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ORIGINAL ARTICLE

Association of body weight with sexual function in women

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Sexual difficulties in women appear to be widespread in society; the relationship between female sexual function and obesity is unclear. This study aimed to investigate the relationship between body weight, the distribution of body fat and sexual function in women. Fifty-two, otherwise healthy women with abnormal values of female sexual function index (FSFI) score ($\leqslant$23) were compared with 66 control women (FSFI $>$23), matched for age and menopausal status. All women were free from diseases known to affect sexual function. FSFI strongly correlated with body mass index (BMI) ($r=-0.72$, $P=0.0001$), but not with waist-to-hip ratio ($r=-0.09$, $P=0.48$), in women with sexual dysfunction. Of the six sexual function parameters, desire and pain did not correlate with BMI, while arousal ($r=-0.75$), lubrication ($r=-0.66$), orgasm ($r=-0.56$) and satisfaction ($r=-0.56$, all $P<0.001$) did. FSFI score was significantly lower in overweight women as compared with normal weight women, while cholesterol and triglyceride levels were higher. On multivariate analysis, both age and BMI explained about 68% of FSFI variance, with a primacy of BMI over age (ratio 4:1). In conclusion, obesity affects several aspects of sexuality in otherwise healthy women with sexual dysfunction.
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Keywords: body weight; female sexual function; FSFI; obesity

Introduction

Female sexual dysfunction (FSD) is characterized by disturbances in the psychophysiological changes associated with the sexual response cycle in women, including disorders of sexual desire, arousal, orgasm and pain.[1] Sexual difficulties in women appear to be widespread in society, influenced by both health-related and psychosocial factors, and are associated with impaired quality of life and interpersonal relationships.[2] Older data reveal that up to 76% of women had some type of sexual dysfunction.[3] Data from the National Health and Social Life Survey (NHSLS), a study of adult sexual behavior, showed that 43% of women in the US had at least one of sexual problem, in relation with age, marital status, education, race or ethnicity.[4] These figures have recently been confirmed by the results of Global Study of Sexual Attitudes and Behaviors (GSSAB), an international survey of various aspects of sex and relationships among adults aged 40–80 years.[5]

Both overweight and obesity have been identified as risk factors for sexual dysfunction in men,[6] but the relationship between female sexual function and amount of body fat is still obscure.[7,8] The discrepancy that still exists among the few reports may mainly be accounted for by the different instruments used to assess sexual function in women. The Female Sexual Function Index (FSFI) is a brief, validated 19 items self-report instrument proposed to decode information on specific sexual dysfunction symptoms.[9] This clinical tool has the advantage of being standardized, easy to administer and score and provides normal values in general and pathological populations.[10]

To the best of our knowledge there are no reported studies assessing the relation between FSFI and body weight in women. Therefore, the aims of this study were: (a) to identify women with pathological values of FSFI across a wide range of body weight;

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(b) to compare them with control, age-matched women with normal values of sexual function and (c) to investigate the relationship between the amount and distribution of body fat and sexual function.

Subjects and methods

During a 6-month period, women were screened among outpatients seeking routine gynecological care or weight loss at the teaching hospital of the Second University of Naples, Italy. All women were asked to complete a personal health and medical history questionnaire, which served as a screening tool and were eligible for inclusion if they had a stable heterosexual partner relationship for the preceding 6 months. Women were excluded if they were pregnant or less than 8 weeks postpartum or if they had experienced any of the following: diabetes mellitus (fasting glucose >126 mg/dl) or impaired glucose tolerance (glucose levels of 140–200 mg/dl 2 h after a 75-g oral glucose load), uremia, multiple sclerosis, chronic alcoholism (intake of $\geqslant 500$ g/week), neoplasm, psychiatric problems, cardiovascular disease, gynecological surgery, lower urinary tract symptoms, pelvic trauma, polycystic ovarian syndrome, abnormal thyroid function and use of any drug. Cases were women satisfying inclusion/exclusion criteria, either pre- or postmenopausal, with abnormal values of FSFI score; controls were women from the same population with normal values of FSFI score, matched with cases for age (± 2 years) and menopausal status. 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
A validated 19 items self-report instrument for assessing key dimensions of female sexual function, as previously described by Rosen *et al*.[9] was used, and a total of six domains was analyzed. Briefly, 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 desire level with two questions. Arousal was assessed as frequency, 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 following vaginal penetration with three question. Each domain was scored on a scale of zero or 1 to 6, with higher score indicating better function. For each six domains a score was calculated and the total score was obtained by adding the six domain scores. The total score range was 2–36: a score of 23 or lower indicated sexual dysfunction. The tool was administered during the follicular (days 5–8) 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 attached stadiometer. BMI was calculated as weight in kg divided by the square of height in meters (kg/m^2). Waist-to-hip ratio (WHR) was calculated as waist circumference in centimeters divided by hip circumference in centimeters.

