



# Evaluation of the difference between sexual functions and depression, anxiety and stress before and after bariatric surgery in men diagnosed with and without diabetes mellitus

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## Abstract

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**Aim:** It was aimed to investigate the difference between erectile function, orgasmic function, sexual desire, sexual satisfaction and general satisfaction, and depression, anxiety and stress before and after bariatric surgery in men with and without diabetes mellitus (DM).

**Materials and Methods:** A total of 80 male patients, 40 individuals who underwent bariatric surgery and were diagnosed with type 2 diabetes and 40 individuals who did not, were included in the study. Patients were evaluated with the International Erectile Function Form and Depression Anxiety Stress Scale before and 6 months after the operation. The difference between stress, anxiety, depression and sexual function values of diabetic and non-diabetic groups undergoing bariatric surgery was analyzed before and after the operation.

**Results:** In the non-diabetic group, there was a difference between pre- and post-bariatric surgery in depression and erectile function, orgasmic function, sexual desire, sexual satisfaction and general satisfaction scores ( $p = 0.000$ ), apart from stress ( $p = 0.720$ ) and anxiety ( $p = 0.675$ ). In the diabetic group, a difference was found in all subscale scores except sexual desire ( $p = 0.160$ ). When the groups are compared after surgery; while stress and anxiety scores decreased more in the diabetic group; erectile function, orgasmic function, sexual desire, sexual satisfaction and general satisfaction scores increased more in the nondiabetic group.

**Conclusion:** The presence of DM in men undergoing bariatric surgery may limit the improvement in sexual functions after surgery; however, diabetic individuals may benefit more from surgery in terms of depression, stress and anxiety.



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## Introduction

Obesity is a serious health problem that has become increasingly common all over the world in recent years [1]. Obesity is considered by the World Health Organization as excessive fat accumulation in the body to the extent that it impairs health and is defined as a body mass index (BMI) equal to or greater than 30 kg/m<sup>2</sup>. Worldwide over the age of 18, 13% of adults are obese [2]. Obesity is also associated with diabetes mellitus (DM), hypertension and metabolic syndrome and is known to negatively affect sexual functions [3]. The prevalence of erectile dysfunction (ED) is much higher in obese people than in those with a normal body mass index [4]. In obesity, widespread inflammation occurs due to increased fat tissue

in the body and penile blood flow is impaired. However, increased aromatase activity also reduces testosterone levels. These changes may lead to ED in obese people [5]. DM causes vascular and neurological damage in men, causing ED three times more frequently than in the normal population [6]. The coexistence of DM and obesity further increases the risk of ED [7]. Bariatric surgery is a treatment method with proven effectiveness in the treatment of obesity, and it has been shown that it can also improve disease symptoms such as diabetes and hypertension that accompany weight loss [8]. It has been reported that it also provides a significant improvement in sexual functions [9].

When evaluating obesity; hypertension, diabetes and lipid metabolism disorders are given more attention, depression and psychological problems are often ignored [10]. Obesity increases the risk of depression, and depression increases the likelihood of developing obesity [11]. Obesity causes

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severe stress and anxiety along with depression [12]. A significant portion of patients applying for bariatric surgery have symptoms of depression and anxiety [13, 14]. Studies evaluating depression and anxiety symptoms after surgery show a significant improvement in symptoms in the early period (1-2 years) [15, 16]. It has been found that in the late period (4-5 years), this recovery slows down and even anxiety and depression symptoms may worsen [17, 18].

The effects of bariatric surgery on sexual functions and depression, anxiety, and stress have been partially discussed in the literature. However, to the best of our knowledge, the effect of bariatric surgery on depression, anxiety, stress and sexual functions in obese patients with type 2 diabetes mellitus (DM) has not been studied. DM may affect the recovery of sexual and cognitive functions in obese men after bariatric surgery. Therefore in our study; it was aimed to investigate the difference between erectile function, orgasmic function, sexual desire, sexual satisfaction and general satisfaction, and depression, anxiety and stress before and after bariatric surgery in men with and without DM who underwent laparoscopic sleeve gastrectomy (LSG) as a bariatric surgery technique.

## Materials and Methods

Eighty male patients who underwent LSG at Memorial Ankara Hospital General Surgery Clinic in 2023 were included in this study. Half of the patients (40 patients) were diagnosed with type 2 DM. The patients' age, marital status, presence of DM, and BMI were recorded. Before reaching the study group of the research, a power analysis was performed and the minimum sample size was calculated as 26 for each group, a total of 52 people. Exclusion criteria from the study; (i) the patient does not want to participate in the study, (ii) the patient has a previous history of sexual dysfunction, (iii) the patient has a known psychiatric history, (iiii) the patient has a history of chronic disease other than DM, (iiiii) the patient has a previous history of surgical or non-surgical having received weight loss treatment, (iiiii) being an active smoker.

