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ORIGINAL ARTICLE
Sexual dysfunction in obese and overweight women

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Both overweight and obesity have been identified as risk factors for sexual dysfunction in men, but the relationship between sexual function and amount of body fat in females is still obscure. There are few reported studies in women assessing the relationship between female sexual function index (FSFI) and body weight. The aim of this study was to identify the frequency of female sexual dysfunction (FSD) among obese and overweight women. A total of 45 obese and overweight and 30 age-matched voluntary healthy women serving as a control group were evaluated by a detailed medical and sexual history, including the FSFI questionnaire. Serum prolactin, cortisol, luteinizing hormone (LH), follicle-stimulating hormone (FSH), dehydroepiandrosterone-SO_4 (DHEA-S), testosterone, estradiol and sex hormone-binding globulin (SHBG) levels were measured. No significant difference was observed between controls and patients in terms of the FSH, LH, estradiol, free thyroxine and thyrotropin (TSH), testosterone and DHEA-S levels. The comparison of total FSFI scores between patients and controls showed no significant difference ($P = 0.74$). As the FSFI score of $\leqslant 26.55$ indicated FSD, 86% of obese patients and 83% of controls were considered to have sexual dysfunction. The mean total FSFI score was 22.1 ± 4.3 for obese patients and 23.1 ± 3.7 for healthy women. FSFI scores were not correlated with any of the anthropometric measurements (body mass index (BMI), waist-to-hip ratio (WHR) and fat percent). The levels of total testosterone and DHEA-S were not correlated with total FSFI scores. We found a significant negative correlation between BMI and orgasm ($P = 0.007$, $r = -0.413$). Satisfaction was also negatively correlated with BMI ($P = 0.05$, $r = -0.305$) and weight ($P = 0.03$, $r = -0.326$). Testosterone levels were negatively correlated with only satisfaction domain scores of FSFI ($P = 0.01$, $r = -0.385$). We found that 86% of obese women and 83% of controls had sexual dysfunction. Although obesity does not seem to be a major contributor to sexual dysfunction, it affects several aspects of sexuality.
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Introduction

The increasing prevalence of obesity represents a major public health problem, with an effect on physical and emotional well-being and psychosocial function.[1,2] Obesity is on the rise worldwide; between 1985 and 2001, the prevalence rates of obesity have trebled in the United States. More than 30% of adults in some of the states are now obese.[3] In the 2003–2004 time period, the prevalence of obesity among adults was 32.2%.[4]

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Increasing trends in obesity cause concern among health authorities in terms of associated co-morbidities, including type II diabetes, heart disease, hypertension and certain cancer types. Furthermore, obesity is related with reduced life expectancy and an increased economic burden to the society. Somatic and psychological dysfunctions, such as infertility, osteoarthritis, social disabilities caused by stigmatization, sleeping problems or apnea, are also known to follow obesity. Sexual dysfunction may also be related to obesity, but is rarely mentioned, and may cause concern for the affected individual and partner, constituting a great problem.[5]

The definition of female sexual dysfunction (FSD) includes persistent or recurrent disorders of sexual interest/desire, disorders of subjective and genital arousal, orgasmic disorders and pain and difficulty with attempted or incomplete intercourse.[6] The lack of more specific measurable characteristics in the medical diagnosis of FSD affects the level of

evidence from clinical trials. Although some studies suggest that women are more frequently affected than men, only few clinical trials are available.[7] Sexual difficulties in women, influenced by both health-related and psychosocial factors, seem to be widespread in society, and are associated with impaired quality of life and interpersonal relationships.[8]

Both overweight and obesity have been identified as risk factors for sexual dysfunction in men,[9] but the relationship between sexual function and amount of body fat in females is still obscure.[10,11] Larsen *et al.*[12] have identified one cross-sectional study that investigated the association between obesity and female sexual satisfaction in their review. Borges *et al.*[13] also stated that the complexity of female sexuality, the lack of well-designed epidemiological studies and the use of different tools to assess FSD limit interpretation of results and conclusions in this area.

