

Obesity, mental health, and sexual dysfunction: A critical review

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Abstract

Obesity has profound medical, psychological, and emotional consequences and is associated with sexual difficulties. Little is known regarding the interrelationship between obesity and sexual functioning from a psychological perspective, and less is known regarding treatment options. This review examines these issues and considers various treatments. Literature searches were conducted to locate original research, reviews, systematic reviews, and meta-analyses of obesity, overweight, sexual function, sexual dysfunction, psychological health, mental health, and weight loss. Research demonstrates an association between obesity, mental health, and sexual functioning, but has failed to identify casual pathways between these conditions. Clarifying such pathways is necessary to inform treatment guidelines for clinical practice.

Keywords

obesity, overweight, psychological factors, sexual dysfunction, sexual function

Introduction

Obesity is one of the fastest-growing and most challenging public health problems and at 2014 was estimated to affect 1.9 billion adults globally (World Health Organization (WHO), 2015). The detrimental effects of obesity are well known within the academic literature. Obesity is a risk factor for early mortality, greater morbidity, and chronic diseases such as heart disease, hypertension, stroke, type 2 diabetes, the metabolic syndrome, negatively impacts mental health (Cook et al., 2003; De Wit et al., 2010; Lechleitner, 2008; McLaren et al., 2008; Weiss et al., 2004), and lead to poorer quality of life (Residori et al., 2003; Sturm and Wells, 2001). Furthermore, overweight usually begins the upward trajectory to obesity (Kranjac and Wagmiller, 2016; Williams, 2011), and the severity of these conditions is positively correlated to the degree of obesity (Abilés et al., 2010).

Sexual functioning is an integral component of health; therefore, one could theorize a correlation between sexual functioning and obesity (WHO, 2006). In psychological terms, sexual functioning is broadly defined by the psychological motivators involved (such as attraction and desire), and acknowledges the effect that conditions such as depression, anxiety, stress, and low self-esteem have on sexual

functioning (DeLamater and Karraker, 2009). Sexual dysfunction is linked with several psychological problems such as depression, anxiety, poor body image, and low self-esteem. Although obesity has been associated with sexual dysfunction, there is little research investigating the associations between obesity and sexual functioning. However, there is strong evidence to suggest an association between sexual functioning and mental wellbeing (Ace, 2007), as well as body mass index (BMI) and mental wellbeing (McCrea et al., 2012). As mentioned, numerous studies have shown a relationship between sexual dysfunction and common mental health disorders, such as depression and anxiety (Ace, 2007; Angst, 1998; Baldwin, 1996; Kennedy et al., 1999; Laurent and Simons, 2009; Saks, 1999), and yet there are few links between sexual functioning and common mental health disorders noted in the *Diagnostic*

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and *Statistical Manual of Mental Disorders*, 5th Edition (DSM-5) (Cooper, 2014).

The aim of present review is to examine the relationship between sexual functioning and body weight in individuals with overweight or obesity and to determine the effect of psychological health conditions have on sexual dysfunction. To this end, literature searches were conducted to locate original research articles, reviews including systematic reviews and meta-analyses of obesity, overweight, sexual function, sexual dysfunction, psychological health, mental health, and weight loss. The data source was Embase and PubMed, searched from 1980 to 2017. Articles were selected and reviewed based on matches within the title and abstract and/or the full text article.

Definitions

Overweight and obesity

The WHO definition of overweight and obesity is “abnormal or excessive fat accumulation that presents a risk to health” (WHO, 2015). The distribution of body fat is an important indicator of the associated health risk, as central or abdominal obesity is associated with a greater risk to health than a gynoid fat distribution, which is fat that is distributed evenly around the body (WHO, 2015). BMI can be used to classify individuals’ weight status according to weight and height (WHO, 2015) and is calculated by dividing the weight in kilograms by the squared height of the individual, in meters (kg/m^2). Overweight is defined as having a BMI between 25 and 29.9 and obesity is defined as having a BMI of 30 or more (WHO, 2015).

Sexual health and sexual function

According to the WHO (2006), sexual health is defined as “a state of physical, mental and social well-being in relation to sexuality; it is not merely the absence of disease, dysfunction or infirmity. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence. For sexual health to be attained and maintained, the sexual rights of all persons must be respected, protected and fulfilled.” Sexual functioning is broader than the frequency of sexual activity alone and includes occurrence of desire, arousal, lubrication, orgasm, pain, satisfaction, and sex hormones (DeLamater and Karraker, 2009; Rosen et al., 2000, 2002).

While there is strong evidence of the relationship between sexual functioning and testosterone in men (DeLamater and Karraker, 2009), the relationship between estrogen and female sexual functioning is not as clear (DeLamater and Karraker, 2009; Diaz-Arjonilla et al., 2008). Examining menopause, a time of hormonal change

in women, can help explain the impact of estrogen on sexual functioning (Basson, 2006). Menopause was associated with a significant reduction in estrogen levels; this, in turn, has been associated with vaginal dryness and atrophy, which may lead to dyspareunia (Basson, 2006; DeLamater and Karraker, 2009). In addition, changes to the size of the clitoris and the tissues lining the vagina, which are associated with menopause, may also impact on sexual functioning (DeLamater and Karraker, 2009).

