Taylor & Francis
Taylor & Francis Group

Journal of Obstetrics and Gynaecology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ijog20

The impact of obesity on fertility and sexual function in women of child bearing age

Alparslan Deniz & Muhammed Okuyucu

To cite this article: Alparslan Deniz & Muhammed Okuyucu (2022): The impact of obesity on fertility and sexual function in women of child bearing age, Journal of Obstetrics and Gynaecology, DOI: 10.1080/01443615.2022.2106828

To link to this article: https://doi.org/10.1080/01443615.2022.2106828

JOURNAL OF OBSTETRICS AND GYNAECOLOGY
https://doi.org/10.1080/01443615.2022.2106828

Taylor & Francis
Taylor & Francis Group

ORIGINAL ARTICLE

The impact of obesity on fertility and sexual function in women of child bearing age

Alparslan Deniz[a] and Muhammed Okuyucu[b]

[a]Department of Obstetrics and Gynecology, Medical Faculty, Alaaddin Keykubat University, Alanya, Turkey; [b]Department of Internal Medicine, Medical Faculty, Ondokuz Mayıs University, Samsun, Turkey

ABSTRACT

Obesity and infertility are health problems that are increasing in frequency. In this study, sexual dysfunction in obese infertile women was investigated. A total of 450 women who met the inclusion criteria were recruited for the study; 150 women who had obesity without infertility, 150 women who had obesity with infertility and 150 women with normal weight but without infertility, which was the control group. The mean age of the groups were 31.3 ± 3.9, 31.2 ± 3.8 and 31.1 ± 4.5, respectively. The participants were administered a sociodemographic data form, the Female Sexual Function Index (FSFI) and the Beck Depression Inventory following the measurement of body mass index (BMI). FSFI score below 26.55 was defined as sexual dysfunction. Our data were analysed using SPSS (Statistical Package for Social Sciences) 21.0 for Windows (SPSS Inc., Chicago, IL). FSFI scores were observed to be statistically significantly lower in the group of obese women with infertility than in the other two groups. In our study, sexual dysfunction was found to be statistically significantly higher in obese women with infertility compared to the control group. Therefore, healthcare professionals should evaluate infertility in obese women in terms of sexual dysfunction as well as infertility treatment.

IMPACT STATEMENT

- **What is already known on this subject?** Psychological problems such as depression and anxiety, changes in sex hormones, and adipokines were reported to have negative impacts on sexual functions (Plaisance et al. 2009; Kendler et al. 2010; Yaylali et al. 2010). There are also various reports stating that female infertility has negative effects on sexual satisfaction and that fertility anxiety may affect sexual functions as an independent factor (Pakpour et al. 2012; Kaya et al. 2021). Even so there is a limited amount of information concerning the effects of obesity and infertility on female sexual function.
- **What do the results of this study add?** It has been found in our study that sexual dysfunction is higher in women with obesity and infertility and that this dysfunction is correlated with BMI.
- **What are the implications of these findings for clinical practice and/or further research?** It is therefore important that healthcare professionals adopt a holistic approach that incorporates sexual health consultancy to improve the treatment and quality of life of women with obesity and infertility.

KEYWORDS

Body mass index; infertility; sexual dysfunction; sexual health; obesity

Introduction

Obesity is a global health problem with its attendant adverse consequences (Seidell and Halberstadt 2015). It causes serious morbidity in the populace by particularly increasing metabolic syndrome, as well as hypertension, diabetes and some types of cancer (Gallagher and LeRoith 2015). It was reported that, in terms of reproductive health, obese women had decreased rates of conception and increased rates of miscarriage (Lashen et al. 2004). Excess free fatty acids can lead to cellular damage to reproductive tissues and a chronic low-grade inflammatory state. Altered levels of adipokines, such as leptin, in the obese state can affect steroidogenesis and directly affect the developing embryo. In addition, the endometrium is sensitive in obese women due to impaired stromal decidualisation. This may lead to placental abnormalities by higher rates of preeclampsia and stillbirth in the obese population (Broughton and Moley 2017). These problems are thought to be associated with ovarian and endometrial pathologies in women with obesity (Vahratian 2009). Furthermore, increased insulin resistance (Al-Jefout et al. 2017), increased levels of leptin (Kumari et al. 2017), hyperandrogenaemia (Banu et al. 2015) and hypothalamic-pituitary-gonadal (HPG) axis dysregulation (Tsatsanis et al. 2015) are considered to be responsible for the negative effects of obesity on reproductive health. These mechanisms can similarly result in impaired sexual functions, unfortunately, there is a limited amount of information concerning the effects of obesity on female sexual function (Larsen et al. 2007).

