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ORIGINAL CONTRIBUTIONS

Does Significant Weight Loss After Bariatric Surgery Affect Sexual Function and Urinary Symptoms? An Iranian Study

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Abstract

Introduction For sexual dysfunction and lower urinary tract symptoms (LUTS), obesity is identified as an independent risk factor. The current study aimed to evaluate the effect of significant rapid weight loss by bariatric surgery on LUTS and sexual function among men and women with class III obesity.

Method A group of patients who were planned to undergo bariatric surgery was enrolled in the study. Male patients were given the International Index of Erectile Function (IIEF) and the International Prostate Symptom Score (IPSS) questionnaires. In the female group, they filled in the female sexual function index (FSFI) and the International Consultation on Incontinence *Questionnaire* short form (ICIQ-SF) questionnaires. Patients were followed up 1 year after their bariatric surgery.

Results All questionnaires were completed by eighty-one patients. (mean age ± SD: 39.4 ± 9.2 years; mean body mass index (BMI) ± SD: 47.15 ± 5.4 kg/m^2). The total score of the IPSS questionnaire decreased from 5.83 ± 3.01 preoperatively to 2.37 ± 1.66 postoperatively. The weight loss caused significant improvement in the storage phase of LUTS domains, but there were no considerable changes in the voiding phase. In the IIEF questionnaire, domains of sexual desire, overall satisfaction, and orgasmic function improved significantly. There was not a significant change in any FSFI domains after bariatric surgery. Mean ICIQ-SF decreased, but it was not substantial.

Conclusion Bariatric surgery can significantly improve the storage phase in men, but not the voiding phase. Sexual desire, orgasmic function, and overall satisfaction were significantly improved in men. No significant improvement in sexual function and UI in women was observed.

Keywords Bariatric surgery · LUTS · Lower urinary tract syndrome · Sexual dysfunction · Sexual activity · Urinary incontinency · IIEF · IPSS · FSFI · ICIQ

Introduction

The World Health Organization (WHO) defines overweight (body mass index (BMI) ≥ 25 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) as "abnormal and excessive fat accumulation that causes overall health impairment." Obesity is grouped into three classes of class I obesity (30 ≤ BMI < 35), class II obesity (35 ≤ BMI < 40), and class

Key points
- Bariatric surgery can improve storage phase in men significantly but not the voiding phase.
- Sexual desire, orgasmic function, and overall satisfaction can be significantly improved in men with bariatric surgery.
- No significant improvement in sexual function and UI in women was observed.

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III obesity (BMI ≥ 40) [1, 2]. A two-fold increment in the prevalence of overweight and obesity has been observed since 1980 globally. Currently, the population of people with obesity consists of about a third of the world's population [3]. Obesity-related diseases include diabetes, cardiovascular diseases, depression, sleep apnea syndrome, and other chronic diseases [1, 4, 5]. From a urologic point of view, in male population, obesity can contribute to appearance of erectile dysfunction (ED) and lower urinary tract symptoms (LUTS) [6–10]. Urinary incontinence (UI) in females can also be the consequence of obesity. However, there is a lack of enough data concerning the effect of weight loss on various aspects of pelvic floor disorders and sexual-related side effects of obesity [11]. Obesity leads to lower androgen levels and erectile dysfunction in males [12]. Also, it is believed that obesity-related comorbidities, particularly hypertension, can cause arteriogenic ED. Microvascular dysfunction observed in men with obesity can lead to appearance of LUTS. Other hypotheses claim that the increased ratio of estrogen to testosterone that happens in males with obesity can lead to appearance of LUTS and benign prostatic hyperplasia (BPH) and increased sympathetic nervous system activity [13, 14].

Weight loss can be achieved through non-surgical methods (i.e., diet, medication, or exercise) or surgical procedures (i.e., bariatric surgery). The weight loss through bariatric surgical method is generally more lasting and effective than non-surgical methods [15, 16]. For patients with class II obesity associated with comorbidities (i.e., hypertension and diabetes) and for class III obesity, bariatric surgery is suggested [17]. Previous studies around the effects of bariatric surgery on ED and LUTS reported that weight loss causes improvements in several domains, such as erectile and urinary function [15, 16, 18–20].