Sexual dysfunction

According to the DSM-5, sexual dysfunction is defined by disorders of desire, arousal, orgasm, and pain (Cooper, 2014); however, there is no universally recognized definition of sexual dysfunction (Boyle et al., 2003; Lewis et al., 2004). As epidemiological research is based on common definitions, prevalence rates have been difficult to ascertain (Lewis et al., 2004). To create a universal definition, and therefore more accurate estimate the prevalence of sexual dysfunction, an International Consultation Committee, consisting of 200 major urology and sexual medicine experts from 60 countries, was assembled (Lewis et al., 2004). As reported by Lewis et al. (2004), the committee defined sexual dysfunction by the following sexual difficulties, faced by women and men:

- Sexual desire dysfunction: diminished sexual interest or desire.
- Persistent sexual arousal dysfunction: genital arousal in the absence of sexual desire that is spontaneous, intrusive, and unwanted.
- Orgasmic dysfunction: the lack, delay, or significantly diminished intensity of orgasmic sensation.
- Sexual aversion: extreme anxiety and/or disgust in response to anticipated or attempted sexual activity.
- Sexual arousal disorder in women: this was defined by the presence of genital sexual arousal dysfunction, subjective sexual arousal dysfunction, or both. Genital sexual arousal dysfunction was defined as absent or impaired genital arousal, and subjective sexual arousal dysfunction was defined as absent or diminished feelings of sexual arousal or pleasure.
- Dyspareunia in women: pain that persists or recurs with attempted or complete vaginal penetration.
- Vaginismus in women: persistent or recurrent difficulty with allowing vaginal penetration, despite the desire to do so.
- Erectile dysfunction in men: this was defined as the inability to attain and/or maintain penile erection sufficient for sexual activity.
- Early ejaculation in men: ejaculation before or shortly after sexual stimulation, which was earlier than desired.

- Delayed ejaculation in men: undesirable delay in attaining orgasm during sexual activity.
- Anejaculation in men: the absence of ejaculation during orgasm evoked by sexual stimulation.

Prevalence of sexual dysfunction

Using the above common definitions, the committee reviewed evidence-based reports to determine global prevalence rates of sexual dysfunction (Lewis et al., 2004). The results of this review, - similar to findings by the WHO (Lewis et al., 2004), indicate that approximately 40 percent–45 percent of women and 20 percent–30 percent of men had at least one sexual dysfunction (Lewis et al., 2004). In women:

- Prevalence of low sexual desire was 17 percent–55 percent, increasing with age;
- Prevalence of arousal and lubrication disorders was 8 percent–15 percent in non-sexually active, while this increased to 21 percent–28 percent in sexually active;
- Prevalence of orgasmic dysfunction varied with location: western societies had a rate of 25 percent among 18–74-year-old women, while Nordic countries reported an 80 percent prevalence rate in this age cohort;
- While global approximations of vaginismus were difficult to ascertain, the committee reported a rate of 6 percent in Morocco and in Sweden;
- Although an approximate world-wide prevalence rate of dyspareunia was not determined, a prevalence of between 18 percent and 20 percent was found in British and Australian studies.

Research in men primarily focused upon erectile dysfunction; however, the committee critically assessed epidemiological studies on other aspects of sexual dysfunction, based on stringent inclusion criteria (Lewis et al., 2004). In men:

- The prevalence of erectile dysfunction in men under 40 years was 1 percent–9 percent; in men between 40 and 59 years, erectile dysfunction ranged from 2 percent–9 percent to 20 percent–30 percent; for men between 60 and 69 years, the range was 20 percent–40 percent; and in men aged in the 70s and 80s, the range was 50 percent–75 percent.
- The prevalence of early ejaculation globally ranged from 9 percent to 31 percent.
- There was limited epidemiological research investigating orgasmic dysfunction in men, although data for men in the United States and France estimated the prevalence rate to be 7 percent.
- There was a lack of research investigating the prevalence of genital pain in men, and therefore no approximate global rate was determined.

Global prevalence rates indicate that sexual dysfunction is a significant public health issue. Similarly, Australian surveys identified this issue as a notable problem within the population, as 57.8 percent of men (McCabe and Connaughton, 2014) and 41 percent of women reported experiencing sexual dysfunction (Dunn et al., 2000). According to the Australian Study of Health and Relationships, the most common sexual dysfunction in men were lack of sexual desire, early ejaculation, and anxiety about sexual performance, while women more commonly reported lack of sexual desire and orgasmic dysfunction (Richters et al., 2003). To further determine the prevalence of sexual dysfunction in Australia, Boyle et al. (2003) conducted a study with 1793 participants (876 males and 908 females, between 18 and 59 years), selected from the Commonwealth electoral roll. In this sample, sexual dysfunction was reported by 55 percent of men and 60 percent of women (Boyle et al., 2003). Of these, 42 percent of men and 41 percent of women had one to two symptoms of sexual dysfunction, and 13 percent of men and 20 percent of women had three or more symptoms (Boyle et al., 2003). Only 6 percent of participants with sexual dysfunction reported seeking help, and help-seeking behaviors were more common in older respondents (Boyle et al., 2003).

Assessing sexual function

The use of validated scales to assess sexual functioning ensures that sexual dysfunction is accurately classified (Lewis et al., 2004). While there are several indices of sexual functioning in general, instruments that measure sexual functioning by gender would better describe how differs for men and women. The committee identified the International Index of Erectile Function (IIEF) (Rosen et al., 2002) and the Female Sexual Function Index (FSFI) (Rosen et al., 2000) as well-validated indices appropriate for the classification of the severity of sexual dysfunction (Lewis et al., 2004).

