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Changes in Total Sperm Count After Gastric Bypass and Sleeve Gastrectomy

Ali Abdulbaqi Ali Ismael[1]*, Faez khalaf Abdulmuhsen[2], Lamees M. Al-Janabi[3]

***Corresponding author:**
Ali Abdulbaqi Ali Ismael, M.D.
Thi-Qar, 64001, Iraq
E-mail: medicalresearch79@yahoo.com

[1]Department of Surgery, College of Medicine, University of Thi-Qar, Thi-Qar, 64001, Iraq
[2]Department of Medicine, College of Medicine, University of Thi-Qar, Thi-Qar, Iraq
[3]Department of Biochemistry, College of Medicine, University of Thi-Qar, Thi-Qar, 64001, Iraq

ABSTRACT

Background: Gastric bypass and sleeve gastrectomy are weight-loss surgeries that significantly reduce obesity, impacting reproductive health by altering total sperm count. *Aim:* to ascertain the impact of gastric bypass and gastric sleeve surgeries on hormonal levels, reproductive health, and alterations in total sperm count in patients with morbid obesity.
Material and Method: A total of 67 obese patients who had undergone both gastric bypass and gastric sleeve operations were recruited to the study, with an age range of 30 – 60 years, and the study period spanned from January 2022 to April 2023. Comprehensive semen and serum hormone analyses were performed on all patients who had undergone bariatric surgery. Sexual function was evaluated using a questionnaire to determine erectile function in patients after surgery.
Results: The study cohort comprised 67 obese men who underwent gastric bypass or sleeve gastrectomy. Most of the participants were aged between 41 and 50 years, and a high prevalence of dyslipidaemia and smoking was observed. The mean surgical time was 114.63 ± 4.68 minutes, with a mean blood loss of 80.42 ± 5.62 millilitres. The postoperative BMI was significantly reduced in all patients, with a preoperative BMI of 40.3 ± 10.23 and a post-operative BMI of 26.14 ± 2.60 in gastric sleeve surgery and 27.94 ± 2.63 in gastric bypass surgery. The hormonal profile, as indicated by SHBG, total testosterone, and free testosterone, exhibited a notable improvement following gastric sleeve surgery. Postoperatively, orgasmic function and sexual activity demonstrated a marked enhancement, while libido, erectile function, sexual satisfaction, and overall satisfaction exhibited a significant increase at the one-year mark.
Conclusion: Both gastric bypass and gastric sleeve surgeries were regarded as efficacious procedures for substantial weight reduction. This contributed to enhanced fertility outcomes in obese patients and had a favorable impact on reproductive health, resulting in discernible improvements in sperm levels and motility.
Key words: gastric bypass, sleeve gastrectomy, obesity, sperm

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INTRODUCTION

Obesity is one of the critical health issues affecting almost the whole world. It has doubled in rank over the past 30 years, thereby making it a global predicament (1,2). Obesity in males has been connected to problems with infertility and

disparities in hormones. Perhaps the cause of this connection lies in the way that fatness affects male reproductive hormones. It has been established beyond reasonable doubt that total testosterone, free testosterone, and sex hormone-binding globulin are markedly lower among obese males, while their levels of estradiol are higher (3).

Sermon Dade at al. found that overweight/obese males were more likely to have sperm abnormalities, which makes them infertile. Weight loss due to an altered lifestyle can lead to an increase in free testosterone (4) and improve obesity-related metabolic disorders like insulin resistance among obese males, thus leading to sperm functionality (5,6). Bariatric surgery is considered to be the most effective treatment for obesity as of now. It was reported that after surgery, 87% of men with secondary hypogonadism had their gonadal functions resolved due to loss of excess body mass (7-9). There isn't much information about the impact of natural weight decrease on sperm parameters. However, the few studies available indicate that lifestyle modification can increase sperm quantity and total count, hence improving potential fertility while reducing the conception period (10,11). However, the impact of bariatric surgery is unclear in terms of semen parameters or sexual function (12), where this prospective study aimed at assessing the lasting effects of gastric sleeve surgery on hormones, sexual functions, and sperms in very overweight men who have had problems with infertility (13,14).