The discrepancy among the few reports may mainly be attributed to the different instruments used to assess sexual function in women. The female sexual function index (FSFI) is a brief, validated, 19-item self-report instrument used in the assessment of specific sexual dysfunction symptoms.[14] This clinical tool is standardized, easy to administer and score and provides normal values in general and pathological populations.[15]

The relationship between obesity and FSD has been investigated rarely, and no prospective studies have been reported on this topic. There is clearly a need for more studies with prospective data, on the development of FSD both before and after the menopause. However, until such studies are performed, the association between obesity and development of FSD will remain elusive.

The aim of this study, therefore, was to identify the frequency of FSD among obese and overweight women.

Materials and methods

Women seeking weight loss at the Endocrinology and Metabolism outpatient clinic of Pamukkale University were screened during a 6-month period. The study was conducted on 45 otherwise-healthy obese and overweight women.

As personal sexual habits were questioned, married women were included in the study, by the assumption that they could talk more comfortably on these subjects. Premenopausal women with regular menstrual cycles, with a body mass index (BMI) of $\geqslant 25\,kg\,m^{-2}$ were included. All subjects met the requirement of having sexual intercourse at least once a month. Women were excluded if they were pregnant, <8 weeks *post partum* or if they had experienced any of the following: diabetes mellitus (fasting glucose $\geqslant 126$ mg per 100 ml on two different occasions), impaired glucose tolerance (glucose levels of 140–200 mg per 100 ml 2 h after a 75-g oral glucose load) or impaired fasting blood glucose (glycemia between 100 and 126 mg per 100 ml) uremia, multiple sclerosis, chronic alcoholism (intake of $500\,g\,week^{-1}$), neoplasms, psychiatric problems, cardiovascular disease, gynecologic surgery, lower urinary tract symptoms, pelvic trauma, polycystic ovarian syndrome, abnormal thyroid function and use of any drugs.

Control subjects were age- and menopausal status-matched 30 women with a normal BMI from the same population. The study was approved by the institutional committee of ethical practice of our institution, and all women gave informed written consent.

Assessment of sexual function

FSFI, which is a validated, 19-item self-report instrument, was used for assessing key dimensions of female sexual function, as previously described by Rosen *et al.*[14] A total of six domains were analyzed. Specific domains analyzed in the FSFI included sexual desire, arousal, lubrication, orgasm, satisfaction and pain during sexual intercourse. Sexual desire was assessed as frequency and level of sexual desire with two questions. Arousal was assessed as frequency, and level, confidence and satisfaction with four questions. Lubrication was assessed as frequency, difficulty, frequency of maintaining and difficulty in maintaining with four questions. Orgasm was assessed as frequency, difficulty and satisfaction with three questions. Satisfaction was assessed as the amount of closeness with partner, sexual relationship and overall sex life with three questions. Pain was assessed as pain frequency during vaginal penetration and pain frequency after vaginal penetration with three questions. Each domain was scored on a scale of 0 or 1–6, with a higher score indicating better function. A score was calculated for each of the six domains, and the total score was obtained by adding the scores of the six domains. The range of the total score was 2–36, and a score of $\leqslant 26.55$ indicated sexual dysfunction. The tool was administered during the early follicular (days 2–5) phase of the menstrual cycle.

Anthropometric measures and laboratory analyses

Height and weight were recorded with participants wearing lightweight clothing and no shoes using a Seca 200 scale (Seca, Hamburg, Germany) with an attached stadiometer. BMI was calculated as weight in kg divided by the square of height in meters ($kg\,m^{-2}$). The waist-to-hip ratio (WHR) was calculated as the waist circumference in cm divided by the hip circumference in cm. Body fat

distribution (fat percent) was assessed by multiple frequency bioelectric impedance measurement using a portable impedance analyzer (Tanita, Tokyo, Japan).

