychPreSurgicalAssessment.pdf. Last accessed August 2017.

Leombruni, P., Pierò, A., Dosio, D., Novelli, A., Abbate-Daga, G., Morino, M., Toppino, M., & Fassino, S. (2007). Psychological predictors of outcome in vertical banded gastroplasty: a 6 months prospective pilot study. *Obesity Surgery, 17*(7), 941-948. doi:10.1007/s11695-007-9173-4

Levenstein, S., Prantera, C., Varvo, V., Scribano, M. L., Berto, E., Luzi, C., & Andreoli, A. (1993). Development of the Perceived Stress Questionnaire: a new tool for psychosomatic research. *Journal of Psychosomatic Research, 37*(1), 19-32. doi:https://doi.org/10.1016/0022-3999(93)90120-5

Löffler, A., Luck, T., Then, F. S., Luppa, M., Sikorski, C., Kovacs, P., Tönjes, A., Böttcher, Y., Breitfeld, J., Horstmann, A., Löffler, M., Engel, C., Thiery, J., Stumvoll, M., & Riedel-Heller, S. G. (2015). Age- and gender-specific norms for the German version of the Three-Factor Eating-Questionnaire (TFEQ). *Appetite, 91*, 241-247. doi:10.1016/j.appet.2015.04.044

Löwe, B., Spitzer, R. L., Zipfel, S., & Herzog, W. (2002). *PRIME MD Patient Health Questionnaire (PHQ). German version [Gesundheitsfragebogen für Patienten]. Manual* (2nd ed.). Karlsruhe: Pfizer. Retrieved from https://www.klinikum.uni-heidelberg.de/fileadmin/Psychosomatische_Klinik/download/PHQ_Manual1.pdf. Last accessed August 2017.

Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., & Herzberg, P. Y. (2008). Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Medical Care, 46*(3), 266-274. doi:10.1097/MLR.0b013e318160d093

Lutz, T. A., & Bueter, M. (2014). The physiology underlying Roux-en-Y gastric bypass: a status report. *American Journal of Physiology – Regulatory, Integrative and Comparative Physiology, 307*(11), R1275-1291. doi:10.1152/ajpregu.00185.2014

Maggard, M. A., Shugarman, L. R., Suttorp, M., Maglione, M., Sugerman, H. J., Livingston, E. H., Nguyen, N. T., Li, Z., Mojica, W. A., Hilton, L., Rhodes, S., Morton, S. C., & Shekelle, P. G. (2005). Meta-analysis: surgical treatment of obesity. *Annals of Internal Medicine, 142*(7), 547-559. doi:10.7326/0003-4819-142-7-200504050-00013

Malik, S., Mitchell, J. E., Engel, S., Crosby, R., & Wonderlich, S. (2014). Psychopathology in bariatric surgery candidates: a review of studies using structured diagnostic interviews. *Comprehensive Psychiatry, 55*(2), 248-259. doi:10.1016/j.comppsych.2013.08.021

Manzoni, A. P., & Weber, M. B. (2015). Skin changes after bariatric surgery. *Anais Brasileiros de Dermatologia, 90*(2), 157-166. doi:10.1590/abd1806-4841.20153139

Matini, D., Ghanbari Jolfaei, A., Pazouki, A., Pishgahroudsari, M., & Ehtesham, M. (2014). The comparison of severity and prevalence of major depressive disorder, general anxiety disorder and eating disorders before

and after bariatric surgery. *Medical Journal of the Islamic Republic of Iran, 28*, 109. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/25664310

McGee, D. L. (2005). Body mass index and mortality: a meta-analysis based on person-level data from twenty-six observational studies. *Annals of Epidemiology, 15*(2), 87-97. doi:10.1016/j.annepidem.2004.05.012

McHorney, C. A., Ware, J. E., & Raczek, A. E. (1993). The MOS 36-Item Short Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Medical Care, 31*(3), 247-263. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8450681

Meany, G., Conceicao, E., & Mitchell, J. E. (2014). Binge eating, binge eating disorder and loss of control eating: effects on weight outcomes after bariatric surgery. *European Eating Disorders Review, 22*(2), 87-91. doi:10.1002/erv.2273