MATERIAL AND METHODS

The study involved a cohort of 67 morbidly obese patients who were to undergo sleeve gastric surgery as well as gastric bypass surgery, scheduled between January 2022 and April 2023. The study included patients selected from hospitals in Thi-Qar, Iraq, based on specific surgical criteria and who had additional surgery appointments. The exclusion criteria for our study consisted of patients who were either over 60 years old or under 30 years old, individuals who had renal, hepatic, gonadal, and endocrine disease, patients undergoing concomitant therapy that could impact sex hormone levels or as semen parameters, patients with a history for malignant testicular tumors, trauma as well as dysplasia, and patients with a history of vascular surgery.

All patients who participated in the study underwent before and after examinations in a follow-up period of 12 months. Measurements, including body mass index (BMI), cigarette usage, and any other health conditions, were recorded before to the operation and during the post-operative monitoring period. Dyslipidaemia is defined through the presence of any one of the following: triglycerides equal to or higher than 1.7 mmol/L, a level of high-density lipoprotein cholesterol (HDLc) equal to or lower than 4.14 mmol/L, or past use of lipid-lowering treatment. Percent total weight loss (%TWL) is calculated by subtracting the follow-up weight of the preoperative weight, dividing it by the preoperative weight, and then multiplying the result by 100.

After the operation, all people were examined for semen and hormone analysis for serum. The research was conducted again after 12 months from the date of the surgery. This is the time when this test was designed to allow for recovery from the immediate effects of rapid weight loss, including massive gain in mass and its attendant effect on sperm count. To complete a man's analysis, the patient has to wait for a period of between three days and five days. During each of his visits to the hospital premises, he would ejaculate into a clean container after exciting himself. They were then put in an incubator maintained at 37°C, which is the normal body temperature for humans, followed by a thirty-minute period of liquefaction so that further tests could be done on them. We measured sex hormone-binding globulin (SHBG), follicle-stimulating hormone (FSH), luteinizing hormone (LH), prolactin, testosterone, and estradiol as hormonal parameters. We estimated serum testosterone and prolactin using electrochemi-luminescence immunoassay; estradiol, FSH, and LH were measured on chemiluminescent microparticle immunoassay (CMIA). We used a chemiluminescent enzyme immunoassay to measure SHBG. Hypogo-nadism was determined by total testosterone measurement and categorical variables. Spearman correlation analysis was applied to establish relationships among observed changes. A significance level of $P < 0.05$ was considered.

RESULTS

According to *table 1*, demographic findings enrolled obesity patients' data, which included 67 men who underwent in both of gastric bypass and sleeve gastrectomy. Patients with ages (41 - 50) years were the highest class of patients, which include 30 cases, BMI classified into (34 – 37) had 11 cases, (38 – 41) had 20 cases, and > 41 with 36 cases, where 86.57% of patients had dyslipidemia, and 56.72% of patients were smokers. *Table 2* listed laboratory parameters of obese patients.

Table 1 - Baseline and preoperative data of patients with obesity.

Parameters	Categories	No. 67	%
Age	30 – 40	26	38.81
	41 – 50	30	44.78
	51 - 60	11	16.42
BMI Kg/m^2	34 – 37	11	16.42
	38 – 41	20	29.85
	> 41	36	53.73
Comorbidities	Type 2 diabetes	18	26.87
	Hypertension	38	56.72
	Dyslipidemia	58	86.57
	cardiovascular disease	16	23.88
	Obstructive sleep apnea	31	46.27
	Osteoarthritis	12	17.91
Smoking	Smokers	38	56.72
	Non - smokers	29	43.28
Family history of obesity	Yes	21	31.34
	No	46	68.66
Previous surgery	Yes	15	22.39
	No	52	77.61
Education status	Primary school	8	11.94
	Secondary school	16	23.88
	College/university	43	64.18
Income status, $	< 740	15	22.39
	740 – 1000	30	44.78
	> 1000	22	32.84

Table 2 - Identify diagnoses data of patients with obesity

Parameters	Details of patients
Fasting glycaemia (mmol/L)	6.20 ± 1.43
HbA1c (%)	5.82 ± 0.60
Triglycerides (mmol/L)	3.70 ± 1.34
Total cholesterol (mmol/L)	4.85 ± 0.81
LDLc (mmol/L)	3.06 ± 0.69
HDLc (mmol/L)	1.09 ± 0.13

According to the outcomes in *table 3*, the current findings shown sleeve gastrectomy time was 114.63 ± 4.68 min and, gastric bypass was 211.45 ± 10.72 min, Blood loss had 80.42 ± 5.62 mL, amount of bleeding cases enrolled 2 cases in sleeve gastrectomy surgery and 3 cases in gastric bypass, stays of patients in hospital 1 – 3 days, there is no death cases.