Assays for glucose were performed in the biochemistry laboratory of the hospital. Blood was obtained to determine prolactin, luteinizing hormone (LH), follicle-stimulating hormone (FSH), dehydroepiandrosterone-SO_4 (DHEA-S), testosterone, estradiol, free thyroxine and thyrotropin (TSH), cortisol and sex hormone-binding globulin (SHBG) in the early follicular phase before 1000 h. The free testosterone levels were calculated according to the Vermeulen formula.[16] HOMA-IR (homeostasis model assessment of insulin resistance) was determined in the study and control groups. Insulin resistance was evaluated according to the Lebovitz classification using a 2.7 cutoff value.[17]

Statistical analysis

Data are presented as the means for normally distributed parameters and presented as the medians for other cases (FSH, LH, estradiol, testosterone, TSH, SHBG and DHEA-S). A two-tailed, unpaired Student's *t*-test was used for comparison of means between women with or without FSD. The Mann–Whitney test was used for non-normally distributed parameters. A value of $P<0.05$ was considered significant.

Results

The clinical and metabolic characteristics of women participating in the study are shown in Table 1. Table 2 lists the scores of FSFI domains for obese and overweight patients.

No significant difference was observed between patients and controls in terms of total FSFI scores ($P=0.74$). As a score of $\leqslant 26.55$ indicated FSD, 86% of obese and overweight patients and 83% of controls were considered to have sexual dysfunction. The mean total FSFI score for obese patients was 22.1 ± 4.3 and the mean total FSFI score for healthy women was 23.1 ± 3.7.

The FSFI scores were not correlated with any of the anthropometric measurements (BMI, WHR and fat percent). In the correlation analysis of total FSFI scores and androgen hormones, the levels of total testosterone and DHEA-S showed no correlation with total FSFI scores. There was also no correlation between FSFI scores and FBG, insulin, estradiol, FSH, LH, prolactin, TSH, cortisol and SHBG levels. We found a significant negative correlation between BMI and orgasm ($P=0.007$; $r=-0.413$). Satisfaction was also negatively correlated with weight ($P=0.03$; $r=-0.326$).

In correlation analysis evaluating age and androgen hormones, a negative correlation was observed between age and free testosterone levels ($P=0.01$; $r=-0.35$), whereas a negative correlation was present between age and DHEA-S levels ($P=0.00$; $r=-0.5$). Although there was no correlation between testosterone and other parameters, free testosterone levels were positively correlated with BMI ($P=0.001$; $r=0.472$), WHR ($P=0.001$; $r=0.495$), insulin ($P=0.00$; $r=0.698$) and DHEAS ($P=0.001$; $r=0.529$) levels. Testosterone levels were negatively correlated with the scores of satisfaction domain of

Table 1 Clinical and metabolic characteristics of women participating in the study

	Obese and overweight (N = 45)	*Control (N = 30)*	P-*value*
Age (years)	36.5 ± 8	33.3 ± 5.2	NS
BMI (kg m^{-2})	37.5 ± 9.1	22.4 ± 2.3	0.00
WHR	0.88 ± 0.3	0.77 ± 0.5	0.00
Fat (%)	41.9 ± 5.7	25.1 ± 5.9	0.00
Fasting glucose (mmol l^{-1})	5.61 ± 0.65	4.97 ± 0.47	0.00
Ins (μIU ml^{-1})	12.7 ± 6.5	4.3 ± 3.5	0.00
HOMA-IR	3.21 ± 1.8	1.1 ± 1.1	0.00
Cortisol (nmol l^{-1})	402.81 ± 157.26	460.8 ± 168.3	NS
FSH (IU l^{-1})	6.75 ± 12.5	7 ± 3.2	NS
LH (IU l^{-1})	4.9 ± 11.4	5.5 ± 3.6	NS
E2 (pmol l^{-1})	165.6 ± 107.2	198.2 ± 117.8	NS
TSH (IU l^{-1})	1.7 ± 0.98	1.8 ± 1.1	NS
SHBG (nmol l^{-1})	34.5 ± 17.8	61.4 ± 29.5	0.00
Free T (nmol l^{-1})	1.08 ± 0.88	0.9 ± 0.6	NS
DHEA-S (μg per 100 ml)	150 ± 85.2	157 ± 90.6	NS
PRL (ng ml^{-1})	12.06 ± 4.6	16.51 ± 4.9	NS
FSFI score	22.1 ± 4.3	23.1 ± 3.7	NS