Mensink, G. B., Schienkiewitz, A., Haftenberger, M., Lampert, T., Ziese, T., & Scheidt-Nave, C. (2013). [Overweight and obesity in Germany: results of the German Health Interview and Examination Survey for Adults (DEGS1)]. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz, 56*(5-6), 786-794. doi:10.1007/s00103-012-1656-3

Middleton, K. M., Patidar, S. M., & Perri, M. G. (2012). The impact of extended care on the long-term maintenance of weight loss: a systematic review and meta-analysis. *Obesity Reviews, 13*(6), 509-517. doi:10.1111/j.1467-789X.2011.00972.x

Miras, A. D., Jackson, R. N., Jackson, S. N., Goldstone, A. P., Olbers, T., Hackenberg, T., Spector, A. C., & le Roux, C. W. (2012). Gastric bypass surgery for obesity decreases the reward value of a sweet-fat stimulus as assessed in a progressive ratio task. *American Journal of Clinical Nutrition, 96*(3), 467-473. doi:10.3945/ajcn.112.036921

Moroshko, I., Brennan, L., & O'Brien, P. (2011). Predictors of dropout in weight loss interventions: a systematic review of the literature. *Obesity Reviews, 12*(11), 912-934. doi:10.1111/j.1467-789X.2011.00915.x

Mühlhans, B., Horbach, T., & de Zwaan, M. (2009). Psychiatric disorders in bariatric surgery candidates: a review of the literature and results of a German prebariatric surgery sample. *General Hospital Psychiatry, 31*(5), 414-421. doi:10.1016/j.genhosppsych.2009.05.004

Müller, A., Herpertz, S., & de Zwaan, M. (2012). [Psychosomatic aspects of bariatric surgery]. *Psychotherapie, Psychosomatik, Medizinische Psychologie, 62*(12), 473-479; quiz p. 480. doi:10.1055/s-0032-1327236

Mun, E. C., Blackburn, G. L., & Matthews, J. B. (2001). Current status of medical and surgical therapy for obesity. *Gastroenterology, 120*(3), 669-681. doi:https://doi.org/10.1053/gast.2001.22430

Must, A., Spadano, J., Coakley, E. H., Field, A. E., Colditz, G., & Dietz, W. H. (1999). The disease burden associated with overweight and obesity. *JAMA, 282*(16), 1523-1529. doi:10.1001/jama.282.16.1523

Nguyen, N. T., Goldman, C., Rosenquist, C. J., Arango, A., Cole, C. J., Lee, S. J., & Wolfe, B. M. (2001). Laparoscopic versus open gastric bypass: a randomized study of outcomes, quality of life, and costs. *Annals of Surgery, 234*(3), 279-289; discussion 289-291. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/11524581

NIH. (1991). Gastrointestinal surgery for severe obesity. National Institutes of Health. Consensus Development Conference Panel. *Annals of Internal Medicine, 115*(12), 956-961. doi:10.7326/0003-4819-115-12-956

Ochner, C. N., Kwok, Y., Conceicao, E., Pantazatos, S. P., Puma, L. M., Carnell, S., Teixeira, J., Hirsch, J., & Geliebter, A. (2011). Selective reduction in neural responses to high calorie foods following gastric bypass surgery. *Annals of Surgery, 253*(3), 502-507. doi:10.1097/SLA.0b013e318203a289

Ochner, C. N., Jochner, M. C., Caruso, E. A., Teixeira, J., & Pi-Sunyer, F. X. (2013). Effect of preoperative body mass index on weight loss after obesity surgery. *Surgery for Obesity and Related Diseases, 9*(3), 423-427. doi:10.1016/j.soard.2012.12.009

OECD. (2014). *Obesity update.* Organisation for Economic Co-Operation and Development. Retrieved from http://www.oecd.org/health/Obesity-Update-2014.pdf. Last accessed August 2017.