In terms of *table 4*, our outcomes shown a high reduced of BMI in all patients, in which preoperative BMI was 40.3 ± 10.23, while postoperative BMI in gastric sleeve surgery was 26.14 ± 2.60, and gastric bypass surgery was 27.94 ± 2.63. However, this study realized no significant change among effects with patients having diabetes, hypertension, or obstructive sleep apnea despite losing weight post gastrectomy (OSA) on them. Twenty-two (32.84%) out of 22 patients who had male obesity secondary hypogonadism before operation underwent complete regression as a result of postoperative treatment. Hormonal profile on SHBG, total testosterone plus free testosterone significantly improved due to undergoing gastric sleeve surgery 12 months ago. At 12 months after surgery, in the same way, the average total serum testosterone went up from 10.5 ± 4.1 to 23.37 ± 6.97 nmol/l preoperatively, while the average free testosterone increased from 0.25 ± 0.05 to 0.38 ± 0.16/L before operation. This increase was seen in the levels of these hormones, and SHGB was noted following surgery on patients.

In *table 5*, our study found that after gastric sleeve surgery and sleeve gastrectomy surgery, orgasmic function improved sexual activity, whereas libido, erectile function, sexual satisfaction, and overall satisfaction increased notably after a year.

Table 3 - Enrol surgery data related to Gastric bypass and sleeve gastrectomy surgeries

Variables	Categories	Sleeve gastrectomy (N = 37)	Gastric bypass (N = 30)
Operative time, min		114.63±4.68	211.45±10.72
Blood loss, mL		80.42±5.62	62.50±4.58
No. of bleeding	Yes	2 (2.99%)	3 (4.48%)
	No	65 (97.01%)	64 (95.52%)
Stays of patients in hospital, days		1 - 2	2 - 3
ICU admission	Yes	1 (1.49%)	2 (2.99%)
	No	66 (98.51%)	65 (97.01%)
Vital signs			
Blood pressure	Systolic	125.45±6.83	127.35±4.66
	Diastolic	75.26±2.45	72.62±3.64
	Heart rate	82.46±6.10	92.30±4.20
Oxygen saturation		98%	96%
Mortality rate, n (%)	Yes	0	0
	No	37	30

Table 4 - Comparison between preoperative hormonal assessment and seminogram and follow- up values at 12- and 18-month post-sleeve gastrectomy surgery.

Parameters	Pre-operative	Postoperative	
		Sleeve gastrectomy surgery	Gastric bypass surgery
Total testosterone (nmol/L)	10.5±4.1	23.37±6.97	20.77±5.32
BMI, Kg/m2	40.3±10.23	26.14±2.60	27.94±2.63
Free testosterone (nmol/L)	0.25±0.05	0.37±0.04	0.38±0.16
Sex hormone-binding globulin (nmol/L)	20.3±12.4	41.33±14.62	38.30±12.56
Follicle-stimulating hormone (UI/L)	4.22±1.47	5.24±1.61	4.19±1.73
Luteinizing hormone (UI/L)	2.84±1.42	3.83±1.12	2.91±1.11
Estradiol (nmol/L)	0.12±0.36	0.9±0.07	0.10±0.04
Prolactin (mUI/L)	224.4±142.3	217.43±181.35	212.66±180.20
Male Obesity Secondary Hypogonadism, N (%)	22 (32.84%)	0 (0%)	0 (0%)
Oligospermic patients	11 (16.42%)	8 (11.94%)	9 (13.43%)
Severe oligospermic patients (<5×106/ml), (N(%))	5 (7.46%)	2 (2.99%)	3 (4.48%)
Semen volume (mL)	2.9±1.7	2.97±1.36	3.08±1.39
Semen pH	7.68±0.27	7.58±0.11	7.67±0.19
Sperm count (× 106/ mL)	2.94±1.13	9.93±1.55	9.61±1.27
Total sperm number/ejaculate	8.23±2.16	29.65±2.28	30.14±2.27
Leucocyte concentration (× 106 / mL)	0.17±0.38	0.11±0.49	0.12±0.56
Sperm progressive motility (%)	18.4±1.64	20.18±2.85	18.25±2.24
Sperm with normal morphology (%)	16.84±3.20	15.53±4.60	17.82±4.32
Teratzoospermia index (%)	1.64±0.11	1.61±0.33	1.58±0.28

Table 5 - Comparison of patients' data between preoperative and postoperative during follow-up in terms of sexual function.