IIEF

The IIEF, developed by Rosen et al. (2002), measures the components of male sexual functioning by collecting scores for five domains: *erectile function*, *orgasmic function*, *sexual desire*, *intercourse satisfaction*, and *overall sexual satisfaction*. This self-administered questionnaire relates to experiences of the previous 4 weeks, with several items defining each domain. For example, *erectile function* is determined by such questions as: *When you had erections with sexual stimulation, how often were your erections hard enough for penetration?* and rated on a scale where 0=no sexual activity, 1=almost never or never, 2=a few times (less than half the time), 3=sometimes (about half the time), 4=most times (more than half the time), and

5=almost always or always. *Orgasmic function* is determined by such questions as: *When you had sexual stimulation or intercourse, how often did you have the feeling of orgasm or climax (with or without ejaculation)?* and rated on a scale where 1=almost never or never, 2=a few times (less than half the time), 3=sometimes (about half the time), 4=most times (more than half the time), and 5=almost always or always. *Sexual desire* is determined by such questions as: *How would you rate your level of sexual desire?* and rated on a scale where 1=very low or none at all, 2=low, 3=moderate, 4=high, and 5=very high. *Intercourse satisfaction* is determined by such questions as: *When you attempted sexual intercourse, how often was it satisfactory for you?* and rated on a scale where 0=did not attempt intercourse, 1=almost never or never, 2=a few times (less than half the time), 3=sometimes (about half the time), 4=most times (more than half the time), and 5=almost always or always. Finally, *overall sexual satisfaction* is determined by such questions as: *How satisfied have you been with you overall sex life?* and rated on a scale where 1=very dissatisfied, 2=moderately dissatisfied, 3=equally satisfied and dissatisfied, 4=moderately satisfied, and 5=very satisfied. Domain scores are calculated to provide an overall sexual functioning score. Sexual dysfunction is classified by an overall score of 21 or less (Esposito et al., 2004; Rosen et al., 2002). A high degree of internal consistency, test–retest reliability, and discriminant validity was observed for all five domains (Rosen et al., 2002). Furthermore, a high level of sensitivity and specificity was demonstrated using the IIEF to assess sildenafil treatment (otherwise known as Viagra) response in patients with erectile dysfunction (Rosen et al., 2002).

FSFI

Developed by Rosen et al. (2000), the FSFI measures components of female sexual functioning by collecting scores for six domains: *desire*, *arousal*, *lubrication*, *orgasm*, *satisfaction*, and *pain*. Each item in this self-administered questionnaire is prefaced with the phrase: *Over the past 4 weeks ...*, and has several items for each domain. For example, *desire* is measured with such questions as: *“... how would you rate your level (degree) of sexual desire or interest?”*, and rated on a scale where 1=very low or none at all, 2=low, 3=moderate, 4=high, and 5=very high. *Arousal* is measured with such questions as: *“... how would you rate your level of sexual arousal (turn on) during sexual activity or intercourse?”* and rated on a scale where 0=no sexual activity, 1=very low or none at all, 2=low, 3=moderate, 4=high, and 5=very high. *Lubrication* is measured with questions such as: *“... how difficult was it to become lubricated (wet) during sexual activity or intercourse?”*, and rated on a scale where 0=no sexual activity, 1=extremely difficult or impossible, 2=very difficult, 3=difficult, 4=slightly difficult, and 5=not difficult. *Orgasm* is

measured with such questions as: *“... when you had sexual stimulation or intercourse, how difficult was it for you to reach orgasm (climax)?”*, and rated on a scale where 0=no sexual activity, 1=extremely difficult or impossible, 2=very difficult, 3=difficult, 4=slightly difficult, and 5=not difficult. *Satisfaction* is measured with such questions as: *“... how satisfied have you been with your overall sexual life?”*, and rated on a scale where 1=very dissatisfied, 2=moderately dissatisfied, 3=about equally satisfied and dissatisfied, 4=moderately satisfied, and 5=very satisfied. Finally, *pain* is measured with such questions as: *“... how often did you experience discomfort or pain following vaginal penetration?”*, and rated on a scale where 0=did not attempt intercourse, 1=almost always or always, 2=most times (more than half the time), 3=sometimes (about half the time), 4=a few times (less than half the time), and 5=almost never or never. Again domain scores are calculated to provide an overall sexual functioning score. During development the FSFI, Rosen et al. (2000) was assessed for internal and test–retest reliability, discriminant and divergent validity; a high degree of reliability and validity was detected in each component. An independent study by Wiegel et al. (2005) cross-validated the FSFI, and developed cut-off scores, using the index in clinical- and population-based samples, and found that scores lower than or equal to 26.55 indicated sexual dysfunction.

Association with obesity

Prevalence of sexual dysfunction in individuals with overweight or obesity

Currently, studies of the relationship between body weight and sexual functioning is minimal. (Kolotkin et al., 2006; Larsen et al., 2007) conducted a review investigating the relationship between sexual functioning and obesity and found no evidence to suggest that sexual dysfunction caused obesity, however there was strong evidence to indicate that obesity caused sexual dysfunction (Larsen et al., 2007). Although there are few studies investigating the association between female sexual functioning and obesity, there is strong support from cross-sectional and prospective studies linking erectile dysfunction and obesity. The above review also noted a positive impact of body weight reduction on sexual functioning in women and men with obesity (Larsen et al., 2007). However, the reviewer was unable to conclude whether the improvements in sexual functioning were attributable to body weight reductions or the intervention methods.