The current study aims to evaluate the effect of significant rapid weight loss by bariatric surgery on LUTS and sexual function among men and women with class III obesity.

Methods

Patient Selection

A group of patients who were planned to undergo bariatric surgery (sleeve gastrectomy, Roux-en-Y, and one-anastomosis gastric bypass) in our center from January 2021 to February 2022 was enrolled in this study. Eligible patients had a BMI higher than or equal to 40 kg/m^2, aged more than 18 years and less than 75, and could read and understand and fill in the questionnaires reliably. Patients with no sexual activity were excluded. None of the patients was treated for ED or LUTS prior to the study.

Data Collection

In order to evaluate the sexual activity and urinary symptoms in male patients, the patients were instructed to fill in two questionnaires, respectively: the Persian versions of the International Index of Erectile Function (IIEF) [21] and the International Prostate Symptom Score (IPSS) [22]. IIEF includes 15 items concerning the five main domains of male sexual function, each scored from 0 to 5. Items are described as erectile function (items 1–5, 15), orgasmic function (items 9,10), sexual desire (items 11,12), intercourse satisfaction (items 6–8), and overall satisfaction (items 13,14) [23, 24]. The common use of IPSS, developed mainly for assessment of patients with benign prostatic hyperplasia (BPH), is to evaluate male LUTS [25, 26]. It contains eight questions, seven of which concerning urinary storage and voiding symptoms over the past month (feeling of incomplete bladder emptying, frequency, intermittency, urgency, weak stream, straining, and nocturia) and one question concerning the impact of urinary symptoms on quality of life (QOL). Each symptom-related question is scored from 0 to 5, so the total score ranges from 0 (asymptomatic) to 35 (very symptomatic). The QOL question is scored from 0 to 6.

To calculate sexual function and urinary incontinence in the female group, the patients were instructed to fill in the Persian versions of the female sexual function index (FSFI) [27] and the International Consultation on Incontinence *Questionnaire* short form (ICIQ-SF) [28], respectively. FSFI is a multidimensional self-report questionnaire that assesses 19 items, including sexual desire, arousal, lubrication, orgasm, satisfaction, and pain [29]. The ICIQ-SF includes six items, of which four main items rate UI symptoms in the past 4 weeks. For the final score, scores of items 3, 4, and 5 are recorded. Demographical items are items 1 and 2. The final item is a self-diagnostic item for the type of UI [30].

The patients were asked to refill the questionnaires after losing 30% of body weight following surgery. Patients were followed up for 1 year after their bariatric surgery.

The demographic data including age, sex, height, smoking, alcohol consumption, past medical and surgical history, weight, BMI, body fat, lean body mass (LBM), and percentage of excessive weight loss (%EWL) for all individuals were recorded preoperatively and at 1, 3, 6, and 12 months following bariatric surgery.

LBM was estimated by using James formula [31] .

For males: $1.1 \times weight\ (kg) - 128(\frac{weight\ (kg)}{height\ (cm)})^2$

For females: $1.07 \times weight\ (kg) - 148(\frac{weight\ (kg)}{height\ (cm)})^2$

Data Analysis

To perform Statistical analysis, SPSS v.26 for Windows was employed to perform exploratory data analysis and produce descriptive statistics. Data are presented as mean ± SD and range. Wilcoxon signed-rank test was used to compare repeated measurements between two time points for non-normally distributed data. Friedman test was used to detect differences in treatments across multiple test attempts. $P < 0.05$ was considered statistically significant.

Ethical Consideration

The data were collected from our hospital. The project was approved by the ethics committee of our university. Written informed consent was obtained from all the participants.

