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Depression and Disordered Eating in the Obese Person

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Abstract

Three mental health problems commonly associated with obesity are major depression, binge eating disorder (BED), and Night Eating Syndrome (NES). Evidence from both cross-sectional and longitudinal studies support independent relationships between obesity and depression, and between obesity and binge eating. These problems are most prevalent in severely obese individuals (Class III obesity; a body mass index (BMI) of >40kgm^2), many of whom seek bariatric surgery, and we briefly review whether the presence of pre-operative depression, BED or NES affects post-operative outcomes. Historically depressed individuals have been screened out of weight loss trials due to concerns of worsening mood with weight loss. Such practices have precluded the development of effective treatments for depressed, obese individuals, leaving large numbers of people without appropriate care. We present recent advances in this area, and attempt to answer whether depressed individuals can lose clinically significant amounts of weight, show improvements in mood, and adhere to the demands of a weight loss intervention.

Keywords

Obesity; Depression; Binge Eating Disorder; Night Eating Syndrome; Weight Loss; Psychological; Bariatric surgery; Disordered Eating

Introduction

The worldwide epidemic of obesity is now overwhelming both industrialized and developing countries. The serious physical and medical health problems that accompany the obese state, including cardiovascular disease, type 2 diabetes, cancer and sleep apnea, are well-recognized. These problems bring considerable physical impairment and burden to obese individuals, and stretch health care systems to their limits. Increasingly clinicians and researchers are recognizing the many adverse *mental* health outcomes that accompany obesity, which also significantly impair quality of life and health-related functioning. For many, the psychological hardships that come with being obese are more distressing than the medical comorbidities they endure. Three of the psychological phenomena most commonly associated with obesity, depression, binge eating disorder (BED), and Night Eating Syndrome (NES), are the focus of this review. Both depression and BED have a bi-directional relationship with weight gain and obesity, and there is some evidence to suggest that each of them can thwart weight loss efforts. Fewer studies exist examining the

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Lucy F. Faulconbridge and Colleen F. Bechtel declare that they have no conflict of interest.

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longitudinal relationship between obesity and NES. All three of these disorders are more prevalent in individuals with Class III obesity (those with a BMI of 40kg/m^2 or greater), many of whom seek bariatric surgery. We explore whether participants with depression, BED or NES achieve sub-optimal outcomes following bariatric surgery. Treatments targeting binge-eating and night-eating in the obese person are well-researched and documented, and are beyond the scope of this review: we refer the reader to several excellent reviews [1–4]. Much less is known about effective treatments for depression in obese individuals, in part because depressed individuals are routinely screened out of weight loss trials. As such, the field knows little about how to treat the obese, depressed patient. We review the evidence that examines whether depressed, obese individuals can undertake weight reduction safely, and achieve clinically significant weight losses. In addition we present the first attempts in the field to develop combined interventions that target depression and obesity concurrently, finally offering treatment options to a large proportion of the obese population.

Relationship between Depression and Obesity

Major depressive disorder (MDD) not only brings significant emotional suffering to the afflicted person and their families, but also places the patient at greater risk for a variety of medical problems, including cardiovascular disease (CVD) and cardiovascular death (even in the absence of obesity) [5–12]. Given that obesity also predisposes individuals to such risks, the combination of depression and obesity is likely to be especially pernicious. Lifetime prevalence rates of depression in the USA are at about 16.2% in the general population [13], and there is now good evidence from both cross-sectional and longitudinal studies that rates of depression are significantly higher in obese persons [14••– 16].

Cross-sectional studies

A large recent meta-analysis of 17 epidemiological studies examining the relationship between obesity and depression found a pooled odds ratio (OR) of 1.18, such that the odds of being depressed were 18% higher in obese vs. non-obese persons [14••]. The risk of depression was increased only for obese women, but not for men: lean and obese men had an equal probability of being depressed but obese women were 32% more likely to be depressed than their non-obese counterparts.