Kolotkin et al. (2006) conducted cross-sectional study of 1158 participants with obesity before weight loss treatment to examine the association between sexual quality of life and obesity. Study participants were either patients about to undergo either gastric bypass surgery ($n=500$; BMI $m=41.3$ kg/m²), an intensive weight loss program

($n=500$; BMI $m=47.1$ kg/m²), or controls ($n=286$; BMI $m=43.6$ kg/m²) (Kolotkin et al., 2006). Results revealed a statistically significant negative correlation between sexual quality of life and BMI ($p<0.001$), with women reporting greater sexual impairment than men (Kolotkin et al., 2006). Of the three groups, gastric bypass patients reported the greatest sexual impairment, while individuals in the weight loss program reported sexual quality of life greater than or equal to the control group, and thus demonstrated a relationship between body weight and sexual quality of life in individuals with obesity (Kolotkin et al., 2006).

Weight loss and sexual functioning

Given an association between obesity and sexual dysfunction exists, the next step would be to investigate whether reductions in body weight improve sexual functioning in individuals with obesity. With this in mind, Kolotkin et al. (2009) conducted a 2-year study of gastric bypass patients ($n=187$) who received regular meetings with a dietitian, personalized diets, an exercise regime, and medication. Data on sexual quality of life and BMI collected every 3 months showed reductions in BMI to be significantly associated with improvements in sexual quality of life ($p<0.0001$) (Kolotkin et al., 2009). Average weight loss over the 2 years was 13.1 percent of baseline body weight; subgroup analysis found that women reported improvements across all items, whereas men reported improvements in their perception of sexual attractiveness only (Kolotkin et al., 2009), and illustrates the benefit of weight loss on sexual functioning (Kolotkin et al., 2009).

These results were supported in other studies specifically investigating the effect of weight loss on the sexual functioning of individuals with obesity by sex. For example, studies using the IIEF to measure post-intervention sexual functioning in men reported improvements in sexual functioning (Hsiao et al., 2012; Khoo, 2010). Further evidence has shown that men with obesity with erectile dysfunction as diagnosed by IIEF had improved sexual functioning following lifestyle changes for weight loss (Esposito et al., 2004). Studies investigating the relationship between weight loss and sexual functioning in obese women are scarce. Kim et al. (2006) conducted an 8-week study of 46 women with overweight or obesity taking weight reduction medication (sibutramine) along with behavioral therapy; sexual functioning data were collected using the FSFI. Weight reduction was significantly associated with improved sexual functioning, specifically in arousal and orgasm scores ($p<0.05$) (Kim et al., 2006). This evidence shows the positive impact that weight loss—achieved by various intervention methods—can have on sexual functioning for men and women. Further research is needed to determine the relationship between sexual functioning and psychological and

metabolic conditions associated with obesity, and to investigate the impact weight loss may have on these variables.

Psychological conditions associated with obesity

The relationship between obesity and common mental disorders such as depression, anxiety, and low self-esteem is well-known (Atlantis and Baker, 2008; De Wit et al., 2010; McCrea et al., 2012). The Royal Australian College of General Practitioners Standing Committee highlighted psychological disorders as a considerable health impact associated with overweight and obesity. Both McCrea et al. (2012) and Kubzansky et al. (2012) demonstrated a positive correlation between body weight and common mental illnesses such as depression, anxiety, and stress. Research has also shown that weight reduction can considerably improve the quality of life and reduce the mental health disorders associated with obesity (Carmichael et al., 2001; Järholm et al., 2012).

Depression, anxiety, stress, and obesity

A range of factors influence the relationship between common mental health disorders and obesity. To investigate this, McCrea et al. (2012) analyzed demographic, physical, and mental health data collected from the UK Adult Psychiatric Morbidity Survey ($n=7043$) and observed a significant relationship ($p<0.05$) between BMI and common mental health disorders, even after controlling for confounding factors. Among young men, mental health disorders were present for those with a lower- or higher-than-normal BMI, whereas a positive correlation between mental health disorders and BMI was observed in young women; this relationship diminished with age for both sexes (McCrea et al., 2012). It is noted however that common mental health disorders, such as depression and anxiety, were combined as a single outcome in this study.

Relationships between BMI and specific common mental health disorders were supported in a study with adolescents ($n=1528$) by Kubzansky et al. (2012) whereby anxiety and depression data were collected every 4 years, along with BMI, demographics, parent education, and stage of pubertal development. The researchers reported that anxiety and depression were significantly associated with higher BMI classifications ($p<0.05$) (Kubzansky et al., 2012). Furthermore, the likelihood of experiencing anxiety or depression was reported to increase with BMI classification; however, BMI trajectories remained stable during the study; therefore, the impact of increasing or decreasing BMI on depression and/or anxiety could not be determined (Kubzansky et al., 2012). The relatively large sample size meant that these results were highly generalizable.

The impact of weight loss on psychological health

With strong evidence of a link between body weight and mental health disorders, it is logical to investigate whether a reduction in body weight improve mental wellbeing. Carmichael et al. (2001) assessed the impact of the Magenstrasse and Mill (M-M; a surgical procedure for weight loss in individuals with obesity) on the quality of life of patients with morbid obesity (MO; $n=82$), compared to participants with MO not undergoing the procedure ($n=35$), and a control group without obesity ($n=20$). The M-M group achieved a higher score on this measure when compared to the MO group ($p<0.01$), but not when compared to the control group (Carmichael et al., 2001). These results suggest that improvements in body weight following the M-M may significantly improve the quality of life in patients with obesity, but also that quality of life may well be restored to that of normal-weight individuals.