Results

Ninety-five patients were initially assessed for the study, fourteen of them withdrew from the study due to unresponsiveness (follow-up rate = 85%). All the pre- and postoperative questionnaires were completely filled in by remaining eighty-one patients (mean age 39.4 ± 9.2 years, range 22–63; mean BMI 47.15 ± 5.4 kg/m^2), who contained forty-one men (mean 39.4 ± 9.2 years) and forty women (mean 41.2 ± 8.8 years). Comparison of the 81 responders versus the 14 non-responders showed no statistically significant differences in terms of their mean age or BMI before and after surgery.

Smoking and alcohol consumption in males were more prevalent than in females (Table 1). The males also had a higher mean preoperative weight (145.44 ± 19.57 kg); However, BMI (47.15 ± 5.4 kg/m^2) and body fat (61.8 ± 13.34 kg) were lower than those of females (126.65 ± 14 kg, 50.16 ± 8.2 kg/m^2, and 65.66 ± 10.2 kg, respectively) (Table 2).

Pre- and postoperative IPSS scores of the male participants are presented in Table 3. Generally, the weight loss caused by surgery resulted in statistically significant

Table 1 Baseline characteristics of participants (mean ± SD (range) or *N* (%))

	Men (*N* = 41)	Women (*N* = 40)	*p* value
Age (years)	39.43 ± 9.26 (22–63)	41.27 ± 8.83 (25–63)	0.364
Height (meters)	1.5 ± 0.07 (1.53–1.90)	1.59 ± 0.09 (1.27–1.78)	< 0.001
Smoking	14 (34.1%)	1 (2.5%)	< 0.001
Alcohol	7 (17.1%)	1 (2.5%)	0.057
History of psychiatric drugs	1 (2.4%)	4 (10%)	0.201
Past surgical history	14 (34.1%)	21 (52.5%)	0.095
History of genitourinary surgery	3 (7.3%)	6 (15%)	0.312

Table 2 Weight-related measures (mean ± SD (range))

		Preoperative	Postoperative (1 year)	*p* value
Weight (Kg)	Men (*N* = 41)	145.44 ± 19.57 (113.8–199.3)	95.16 ± 10 (80.2–117.7)	< 0.01
	Women (*N* = 40)	126.65 ± 14 (102–157.7)	92.77 ± 10.26 (70.3–116.1)	< 0.01
BMI (Kg/m^2)	Men (*N* = 41)	47.15 ± 5.4 (37.16–60.17)	30.88 ± 2.88 (27.1–38.2)	< 0.01
	Women (*N* = 40)	50.16 ± 8.02 (39.84–77.1)	36.57 ± 4.33 (30.5–50.1)	< 0.01
Body fat (Kg)	Men (*N* = 41)	61.8 ± 13.34 (40.9–99.7)	25.95 ± 6.98 (13.1–42.7)	< 0.01
	Women (*N* = 40)	65.66 ± 10.2 (48.4–86.5)	39.86 ± 8.6 (20.1 ± 60.5)	< 0.01
LBM (Kg)	Men (*N* = 41)	83.64 ± 14.5 (61.6–134.5)	69.21 ± 9.57 (55.6–90.2)	< 0.01
	Women (*N* = 40)	60.99 ± 6.74 (45.9–75.1)	52.9 ± 7.56 (29.8–67.1)	< 0.01
After one year follow-up:				
BMI Change	Men (*N* = 41)	16.25 ± 3.90 (7.76–24.67)		
	Women (*N* = 40)	13.59 ± 4.40 (7.01–27.51)		
EWL (%)	Men (*N* = 41)	74.08 ± 8.93 (52–85.1)		
	Women (*N* = 40)	54.31 ± 7.36 (37.6–73)		
TWL (%)	Men (*N* = 41)	34.13 ± 5.24 (20.91–43.56)		
	Women (*N* = 40)	26.61 ± 4.70 (16.03–38.51)		

BMI body mass index, *EWL* excessive weight loss, *TWL* total weight loss, *LBM* lean body mass