Assays for glucose, total, low-density lipoprotein and high-density lipoprotein cholesterol, and triglyceride levels were performed in the hospital's chemistry laboratory.

Statistical analysis
Data are presented as mean $\pm$ s.d. unless otherwise indicated. Continuous variables were tested for normality distribution with the Kolmogorov–Smirnov test. A two-tailed, unpaired Student's *t*-test was used for comparison of means between women with or without FSD. The 1-way ANOVA test with *post hoc* Bonferroni analysis was used for comparisons of categorical variables. Univariate correlation was performed with the Pearson correlation coefficient or the Spearman rank order correlation test when appropriate. Multiple linear regression analysis was performed to identify independent variables influencing the prediction of FSFI. A value of $P<0.05$ was considered significant. All analyses were performed using SPSS 11.5 for Windows.

Results

The clinical and metabolic characteristics of women participating in the study are shown in Table 1. Fifty-two women totalizing a score $\leqslant 23$ (sexual dysfunction) were considered cases: they were compared with age- and menopausal status-matched 66 women with a score >23. In women with FSD, 29 were premenopausal and 23 menopausal; in control women, 37 were premenopausal and 29 menopausal. There was no significant difference in anthropometric measures (BMI and WHR) between the two groups of women with or without FSD; triglyceride levels were significantly higher in women with FSD. The menopausal status did not

Table 1 Clinical characteristics and sexual function scores for each sexual function parameter as w

Parameters	*Women with FSD (N = 52)*	*Women without FSD (N = 66)*	P-*value*
Age (years)	42.3 ± 8.4	44.7 ± 8.4	0.12
BMI (kg/m^2)	26.3 ± 5.1	25.5 ± 4.9	0.38
WHR	0.87 ± 0.06	0.86 ± 0.06	0.45
Menopause (yes/no)	23/29	29/37	0.67
Smoking (yes/no)	24/28	30/36	0.43
Glucose (mg/dl)	85 ± 12	83 ± 11	0.21
Total cholesterol (mg/dl)	213 ± 52	203 ± 51	0.32
LDL-cholesterol (mg/dl)	133 ± 47	131 ± 43	0.83
HDL-cholesterol (mg/dl)	63 ± 14	63 ± 18	1.00
Triglycerides (mg/dl)	98 ± 30	81 ± 39	0.01
FSFI score	19.4 ± 3.5	28.3 ± 2.7	0.001
Desire	2.5 ± 0.9	3.8 ± 0.7	0.001
Arousal	3.3 ± 0.9	4.5 ± 0.8	0.001
Lubrication	3.5 ± 1.0	5.1 ± 0.9	0.001
Orgasm	3.4 ± 0.8	5.0 ± 0.9	0.001
Satisfaction	3.5 ± 1.0	4.9 ± 0.6	0.001
Pain	3.4 ± 0.6	5.0 ± 1.2	0.001

Abbreviations: BMI, body max index; FSD, female sexual dysfunction; FSFI: Female Sexual Function Index; HDL, high-density lipoprotein; LDL, low-density lipoprotein; s.d., standard deviation; WHR: waist-to-hip ratio.
Data are presented as mean ± s.d. Conversion factors to SI units: glucose × 0.0551 (mmol/l); triglyceride × 0.0113 (mmol/l); total, LDL and HDL cholesterol × 0.0259 (mmol/l).