CONTACT Muhammed Okuyucu muhammedokuyucu55@gmail.com Department of Internal Medicine, Medical Faculty, Ondokuz Mayıs University, Korfez Mahallesi, 55270 Atakum, Samsun, Turkey

Sexual dysfunction is a multifaceted and multidimensional condition that is associated with biological, psychological and personal factors (Steinke et al. 2016), and obesity is also associated with all of these factors (Kolotkin et al. 2006). Psychological problems such as depression and anxiety (Kendler et al. 2010), changes in sex hormones (Yaylali et al. 2010), and adipokines (Plaisance et al. 2009), which may be associated with obesity, were reported to have negative impacts on sexual functions. There are also various reports stating that female infertility has negative effects on sexual satisfaction (Kaya et al. 2021) and that fertility anxiety may affect sexual functions as an independent factor (Pakpour et al. 2012). Reproductive ability is closely related to self-esteem and sexuality. Since the main purpose is to get pregnant, sexual intercourse may become ordinary and lose its erotic value. This can affect sexual ability moreover lead to some sexual dysfunctions such as sexual dissatisfaction (Daniluk et al. 2014; Piva et al. 2014). On the other hand, sexual dysfunctions are frequently reported in cases of obesity-associated diabetes and cardiovascular and mental diseases (Alidu et al. 2018).

It is therefore important that healthcare professionals adopt a holistic approach that incorporates sexual health consultancy to improve the treatment and quality of life of women with obesity and infertility. The present study is aimed at investigating the sexual dysfunction in obese women with infertility.

Methods

Study population, area, design and sample size determination

This cross-sectional study included 150 obese women with infertility, 150 obese women without infertility and 150 normal body mass index (BMI) volunteers without infertility, who applied to our obstetrics clinic between January 1 2019 and December 31 2019. In Minitab v17 power analysis program, Esposito et al. (2007) based on the study comparing the sexual function indexes of obese and without obese women, the minimum number of patients to be included in each group was calculated as 102, when 95% power and α: 0.005 were accepted. In order to make the study stronger, the number of patients in the groups was planned as 150.

Body mass index was calculated, and those with a BMI of 18.5–24.9 kg/m^2 were considered to be within the normal weight range. Those with a BMI of $\geq$30 kg/m^2 were considered as obese participants. The cases where women had sexual intercourse regularly for 12 months and could not conceive a child despite not using a contraceptive method were considered as cases of infertility.

Inclusion criteria

Those aged 20–45 years, in the reproductive period and with heterosexual partners were included in the study.

Exclusion criteria

Women who did not have sexual intercourse within the last one month, cases where the woman or her husband needed hospitalisation for treatment, cases where women have not had their husbands at the same address within the last month, cases where woman or her husband had a medical condition that prevented sexual intercourse, use of alcohol and illegal drugs, use of psychiatric medication, use of oral contraceptives or hormonal drugs, presence of systemic diseases that render physical activity difficult/impossible, presence of genital anatomic anomalies, presence of pathologies that lead to masses in genital and pelvic organs, presence of genitourinary infections, and a diagnosis of endometriosis. In addition, those with thyroid dysfunction, diabetes mellitus, chronic renal failure, gynaecological malignancies, primary ovarian failure, hypothalamic amenorrhoea, psychiatric disorders such as anxiety and depression were not included.

Data collection

All of the participants were administered a sociodemographic data form to evaluate their sociodemographic data such as age, educational background and marital status. Female Sexual Function Index (FSFI) and Beck Depression Inventory (BDI) were applied by the investigator.

Female Sexual Function Index

Developed by Rosen et al. (2000), FSFI was intended as a multidimensional scale consisting of 19 items to assess female sexual function. This scale assesses the sexual problems or function in the last 4 weeks. The scale composes of six subdimensions, which are desire, arousal, lubrication, orgasm, satisfaction and pain. Its validity and reliability study for Turkish was conducted by Aygin and Aslan (2005). The highest total raw score that can be obtained in this scale is 95, and the lowest raw score is 4. After multiplying the coefficients, the highest score is 36 and the lowest score is 2. The effect coefficients used for scoring the whole scale vary (Table 1). An FSFI score below 26.55 was defined as compatible with sexual dysfunction (Rosen et al. 2000). We used the same cut-off value for FSFI to diagnose female sexual dysfunction in this study.