Table 3 IPSS score in men (mean ± SD) ($N=41$)

IPSS items	Preoperative	Postoperative (1 year)	p value
Incomplete emptying	0.69 ± 1.35	0.39 ± 0.83	> 0.05
Frequency	1.52 ± 0.42	0.66 ± 0.92	< 0.001
Intermittency	0.46 ± 1.05	0.22 ± 0.66	> 0.05
Urgency	0.82 ± 1.21	0.18 ± 0.38	< 0.001
Weak stream	0.45 ± 1.2	0.41 ± 0.8	> 0.05
Straining	0.39 ± 0.84	0.25 ± 0.22	> 0.05
Nocturia	1.61 ± 1.03	0.43 ± 0.8	< 0.001
IPSS total score	5.83 ± 4.2	2.37 ± 2.65	< 0.001
Quality of life	1.6 ± 1.61	2.63 ± 1.72	0.002

Paired T-test

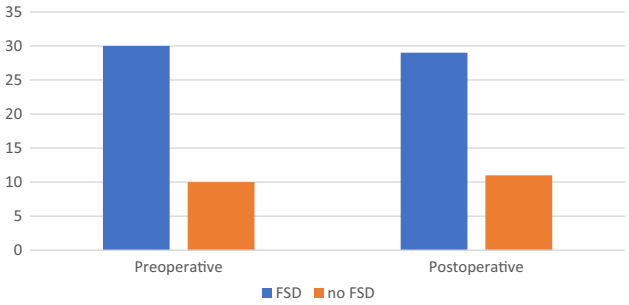

Fig. 1 Prevalence of FSD in the preoperative and postoperative groups ($N=40$)

improvement in storage phase of LUTS domains (measured by questions 2, 4, and 7 of the IPSS questionnaire) and QOL (question 8). Furthermore, there was a significant decrement in the total score of the IPSS questionnaire, from 5.83 ± 3.01 preoperatively to 2.37 ± 1.66 postoperatively ($p<0.001$). The voiding phase of LUTS domains, evaluated by questions 1, 3, 5, and 6 of the IPSS, showed no significant improvement postoperatively.

IIEF questionnaire was used for measuring the sexual function in men. All male patients were sexually active prior to the surgery. A comparison of pre- and postoperative IIEF scores of 41 males with sexually activity is reported in Table 4. Only items of questions 11 and 12 of the IIEF questionnaire, which measures sexual desire, were significantly improved (5.87 ± 2.09 vs. 7.07 ± 2.16, $p=0.003$). Furthermore, a significant improvement was observed in postoperative orgasmic function (6.73 ± 2.62 vs. 7.97 ± 2.38, $p=0.01$) and overall satisfaction (5.87 ± 2.24 vs. 6.95 ± 2.21, $p=0.02$).

The mean total FSFI scores for the preoperative and postoperative women groups were 24.51 ± 4.7 and 24.89 ± 4.67, respectively ($p=0.712$). Based on the total FSFI score, female sexual dysfunction (FSD) was diagnosed in 30 of 40 patients (75%) in the preoperative group and 29 of 40 (72.5%) in the postoperative group ($p=0.418$) (Fig. 1). There was not a significant change in any FSFI domains after bariatric surgery (Table 5).

Table 5 FSFI score in women (mean ± SD) ($N=40$)

FSFI items	Preoperative	Postoperative (1 year)	p value
Desire	3.57 ± 1.44	4.09 ± 1.06	0.088
Arousal	4.07 ± 1.33	4.13 ± 1.01	0.961
Lubrication	4.8 ± 0.88	5 ± 1.06	0.286
Orgasm	4.12 ± 1.19	4.29 ± 1.29	0.591
Satisfaction	4.15 ± 1.18	4.42 ± 1.19	0.37
Pain	3.53 ± 0.77	3.22 ± 0.7	0.076
FSFI total score	24.51 ± 4.7	24.89 ± 4.67	0.712

Paired T-test

Mean ICIQ-SF decreased from 5.05 ± 3.05 preoperatively to 2.94 ± 1.58 postoperatively, but the difference was not significant ($p=0.068$). There was a 24.2% reduction in the number of patients reporting moderate to severe urinary incontinence from six (35.3%) to two (11.1%) (Fig. 2).