Similar findings were reported by Thonney et al. (2010), who investigated this issue in women with MO ($n=43$) following bariatric surgery and found the decrease in weight to be associated with reduced anxiety and depressive symptoms (Thonney et al., 2010). Despite the small sample size and lack of a control group, these findings support the hypothesis that improvements in BMI may be positively associated with improvements in mental health disorders in individuals with obesity. While these findings demonstrate some benefits to weight loss (following bariatric surgery) in women with obesity, further research is needed to determine whether weight loss by means other than surgery produces similar results.

Self-esteem and obesity

Self-esteem is a reflection of self-worth and encompasses beliefs individuals have about themselves, as well as their emotional responses to those beliefs (McClure et al., 2010). Therefore, self-esteem can act as a predictor of life satisfaction, as a reflection of self-worth given the particular circumstances and environments (Biro et al., 2006). To observe the psychological wellbeing of individuals with MO, Abilés et al. (2010) conducted an investigation in 50 bariatric surgery patients before treatment, compared to 25 normal-weight volunteers, and found bariatric surgery patients to report lower self-esteem and quality of life and higher depression, anxiety, and stress, when compared to their normal-weight counterparts (Abilés et al., 2010).

Further evidence demonstrates the link between obesity and low self-esteem, in certain population cohorts. For example, McClure et al. (2010) found a significant negative correlation between obesity and self-esteem in 6522 adolescents recruited through a national study in the United States. In addition, the perception of body weight was shown to be a potent factor for self-esteem in a study by

Perrin et al. (2010) who reported that adolescents who perceive themselves as overweight, whether accurate or not, also had lower levels of self-esteem, with a stronger correlation in those who *misperceived* themselves as overweight. It would appear that an inverse relationship exists between obesity and self-esteem, in the obese population in general and certain cohorts in particular.

While this demonstrates the impact of obesity on self-esteem and other components of psychological wellbeing compared to the normal-weight cohort, it does not determine a causal relationship (Abilés et al., 2010). A complex interrelationship exists between obesity and psychological wellbeing such that a causal relationship is difficult to ascertain; therefore, further research is required to identify factors which may influence psychological wellbeing, such as weight loss interventions.

Weight loss and self-esteem

Studies have been conducted to ascertain whether a reduction in body weight would result in improvements in self-esteem in individuals with obesity. Werrij et al. (2008) investigated the influence of two different weight loss diets on self-esteem with 54 with obesity and found self-esteem to significantly increased with a reduction in BMI ($p<0.05$); weight concerns and depressive symptoms were also reduced (Werrij et al., 2008). Interestingly, no significant difference in self-esteem was detected between the individual and group treatment groups (Werrij et al., 2008). It appears that dietary weight loss is positively correlated with improvements in self-esteem.

Improvements in psychological wellbeing attained by individuals with obesity that underwent non-surgical methods of weight loss may be attributed to a range of modifiable lifestyle factors. Assessing the effects of surgical treatment for obesity may better demonstrate the impact of weight loss with a limited number of confounding factors, as minimal behavioral changes are required compared to non-surgical interventions. Dube (2008) examined the impact of bariatric surgery on self-esteem in women with obesity and hypothesized that while self-esteem would improve immediately following surgery, these improvements diminished significantly 12 months post-surgery, regardless of whether weight loss was maintained. This investigator also suggested that individuals with lower self-esteem prior and after weight loss would have a lower likelihood of maintaining weight reductions gained from bariatric surgery; however, these hypotheses were disproved (Dube, 2008). As self-esteem was reported to improve significantly 4 months following bariatric surgery ($p<0.02$), and this improvement was maintained at the 12-month follow-up, these results support the notion of improved self-esteem in individuals with obesity following bariatric surgery (Dube, 2008).

Further research was conducted by Burgmer et al. (2007) assessed the long-term psychological effects of bariatric surgery on depression, self-esteem, and quality of life 1 and 2 years after surgery in 149 patients. The results showed a mean BMI loss of $12.7 \pm 1.6 \text{ kg/m}^2$ at 1 year and $13.4 \pm 1 \text{ kg/m}^2$ at 2 years following bariatric surgery; self-esteem improved significantly at 1 and 2 years after the surgery compared to the baseline ($p \leq 0.05$), with similar improvements in depression and quality of life (Burgmer et al., 2007). Observing depression in particular, a reduction in depressive symptoms from 40.5 percent at baseline to 17.7 percent was found at the 1-year mark, and to 16.4 percent 2 years following surgery (Burgmer et al., 2007). These results indicate that significant improvements in self-esteem and depression can be achieved with weight loss from bariatric surgery. That such changes can be maintained over the long-term highlights the importance of weight loss as a means of improving psychological wellbeing; however further research in this area is needed. While the impact of improvements in body weight and self-esteem on sexual functioning was not discussed in these studies, the relationships between weight loss, common mental health issues, and sexual function are discussed in greater detail below.