In addition to gender, obesity severity has been repeatedly shown to influence the strength of the relationship. Onyike et al., [15] failed to find an association between depression and obesity for persons with either Class I (BMI 30–34.9kg/m^2) or Class II (BMI 35–39.9kg/m^2) obesity [15]. However, a strong relationship was found for persons with Class III obesity (past-month OR=4.98, 95% CI: 2.07–11.99; past-year OR=2.92, 95% CI: 1.28–6.67; lifetime OR=2.60, 95% CI: 1.38–4.91), indicating significantly greater risk for all time periods. These results were consistent with findings of Petry et al., [16] who found a much greater risk for depression among individuals with Class III Obesity (OR=2.02, 95% CI: 1.74–2.35) than among obese individuals of all classes (OR=1.53, 95% CI: 1.41–1.67).

Cross-sectional studies establish that a relationship exists between obesity and depression, but do not address whether one develops as a consequence of the other. Obese persons struggle not only with prejudice and social stigma, but also with significant impairments in physical functioning. Often repeated attempts at weight loss do not result in success, which can result in internal feelings of failure and hopelessness. As such, it is not difficult to imagine how obesity could lead to depression. On the other hand, it is also easy to comprehend how depression could cause weight gain and eventual obesity. One of the defining symptoms of depression is anhedonia – a loss of interest or pleasure in things once enjoyed [17]. This, alongside increased fatigue, difficulty concentrating, and loss of feelings

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of self-efficacy, may contribute to self-neglect and interfere with attempts to adhere to a healthy lifestyle. Longitudinal studies addressing whether obesity leads to depression and vice versa broadly conclude that there is evidence to support relationships in both directions.

Longitudinal studies

Obesity to depression—A recent, large meta-analysis examining the prospective relationship between obesity and the development of depression found an adjusted pooled OR of developing depression (among those who were obese at baseline) of 1.57 (95% CI: 1.23–2.01), indicating a significantly increased risk of developing depression [18••]. Interestingly, no moderating effect of gender was found in this study, with the risk for developing depression among obese men and women being approximately equal. In contrast, a recent study by Gariepy and colleagues found no overall increased risk for depression in individuals who were obese at baseline [19]. Obesity and depression were assessed seven times over a 12-year period in more than 10,500 Canadian adults. In this study there was also no effect of gender such that obese women were not at increased risk of developing depression, and obesity appeared protective against depression for men (i.e., their risk of depression was lower than for non-obese men).

In a systematic review of the literature designed to evaluate the temporal associations between obesity and depression, Faith et al., examined 25 studies, 10 of which tested “obesity-to-depression” pathways, and 15 tested “depression-to-obesity” pathways [20]. A significant majority (80%) of the studies supported a significant obesity-to-depression association, with adjusted ORs within the range of 1.0 to 2.0. Only two of seven studies which examined gender as a moderator of the relationship reported significant findings [21,22]. Thus, while the current data allows the tentative conclusion that obesity is a risk factor for the development of depression, more research is required to make strong conclusions. Clearly not all obese individuals go on to develop depression, and research which focuses on identifying at-risk sub-populations, as well as work which reveals the factors that provide immunity for the obese patient against developing depression, is required.

Depression to obesity—Data supporting a temporal depression-to-obesity relationship is more mixed than for the obesity-to-depression relationship. In the review by Faith et al., only 8 of the 15 (53%) studies addressing depression-to-obesity relationships reported significant depression-to-obesity ORs, and three of these studies indicated that individuals had a *lower* risk of obesity if they had a history of depression [20]. Interestingly, however in those studies which did find a positive relationship, the strength of the ORs were notable, with ORs in the range of 2.0 to 3.0. In the meta-analysis by Luppino et al. [18], the pooled depression-to-obesity relationship was significant (even after adjustment for co-variates), but the ORs were smaller than those found for obesity-to-depression relationships, and smaller than those in the Faith et al. review [20]. Again, there was no moderating effect of gender, such that women were not at greater risk for development of depression than men.