Discussion

Sexual Function

It is suggested that one of the best methods to achieve significant weight loss is bariatric surgery. In our study,

Table 4 IIEF score in men (mean ± SD) ($N=41$)

IIEF items	Preoperative	Postoperative (1 year)	p value
Erectile function [1–5, 15]	20.9 ± 6.75	22.75 ± 6.34	0.141
Orgasmic function [9, 10]	6.73 ± 2.62	7.97 ± 2.38	0.018
Sexual desire [11, 12]	5.87 ± 2.09	7.07 ± 2.16	0.003
Intercourse satisfaction [6–8]	9.85 ± 3.26	10.04 ± 3.28	0.453
Overall satisfaction [13 , 14]	5.87 ± 2.24	6.95 ± 2.21	0.042

Paired T-test

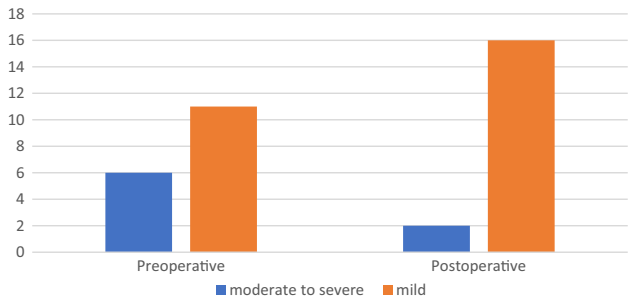

Fig. 2 Prevalence of urinary incontinency in the preoperative and postoperative

after 1 month, 25.49 ± 6.89% and 20.6 ± 4.9% %EWL in men and women were observed, respectively. Subsequently, after 6 months, %EWL had reached 63.59 ± 8.65% and 50.25 ± 10.12% in men and women, respectively, which is comparable to other studies with similar postoperative follow-up duration [1–4, 32]. The correlation between sexual function and bariatric surgery has been investigated in previous studies. Most of them have concluded that in the early 12-month postoperative interval, bariatric surgery has been significantly effective in improving the sexual function [1, 2, 5, 6]. The investigators reported significant improvement in all IIEF domains at 3 months postoperatively. These findings are also confirmed by our findings, which showed a significant improvement in all the domains except erectile function and intercourse satisfaction over a 1-year follow-up period [2].

The improvement in sexual function after bariatric surgery is attributed to several causes proposed in different studies. Mora et al. [16] suggested that there is an improvement in testosterone levels and metabolic profiles such as insulin sensitivity, C-reactive protein, and lipid profile after weight loss which is associated with an improvement in sexual function. Reis et al. [18] mentioned they found that as the patients' BMI decreases after bariatric surgery, hormone levels remarkably rise. Due to this observation, they suggested that estrogens are the main factors in erectile function and cause the improvement of sexual function. The sharp decrement in fasting blood glucose (FBG) is considered another attributing factor in their study.

Ranasinghe et al. [33] reached to a different conclusion in their study. Three validated questionnaires (ICIQ-SF, IPSS, and IIEF) were given to all patients who underwent laparoscopic gastric banding (LGB) surgery. Some degrees of erectile dysfunction were reported by 83.3% of patients preoperatively. The postoperative results showed that although there was a remarkable weight loss, a lack of improvement in all domains of the IIEF questionnaire was observed. There was no trending connection between age and erectile or orgasmic function. These unexpected results should be interpreted with caution mainly due to several reasons, including the retrospective nature of the study, the poor response rate, the small series, and the possible recall bias [33].