International Index of Erectile Function (IIEF); According to the European Association of Urology Guidelines, it is a form applied to men to evaluate sexual dysfunction. The IIEF has been shown to be a cross-culturally and psychometrically valid measure of male erectile dysfunction and a valid diagnostic tool in discriminating men with and without ED [19]. With this form, patients are asked 15 questions determining erectile function, orgasmic function, sexual desire, sexual intercourse satisfaction and general satisfaction, and these 5 different sexual function areas are scored according to the answers received (19). The validity and reliability of this form in Turkish was determined by various researchers and it was found to show adequate psychometric properties [20 - 22].

Depression-Anxiety-Stress Scale (DASS); this scale, developed by Lovibond and Lovibond (1995), has 3 subscales: depression, anxiety and stress [23]. This form consists of a total of 21 questions and is a 4-point Likert type scale. The DASS-Depression focuses on reports of low mood, motivation and self-esteem, DASS-anxiety on physiological arousal, perceived panic, and fear, and DASS-stress on tension and irritability. The clinimetric properties of the

questionnaire have been examined in general and clinical populations including chronic pain, post myocardial infarction, psychiatric inpatients and out-patients [24]. The Turkish validity and reliability of this form was determined by Akın and Çetin. Factor loadings were found to be between 0.39 and 0.88, the internal consistency reliability coefficient was found to be 0.89 for the entire scale, and it was understood that it showed adequate psychometric properties [25].

LSG was applied to the patients as a bariatric surgery technique. The operations were performed by one and the same surgeon at Memorial Ankara Hospital General Surgery Clinic. LSG; It is an extremely effective primary bariatric surgery method that is popular among patients and more frequently preferred by general surgeons [26]. Patients who meet the criteria; IIEF and DASO were filled in before and 6 months after the operation. Changes in sexual functions, depression, anxiety, and stress symptoms before and after surgery were compared between diabetic men who underwent bariatric surgery and non-diabetic men.

Ethics committee approval for the research was given by Omer Halisdemir University Non-Interventional Clinical Research Ethics Committee (decision no: 20.23.61). Each participant was given information about the research at the beginning of the application, had them sign an informed consent form, and then was included in the study.

### Power analysis

Power analysis was conducted through the Gpower (version 3.1.9.7) package program (for power analysis,  $\alpha = .05$ ; effect size = .80;  $1-\beta = .80$ ; two-way hypothesis;  $n1/n2 = 1$ ).

### Statistical analysis

SPSS version 25 (IBM SPSS, Turkey) package program was used in data analysis. In data analysis, first descriptive statistical measures (frequency and percentages) were used. It was determined that there were no missing values during the data collection process. Kolmogorov-Smirnov test was used for distribution. To determine the difference between groups, dependent samples t-test was performed. Since the age variable had a statistically significant difference between the groups within the scope of the research, Ancova analysis was performed by taking the age variable as the control variable in comparing both groups. An alpha level of 0.05 was considered for statistical significance.

## Results

Descriptive statistics of the sociodemographic information of the patients are given in Table 1. The average age of the patients was 34.55 ( $\pm 8.09$ ) in the group without DM and 43.05 ( $\pm 6.98$ ) in the group with DM. In terms of marital status, in the group without DM, the rate of those who are single and not in a regular relationship is 57.5%, the rate of those who are single and in a regular relationship is 27.5%, the rate of those who are married is 15%; In the DM group, the rate of those who were single and not in a regular relationship was 35%, the rate of those who were single and in a regular relationship was 37.5%, and

**Table 1.** Sociodemographic data of the patients.

Categorical variables						
Variables	Variable levels	Patients with DM		Patients without DM		$\chi^2$ (diff)
		f	%	f	%	
Marital status	Single, occasional relationship (no partner)	14	35.0	23	57.5	4.28
	Single, in a stable relationship (has a partner)	15	37.5	11	27.5	
	Married	11	27.5	6	15.0	
Total		40	100	40	100	
Continuous Variables						
		M	SD	M	SD	t-values (diff)
Age (years)		43.05	6.98	34.55	8.09	5.03*
BMI (pre-surgery)		48.38	2.99	41.68	2.10	11.58*
BMI (6th month after surgery)		35.45	2.57	31.58	1.68	7.98*

\*p<.05.