The causal mechanisms that lead a depressed person to become overweight or obese have yet to be established empirically. Eating and sleeping disturbances are common features of depression; overeating and disrupted sleeping combined with other symptoms such as loss of motivation, fatigue, and decreased ability to concentrate (and therefore adhere to a diet) could all contribute to weight gain over the long term. Distorted thinking is a core element of depression, and thoughts such as “I will never be able to stick to this healthy eating plan over the long-term, I may as well give up now,” or “Who cares if I give up on myself,” may repeatedly interfere with weight loss attempts. Finally, biological factors may play a role. Depression and stress lead to an altered physiological state, with known hormonal

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disruptions in the hypothalamic-pituitary axis. Possible sequelae of such alterations include hyperphagia [23] and increases in fat deposition [24,25].

Obesity and Binge Eating Disorder

Binge eating disorder (BED) is another mental health problem that is independently associated with obesity and depression. BED, the most common eating disorder in the United States, affecting 1–3% of adults [26], is defined by recurrent episodes of binge eating, defined as the consumption of an objectively large amount of food in a short period of time (<2 hours), accompanied by a sense of loss of control over eating during the episode. Binge eating episodes are also associated with eating more rapidly than normal, eating until feeling uncomfortably full, eating large amounts of food when not feeling physically hungry, eating alone due to embarrassment about the amount of food consumed, and feeling disgust, depression or guilt following overeating [27].

The lifetime prevalence of BED has been assessed in both the USA [26] and Europe [28•] in large population samples. Rates in the USA were higher than in Europe, with rates being 3.5% in women (compared to 1.9% in Europe) and 2.0% in men (compared to 0.3% for European males) [26,28•]. Given that binge episodes are core features of the disorder, it is not surprising that obesity is common among individuals suffering from BED. In Hudson's study, 42% of participants with BED were obese (BMI >30kg/m^2), and among these participants, the likelihood of being morbidly obese (BMI>40kg/m^2) was significantly greater than those without any eating disorder (OR = 4.9, 95% CI: 2.2–11.0) [26]. Higgins et al., surveyed binge-eating behavior in 45,477 overweight or obese veterans and found very high rates (78.2%) [29]. Moreover, the rates of binge-eating increased with increasing obesity severity: Class I (76.3%), Class II (80.2%) and Class III (83%). Prevalence rates of BED are highest in severely obese treatment-seeking adults, with rates ranging from 5% [30–32] to 50% [33–35], depending on the strictness of criteria used to diagnose BED. It is worth noting that these prevalence rates may increase in future studies due to changes to the diagnostic criteria of BED in DSM V [17]. In order to be diagnosed with BED, binge episodes must now be experienced once per week over the previous 3 months representing a change from the DSM-IV criterion which required twice-weekly binge episodes for at least 6 months.

Depression in Persons with BED

Depression and BED are highly comorbid. Several studies in the 1990s found that 47–51% of BED patients had a lifetime comorbidity of MDD [36–39], significantly more than lifetime rates of depression in the general population (around 16% [13]). A more recent study by Grucza and colleagues also found significantly greater risk of MDD for participants with BED compared to those without BED (OR = 5.4, 95% CI: 2.3–12.9), even after controlling for BMI [40]. BED has also been found to be associated with higher rates of suicidal ideation than the general population (27.5% in individuals with BED [41] versus 2–18% in the general population [42]). Moreover, Carano et al. [41] found suicide attempts to be more common in individuals with BED (12.5%) than in those without BED (approximately 4.6% [42–43]). Given the greater prevalence of depression and BED in those with Class III obesity, it would be reasonable to hypothesize that depression is most prevalent in participants with BED who are also severely obese. Yanovski and colleagues [36] compared rates of depression among BED patients with moderate (BMI 30.0–38.1 kg/m^2) and severe obesity (BMI > 38.1 kg/m^2). While participants with BED had a much higher rate of depression than those without BED, there was no difference in the rate of depression between moderately and severely obese participants with BED. This suggests that that severity of obesity did not significantly affect prevalence of depression in binge-eaters.