One could argue that improved self-esteem—as a component of self-concept—following weight loss may be the result changes to *perceived* body weight rather than actual BMI. While there are some minor variations depending on gender, in a cross-sectional study with 215 young adults, Connors and Casey (2006) found perceived attractiveness to be positively associated with self-esteem. In newer research, Kamody et al. (2018) found perceived weight status to be inversely associated with both perceived physical health and self-esteem. Although noting similar small variations according to age and gender, a study with 437 adults (mean age 42.3 years) by Davison and McCabe (2005) found body image to be positively associated with both sexual functioning and self-esteem, whereas Kolotkin et al. (2012) reported in a review of the literature that it was *actual* body weight that was negatively associated with sexual dysfunction rather than perceived weight status. This point was supported by the results of a meta-analysis conducted by Blaine et al. (2007), which found weight *loss* to be correlated to higher self-esteem.

Mental health disorders and sexual functioning

The link between sexual functioning and depression is highlighted when considering the issue from the perspective of the DSM-5 (Cooper, 2014) and exists for both women and men, to the extent that both sexual desire and sexual arousal were negatively associated with depression (Laurent and Simons, 2009). Laurent and Simons (2009) identified a negative association between depression and sexual pleasure or satisfaction, as well as a correlation

between orgasm, pain, and depression; however, the latter was not investigated extensively. Other studies have demonstrated that depression is significantly associated with orgasm difficulty and pain in women, and delayed and premature ejaculation in men (Frohlich and Meston, 2002; Kennedy et al., 1999). More specifically, the likelihood of premature ejaculation was more than double in men with emotional problems or stress, and sexual pain was twice as likely in women with emotional problems or stress (Laumann et al., 1999). Furthermore, a study with 203 middle-aged Korean men reported a significant positive association between erectile dysfunction and depressive symptoms, which remained strong after adjusting for age, marital status, education, smoking, alcohol, hypertension, physical activity level, cholesterol, and BMI (Jeong et al., 2011).

The relationship between sexual dysfunction and depression among the female population has been well researched. Mezones-Holguin et al. (2011) measured sexual functioning, menopause, and depression in a sample of 335 healthy, middle-aged, sexually active Peruvian women and found depression to be associated with reduced sexual functioning and hormonal status in this cohort (Mezones-Holguin et al., 2011). These results have been supported in women with an existing health condition. Moel et al. (2010) reported an association between poor sexual functioning and increased depression in postpartum women with depression compared to those who had never suffered depression. Despite an improvement in sexual functioning following psychotherapy, sexual functioning remained lower than in those who had never suffered postpartum depression (Moel et al., 2010). In addition, research assessing sexual functioning in women with hypoactive sexual desire disorder reported that lower FSFI scores were associated with greater sexual distress (Connor et al., 2011). These results provide further evidence of the relationship between sexual dysfunction and depression in women.

Anxiety, another common mental health disorder, is also associated with sexual dysfunction, while this relationship is evident in both women and men (Kaya et al., 2006), the research is not extensive. Kaya et al. (2006) reported a positive correlation between sexual dysfunction and anxiety in women with chronic pelvic pain. In addition, increased anxiety is associated with a greater risk of erectile difficulties and reduced sexual enjoyment (Laurent and Simons, 2009). While Seto (1992) reported that the onset of anxiety had no impact on sexual functioning, there appears to be no evidence to establish a causal pathway for the relationship between anxiety and sexual dysfunction in men and women (Laurent and Simons, 2009).

In general, sexual functioning and mental health disorders appear to have a bidirectional associative relationship; that is mental health disorders have been shown to influence sexual activity, and vice versa (Ein-Dor and Hirschberger, 2012; Kashdan et al., 2011; Laurent and

Simons, 2009). Kashdan et al. (2011) examined the effects of anxiety and depression on sexual activity of 150 college students over 3 weeks, and found both social anxiety and depression to be associated with less pleasure and connectedness during sexual activity. Furthermore, the frequency of sexual contact was negatively associated with depressive symptoms (Kashdan et al., 2011), indicating that sexual contact may have a protective effect against depressive symptoms, although this aspect was not investigated in the study.

Physical activity has many health benefits and is important in reducing the risk of serious health conditions and can improve mental health regardless of its impact on weight (Herman et al., 2012). Conversely, physical inactivity is a significant and independent contributor to obesity (Fogelholm, 2010; Fogelholm et al., 2006). Both low exercise and long sedentary activities decrease energy expenditure and impair weight control and prevention of obesity (Fogelholm, 2008). A recent epidemiologic study suggests that both obesity and physical inactivity are associated with sexual dysfunction (Derby et al., 2000). On the other hand, some studies support a relationship between increased physical activity and improved sexual functioning (Bacon et al., 2003; Esposito et al., 2004; Esposito and Giugliano, 2005); specifically, increased physical activity is associated with lower risk of erectile dysfunction (Laumann et al., 1999).

Esposito et al. (2008) evaluated the effect of weight loss and increased physical activity on erectile dysfunction in men with obesity and found that weight loss and physical activity improved sexual function in one-third of the participants after 2 years; however, the authors were unable to determine whether this improvement was due to reduced weight or increased physical activity as causal pathways were not investigated. Dabrowska et al. (2010) assessed self-reported physical activity and sexuality in pre-menopausal Polish women and found that impaired sexual functioning was less frequent among women with moderate and high physical activity. In addition, as physical activity can have a moderating effect on depressive symptoms, increasing physical activity may improve sexual functioning in individuals with depression (Hoffman et al., 2009). There is evidence to suggest a possible physiological pathway between increased physical activity and improved sexual functioning, although the research is more abundant for men than for women. Increased physical activity has been found to improve sexual functioning by improving endothelial function (i.e. blood flow) in men (Gerbild et al., 2018; Leoni et al., 2014), whereas a multidisciplinary approach, which includes diet and physical activity, can improve endothelial function and sexual functioning in women with obesity (Aversa et al., 2013; Esposito et al., 2008). However, weight loss alone does not appear to improve endothelial function in men or women with obesity (Kerr et al., 2011);

however, more research is needed to confirm a relationship between all of these factors.