Ogden, C. L., Yanovski, S. Z., Carroll, M. D., & Flegal, K. M. (2007). The epidemiology of obesity. *Gastroenterology, 132*(6), 2087-2102. doi:10.1053/j.gastro.2007.03.052

Omotosho, P., Mor, A., Shantavasinkul, P. C., Corsino, L., & Torquati, A. (2016). Gastric bypass significantly improves quality of life in morbidly obese patients with type 2 diabetes. *Surgical Endoscopy, 30*(7), 2857-2864. doi:10.1007/s00464-015-4568-0

Ordemann, J., Elbelt, U., & Menenakos, C. (2014). [Procedure selection and technique of metabolic surgery]. *Der Chirurg, 85*(11), 969-974. doi:10.1007/s00104-014-2798-7

Oria, H. E., Carrasquilla, C., Cunningham, P., Hess, D. S., Johnell, P., Kligman, M. D., Moorehead, M. K., Papadia, F. S., Renquist, K. E., Rosenthal, R., & Stellato, T. A. (2005). Guidelines for weight calculations and follow-up in bariatric surgery. *Surgery for Obesity and Related Diseases, 1*(1), 67-68. doi:10.1016/j.soard.2004.12.005

Paul, T., & Thiel, A. (2005). *Eating Disorder Inventory-2. German version. Manual*. Göttingen: Hogrefe.

Peacock, J. C., & Zizzi, S. J. (2011). An assessment of patient behavioral requirements pre- and post-surgery at accredited weight loss surgical centers. *Obesity Surgery, 21*(12), 1950-1957. doi:10.1007/s11695-011-0366-5

Peacock, J. C., & Zizzi, S. J. (2012). Survey of bariatric surgical patients' experiences with behavioral and psychological services. *Surgery for Obesity and Related Diseases, 8*(6), 777-783. doi:10.1016/j.soard.2011.11.015

Pessina, A., Andreoli, M., & Vassallo, C. (2001). Adaptability and compliance of the obese patient to restrictive gastric surgery in the short term. *Obesity Surgery, 11*(4), 459-463. doi:10.1381/096089201321209332

Peterson, C. B., Berg, K. C., & Mitchell, J. E. (2011). Assessment of bariatric surgery candidates: structured interviews and self-report measures. In J. E. Mitchell & M. de Zwaan (Eds.), *Psychosocial assessment and treatment of bariatric surgery patients* (pp. 37-60). New York: Routledge.

Petry, N. M., Barry, D., Pietrzak, R. H., & Wagner, J. A. (2008). Overweight and obesity are associated with psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychosomatic Medicine, 70*(3), 288-297. doi:10.1097/PSY.0b013e3181651651

Pi-Sunyer, F. X. (1999). Comorbidities of overweight and obesity: current evidence and research issues. *Medicine and Science in Sports and Exercise, 31*(Suppl 11), S602-608. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/10593535

Pietiläinen, K. H., Kaprio, J., Borg, P., Plasqui, G., Yki-Järvinen, H., Kujala, U. M., Rose, R. J., Westerterp, K. R., & Rissanen, A. (2008). Physical inactivity and obesity: a vicious circle. *Obesity, 16*(2), 409-414. doi:10.1038/oby.2007.72

Pudel, V., & Westenhöfer, J. (1989). *The Three-Factor Eating Questionnaire (TFEQ). German version [Fragebogen zum Essverhalten FEV]. Manual*. Göttingen: Hogrefe.

Rademacher, C., & Oberritter, H. (2008). ICH nehme ab – das evaluierte Konzept der DGE zur Gewichtsreduktion und langfristigen Umstellung auf eine vollwertige Ernährung. ["ICH nehme ab" - an evaluated approach to weight reduction and to long-term improvement of nutrition and nutrition behaviour]. *Adipositas – Ursachen, Folgeerkrankungen, Therapie, 02*(02), 67-73. doi:10.1055/s-0037-1618625

Ratcliffe, D., Ali, R., Ellison, N., Khatun, M., Poole, J., & Coffey, C. (2014). Bariatric psychology in the UK National Health Service: input across the patient pathway. *BioMed Central Obesity, 1*, 20. doi:10.1186/s40608-014-0020-6