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Obesity and Night Eating Syndrome

Night-eating syndrome (NES), first described in 1955 by Dr. Albert Stunkard, is characterized by evening hyperphagia, meaning that at least 25% of the daily caloric intake is consumed after the last evening meal *or* that two or more nocturnal eating episodes (waking up at night to eat) occur per week [4]. An individual must be aware of, and able to recall, evening and nocturnal eating in order to meet criteria for NES. Night eating syndrome is also associated with a lack of desire to eat in the morning, a strong urge to eat between dinner and sleep onset or during the night, insomnia, a belief that one must eat in order to initiate or return to sleep, and depressed mood or worsening of mood during evening hours [4]. NES was not listed in the DSM-IV, but has been included in DSM-V in the "Other Specified Feeding or Eating Disorder" category [17].

The lifetime prevalence of NES is slightly below that of BED, affecting approximately 1.5% of adults [44]. Although NES is not exclusive to the overweight/obese population, it is more common among obese persons, affecting approximately 10% of obese individuals [45]. NES may lead to weight gain in both normal weight and overweight/obese individuals [46], though no significant difference in BMI has been found between obese individuals with NES (mean BMI=44.4 kg/m^2, sd = 6.3) compared to those without NES (mean BMI=42.7 kg/m^2, sd = 6.7) [47]. In a Swedish population-based sample, Tholin et al. [48] found that the likelihood of being diagnosed with NES was greater for both overweight men and women than for their lean counterparts (men: OR = 1.38, 95% CI: 1.12–1.71; women: OR = 1.51, 95% CI: 1.17–1.96) [48]. The ORs were even stronger when comparing *obese* men and women to normal weight men and women (men: OR = 2.47, 95% CI:1.80–3.41; women: OR = 2.80, 95% CI: 2.03–3.86) [48], indicating that the prevalence of NES may be greater with increasing obesity severity. Other studies support this, estimating prevalence rates of NES as highest in severely obese treatment-seeking adults, with rates ranging from 8% [49] to 42% [50]. The lack of standard diagnostic criteria until recently [51], may account for this wide range.

Depression in Persons with NES

One of the criteria for NES (see above) is depressed mood, which tends to worsen over the course of the day, reaching a nadir in the evening [52]. Clear prevalence rates of depression among those with NES, however, are difficult to pinpoint, partly because depressed individuals are screened out of night-eating trials [53–55]. Numerous studies have revealed higher scores on the Beck Depression Inventory in individuals with NES than in obese-matched controls without NES [49,52,56–58]. A recent study conducted in Turkey investigated the prevalence of NES in a group of 335 patients with and without major depression, and found that the rate of NES was significantly higher (32.5%) in the depressed group than in the non-depressed group (19.2%) [59]. Risk factors for the development of NES in this sample were depression, male gender, and a BMI of 25 or greater. Disruptions in the serotonin system are characteristic of both depression and night eating, and selective serotonin reuptake inhibitors are the primary pharmacotherapy for NES [60,61]. More research is needed to understand the shared common pathway linking these two disorders, and longitudinal studies are required to determine whether low mood predisposes a patient to developing NES, or whether it is a consequence of the disorder.

Do Depression and Disordered Eating Impair Weight Loss following Bariatric Surgery?

As noted above, depression, binge eating and night eating are particularly prevalent among patients in the highest BMI categories, many of whom will seek bariatric surgery. Bariatric

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surgery is the most effective means to achieve weight loss for persons who have a BMI of 40 kg/m^2 or greater, routinely inducing weight losses of 25% to 30% of initial weight. The relationship between depression and bariatric surgery is of particular interest to the field, in part due to reports of increased suicidal behavior following surgery compared to obese controls who have not had the surgery [62]. Tindle et al., examined the outcomes of 16,683 bariatric surgery operations conducted in Pennsylvania residents and found an overall suicide rate of 6.6/10,000 (13.7 per 10,000 in men and 5.2 per 10,000 in women) [63••]. These rates are significantly higher than the age- and gender-matched suicide rates in the USA (2.4/10,000 for men and 0.7/10,000 for women). The mechanisms behind an increased risk of suicidal behavior following surgery are currently unknown. Potential explanations include the presence of depression and/or suicidal behavior prior to surgery, and acute feelings of failure if bariatric surgery should fail. As yet it is not known whether suicide rates are higher in participants who are considered treatment failures (i.e., those who do not lose a significant amount of weight, or who regain weight, following surgery). Research in this area is imperative to determine those most at risk for suicide, such that early intervention can protect them.