**Table 2.** Comparison of preoperative and postoperative sexual functions and depression, anxiety and stress scores of patients without DM.

Variables	Test	$\bar{X}$	SD	sd	p	$\eta^2$
DASS-Stress	Before surgery	3.20	2.79	39	.720	-
	After surgery	3.25	2.80			
DASS-Anxiety	Before surgery	3.23	2.48	39	.675	-
	After surgery	3.28	2.57			
DASS-Depression	Before surgery	7.30	3.75	39	.000	.83***
	After surgery	2.98	2.47			
IIEF-Erectyl Function	Before surgery	19.85	5.86	39	.000	.35***
	After surgery	22.55	4.21			
IIEF-Orgasmic Function	Before surgery	6.75	1.60	39	.000	.44***
	After surgery	7.80	1.38			
IIEF-Desire	Before surgery	6.63	1.66	39	.000	.49***
	After surgery	7.75	1.55			
IIEF- Sexual Satisfaction	Before surgery	10.00	3.06	39	.000	.34***
	After surgery	11.45	2.14			
IIEF- General Satisfaction	Before surgery	6.65	1.78	39	.000	.51***
	After surgery	7.95	1.55			

Note: DASS= The Depression, Anxiety and Stress Scale; IIEF= International Index of Erectile Function Questionnaire  $\eta^2^*$  = small effect;  $\eta^2^{**}$  = moderate effect;  $\eta^2^{***}$  = large effect.

the rate of those who were married was 27.5%. Considering BMI values, in the group without DM, it was 41.68 ( $\pm 2.10$ ) before surgery and 31.58 ( $\pm 1.68$ ) after surgery; In the DM group, it was 48.38 ( $\pm 2.99$ ) before surgery and 35.45 ( $\pm 2.57$ ) after surgery. There were no complications other than one wound infection in both groups.

Stress, anxiety, depression, erectile function, orgasmic function, sexual desire, sexual satisfaction and general satisfaction values of the groups with and without DM were compared before and at the 6th month after surgery.

When Table 2 is examined, it is seen that there is no statistically significant difference in the stress and anxiety levels of patients without DM before and after surgery ( $p > 0.05$ ). It was found that the depression scores ( $\bar{X} =$

2.98) were lower than the preoperative depression scores ( $\bar{X} = 7.30$ ) and this difference was significant. When the effect size was examined, it was determined that the significant difference had a large effect. Similarly, a statistically significant difference was detected in the pre- and postoperative erectile function, orgasmic function, sexual desire, sexual satisfaction and general satisfaction levels of patients without DM, with a large impact.

When Table 3 was examined, it was determined that the stress, anxiety and depression levels of patients with DM before and 6 months after surgery were statistically significant, and the postoperative depression, stress and anxiety levels decreased and the statistical difference had a large effect. While erectile function, orgasmic function,

**Table 3.** Comparison of preoperative and postoperative sexual functions and depression, anxiety and stress scores of patients with DM.

Variables	Test	$\bar{X}$	SD	sd	p	$\eta^2$
DASS-Stress	Before surgery	5.20	3.20	39	.000	.34***
	After surgery	3.53	2.64			
DASS-Anxiety	Before surgery	5.68	3.40	39	.000	.49***
	After surgery	3.03	2.43			
DASS-Depression	Before surgery	6.63	2.95	39	.000	.81***
	After surgery	1.85	1.61			
IIEF-Erectyl Function	Before surgery	16.45	4.03	39	.000	.32***
	After surgery	17.38	4.10			
IIEF-Orgasmic Function	Before surgery	5.68	1.40	39	.005	.19***
	After surgery	6.03	1.39			
IIEF-Desire	Before surgery	5.78	1.25	39	.160	-
	After surgery	5.93	1.40			
IIEF- Sexual Satisfaction	Before surgery	8.45	1.89	39	.001	.24***
	After surgery	8.90	1.86			
IIEF- General Satisfaction	Before surgery	5.70	1.11	39	.003	.21***
	After surgery	6.08	1.19			

Note: DASS= The Depression, Anxiety and Stress Scale; IIEF= International Index of Erectile Function Questionnaire  $\eta^2^*$  = small effect;  $\eta^2^{**}$  = moderate effect;  $\eta^2^{***}$  = large effect.

sexual satisfaction and general satisfaction levels of patients with DM were found to differ statistically before and after surgery ( $p < 0.05$ ), it was observed that the level of sexual desire after surgery did not have a statistically significant difference compared to the pre-operative one ( $p > 0.05$ ).