A recent study by Sarwer et al. [34] included 32 men who underwent a Roux-en-Y gastric bypass between years 2006 and 2012. Changes in sexual function, sex hormones, and relevant psychosocial aspects were assessed in their study. Results indicated nearly a 30% weight loss two years after surgery. Improvements in all domains of the IIEF at 2, 3, and 4 years postoperatively were reported by all patients but these changes did not significantly differ from baseline [34].

Xu et al. [35] demonstrated a significant improvement in erectile function, sexual desire, and sexual satisfaction of patients with obesity following bariatric surgery. However, the orgasmic function did not change significantly [35].

The results of Bond et al.'s [36] study, which was done among female patients, indicated a decrease in FSD after surgery. Among 34 women with indicative scores of FSD (63%), after 6 months, the FSD had resolved in 23 (68%) of these 34 women. Comparison of before and after FSFI domains indicated a significant ($p < 0.05$) improvement in the entire sample. Results showed that there were developments in FSFI total scores after laparoscopic adjustable gastric banding (from 24.2 ± 5.9 to 29.1 ± 4.1, $p > 0.001$) and Roux-en-Y gastric bypass (from 23.7 ± 7.7 to 30.0 ± 4.7, $p > 0.001$). These findings were in agreement with our study (from 24.51 ± 4.7 to 24.89 ± 4.67). Several factors were involved in sexual function improvements, including marriage, younger age, and lower preoperative sexual function [36].

Urinary Symptoms

Obesity, female LUTS, and sexual dysfunction are interconnected. Remarkable improvement of LUTS and SD are reported after surgical weight loss [11–14, 18]. In literature, there are more studies about female than male LUTS because females comprise most of the bariatric surgery applicants. That is why data including the prevalence of LUTS and sexual function among men with obesity pre- and post-operatively remains controversial and rare. A decrement of mean ICIQ-SF from 5.05 ± 3.05 preoperatively to 2.94 ± 1.58 postoperatively was observed in females, which was not significant ($p = 0.068$). Obesity and male LUTS are strongly correlated to each other [37, 38]. However, the effectiveness of losing weight on male LUTS has been determined by only a few studies. Improvement of sections including frequency, urgency, nocturia, and IPSS total score was observed in our study. On the other hand, there no notable change in other domains, such as incomplete voiding of bladder, intermittency, weak stream, and straining in males. Groutz et al. [20] suggested that

morbid obesity is associated with male LUTS, specifically storage phase symptoms. For assessment of LUTS in our study, a mean total IPSS score of 5.5 ± 4.4 was observed preoperatively, indicating the presence of slight preoperative symptom. A notable decrement to 2.7 ± 2.6 ($p < 0.001$) was observed in total IPSS due to improvement in storage phase symptoms of LUTS. Questions 2, 4, and 7 of the IPSS questionnaire were used to assess this domain. Assessment of voiding phase LUTS using questions 1, 3, 5, and 6 of the IPSS did not show a noticeable change. It is considered that the young age of the male participants (mean age 39 ± 12.5 years) can be attributed to this observation [20].

In a recent study, IPSS scores of male patients were assessed at 6 weeks and 1 year after bariatric surgery. At 6 weeks, the association between weight loss and a significant improvement in urgency and frequency was observed [39]. One month after surgery, we observed an improvement in frequency, intermittency, weak stream, nocturia, and quality of life; however, the significant improvement in urgency did not happen for up to 3 months [40].

Khoo et al. [41] claimed that an average weight loss of 10% is strongly connected to improvements in both LUTS (measured by the IPSS questionnaire) and erectile function (measured by the five-item version of the IIEF questionnaire). They suggested that losing weight through diet is considered to improve LUTS and sexual function in middle-aged men with obesity effectively [41].