Despite the above-noted concerns, most studies show improvements in symptoms of depression and quality of life in surgery patients as they lose weight, although these studies were conducted in primarily non-depressed patient populations [64–66]. In fact, some studies showed greater weight losses in surgery patients who had symptoms of depression, or a history of psychiatric treatment, prior to surgery [67–70]. In a prospective, observational study of BED patients choosing surgery or lifestyle modification for weight loss, Faulconbridge et al., found significant improvements in both depression and quality of life in both groups at 6 and 12 months, even after controlling for the remission of binge episodes [71]. In contrast to the favorable findings noted above, no study to date has directly compared outcomes in bariatric surgery participants with and without diagnosed MDD. While most bariatric surgery centers require a psychological assessment as part of the screening process for surgery, many centers do not require post-operative follow-up with mental health professionals. It is not yet possible to predict which participants may experience incident depression, or worsening of existing symptoms of depression, following the surgery.

Another focus of the pre-surgical psychological assessment is whether disordered eating, including binge-eating or night-eating episodes, are a contra-indication for surgery. Many researchers and clinicians have expressed concern that pre-operative binge episodes would interfere with post-operative weight loss [72–74], leading some [75] to recommend that surgical candidates with BED seek treatment as a prerequisite to surgery. To address this debate, Wadden et al., [76•] compared weight loss outcomes in surgery candidates with BED with obese-matched controls without any symptoms of BED. At one year, there was no difference between the groups in the percent of initial weight loss (22.1 vs. 24.2%). The number of days on which participants reported a binge episode fell sharply, from a mean of 9.5 days prior to surgery to 0 days at month 6, and 1.5 days at month 12. At 6 months, 34/36 (94.4%) of surgery participants with BED met remission criteria, with 33/36 (91.7%) participants meeting such criteria at 12 months. These data add support to accumulating evidence that preoperative BED (or sub-clinical BED) does not impair weight loss following bariatric surgery [77–81].

Few studies have directly examined whether NES predicts poor weight loss following surgery. A small, retrospective study found no correlation between pre-surgical nocturnal eating and post-surgical weight loss [82]. In a prospective study, Powers et al., [83] found no differences in weight 5 years after surgery between participants with and without pre-surgical NES. Wide variability in the night eating criteria, small sample side, and

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retrospective analysis limits the ability to generalize these findings. In summary, the presence of depression, BED, or NES should not necessarily be viewed as a contra-indication for surgery, as surgery yields positive outcomes for the majority of patients with these disorders. However, researchers are not yet able to predict which surgery patients will have suboptimal weight loss or suffer from worsening symptoms of depression, binge eating or night eating. As such, mood and eating behavior should, ideally, be monitored carefully both pre- and post-operatively by mental health professionals with expertise in weight management.

Lack of Treatments for the Depressed, Obese Individual

Research on effective treatments for obese, depressed individuals is scarce, predominantly because depressed individuals are routinely screened out of weight loss trials. This practice began in the 1950s following the results of two studies which raised concerns about the effects of dieting and weight loss on psychological health. The first study induced dramatic weight loss (25% of initial weight) in lean men, causing them to become emaciated. The researchers observed worrying psychological problems in the starving men, including depression, nervousness, anxiety and kleptomania [84]. The second study coined the term “dieting depression” to characterize symptoms of nervousness and weakness in a group of obese adults on a psychiatric inpatient ward trying to lose weight [85]. Clearly the samples in these two studies are quite different from the majority of obese individuals undertaking more moderate weight losses (~5–10% of initial weight). In fact, the majority of weight loss trials undertaken in non-depressed individuals reveal improvements, rather than worsening, in mood, as well as protection against the incidence of depression and suicidal ideation [86–91]. The concerns about the effects of weight loss on psychological health and mood, however, still stand and depressed individuals are usually screened out of weight loss trials [92–95]. The unfortunate consequence is that we know little about the effects on mood of weight loss in participants who are already depressed.