Parameters	Pre-operative	Postoperative	
		Sleeve gastrectomy surgery	Gastric bypass surgery
Sexual desire	9.58 ± 1.01	18.64 ± 0.38	16.47 ± 1.35
Erectile function	23.46 ± 6.82	26.72 ± 4.58	27.01 ± 4.60
Orgasmic function	9.60 ± 3.78	11.24 ± 2.05	10.02 ± 3.84
Intercourse satisfaction	6.20 ± 1.47	8.90 ± 0.92	8.42 ± 0.82
Overall satisfaction	6.31 ± 2.10	8.62 ± 0.40	8.51 ± 1.01

DISCUSSION

Obesity has negative effects on male fertility, and this condition can be blamed on several factors, among them alteration of sexual activity, interruption of hormonal systems (15), deposition of toxic substances within fatty tissues, increased scrotum temperatures, or as a consequence of genetic flaws resulting into defective sperms (16). Weight loss can change the levels of systemic low-grade inflammation, which depends on the mass of the human body (17). This is well supported by the significant changes in 51 inflammation-associated proteins, among them c-reactive protein (CRP) (18).

Many recent studies have highlighted the role of fertility problems caused by obesity and bariatric surgeries. Existing studies show that bariatric surgery may improve some obesity- related co-morbidities like heart diseases, diabetes, or high blood pressure while at the same time greatly reducing the need for drugs and related costs as drugs (19-21). Weight loss plastic surgery might decrease fat accumulation on the thigh and suprapubic regions, decrease testicular temperature, and hence enhance spermatogenesis by cutting down on fat mass after losing weight (22,23). The study's findings demonstrate that Shaklee energy makes total testosterone, free testosterone, and SHBG levels go up significantly in very obese men, treating male obesity-related secondary hypogonadism (MOSH) (24). After gastric sleeve surgery, levels of sex hormone-binding globulin and free testosterone increase to demonstrate that not all decreases in testosterone concentration are as a result of obesity's effect on SHBG levels and weight loss (25). This current

work is in line with other previous literatures researching on how bariatric surgery affects testosterone concentrations in men (26).

Our study found that gastric sleeve surgery improves male reproductive system health metrics without affecting orgasm (27). Erectile function has not been thoroughly explored in existing literature although optimal hormonal surveillance should accompany bariatric surgery procedures too. Nonetheless, these results are in line with earlier studies endorsing weight loss interventions through IIEF parameters (28). Various previous studies have investigated the advantages of significant weight loss post- bariatric surgery. At first, many case studies mostly addressed the harmful impact of roundness surgery for male fertility. Subsequent prospective research using small sample sizes have contradicted these anecdotal results (29).

El Bardisi et al (30). Performed a study on the impact in sleeve gastrectomy on semen parameters. After 12 months, researchers noticed improved sperm motility in men that had previously had low sperm count and absence of sperm in their semen. Samavat et al (31). Saw improvements in both the amount and movement of semen six months after surgery. On the contrary, a decrease in the level of awareness and total number of sperm has been registered in two recent studies. Legro et al., on the one hand, and Reis et al., on the other, found no change in sperm parameters at 12- and 24-months post-surgery (32).

CONCLUSION

In general, both gastric bypass as well as sleeve gastrectomy are related to enhancements of overall sperm count and other sperm characteristics in men who are obese. Sleeve gastrectomy surgery effectively enhances testosterone levels, sexual function, and sperm count for obese men, causing significant weight loss.

Conflict of interest

All authors declared no any conflict of interesting.

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Ethical Statement

This work approved by Department of Surgery, College of Medicine (No. 12 in 2022).

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