Rieber, N., Giel, K. E., Meile, T., Enck, P., Zipfel, S., & Teufel, M. (2013). Psychological dimensions after laparoscopic sleeve gastrectomy: reduced mental burden, improved eating behavior, and ongoing need for cognitive eating control. *Surgery for Obesity and Related Diseases, 9*(4), 569-573. doi:10.1016/j.soard.2012.05.008

Runkel, N., Colombo-Benkmann, M., Hüttl, T. P., Tigges, H., Mann, O., Flade-Kuthe, R., Shang, E., Susewind, M., Wolff, S., Wunder, R., Wirth, A., Winckler, K., Weimann, A., de Zwaan, M., & Sauerland, S. (2011). Evidence-based German guidelines for surgery for obesity. *International Journal of Colorectal Disease, 26*(4), 397-404. doi:10.1007/s00384-011-1136-5

Runkel, N., & Brydniak, R. (2016). Surgical treatment of metabolic syndrome. *Visceral Medicine, 32*(5), 352-356. doi:10.1159/000449110

Rutledge, T., Adler, S., & Friedman, R. (2011a). A prospective assessment of psychosocial factors among bariatric versus non-bariatric surgery candidates. *Obesity Surgery, 21*(10), 1570-1579. doi:10.1007/s11695-010-0287-8

Rutledge, T., Groesz, L. M., & Savu, M. (2011b). Psychiatric factors and weight loss patterns following gastric bypass surgery in a veteran population. *Obesity Surgery, 21*(1), 29-35. doi:10.1007/s11695-009-9923-6

Rydén, A., Karlsson, J., Persson, L. O., Sjöström, L., Taft, C., & Sullivan, M. (2001). Obesity-related coping and distress and relationship to treatment preference. *British Journal of Clinical Psychology, 40*(2), 177-188. doi:10.1348/014466501163625

Rydén, A., Sullivan, M., Torgerson, J. S., Karlsson, J., Lindroos, A. K., & Taft, C. (2004). A comparative controlled study of personality in severe obesity: a 2-y follow-up after intervention. *International Journal of Obesity, 28*(11), 1485-1493. doi:10.1038/sj.ijo.0802768

Sarwer, D. B., Cohn, N. I., Gibbons, L. M., Magee, L., Crerand, C. E., Raper, S. E., Rosato, E. F., Williams, N. N., & Wadden, T. A. (2004). Psychiatric diagnoses and psychiatric treatment among bariatric surgery candidates. *Obesity Surgery, 14*(9), 1148-1156. doi:10.1381/0960892042386922

Sarwer, D. B., Wadden, T. A., Moore, R. H., Baker, A. W., Gibbons, L. M., Raper, S. E., & Williams, N. N. (2008). Preoperative eating behavior, postoperative dietary adherence, and weight loss after gastric bypass surgery. *Surgery for Obesity and Related Diseases, 4*(5), 640-646. doi:10.1016/j.soard.2008.04.013

Scholler, G., Fliege, H., & Klapp, B. F. (1999). [Questionnaire for Self-Efficacy, Optimism, and Pessimism: reconstruction, selection of items and validation of an instrument by means of examinations of clinical samples]. *Psychotherapie, Psychosomatik, Medizinische Psychologie, 49*(8), 275-283. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/10488648

Scholtz, S., Miras, A. D., Chhina, N., Prechtl, C. G., Sleeth, M. L., Daud, N. M., Ismail, N. A., Durighel, G., Ahmed, A. R., Olbers, T., Vincent, R. P., Alaghband-Zadeh, J., Ghatei, M. A., Waldman, A. D., Frost, G. S., Bell, J. D., le Roux, C. W., & Goldstone, A. P. (2014). Obese patients after gastric bypass surgery have lower brain-hedonic responses to food than after gastric banding. *Gut, 63*(6), 891-902. doi:10.1136/gutjnl-2013-305008

Schumacher, J., Wilz, G., Gunzelmann, T., & Brähler, E. (2000). [The Antonovsky Sense of Coherence Scale. Test statistical evaluation of a representative population sample and construction of a brief scale]. *Psychotherapie, Psychosomatik, Medizinische Psychologie, 50*(12), 472-482. doi:10.1055/s-2000-9207