Beck Depression Inventory

Developed by Beck et al. (1961), BDI measures the physical, emotional, cognitive and motivational indicators observed in depression. The scale is intended to determine the degrees of depression indicators in an objective manner. There are four options under each of the 21 items, and each item is given a score between 0 and 3. The total score varies between 0 and 63. The cut-off score of the scale is 17. Its validity and reliability study for Turkish was conducted by Hisli (1989).

Table 1. Female Sexual Function Index.

Sexual function domain	Item number	Score range	Coefficient	Minimum score	Maximum score
Desire	1–2	1–5	0.6	1.2	6
Arousal	3–6	0–5	0.3	0	6
Lubrication	7–10	0–5	0.3	0	6
Orgasm	11–13	0–5	0.4	0	6
Satisfaction	14–16	0/1–5	0.4	0.8	6
Pain	17–19	0–5	0.4	0	6
Total score range				2	36

Statistical analysis

Data collected for the study were uploaded to a computer and analysed using SPSS (Statistical Package for Social Sciences) 21.0 for Windows (SPSS Inc., Chicago, IL). Descriptive statistics were presented as mean ± standard deviation. Analytical methods (Kolmogorov–Smirnov/Shapiro–Wilk tests) were used to assess whether the variables had a normal distribution. The Kruskal–Wallis test was used as the statistical method in cases of statistical significance between two independent groups for the variables that were found to be non-normally distributed. For the normally distributed variables, one-way analysis of variance (ANOVA) was used as the statistical method. Tukey's test was used for post hoc paired comparisons to determine the source of the difference in cases of statistical significance among three independent groups. The level of statistical significance was assumed as $p < .05$.

Ethics statement

The present study protocol was reviewed and approved by the Ethics Committee of Alaaddin Keykubat University (approval no. 10354421). Informed consent was submitted by all subjects when they were enrolled.

Results

The study included 150 (33.3%) obese women without infertility, 150 (33.3%) obese women with infertility and 150 (33.3%) normal-weighed women without infertility which served as a control group. Mean age of the groups were 31.3 ± 3.9, 31.2 ± 3.8 and 31.1 ± 4.5, respectively. No significant difference was noted among the groups in terms of age, educational background and marital status $p > .05$. FSFI scores were measured as (19.6 ± 3.6 vs. 21.0 ± 3.7 vs. 27.1 ± 4.3) in the group of obese women with infertility, the group of obese women without infertility and the control group, respectively. One-way ANOVA test, conducted to compare the FSFI scores of the three groups, revealed statistically significant differences. The post hoc analysis of FSFI scores also revealed differences between the groups of obese women without infertility and group of obese women with infertility ($p = .001$), and the group of control and group of obese women with infertility ($p=.001$). The comparison of the groups' age, education level, marital status and BMIs is presented in Table 2.

When the FSFI subscores were examined, the scores were observed to be significantly lower in the group of obese women with infertility than in the group of obese women without infertility and control group in terms of desire, arousal, lubrication, orgasm, satisfaction and pain ($p=.001$). The comparison between FSFI subscores of the group of obese women without infertility, group of obese women with infertility and control group is presented in Table 3.

It was determined that orgasm ($p=.01$), satisfaction ($p=.001$) and pain ($p=.001$) sub-scores were negatively correlated with BMI in the group of obese women without infertility; orgasm, pain, desire, arousal, lubricity and satisfaction sub-scores were negatively correlated with BMI in the group of obese women with infertility ($p=.001$). Correlation analysis is shown in Table 4.

Discussion

This study shows that obese women with infertility have lower sexual function scores, and BMI has a negative effect on sexual health.

Female sexuality plays an essential role in personal development, quality of life, and interpersonal relations in marriages (Jarząbek-Bielecka et al. 2012). The effects of obesity on female sexual dysfunction are still controversial in the literature. Esposito et al. (2007) compared 52 women with obesity with normal weight controls, and reported that all of the FSFI subscores were lower in the obese group and that BMI was strongly correlated with sexual dysfunction scores. Yaylali et al. (2010) in their study that included 45 women with obesity that the subscores of orgasm and satisfaction were negatively correlated with BMI at a moderate level. Similarly in our study when the FSFI scores were compared; it was observed that the obese women without infertility group had lower sexual function scores than the control group and also that BMI was negatively correlated with sexual functions in the group of obese women without infertility and group of obese women with infertility.