Among 38 females with obesity who underwent bariatric surgery (mostly gastric bypass surgery) in Kuruba et al.'s [19] study, half of them reported that they were symptom-free after 6 months postoperatively [19]. Deitel et al. [42] studied on 138 females with loss of more than 50% body weight postoperatively. Evaluations indicated a decrement in urinary stress incontinence from 61.2 to 11.6% [42]. Laungani et al. [43] applied their analyses to a group of 58 females who had undergone LGB. They showed a resolution of symptoms in 64% and improvement in 92% of participants at 12 months. The QOL score on the ICIQ-SF improved from 3.2 ± 3 to 0.4 ± 2 ($p < 0.001$) at 1 year. Additionally, the ICIQ-SF scores improved from 7.6 ± 4 preoperatively to 3.0 ± 4 at 3 months and 1.8 ± 4 at 12 months ($p < 0.001$) [43]. Similar to previous studies, Shimonov et al. [44] reported that weight loss through surgery led to significant improvements in UI and filling phase symptoms, pelvic organ prolapses and colorectal-anal scores, condition-specific sexual function, and quality of life parameters. Assessments showed a decrement in the total score of the ICIQ-UI questionnaire from 9.28 ± 3.6 preoperatively to 2.9 ± 3.8 postoperatively ($p < 0.001$). The urinary inventory score of the PFDI-20 questionnaire decreased from a mean of 31.4 ± 17.9 preoperatively to 9.3 ± 12.3 postoperatively ($p < 0.001$). Also, the complete resolution of UI was reported by 51.7% of women after their weight loss [44].

In contrast, in our study, ICIQ-SF decreased from 5.05 ± 3.05 preoperatively to 2.94 ± 1.58 postoperatively, but the difference was not significant ($p = 0.068$).

Montenegro et al. [45] reported in their meta-analysis that bariatric surgery could not decrease pelvic organ prolapse significantly in female patients with obesity ($p = 0.07$). Therefore, it is possible that UI has not improved significantly by bariatric surgery in our patients due to pelvic organ prolapse and pelvic floor dysfunctions.

Our examinations indicated only slight improvement in male sexual satisfaction. This result can be explained by the effect of surgery on the patients' overall well-being (i.e., the tiredness after surgery leading to the patient not being interested in sexual activity). Previous studies claimed a relation between testosterone and other hormone levels and erectile dysfunction [4, 5, 8, 25–27, 33, 46–50]. Corona et al. [51] indicated that testosterone is a primary factor for controlling male libido, and improvement of libido and ED in hypogonadal individuals can be achieved by hormone replacement therapy. Additionally, two essential factors in determining erectile and urologic function are serum testosterone and aromatase enzyme levels, which can change due to obesity [52]. The underlying mechanism of functional improvement can be investigated easier by assessment of serum testosterone and aromatase levels simultaneously. Not measuring the hormone levels is considered a limitation in our study. Also, being a retrospective study may have caused recalling bias, and the use of questionnaires based on subjective assessment could have also reflected confounding factors such as individual patient's satisfaction with the surgery.

Further studies are required to explore the pathophysiology of LUTS and sexual dysfunction among men and women with obesity, as well as optimal measurement tools and treatment modalities.

Conclusion

Sexual dysfunction and LUTS are commonly observed in males and females with obesity. Bariatric surgery can improve storage phase symptoms without a considerable change in voiding phase symptoms. Sexual desire, orgasmic function, and overall satisfaction were significantly improved in men. However, no significant improvement in sexual function and UI was observed in women.

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Author Contribution All authors have contributed to:
1. Conception and design of the study.
2. Analysis and interpretation of data.

2. Provision of study material or patients.
4. Collection, assembly, possession of raw data (doing experiments).
5. Statistical analysis
6. Critical revision of the article for important intellectual content.
7. Final approval of the study.
8. Guarantee of integrity of the entire study.

Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics Approval and Consent to Participate The data were collected from our hospital (Sina Hospital). The project was approved by the ethics committee of our university (Tehran University of Medical Sciences) (ethical ID: IR.TUMS.Sinahospital.rec.1399.126). Written informed consent was obtained from all the participants.

Consent for Publication The authors all agree for submission and publication of the manuscript.

Conflict of Interest The authors declare no competing interests.

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