Outcomes for Depressed Individuals in Weight Loss Trials

Researchers have considered three questions when enrolling depressed individuals in weight loss trials. First, researchers have asked whether depressed individuals can achieve the same *magnitude of weight loss* as non-depressed individuals [96–99]. Second, there is concern that depressed persons may experience *worsening symptoms of depression* when enrolled in a weight loss trial [84,85]. Potential explanations for this include the pressure of being asked to complete the rigorous requirements of most lifestyle intervention programs, which typically involve regular participation in group meetings, and strongly encourage completion of food diaries and adherence to calorie goals and exercise prescriptions [100]. Other potential factors may be disappointment associated with less than desired weight losses, or some biological link between weight loss and depression. Finally, some have suggested that depressed individuals will not be able to *adhere* to the requirements of a weight loss trial and that they will drop out of the trial prematurely [101–104]. Robust answers to these questions have been lacking until recently, due to a paucity of studies examining the effect of weight loss on mood in obese individuals with clinically diagnosed MDD. In this section we review the studies which address these questions.

Can depressed individuals lose as much weight as non-depressed individuals?

Some studies have found no relationship between the magnitude of weight loss and depression status at baseline, [89,101] whereas others observed smaller weight losses in patients with greater symptoms of depression [96,99,105]. Most of these studies were conducted primarily in non-depressed samples and were limited by small sample sizes. Thus, the question of whether individuals with MDD can lose as much weight as non-

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depressed individuals was, until recently, an open question. The first pilot study to approach this issue recruited 14 obese participants who met criteria for MDD, assessed via structured clinical interview [106•]. Participants received a modified behavioral activation intervention which emphasized overeating as a depressive behavior for 12 weeks combined with 6 dietary counseling sessions and lost a mean of 5.5 lbs. These results provided initial evidence that obese individuals with MDD could lose weight. More encouraging results were yielded by Faulconbridge and colleagues [107•] who conducted a pilot study with 12 obese, depressed individuals who received a combination of lifestyle modification for their obesity and cognitive-behavioral therapy for their depression for 16 weeks. The mean weight loss among those who completed the study was 11.4% of initial weight, comparable to the magnitude of weight loss observed in non-depressed participants undergoing lifestyle modification interventions [100]. While each of these pilot studies was limited by the lack of a control group, small sample size, and lack of longer-term follow-up, they provided the first indication that depressed individuals could achieve clinically significant weight losses. In a larger, randomized controlled trial, Linde and colleagues confirmed these indications [108••]. In this study, 203 obese, depressed women were randomized to behavioral weight loss treatment alone or to a behavioral weight loss combined with cognitive-behavioral depression management. Participants receiving each intervention lost comparable amounts of weight (−2.8kg vs. −1.8kg, respectively). Moreover, in that same trial, weight losses achieved by women with and without MDD in the behavioral weight loss treatment alone condition were comparable at both 6 and 12 months [97••].

In contrast, however, a recent study found that remission of depression was associated with greater weight losses than in those whose depression did not remit [109••]. The Be Active trial aimed to test whether treatment of depression via behavioral activation (BA) *prior* to initiation of the weight loss treatment would facilitate greater weight loss and improved symptoms of depression than a lifestyle intervention alone (LI) in obese, depressed women. While no differences were found between treatment conditions in the amount of weight lost, participants in remission from depression (as measured by the BDI-II) lost significantly more weight at 6 months (−4.29%) than those who were not in remission (−2.48%), regardless of treatment group. This suggests that active depression symptoms may interfere with weight loss, although depressed persons who remit are capable of achieving clinically significant weight loss. As such, it may be that concurrent treatment of depression alongside weight loss treatment is advisable for some. These studies provide good evidence that participants with major depression can lose clinically significant amounts of weight, although whether the magnitude of weight loss is comparable to non-depressed individuals is not yet clear.

Will depression at baseline worsen with weight loss?