Unlike our study, Kadioglu et al. (2010) found sexual dysfunction in 50% and 41% of the cases in the obesity group and in the control group, respectively, thereby concluding that obesity is not a strong factor by itself for sexual dysfunction. Again unlike our study, Erbil (2013) also reported that BMI and sexual dysfunction are not correlated and that negative body image can be predictive of sexual functions. These differences might have been caused by the different cultures where the studies were conducted and differences in samples and measuring tools. Sexual dysfunction is significantly higher in the eastern cultures, where there is a sexual taboo and sexual education is not integrated into the education given at schools (Erenel and Kılınc 2013).

Obesity poses a risk for most of the underlying aetiologies for infertility, and current evidences describe obesity alone as

Table 2. Comparison of sociodemographic data of groups.

Study parameter	Group of obese women without infertility (*n*: 150)	Group of obese women with infertility (*n*: 150)	Control group (*n*: 150)	Test statistics	*p* Value
Age	31.3 ± 3.9 (29.2–33.4)	31.2 ± 3.8 (29.3–33.1)	31.1 ± 4.5 (30.4–34.0)	KW: 0.38	.827
Elementary or none educated	24 (16.0%)	19 (12.7%)	16 (10.7%)	χ^2: 3.909	
Secondary school	91 (60.7%)	84 (56.0%)	89 (59.3%)		
High or above	35 (23.3%)	47 (31.3%)	45 (30.0%)		.418
Marital status (married)	93.4%	100.0%	96.7%	χ^2: 3.730	.156
Body mass index	34.1 ± 2.0 (32.5–36.1)	34.6 ± 2.1 (31.9–36.8)	22.4 ± 1.7 (21.7–23.4)	KW: 300.71	.001
FSFI total scores	21.0 ± 3.7	19.6 ± 3.6	27.1 ± 4.3	*F*: 159.84	.001[a]

F: one-way ANOVA test; χ^2: Chi-Square test; KW: Kruskal–Wallis; FSFI: Female Sexual Function Index.
aThere was a statistically significant difference between post hoc Tukey's test of the group of obese women without infertility and group of obese women with infertility (p=.003), control group and group of obese women without infertility (p=.001) as well as control group and group of obese women with infertility (p=.001).

Table 3. Comparison of FSFI sub-scores of groups.

Study parameter			Group of obese women without infertility (*n*: 150)	Group of obese women with infertility (*n*: 150)	Control group (*n*: 150)	KW	*p* Value
FSFI subscales	Desire	Mean ± SD	3.89 ± 0.78	3.46 ± 0.71	4.39 ± 0.75	2.489	.001
		Mean rank	222.02	163.46	291.02		
	Arousal	Mean ± SD	2.59 ± 0.51	2.51 ± 0.50	3.54 ± 0.56	1.372	.001
		Mean rank	164.03	176.52	335.95		
	Lubrication	Mean ± SD	3.61 ± 0.60	3.18 ± 0.74	4.55 ± 0.68	2.288	.001
		Mean rank	199.12	149.86	327.52		
	Orgasm	Mean ± SD	3.36 ± 0.61	2.97 ± 0.65	4.58 ± 0.67	2.397	.001
		Mean rank	142.14	193.30	341.06		
	Satisfaction	Mean ± SD	3.37 ± 0.59	3.04 ± 0.60	4.81 ± 0.66	2.455	.001
		Mean rank	180.71	140.17	355.63		
	Pain	Mean ± SD	4.21 ± 0.58	4.01 ± 0.27	5.21 ± 059	3.615	.001
		Mean rank	187.29	164.33	324.86		

KW: Kruskal–Wallis; FSFI: Female Sexual Function Index.

Table 4. FSFI and BMI correlation analysis between group of obese women with infertility and group of obese women without infertility.

		Group of obese women with infertility BMI (*n*: 150)		Group of obese women without infertility BMI (*n*: 150)	
Study parameter		Spearman rho	*p* Value	Spearman rho	*p* Value
FSFI total		−0.535	.001	−0.198	.015
FSFI sub-scores	Desire	−0.313	.001	−0.037	.649
	Arousal	−0.316	.001	−0.016	.337
	Lubrication	−0.326	.001	−0.159	.052
	Orgasm	−0.477	.001	−0.210	.01
	Satisfaction	−0.398	.001	−0.290	.001
	Pain	−0.380	.001	−0.287	.001

FSFI: Female Sexual Function Index; BMI: body mass index.

a risk factor for infertility (Rittenberg et al. 2011). In a study, infertile women who want to conceive a child and those who voluntarily underwent sterilisation were reported to have similar sexual functions; however, the group of infertile women experienced higher levels of stress (Monga et al. 2004).