The postoperative measurements of patients without DM and patients with DM were subtracted from the preoperative measurements and the average of the differences was found. When Table 4 is examined, it is seen that the differences in depression levels between these two groups before and after surgery are not statistically significant ( $p > 0.05$ ). This result shows that the changes in depression levels of individuals in both groups are close or similar, and it has been determined that postoperative depression levels decreased in both groups.

It was determined that the stress levels of both patient groups before and after surgery had a statistically significant difference. It was determined that while the stress level of the patient group without DM ( $\bar{X} = 0.05$ ) increased slightly, the stress level of the patient group with DM ( $\bar{X} = -1.68$ ) decreased and this difference between the two groups was significant and had a large effect size.

It was determined that the anxiety levels of both patient groups before and after surgery had a statistically significant difference. It was determined that while the anxiety level of the patient group without DM increased slightly ( $\bar{X} = 0.05$ ), the anxiety level of the group with DM ( $\bar{X} = -2.65$ ) decreased and this difference between the two groups was significant and had a large effect size.

It was determined that the erectile function levels of both patient groups before and after surgery had a statistically significant difference. While the erectile function level of

the group without DM increased ( $\bar{X} = 2.70$ ), the erectile function level of the group with DM ( $\bar{X} = 0.93$ ) decreased. It was determined that it increased less, but this difference between both groups was significant and had a moderate effect.

It was determined that there was a statistically significant difference in the orgasmic function levels of both patient groups before and after surgery. It was determined that while the orgasmic function level of the patient group without DM increased ( $\bar{X} = 1.05$ ), the orgasmic function level of the DM group ( $\bar{X} = 0.35$ ) increased less, but this difference between both groups was significant and had a moderate effect.

It was determined that there was a statistically significant difference in the sexual desire levels of both patient groups before and after surgery. It was determined that while the sexual desire level of the patient group without DM increased ( $\bar{X} = 1.13$ ), the sexual desire level of the DM group ( $\bar{X} = 0.15$ ) increased less, but this difference between the two groups was significant and had a large effect.

It has been shown that there is a statistically significant difference in the sexual satisfaction levels of both patient groups before and after surgery. It was determined that while the sexual satisfaction level of the group without DM increased ( $\bar{X} = 1.45$ ), the sexual satisfaction level of the group with DM ( $\bar{X} = 0.45$ ) increased less, but this difference between the two groups was significant and had a moderate effect. It was determined that the general satisfaction levels of both patient groups before and after surgery had a statistically significant difference.

It was determined that while the general satisfaction level of the group without DM increased ( $\bar{X} = 1.30$ ), the general satisfaction level of the group with DM ( $\bar{X} = 0.38$ )

**Table 4.** Comparison of pre- and postoperative score differences in sexual functions and depression, anxiety and stress scores of patients without and with DM by ANCOVA.

Variables	Group	N	Diff $\bar{X}$	SD	p	$\eta^2$
DASS-Stress	Patients without DM	40	0.05	0.88	.000	.22***
	Patients with DM	40	-1.68	2.37		
DASS-Anxiety	Patients without DM	40	0.05	0.75	.000	.32***
	Patients with DM	40	-2.65	2.74		
DASS-Depression	Patients without DM	40	-4.33	2.23	.381	-
	Patients with DM	40	-4.78	2.34		
IIEF-Erectyl Function	Patients without DM	40	2.70	3.72	.006	10**
	Patients with DM	40	0.93	1.47		
IIEF-Orgasmic Function	Patients without DM	40	1.05	1.26	.003	.13***
	Patients with DM	40	0.35	0.74		
IIEF-Desire	Patients without DM	40	1.13	1.16	.000	.24***
	Patients with DM	40	0.15	0.66		
IIEF- Sexual Satisfaction	Patients without DM	40	1.45	2.04	.005	.10***
	Patients with DM	40	0.45	0.81		
IIEF- General Satisfaction	Patients without DM	40	1.30	1.29	.000	.17***
	Patients with DM	40	0.38	0.74		

Note: DASS= The Depression, Anxiety and Stress Scale; IIEF= International Index of Erectile Function Questionnaire  $\eta^2$ \* = small effect;  $\eta^2$ \*\* = moderate effect;  $\eta^2$ \*\*\* = large effect.

increased less, but this difference between the two groups was significant and had a large impact.