Abbreviations: BMI, body mass index; DHEA-S, dehydroepiandrosterone-SO_4; E2, estradiol; FSFI, female sexual function index; FSH, follicle-stimulating hormone; HOMA-IR, homeostasis model assessment of insulin resistance; LH, luteinizing hormone; NS, not significant; PRL, prolactin; SHBG, sex hormone-binding globulin; T, testosterone; TSH, free thyroxine and thyrotropin; WHR, waist-to-hip ratio.
Data are presented as means for normally distributed parameters and presented as medians for other cases (FSH, LH, E, T, TSH, SHBG, and DHEA-S).

Table 2 FSFI questionnaire scores

	Obese and overweight (N = 45)	*Control (N = 30)*	P-*value*
FSFI score	22.1 ± 4.3	23.1 ± 4.1	NS
Desire	3.1 ± 0.9	3.3 ± 0.7	NS
Arousal	4.0 ± 1.0	4.1 ± 0.7	NS
Lubrication	4.3 ± 1.2	4.5 ± 1.3	NS
Orgasm	4.0 ± 1.4	4.1 ± 1.3	NS
Satisfaction	4.4 ± 1.3	4.5 ± 1.1	NS
Pain	2.4 ± 1.3	2.5 ± 1.0	NS

Abbreviations: FSFI, female sexual function index; NS, not significant.

FSFI ($P=0.01$; $r=-0.385$). There were negative correlations between serum SHBG levels and WHR ($P=0.05$; $r=-0.29$) and insulin levels ($P=0.001$; $r=-0.46$). Estrogen was positively correlated with body weight ($P=0.001$; $r=0.48$) and fasting insulin levels ($P=0.007$; $r=0.41$).

Discussion

It is unclear whether obese women have sexual dysfunctions more often than non-obese women. Clinical trial data suggest an ambiguous association between obesity and sexual satisfaction in young women.[18,19] Although some studies indicate that women with normal weight may be more sexually active than obese and overweight women, other studies have stated that the contrary may be true.[13] However, weight reduction seems to improve sexual function in young obese women.[20–22] Veronelli *et al.*[23] reported that obese women had a lower score in the FSFI questionnaire when compared with healthy women, and a higher FSFI score was associated with a healthier anthropometric and metabolic status. In addition, the FSFI global score was negatively correlated with the known risk factors for cardiovascular disease, such as blood pressure, HbA1c, low-density lipoprotein cholesterol and TSH, whereas it was positively correlated with high-density lipoprotein cholesterol.[23] In our study, there was no difference between obese and overweight women and controls in terms of FSFI scores. As a score of $\leqslant 26.55$ indicated FSD, 86% of obese patients and 83% of controls were considered to have sexual dysfunction, suggesting that obesity itself is not a major determining factor in sexual dysfunction in women.

The prevalence of FSD in different populations is variable. In a national probability sample of 1749 women between the ages of 18 and 59 years, Lauman *et al.*[7] reported the risk of experiencing FSD based on in-person surveys. They observed an overall rate for sexual problems among women at 43%.[7] Additional instructive reviews have also been published. Lewis *et al.*[24] concluded that estimates of the prevalence of low sexual interest among women showed high variability, ranging from 17 to 55% in studies that they reviewed. Hayes *et al.*[25] in Australia found desire disorder to be the most prevalent FSD condition with a mean of 64% and a range of 16–75%.[25] In addition, using the Women's International Study of Health and Sexuality (WISHeS) data set, Graziottin[26] estimated the prevalence of desire arousal, and orgasmic disorders and observed a significant inter-country variation, with the highest rates of dysfunction in Germany and the United Kingdom, and the lowest rates in Italy and France. Data on arousal and orgasmic disorders were similar, showing the potential for considerable intercultural variation. Graziottin[26] subsequently went on to review the implications of these data for clinical assessment, and explored etiologic differentiation and prognostic implications.