Infertility alone may cause psychiatric problems (Biringer et al. 2015), and it was also reported that patients with obesity and menstruation problems have 8.1 times higher risk of clinic depression than healthy controls (Cinar et al. 2011). It is known that sexual dysfunction, particularly arousal problems, is common in women with infertility (Jain et al. 2000), and women who present for *in vitro* fertilisation were reported to have lower self-confidence scores than controls (Rittenberg et al. 2011). In a study that examined a group of patients with polycystic ovaries, where in obesity and infertility are frequently comorbid, it was reported that obesity and infertility had adverse effects on sexual life and that obesity had a greater impact (Barnard et al. 2007). The results from the present study indicate that infertility and obesity are in a two-way interaction and that both conditions cause sexual dysfunction. Similarly in our study when the FSFI subscores were examined, the scores were observed to be significantly lower in the group of obese women with infertility than in the group of obese women without infertility and control groups in terms of desire, arousal, lubrication, orgasm, satisfaction and pain.

The limitations of the study may be the fact that patients' sex hormones were not studied. There is a complex relationship between sex hormones and sexual functions, and women with obesity were observed to have statistically increased levels of sex hormones and sexual functions following bariatric surgery (Sarwer et al. 2014).

In conclusion, it has been found in our study that sexual dysfunction is higher in women with obesity and infertility and that this dysfunction is correlated with BMI. It is

therefore important that healthcare professionals adopt a holistic approach that incorporates sexual health consultancy to improve the treatment and quality of life in women with obesity and infertility.

Disclosure statement

The authors declare that they have no conflict of interest.

ORCID

Alparslan Deniz http://orcid.org/0000-0003-1421-9962
Muhammed Okuyucu http://orcid.org/0000-0002-6026-2024