In all of the studies outlined above, mean depression scores declined significantly over the course of the study, indicating improvements, rather than worsening symptoms of depression. In Faulconbridge's study, depression scores (as assessed by the Hamilton Severity Rating Scale for Depression (HDRS) [110] declined from 20.4 (moderate to severe depression) at baseline to 9.3 (mild depression) at the end of treatment. All but one of the study's completers showed significant improvements in their symptoms of depression and 67% met complete remission standards [111]. One participant, however, did show worsening symptoms of depression and required extra psychiatric care, despite losing >8% of her initial weight. Participants in Pagoto's trial [106•] also showed significant improvements in their symptoms of depression, as measured by the Beck Depression Inventory-II (BDI-II). Finally, in Linde's study [108••], comparable improvements in symptoms of depression were observed in participants assigned to either treatment group,

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providing further evidence that neither the demands of a weight reduction program, nor weight loss itself, appear to worsen mood for the majority.

In the Be Active Trial outlined in the previous section [109••], participants who received treatment for depression prior to weight loss treatment (i.e., those in the BA condition) showed greater declines in their symptoms of depression (as measured by the BDI-II) than those assigned to LI at 6 and 12 months, indicating that treating both depression and obesity achieves the best outcomes. That said, participants in the LI only condition, who received no depression treatment at all, showed remarkable improvements in their symptoms of depression. Remission rates in this group ranged from 39.7–50.5% at 6 months and 47.2–62.9% at 12 months, depending on the assessment tool. Thus, for some individuals in weight loss trial, depression will remit in the absence of treatment for depression, while others benefit more from a combined treatment approach. Taken together, these studies argue against the notion that weight loss exacerbates or worsens mood for the majority of individuals with MDD.

Can depressed individuals adhere to a weight loss trial?

Several studies conducted in primarily non-depressed samples have found higher attrition rates from weight loss trials among participants with greater depression symptomology at baseline [101–104]. Only one study, to our knowledge, has examined adherence to a weight loss intervention specifically in participants diagnosed with clinical depression. Ludman et al., examined adherence to a 26-session weight loss intervention which spanned a year in obese women with and without MDD [97••]. They found no differences either in participation of assessment visits, or attendance at group sessions, between depressed and non-depressed individuals at 6 or 12 months. It remains unclear which variables account for the high attrition rates sometimes observed in this population.

Overall, these findings suggest that the exclusion of depressed persons from weight loss treatments based on the rationale that they will fail treatment is not justified. Moreover, these studies provide the first attempts at developing combined treatments targeting depression and obesity simultaneously, at last providing effective treatment options for obese persons who present with comorbid depression. The weight loss achieved in the participants in three of the studies noted above [97,108,109], although clinically significant, was less (by about half) than that achieved in other lifestyle modification trials (which recruit predominantly non-depressed individuals) [100]. As such, it may be prudent to moderate the weight loss expectations of depressed individuals undertaking weight reduction. In addition, a small minority of patients do experience adverse psychological events during weight loss [89,107], and thus careful monitoring of mood in all individuals who undertake weight loss is advisable.

Conclusions

Obese individuals who suffer from depression or disordered eating, or both, deserve particular attention. This article has shown that triangular relationships exists between obesity, depression, and either binge-eating or night-eating.. The literature points to mostly favorable outcomes for individuals with symptoms of depression or disordered eating (BED or NES) who undergo bariatric surgery, both in terms of weight loss and in terms of improvements in mood and quality of life. However, some patients show worsening in mood and increased suicidal ideation, and research must focus on identifying predictors of such outcomes. Depressed individuals have been routinely screened out of weight loss trials due to concerns that they will yield sub-optimal weight loss outcomes and will drop out prematurely. Early evidence suggests that the majority of depressed individuals can lose significant amounts of weight, can adhere to the demands of a lifestyle intervention, and that

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the majority experience significant improvements in mood. Recent studies have made progress in developing combined treatments, targeting both depression and obesity for these individuals. Some depressed participants enrolled in weight loss trials show improved mood in the absence of specific treatments for depression, while others benefits from a two-pronged approach (targeting depression and obesity simultaneously). Future research should focus on the identifying the patients most at risk for adverse psychological outcomes when undertaking intentional weight reduction such that treatments can be tailored accordingly.

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