A study concerning the prevalence of FSD in Turkish population in the Ankara region reported that the prevalence of FSD was 53.1% between 31 and 45 years of age. According to the FSFI score, 48.3% of women were observed to have FSD.[27] Another group from Turkey investigated the prevalence of FSD, and possible risk factors causing FSD in the Mersin region. The prevalence of FSD was 25.5% between the ages of 28 and 37 years.[28] Kadioglu *et al.*[29] studied FSD in hyperprolactinemic women. FSD was diagnosed in 22 of 25 patients with hyperprolactinemia (88%), whereas only 4 of 16 healthy women (25%) had FSD by FSFI. Healthy Turkish women living in the Istanbul region had a median total FSFI score of 31.10.[29] Another group investigated sexual function in female patients with coronary artery disease in Istanbul. The average FSFI total score was 26.0 ± 4.8 in healthy controls, and 5 of 15 healthy women (33.3%) had FSD according to a cutoff value of 25.[30] These studies suggest that the prevalence of FSD in different regions of Turkey may vary widely. This might be because of the cultural and traditional differences in different parts of the country. Personal distress levels about sexual behavior may be difficult to estimate. To overcome this drawback and estimate the prevalence of FSD in the general population, studies in different regions with larger populations need to be carried out.

Esposito *et al.*[31] showed that obesity affects several aspects of sexuality, including arousal, lubrication, satisfaction and orgasm in healthy Italian women with FSD who were otherwise healthy. On the other hand, desire and pain were not affected by obesity. Central fat distribution, as evaluated by the WHR, showed no correlation with the FSFI score, nor with any individual sexual domains, suggesting that the amount of fat is more important than its distribution.[31] It is noteworthy that, although not significant, desire has been the only domain showing a positive relationship with BMI, supporting the hypothesis that the domains of women's sexual function may not represent a linear progression.[31,32] The lack of relationship between BMI and FSFI in women without FSD ($r=0.2$; $P=0.09$) seems to suggest that obesity may be an important factor once FSD is manifested. It was speculated that the increasing number of circulating factors produced by the fat cell may have a role,[33] although specifically focused studied are needed. Women with severe obesity, particularly those seeking bariatric surgery, are at considerable risk of having problems with sexual function.[34] Bond *et al.*[35] found that severely obese women seeking bariatric surgery are clearly a population with

diminished sexual function, with approximately 60% of participants reporting FSD. Compared with published norms, bariatric surgery candidates had FSFI domain scores that were lower than those of the control group (all *P*-values <0.0001) but greater than those of the female sexual arousal disorder group (all *P*-values <0.0001), except for desire, for which the scores were similar.[35] In this study, we did not observe any relationship between total FSFI scores and any anthropometric measurements. However, when we evaluated the individual sexual domains, we found that BMI effects orgasm in a negative manner.

Esposito *et al.*[9] also investigated the association of metabolic syndrome and FSD, using the FSFI as previously. Compared with the control group, the women who had metabolic syndrome had overall lower FSFI scores (23.2 ± 5.4 vs 30.1 ± 4.7; $P<0.001$) and lower scores on the six individual domains, all of which except desire were statistically significant ($P<0.01$).[9] Ponholzer *et al.*[36] found that MS in premenopausal women was an independent risk factor for impaired sexual desire ($P=0.03$, with an age-adjusted relative risk of 3.3). Kaneshiro *et al.*[37] showed that sexual behavior differs little among women with different BMI, with the exception of overweight and obese women who were more likely to report ever having male sexual intercourse (92 vs 87%, $P<0.001$). Shah[38] reviewed that one may theorize that there is an increased prevalence of FSD in obese patients, but confirmation with further studies is needed.