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

References

Al-Jefout M, Alnawaiseh N, Al-Qtaitat A. 2017. Insulin resistance and obesity among infertile women with different polycystic ovary syndrome phenotypes. Scientific Reports 7:9.
Alidu H, Owiredu WKBA, Amidu N, Gyasi-Sarpong CK, Dapare PPM, Bawah AT, et al. 2018. Hypertension and obesity comorbidities increases coronary risk, affects domains of sexual function and sexual quality of life. International Journal of İmpotence Research 30:8–13.
Aygin D, Aslan FE. 2005. The Turkish adaptation of the Female Sexual Function Index. Turkish Journal of Medical Sciences 25:393–399.
Banu LM, Begum D, Rahman SA, Mollah FH, Ferdousi S, Habibullah M. 2015. Correlation of hyperinsulinemia with hyperandrogenemia in primary infertile women with polycystic ovary syndrome. Mymensingh Medical Journal 24:127–132.
Barnard L, Ferriday D, Guenther N, Strauss B, Balen AH, Dye L. 2007. Quality of life and psychological well being in polycystic ovary syndrome. Human Reproduction 22:2279–2286.
Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. 1961. An inventory for measuring depression. Archives of General Psychiatry 4:561–571.
Biringer E, Howard LM, Kessler U, Stewart R, Mykletun A. 2015. Is infertility really associated with higher levels of mental distress in the female population? Results from the North-Trøndelag Health Study and the Medical Birth Registry of Norway. Journal of Psychosomatic Obstetrics and Gynaecology 36:38–45.
Broughton DE, Moley KH. 2017. Obesity and female infertility: potential mediators of obesity's impact. Fertility and Sterility 107:840–847.
Cinar N, Kizilarslanoglu MC, Harmanci A, Aksoy D, Bozdag G, Demir B, et al. 2011. Depression, anxiety and cardiometabolic risk in polycystic ovary syndrome. Human Reproduction 26:3339–3345.
Daniluk JC, Koert E, Breckon E. 2014. Sexuality and infertility. Principles and Practice of Sex Therapy 5:419–436.
Erbil N. 2013. The relationships between sexual function, body image, and body mass index among women. Sexuality and Disability 31: 63–70.
Erenel AŞ, Kılınc FN. 2013. Does obesity increase sexual dysfunction in women? Sexuality and Disability 31:53–62.
Esposito K, Ciotola M, Giugliano F, Bisogni C, Schisano B, Autorino R, et al. 2007. Association of body weight with sexual function in women. International Journal of Impotence Research 19:353–357.
Gallagher EJ, LeRoith D. 2015. Obesity and diabetes: the increased risk of cancer and cancer-related mortality. Physiological Reviews 95:727–748.
Hisli NA. 1989. Reliability and validity study of Beck Depression Inventory in a university student sample. Turkish Journal of Psychology 7:3–13.
Jain K, Radhakrishnan G, Agrawal P. 2000. Infertility and psychosexual disorders: relationship in infertile couples. Indian Journal of Medical Sciences 54:1–7.
Jarząbek-Bielecka G, Sowińska-Przepiera E, Pawlaczyk M. 2012. Aging and sexual activity: gynecological, sexological and psychological aspects. Menopausal Review 6:487–489.
Kadioglu P, Yetkin DO, Sanli O, Yalin AS, Onem K, Kadıoglu A. 2010. Obesity might not be a risk factor for female sexual dysfunction. BJU International 106:1357–1361.
Kaya Y, Kaya C, Tahta T, Kartal T, Tokgöz VY. 2021. Examination of the effect of COVID-19 on sexual dysfunction in women. International Journal of Clinical Practice 75:e13923.
Kendler KS, Kessler RC, Walters EE, MacLean C, Neale MC, Heath AC, et al. 2010. Stressful life events, genetic liability, and onset of an episode of major depression in women. Focus 8:459–470.
Kolotkin RL, Binks M, Crosby RD, Østbye T, Gress RE, Adams TD. 2006. Obesity and sexual quality of life. Obesity 14:472–479.
Kumari P, Jaiswar S, Shankhwar P, Deo S, Ahmad K, Iqbal B, et al. 2017. Leptin as a predictive marker in unexplained infertility in North Indian population. Journal of Clinical and Diagnostic Research 11:QC2831.
Larsen SH, Wagner G, Heitmann BL. 2007. Sexual function and obesity. International Journal of Obesity 31:1189–1198.
Lashen H, Fear K, Sturdee D. 2004. Obesity is associated with increased risk of first trimester and recurrent miscarriage: matched case-control study. Human Reproduction 19:1644–1646.
Monga M, Alexandrescu B, Katz SE, Stein M, Ganiats T. 2004. Impact of infertility on quality of life, marital adjustment, and sexual function. Urology 63:126–130.
Pakpour AH, Yekaninejad MS, Zeidi IM, Burri A. 2012. Prevalence and risk factors of the female sexual dysfunction in a sample of infertile Iranian women. Archives of Gynecology and Obstetrics 286: 1589–1596.
Piva I, Lo Monte G, Graziano A, Marci R. 2014. A literature review on the relationship between infertility and sexual dysfunction: does fun end with baby making? European Journal of Contraception & Reproductive Health Care 19:231–237.
Plaisance EP, Grandjean PW, Judd RL, Jones KW, Taylor JK. 2009. The influence of sex, body composition, and nonesterified fatty acids on serum adipokine concentrations. Metabolism 58:1557–1563.
Rittenberg V, Seshadri S, Sunkara SK, Sobaleva S, Oteng-Ntim E, El-Toukhy T. 2011. Effect of body mass index on IVF treatment outcome: an updated systematic review and meta-analysis. Reproductive Biomedicine Online 23:421–439.
Rosen R, Brown C, Heiman J, Leiblum C, Meston R, Shabsigh D, et al. 2000. The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. Journal of Sex and Marital Therapy 26:191–208.
Sarwer DB, Spitzer JC, Wadden TA, Mitchell JE, Lancaster K, Courcoulas A, et al. 2014. Changes in sexual functioning and sex hormone levels in women following bariatric surgery. JAMA Surgery 149:26–33.
Seidell JC, Halberstadt J. 2015. The global burden of obesity and the challenges of prevention. Annals of Nutrition and Metabolism 66:7–12.
Steinke E, Palm Johansen P, Fridlund B, Broström A. 2016. Determinants of sexual dysfunction and interventions for patients with obstructive sleep apnoea: a systematic review. International Journal of Clinical Practice 70:5–19.
Tsatsanis C, Dermitzaki E, Avgoustinaki P, Malliaraki N, Mytaras V, Margioris AN. 2015. The impact of adipose tissue-derived factors on the hypothalamic-pituitary-gonadal (HPG) axis. Hormones 14:549–562.
Vahratian A. 2009. Prevalence of overweight and obesity among women of childbearing age: results from the 2002 National Survey of Family Growth. Maternal and Child Health Journal 13:268–273.
Yaylali G, Tekekoglu S, Akin F. 2010. Sexual dysfunction in obese and overweight women. International Journal of Impotence Research 22: 220–226.