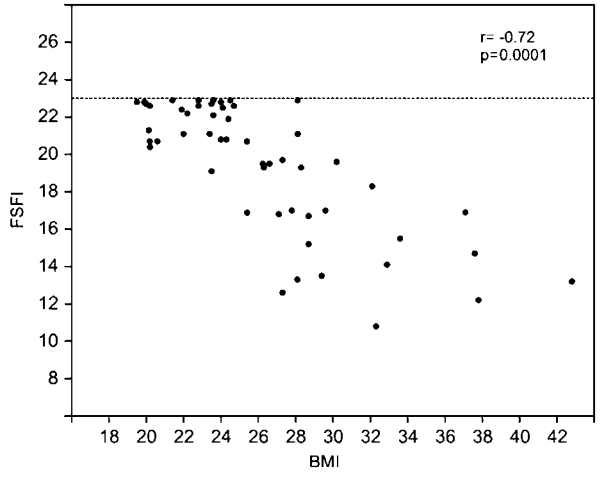

Figure 1 Correlation between FSFI and BMI in the population of women ($n = 52$) with FSD. The horizontal line indicates the cutoff of 23 below which a diagnosis of FSD is currently made.

Table 2 Clinical characteristics and FSFI score in women with FSD according to BMI

Parameters	*Normal weight (BMI < 25)* (n = *26*)	*Overweight (BMI ⩾ 25)* (n = *26*)	P-*value*
Age (years)	47.9 ± 9.0	49.4 ± 7.2	0.29
BMI (kg/m^2)	22.4 ± 1.7	30.1 ± 4.4	0.001
WHR	0.86 ± 0.05	0.87 ± 0.07	0.55
Menopause (yes/no)	10/16	13/13	0.25
Glucose (mg/dl)	83 ± 11	88 ± 11	0.15
Total cholesterol (mg/dl)	184 ± 29	242 ± 54	0.001
Triglycerides (mg/dl)	88 ± 20	109 ± 35	0.011
FSFI score	21.9 ± 1	16.8 ± 3.1	0.001

Abbreviations: BMI, body max index; FSD, female sexual dysfunction; FSFI: Female Sexual Function Index; s.d., standard deviation; WHR: waist-to-hip ratio.
Data are presented as mean ± s.d.

influence these figures. Table 1 also lists FSFI score as well as sexual function scores for each sexual function parameter. There were significant differences in each parameters between the two groups of women, indicating a global dysfunction of the sexuality.

FSFI strongly correlated with BMI ($r = -0.72$, $P = 0.0001$) in women with FSD (Figure 1). Of the six sexual function parameters, desire ($r = 0.24$, $P = 0.08$) and pain ($r = -0.138$, $P = 0.3$) did not correlate with BMI; on the other hand, there was a strong and inverse correlation between BMI and arousal ($r = -0.75$, $P < 0.001$), lubrication ($r = -0.66$, $P < 0.001$), orgasm ($r = -0.56$, $P < 0.001$) and satisfaction ($r = -0.56$, $P < 0.001$). Other parameters that showed significant correlations with FSFI were age, glucose, cholesterol and LDL-cholesterol, and triglycerides. No significant correlations between FSFI and these parameters were seen in women without FSD. Women with FSD were divided according to BMI in normal weight (BMI < 25) or overweight/obese (BMI $\geqslant 25$) (Table 2). FSFI score was significantly lower in overweight /obese women, while total cholesterol and triglyceride levels were significantly higher. In Table 3 are reported univariate and multivariate analyses of correlation between FSFI and clinical, anthropometric and laboratory parameters. The model including all the variables explained about 75% of the variance of FSFI ($R^2 = 0.754$); however, on multivariate analysis subject age, BMI and triglycerides were found to be