Scott, K. A., Melhorn, S. J., & Sakai, R. R. (2012). Effects of chronic social stress on obesity. *Current Obesity Reports, 1*(1), 16-25. doi:10.1007/s13679-011-0006-3

Shah, N. R., & Braverman, E. R. (2012). Measuring adiposity in patients: the utility of body mass index (BMI), percent body fat, and leptin. *PLoS ONE, 7*(4), e33308. doi:10.1371/journal.pone.0033308

Shi, X., Karmali, S., Sharma, A. M., & Birch, D. W. (2010). A review of laparoscopic sleeve gastrectomy for morbid obesity. *Obesity Surgery, 20*(8), 1171-1177. doi:10.1007/s11695-010-0145-8

Sjöström, L. (2008). Bariatric surgery and reduction in morbidity and mortality: experiences from the SOS study. *International Journal of Obesity, 32*(Suppl 7), S93-97. doi:10.1038/ijo.2008.244

Sjöström, L. (2013). Review of the key results from the Swedish Obese Subjects (SOS) trial – a prospective controlled intervention study of bariatric surgery. *Journal of Internal Medicine, 273*(3), 219-234. doi:10.1111/joim.12012

Snyder, B., Nguyen, A., Scarbourough, T., Yu, S., & Wilson, E. (2009). Comparison of those who succeed in losing significant excessive weight after bariatric surgery and those who fail. *Surgical Endoscopy, 23*(10), 2302-2306. doi:10.1007/s00464-008-0322-1

Södlerlund, A., Fischer, A., & Johansson, T. (2009). Physical activity, diet and behaviour modification in the treatment of overweight and obese adults: a systematic review. *Perspectives in Public Health, 129*(3), 132-142. doi:10.1177/1757913908094805

Sogg, S., & Mori, D. L. (2009). Psychosocial evaluation for bariatric surgery: the Boston interview and opportunities for intervention. *Obesity Surgery, 19*(3), 369-377. doi:10.1007/s11695-008-9676-7

Sogg, S., Lauretti, J., & West-Smith, L. (2016). Recommendations for the presurgical psychosocial evaluation of bariatric surgery patients. *Surgery for Obesity and Related Diseases, 12*(4), 731-749. doi:10.1016/j.soard.2016.02.008

Spitzer, R. L., Kroenke, K., & Williams, J. B. (1999). Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. *JAMA, 282*(18), 1737-1744. doi:10.1001/jama.282.18.1737

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine, 166*(10), 1092-1097. doi:10.1001/archinte.166.10.1092

Stefater, M. A., Wilson-Pérez, H. E., Chambers, A. P., Sandoval, D. A., & Seeley, R. J. (2012). All bariatric surgeries are not created equal: insights from mechanistic comparisons. *Endocrine Reviews, 33*(4), 595-622. doi:10.1210/er.2011-1044

Stice, E., Sysko, R., Roberto, C. A., & Allison, S. (2010). Are dietary restraint scales valid measures of dietary restriction? Additional objective behavioral and biological data suggest not. *Appetite, 54*(2), 331-339. doi:10.1016/j.appet.2009.12.009

Strissel, K. J., Denis, G. V., & Nikolajczyk, B. S. (2014). Immune regulators of inflammation in obesity-associated type 2 diabetes and coronary artery disease. *Current Opinion in Endocrinology, Diabetes and Obesity, 21*(5), 330-338. doi:10.1097/MED.0000000000000085

Stroh, C., Weiner, R., Horbach, T., Ludwig, K., Dressler, M., Lippert, H., Wolff, S., Büsing, M., Schmidt, U., & Manger, T. (2013). [New data on quality assurance in bariatric surgery in Germany]. *Zentralblatt für Chirurgie, 138*(2), 180-188. doi:10.1055/s-0031-1283889

Stunkard, A. J., & Messick, S. (1985). The Three-Factor Eating Questionnaire to measure dietary restraint, disinhibition and hunger. *Journal of Psychosomatic Research, 29*(1), 71-83. doi:http://dx.doi.org/10.1016/0022-3999(85)90010-8