## Discussion

It is known that bariatric surgery has positive effects on depression and quality of life and improves sexual functions [27]. As far as we know, there are not enough studies in the literature on how DM can change these effects. In our study; while there was a statistically significant difference in erectile function, orgasmic function, sexual desire, sexual satisfaction, general satisfaction and depression symptoms after bariatric surgery in the patient group without DM, no difference was detected in stress and anxiety. In the DM patient group, after bariatric surgery, a difference was detected in all independent variables before and at 6 months after surgery. When the groups are compared; the improvement in sexual functions is more evident in the patient group without DM, and the improvement in stress and anxiety symptoms is more evident in the patient group with DM.

The risk of ED in obese men is approximately 3 times higher than in men with normal BMI [28]. There are multifactorial links between obesity and sexual dysfunction. It has been reported that insulin resistance, widespread inflammatory processes and T cell activity are effective in the process [29]. Improvement in sexual functions with bariatric surgery has been reported in many studies [9, 30, 31]. The most important factor in this improvement is thought to be weight loss [32]. However, there are also studies that did not find significant improvements in sexual functions in the postoperative period [33, 34]. In fact, deterioration in erectile function has also been reported after surgery [35]. Our study, in line with the general literature, shows that there is an improvement in sexual

functions in men after bariatric surgery. In addition to the literature, it has been found that this improvement is more pronounced in men without a diagnosis of DM. Obesity accompanied by DM accelerates pathological processes such as oxidative stress, inflammatory activity, and microvascular damage; it can be explained as exacerbating the deterioration in penile blood flow and limiting the recovery in sexual functions after surgery. However, the effect of bariatric surgery on long-term glycemic control and microvascular complications is not sufficient [36]. This may limit its contribution to sexual functions in diabetics. Obesity creates a psychopathological burden and negatively affects the quality of life [37], and its relationship with depression is also known [38]. A meta-analysis also reported that anxiety and depressive symptoms are more common in obese people [39]. Bariatric patients seeking surgery have a higher prevalence of psychological distress compared to other obese patients who do not seek surgery [40]. Consistent with our study findings, there are studies in the literature showing improvements in general mental health and quality of life with bariatric surgery [41]. The most important factors affecting the improvement in mental health of patients after surgery are; the type of obesity surgery was determined as weight loss, comorbidities and social support, and it was observed that this improvement was supported by the physical, psychological and social recovery that occurred with weight loss [42]. Recent studies also report that bariatric surgery relieves symptoms of depression and anxiety [43]. However, there are not enough studies on the effect of the presence of DM on the improvement in mental health after surgery in obese men. The coexistence of obesity and type 2 DM increases the frequency of depression and anxiety [44]. In another study, the deterioration of psychological health in



the obese population has also been attributed to the development of obesity-related comorbidities such as type 2 diabetes mellitus [45]. In our study, consistent with the literature, depressive symptoms decreased after bariatric surgery. However, in addition to the existing literature, a decrease in stress and anxiety symptoms was observed in the patient group with DM, while no significant change was detected in the patient group without DM. It has been observed that men with DM have more severe stress and anxiety symptoms before surgery. The decrease in stress and anxiety symptoms in men with DM compared to the patient group without DM can be explained by the fact that the coexistence of obesity and DM has increased the psychopathological burden on the patients, and by the improvement of obesity and the alleviation of DM symptoms after bariatric surgery. There are limitations in our study. It is a single-center survey study. The sample size was relatively small and consisted only of men. This might lead to insufficiency of study to detect meaningful differences in sexual function and mental health outcomes. Variables other than age, marital status and BMI, and hormones affecting sexual functions were not studied. Diagnosis, treatment processes and clinical conditions of diabetic patients have not been studied. The follow-up period is relatively short, limited to 6 months. There is no control group consisting of obese individuals who have not undergone bariatric surgery. Despite this, we think that the presence of DM in patients contributes to the literature by examining its effects on sexual function and depression, anxiety and stress after bariatric surgery.

## Conclusion

Our study showed that; the presence of DM in men who have bariatric surgery may limit the improvement in sexual functions after surgery. However, diabetic individuals may benefit more from surgery in terms of depression, stress and anxiety. In order to better determine whether diabetes is predictive of bariatric surgery outcomes; there is a need for randomized controlled, prospective, multicenter studies with high participation, in which the clinical conditions of diabetic patients are evaluated in detail.

## Ethical approval

Ethics committee approval for the research was given by Omer Halisdemir University Non-Interventional Clinical Research Ethics Committee (decision no: 20.23.61).

## Author contributions

Idea and Concept: E.Y.; Design: E.Y., E.E.; Data Collection: E.Y.; Analysis and Comment: E.Y.; Literature Review: E.Y., E.E.; Article Writing: E.Y., E.E.; Critical Review: E.Y., E.E.

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