Table 3 Correlation of FSFI with age, anthropometric measures, and some cardiovascular risk factors in obese women with FSD ($n=52$)

Characteristic	*Univariate analyses*	*Multivariate analyses*
Age	$r=-0.36$, $P<0.007$	$P=0.001$
BMI	$r=-0.72$, $P=0.0001$	$P=0.0001$
WHR	$r=-0.09$, $P=0.48$	$P=0.96$
Glucose	$r=-0.29$, $P=0.03$	$P=0.12$
Total cholesterol	$r=-0.63$, $P=0.0001$	$P=0.08$
LDL-cholesterol	$r=-0.63$, $P=0.0001$	$P=0.08$
HDL-cholesterol	$r=-0.15$, $P=0.2$	$P=0.10$
Triglycerides	$r=-0.47$, $P=0.0001$	$P=0.01$

Abbreviations: BMI, body max index; HDL, high-density lipoprotein; LDL, low-density lipoprotein; WHR: waist-to-hip ratio.

independently and significantly associated with FSFI. Moreover, both age and BMI explained about 68% of FSFI variance, with a huge prominence of BMI over age (ratio 4:1).

Discussion

Sexuality is an integral part of being human. Sexual difficulties in women are a highly prevalent health problem affecting 22–93% of women according to age group,[2–5,11] although well-designed, random-sample, community-based epidemiological studies are limited and hampered by low response rate, the use of different tools to assess FSD, and the underlying complexity of female sexuality.

In this study, we have shown for the first time that obesity affects several aspects of sexual function in otherwise healthy women with FSD, including arousal, lubrication, satisfaction and orgasm, but not desire and pain. Central fat distribution, as evaluated by the waist-to-hip ratio, showed no correlation with FSFI score, nor with any individual sexual domains, suggesting that the amount of fat is more important than its distribution. Interestingly enough, desire was the only domain showing a positive, yet not significant relation with BMI, supporting the hypothesis that the domains of women' sexual function (desire, arousal, lubrication and orgasm) may not represent a linear progression.[12] The lack of relation 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, but prospective studies are needed to answer this question. At present, we can only speculate that the increasingly number of circulating factors produced by the fat cell may probably play a role,[13] although specifically addressed studied are needed.

Previous evidence linking FSD to obesity is very scanty. In 171 postmenopausal women, Kirchengast *et al.*[7] reported that body weight and BMI were significantly related to the degree of reduced sexual interest. In 59 healthy women aged 19–40 years, Brody[8] found that hip size was negatively associated with a lower frequency of penile–vaginal intercourse. However, both studies focused upon single aspects of women sexuality, and used different tools for investigating sexual function. In a preliminary observation, we showed that women with the metabolic syndrome have an increased prevalence of sexual dysfunctions as compared with matched control women, although the association remained not easily explained.[14] Also for diabetes mellitus, which represents an important causes of erectile dysfunction in men,[15] the data about the prevalence of FSD are controversial.[16,17]

Our study design has several strengths and weaknesses. (1) We did a case–control study across a wide range of body weight and including both premenopausal and postmenopausal women; so, it was not limited by the more prevalent sexual dysfunction in menopause. (2) The two groups of women (with or without FSD) came from the same population as suggested by the similar anthropometric and clinical characteristics (Table 1) and were physically health given the strict inclusion/exclusion criteria. (3) We used a validated, internationally established questionnaire (FSFI) to assess the prevalence of sexual dysfunction, which was administered during the same phase of the cycle in order to avoid interference in the assessment of sexual function.[18] However, women above 60 years were not included in the study, and hormonal and mood assessments were not performed. On the other hand, decreased sexual function occurs independently of mood deflections, while the role of the endocrine milieu remains unclear.[7,18]

In conclusion, we showed that in Italian otherwise healthy women with FSD obesity affects several aspects of sexuality. Interventional studies aimed at reducing body weight in women with FSD are needed to disclose a cause and effect relation between obesity and FSD.

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