Tichansky, D. S., DeMaria, E. J., Fernandez, A. Z., Kellum, J. M., Wolfe, L. G., Meador, J. G., & Sugerman, H. J. (2005). Postoperative complications are not increased in super-super obese patients who undergo laparoscopic Roux-en-Y gastric bypass. *Surgical Endoscopy, 19*(7), 939-941. doi:10.1007/s00464-004-8929-3

Tolonen, P., & Victorzon, M. (2003). Quality of life following laparoscopic adjustable gastric banding – the Swedish band and the Moorehead-Ardelt questionnaire. *Obesity Surgery, 13*(3), 424-426. doi:10.1381/096089203765887778

Tritt, K., von Heymann, F., Zaudig, M., Zacharias, I., Sollner, W., & Loew, T. (2008). [Development of the "ICD-10-Symptom-Rating" (ISR) questionnaire]. *Zeitschrift für Psychosomatische Medizin und Psychotherapie, 54*(4), 409-418. doi:10.13109/zptm.2008.54.4.409

Turrell, G., Hewitt, B., Patterson, C., Oldenburg, B., & Gould, T. (2002). Socioeconomic differences in food purchasing behaviour and suggested implications for diet-related health promotion. *Journal of Human Nutrition and Dietetics, 15*(5), 355-364. doi:10.1046/j.1365-277X.2002.00384.x

van Hout, G. C., Verschure, S. K., & van Heck, G. L. (2005). Psychosocial predictors of success following bariatric surgery. *Obesity Surgery, 15*(4), 552-560. doi:10.1381/0960892053723484

Vandenbroeck, P., Goossens, J., & Clemens, M. (2007). *Foresight tackling obesities: future choices – building the obesity system map*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295154/07-1179-obesity-building-system-map.pdf. Last accessed August 2017.

Wadden, T. A., Sternberg, J. A., Letizia, K. A., Stunkard, A. J., & Foster, G. D. (1989). Treatment of obesity by very low calorie diet, behavior therapy, and their combination: a five-year perspective. *International Journal of Obesity, 13*(Suppl 2), 39-46. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/2613427

Wadden, T. A., Butryn, M. L., Sarwer, D. B., Fabricatore, A. N., Crerand, C. E., Lipschutz, P. E., Faulconbridge, L., Raper, S., & Williams, N. N. (2006). Comparison of psychosocial status in treatment-seeking women with class III vs. class I-II obesity. *Surgery for Obesity and Related Diseases, 2*(2), 138-145. doi:10.1016/j.soard.2006.03.016

Wadden, T. A., Sarwer, D. B., Fabricatore, A. N., Jones, L., Stack, R., & Williams, N. S. (2007). Psychosocial and behavioral status of patients undergoing bariatric surgery: what to expect before and after surgery. *Medical Clinics of North America, 91*(3), 451-469. doi:10.1016/j.mcna.2007.01.003

Walfish, S., Vance, D., & Fabricatore, A. N. (2007). Psychological evaluation of bariatric surgery applicants: procedures and reasons for delay or denial of surgery. *Obesity Surgery, 17*(12), 1578-1583. doi:10.1007/s11695-007-9274-0

Walle, H., & Becker, C. (2011). LEAN-Studie II: 1-Jahresergebnisse eines ambulanten, ärztlich betreuten Ernährungskonzepts. [LEAN-Study II: 1-year results of an ambulant, medical attended Nutrition-Concept]. *Adipositas – Ursachen, Folgeerkrankungen, Therapie, 05*(01), 15-24. doi:10.1055/s-0037-1618728

Wardle, J., & Cooke, L. (2005). The impact of obesity on psychological well-being. *Best Practice and Research: Clinical Endocrinology and Metabolism, 19*(3), 421-440. doi:10.1016/j.beem.2005.04.006

Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-Item Short Form Health Survey (SF-36). I. Conceptual framework and item selection. *Medical Care, 30*(6), 473-483. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/1593914

Ware, J. E., Kosinski, M., Dewey, J. E., & Gandek, B. (2001). *How to score and interpret single-item health status measures: a manual for users of the of the SF-8 Health Survey*. Lincoln (RI): Quality Metric Inc.