Mental health disorders can reduce the quality of sexual activity; however, conversely sexual activity can alleviate some conditions, such as stress (Ein-Dor and Hirschberger, 2012; Laurent and Simons, 2009). An association exists between stress and the onset of anxiety; therefore, the relationship between stress and sexual activity may be an important factor in the relationship between anxiety sexual functioning (Bale and Vale, 2004). Ein-Dor and Hirschberger (2012) observed the influence of sexual activity on stress in 75 heterosexual Israeli adults, by measuring stress and relationship satisfaction over 18 consecutive weekdays, and found sexual intercourse to relieve stress in participants with satisfying relationships. Furthermore, a stressful day increased the likelihood of sexual activity occurring on a subsequent day, with no significant differences between men and women (Ein-Dor and Hirschberger, 2012).

Self-esteem, body image, and sexual functioning

Some evidence suggests a link between self-esteem and certain health conditions, although the relationships between self-esteem, sexual functioning, and obesity are unclear (Goodson et al., 2006; Shackelford, 2001), as this has not been researched extensively. However, a correlation between self-esteem and the components sexuality has been found (e.g. relationship satisfaction and sexual behaviors) (Park, 1999) and may provide an indication of sexual functioning. Observing a sample of 214 heterosexual married individuals, Shackelford (2001) reported that self-esteem was positively correlated with marital satisfaction. Choi et al. (2011) reported a similar relationship in an elderly married cohort ($n = 156$), after conducting a cross-sectional investigation into self-esteem and sexual behaviors; they found that individuals with a more active sexual life had significantly higher self-esteem than those who were less sexually active ($p < 0.05$) (Choi et al., 2011). Furthermore, satisfaction with their sexual life was positively correlated with levels of self-esteem (Choi et al., 2011).

Adolescence is a period of considerable development in sexuality and self-esteem and therefore provides an opportunity to investigate the relationship between these two factors. Goodson et al. (2006) conducted an extensive review to investigate the relationship between self-esteem and sexual behaviors, attitudes, and intentions in adolescents and found no significant associations, which was contrary to the results from previous research in older cohorts (Choi et al., 2011; Shackelford, 2001). With the many psychological and physiological challenges stemming from obesity, it is necessary to determine whether this relationship is evident in the obese population in general.

Self-esteem

The relationship between self-esteem, body weight, and sexual functioning is complex, and while there are some similarities, sexual functioning differs between men and women, thereby posing unique factors in the relationship with self-esteem. Erectile dysfunction is known to cause anxiety and lower self-esteem (Ar et al., 1997; Krane et al., 1989; National Institute of Health, 1993). Martinez-Jabaloyas et al. (2010) demonstrated this relationship in a 14-week case-control study (treatment vs placebo) conducted in 119 men with erectile dysfunction and found that erectile function to improve significantly ($p < 0.0001$). In addition, the treatment group reported significant improvements in self-esteem compared to the placebo group ($p < 0.0001$) (Martinez-Jabaloyas et al., 2010). Furthermore, the authors noted a positive correlation between self-esteem and erectile functioning (Martinez-Jabaloyas et al., 2010).

Strong evidence exists of an association between sexual functioning, body weight, and self-esteem in the women. Woertman and Van den Brink (2012) conducted a review of body image and desire, arousal and lubrication, orgasm, satisfaction, pain, and sexual functioning in general and found that a better body image was associated with greater sexual functioning across all domains. In addition, a positive association between improvements in body image and sexual functioning was associated with weight loss in this group (Woertman and Van den Brink, 2012). Due to a lack of evidence, the reviewers could not comment extensively on the relationship between sexual pain and body image; however, pain was noted as negatively correlated with satisfaction; a domain positively associated with body image (Woertman and Van den Brink, 2012).

Body image

Body image, being the perception of one's own body, is a major component of self-esteem (Akhondi et al., 2011). A positive correlation between body image and sexual functioning has been reported in a range of population cohorts (Lachowsky, 2002; Seal et al., 2009). It follows then that there may be a link between body image and BMI, a hypothesis investigated by Watkins et al. (2008). These investigators analyzed body image scores, together with BMI, collected from 188 male college students, and found BMI to be negatively correlated with body image, noting that satisfaction of body image diminished as BMI increased (Watkins et al., 2008). Body image is influenced by a range of physical factors; therefore, the relationship between body image and physiological conditions can be quite complex. Akhondi et al. (2011) investigated the correlation between body image and sexual functioning in a study of 120 fertile and 120 infertile men and noted that fertile men reported a better body image, compared to their infertile counterparts. This research demonstrates another factor in

the multifaceted relationship between body image and BMI.

Seal et al. (2009) examined body-esteem and sexual desire in 85 female college students by measuring arousal, sexual functioning, and body-esteem at baseline and after reading an erotic story. Body-esteem was positively correlated with greater sexual desire and functioning, although there was no significant relationship between body-esteem and mental and physical sexual arousal, or lubrication (Seal et al., 2009).