Adolfsson *et al.*[18] conducted a study on a Swedish population of 840 younger women (18–49 years), of whom 18% were overweight and 6% were obese, and 426 older women (50–74 years), of whom 32% were overweight and 11% were obese. There was no difference in terms of sexual life satisfaction between the obese and normal-weight women in both age groups. However, in the younger age group there was a tendency toward lower sexual satisfaction and sexual desire associated with higher weights.[18]

Kolotkin *et al.*[19] examined the effect of weight loss on quality of life among 37 men and women. Among women, there was no association between weight changes and changes in sexual life.[19]

The studies generally find that surgery (jejunoileal bypass) for obesity may affect sexual relationships in a positive manner, but the degree of the effect is not clear.[18,19] The study by Rand *et al.*[20] compared sexual function among 32 morbidly obese women and 56 morbidly obese men (>45 kg overweight), aged 36–38 years before and after surgery.[20] After 1 year of surgery, 61% ($n=88$) reported a better sex life compared with the presurgery condition, whereas 27% reported no change. In addition, 14 participants (34%) reported an increased interest in sex, and 56% reported that their partner had showed more interest in sex.[21] Kinzl *et al.*[22] found a low frequency of sexual activity using 82 semistructured interviews with morbidly obese women (average BMI, $42.8\,kg\,m^{-2}$). Preoperatively, 44% were satisfied with their sexual life, but more than one-half of the obese women had some kind of sexual problem, such as low sexual desire (11.2%), sexual avoidance or rare sexual intercourse (23.3%) and difficulty in engaging in sexual intercourse because of physical problems (11%). Postoperatively (1 year later), 63% stated that they enjoyed sexual intercourse more than pre-operatively.[22]

The most important factors that may contribute to an overall change in sexual function after weight reduction in obese young women are alteration of the sex hormones, estrogen and androgen, and improvement in body image. Estrogen is produced from cholesterol in the ovaries or by aromatization of steroids in the adipose tissue. A reduction in fatty tissue can therefore result in decreased levels of blood cholesterol, aromatization and estrogen.[39] Estrogen levels are likely to decrease after weight loss, and this may directly influence the domains of both lubrication and pain, resulting in an increase in sexual pain. We also found a correlation between estrogen and body weight, but no correlation was observed with any of the FSFI domains.

The changes in androgen levels after weight reduction in regularly menstruating obese women reported in several studies indicate that SHBG consistently increases after weight loss, and in turn, free testosterone decreases.[3,40–42] Androgen insufficiency is associated with hypoactive sexual desire disorder,[43] and androgen, in contrast, can increase sexual desire, arousal, orgasm and satisfaction.[44,45] Weight reduction, therefore, can reduce the score in each of these domains. In other words, as people get more obese, they tend to have better satisfaction in sexual life.

Several limitations of the study should be mentioned, including the small sample size, and recruitment of patients from a university outpatient clinic and from a small region. Thus, the findings of this study need to be confirmed in a larger patient population. Because of the limited sample size, our data cannot be of epidemiologic relevance and need to be confirmed in studies of larger size. On the other hand, our study population consisted of women who applied to the university hospital. This may not represent the sexual behavior of the entire population. In addition, the findings might differ in different regions; thus, further investigations are needed to confirm these findings.

Conclusion

In this study we found that 86% of obese and overweight patients and 83% of controls had FSD. Although obesity does not seem to be a major contributor to sexual dysfunction, it affects several aspects of sexuality. As there are inadequate number

of studies investigating female sexual function and obesity, further studies with larger sample size are necessary.

Conflict of interest

The authors declare no conflict of interest.

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