White, M. A., Kalarchian, M. A., Masheb, R. M., Marcus, M. D., & Grilo, C. M. (2010). Loss of control over eating predicts outcomes in bariatric surgery patients: a prospective, 24-month follow-up study. *Journal of Clinical Psychiatry, 71*(2), 175-184. doi:10.4088/JCP.08m04328blu

Whitlock, G., Lewington, S., Sherliker, P., Clarke, R., Emberson, J., Halsey, J., Qizilbash, N., Collins, R., & Peto, R. (2009). Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet, 373*(9669), 1083-1096. doi:10.1016/S0140-6736(09)60318-4

WHO. (2000). *Obesity: preventing and managing the global epidemic. Report of a WHO consultation (WHO technical report series 894).* World Health Organization. Retrieved from http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/. Last accessed August 2017.

WHO. (2010). *International Classification of Diseases, 10th Revision (ICD-10)*. Geneva: World Health Organization.

WHO. (2016). *Obesity and overweight, fact sheet 311*. World Health Organization. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/. Last accessed August 2017.

Wimmelmann, C. L., Dela, F., & Mortensen, E. L. (2014). Psychological predictors of weight loss after bariatric surgery: a review of the recent research. *Obesity Research and Clinical Practice, 8*(4), e299-313. doi:10.1016/j.orcp.2013.09.003

Wing, R. R., & Phelan, S. (2005). Long-term weight loss maintenance. *American Journal of Clinical Nutrition, 82*(Suppl 1), 222S-225S. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/16002825

WOF. (2017). *Adult overweight and obesity in the European Union (EU28) based on measured height and weight*. World Obesity Federation. Retrieved from https://content.worldobesity.org/site_media/filer_public/42/c9/42c96a6f-599d-4d57-a80c-6fe31a782a6b/libraryresource_imageseu_28_adults_january_2017_v2.pdf. Last accessed August 2017.

Wright, S. M., & Aronne, L. J. (2012). Causes of obesity. *Abdominal Imaging, 37*(5), 730-732. doi:10.1007/s00261-012-9862-x

Wu, T., Gao, X., Chen, M., & van Dam, R. M. (2009). Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: a meta-analysis. *Obesity Reviews, 10*(3), 313-323. doi:10.1111/j.1467-789X.2008.00547.x

Zhang, Y., Wang, J., Sun, X., Cao, Z., Xu, X., Liu, D., Xin, X., & Qin, M. (2015). Laparoscopic sleeve gastrectomy versus laparoscopic Roux-en-Y gastric bypass for morbid obesity and related comorbidities: a meta-analysis of 21 studies. *Obesity Surgery, 25*(1), 19-26. doi:10.1007/s11695-014-1385-9

Eidesstattliche Erklärung

Hiermit erkläre ich an Eides statt,

1) dass keine Zusammenarbeit mit gewerblichen Promotionsberatern stattfand,
2) dass mir die zugrundeliegende Promotionsordnung der Lebenswissenschaftlichen Fakultät der Humboldt-Universität zu Berlin vom 05. März 2015, veröffentlicht im Amtlichen Mitteilungsblatt Nr. 12/2015, bekannt ist,
3) dass die Dissertation oder Teile davon nicht bereits bei einer anderen wissenschaftlichen Einrichtung eingereicht, angenommen oder abgelehnt wurden,
4) dass ich mich nicht anderwärts um einen Doktorgrad der Psychologie beworben habe und noch keinen entsprechenden Doktorgrad besitze,
5) dass ich die Dissertation auf der Grundlage der angegebenen Hilfsmittel und Hilfen selbstständig angefertigt habe gemäß § 6 (3) der zugrundeliegenden Promotionsordnung und
6) dass ich die Grundsätze der Humboldt-Universität zu Berlin zur Sicherung guter wissenschaftlicher Praxis eingehalten habe.

Berlin, 27. September 2017

_____

Andrea Figura