Evidence of a relationship between sexual functioning and self-esteem also exists for older age cohorts. A discussion paper examining the impact of menopause on self-esteem by Lachowsky (2002) noted that women identified menstruation as a key component of their youth and femininity; therefore, menopause had the potential to represent the end of youth and femininity and may negatively impact sexuality and potentially reduce self-esteem (Reid et al., 2014; Tremayne and Norton, 2017).

Considerable evidence of a relationship between body weight and self-esteem in women has been recorded. The 10-year US National Growth and Health Study ($n = 2206$) reported BMI and race as important predictors of self-esteem, with reduced self-esteem potentially leading to increased risk-taking behaviors in adolescent females (Biro et al., 2006). In addition, self-esteem was found to be lower in normal-weight women who were previously obese than in ordinarily normal-weight women, indicating the negative impact of obesity on self-esteem can linger (Mustillo et al., 2012). Rosenberger et al. (2006) investigated the impact of body image in 131 female bariatric candidates with obesity and found depression, self-esteem, and perfectionism to be predictors of body image dissatisfaction, with higher depression and perfectionism, and lower self-esteem, associated with greater body image dissatisfaction. These findings indicate the importance of body weight for self-esteem and psychological wellbeing; however, the impact of weight loss on body image, self-esteem, and sexual functioning in the female population has not yet been investigated.

Weight loss, mental health, and sexual function

Due to the interrelated nature of body weight, mental health, and sexual functioning, possible associations between all of these factors warrant further discussion. Strain et al. (2014) examined changes in BMI along with self-reported health- and impact-of-weight-related quality of life as well as depression in 105 bariatric surgery patients, approximately 2 years after surgery. Participants experienced a reduction in BMI ($p = 0.0001$), as well as improved general health, depression, and sexual life scores ($p = 0.05$, 0.0001 , and 0.04 , respectively), among many other variables (Strain et al., 2014). More specifically, Efthymiou et al. (2015) explored changes to BMI, sexual functioning

(IIEF and FSFI), and health-related quality of life at four time points in the first year after bariatric surgery in 80 adults with MO. BMI improved significantly ($p < 0.001$), along with all components of sexual functioning, with the exception of male orgasm, as well as all health-related quality of life sub-scales (Efthymiou et al., 2015).

Existing evidence clarifying the sex differences in the relationships between weight loss, mental health, and sexual function is scarce. A review by Glina et al. (2013) investigating modifiable risk factors to treat and prevent erectile dysfunction concluded that weight loss may improve erection functioning, either by increasing testosterone, reducing inflammation, or by improving self-esteem and mood, in men without comorbidities; however, co-existing conditions such as depression, diabetes, and hypertension may require additional treatments. As well as enhancing mental wellbeing, reductions in body weight appear to improve sexual functioning in individuals with obesity (Assimakopoulos et al., 2011; Dymek et al., 2002; Kolotkin et al., 2009; Mamplekou et al., 2005). Assimakopoulos et al. (2011) investigated the impact of bariatric surgery on depressive symptoms and sexual functioning in female patients with obesity ($n = 59$). Significant reductions in BMI in all patients were reported ($p < 0.001$) and was associated with a reduction in depression, as well as improved sexual functioning (Assimakopoulos et al., 2011). Detailed analysis revealed significant improvements in desire, arousal, lubrication, and satisfaction ($p < 0.02$), as well as a significant reduction in the experience of sexual pain ($p < 0.02$) (Assimakopoulos et al., 2011); however, a causal relationship between these outcome measures was not established. Strong associations between weight loss, mental health, and sexual function cannot be confirmed based on the current evidence; therefore, further research is needed to develop a range of treatment options for overweight and individuals with obesity experiencing sexual dysfunction.

Conclusion

Currently, obesity is at epidemic proportions throughout the world. Many interventions have been implemented in an effort to address this critical issue. Obesity has been shown to be associated with a number of chronic diseases, psychological disorders, as well as sexual dysfunction. The relationship between sexual functioning and obesity is highly complex, and while there is strong evidence to support an association between these two variables, research into sexual functioning and the psychological impacts of obesity (specifically, depression, anxiety, stress, self-esteem, and body image) is limited. Even less research exists for the impact of weight loss on these relationships, therefore research investigating the impact of obesity on sexual functioning, and to illustrate the complex interplay between these two variables, is much needed. Furthermore, while physical activity can improve mental health, it is

unclear whether increasing physical activity and therefore mental health will improve sexual functioning in overweight and individuals with obesity suffering from sexual dysfunction.

Implications for future research and clinical practice

While it is understood that obesity can negatively impact sexual functioning, the complex interrelationships between excessive body weight, mental health, and sexual functioning are unclear. Many of the studies cited in this review failed to establish causation or identify possible pathways between obesity, mental health, and sexual functioning. Clarifying such pathways is necessary to inform treatment guidelines for clinical practice in individuals with overweight or obesity suffering from poor mental health and/or impaired sexual functioning. For example, future research could focus on pharmaceutical treatments for depression and whether they improve sexual functioning in individuals with overweight or obesity. Investigating physical activity as an alternative treatment to improve mental health and/or sexual functioning in this group is another potential focus for research and treatment. Dietary interventions for weight loss, as an alternative to bariatric surgery, may also need to be examined to assist and treat individuals with overweight or obesity to improve sexual functioning. The findings of this research may have important policy and public health practice implications and place sexual functioning higher on the agenda to help curb obesity.

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