

2022

The Positive and Negative Effects on Patients Undergoing Laparoscopic Sleeve Gastrectomy

Jameelah Allaboon

College of Social Work, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia,
jameelahallaboon@gmail.com

Follow this and additional works at: <https://digitalcommons.aaru.edu.jo/isl>

Recommended Citation

Allaboon, Jameelah (2022) "The Positive and Negative Effects on Patients Undergoing Laparoscopic Sleeve Gastrectomy," *Information Sciences Letters*: Vol. 11 : Iss. 5 , PP -. Available at: <https://digitalcommons.aaru.edu.jo/isl/vol11/iss5/21>

This Article is brought to you for free and open access by Arab Journals Platform. It has been accepted for inclusion in Information Sciences Letters by an authorized editor. The journal is hosted on Digital Commons, an Elsevier platform. For more information, please contact rakan@aarj.edu.jo, marah@aarj.edu.jo, u.murad@aarj.edu.jo.

The Positive and Negative Effects on Patients Undergoing Laparoscopic Sleeve Gastrectomy

J. M. Allaboon

College of Social Work, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia

Received: 6 Mar. 2022, Revised: 31 Mar. 2022, Accepted: 5 Apr. 2022.

Published online: 1 Sep. 2022.

Abstract: Background: Bariatric surgery has long been acknowledged as the most effective long-term treatment for severe obesity and overweight. Among the different bariatric surgeries, laparoscopic sleeve gastrectomy (LSG) has become the most commonly performed treatment in the world. However, data regarding the expected effects of this treatment still need more investigation. **Objective:** The current research aimed at investigating the expected positive and negative effects of laparoscopic sleeve gastrectomy (LSG) including the health-related, social and psychological effects. **Methods:** The sample consisted of 327 participants of those who underwent laparoscopic sleeve gastrectomy operations, whether Saudis or non-Saudis who reside in Saudi Arabia. Following the descriptive analytical design, the research utilized a questionnaire as a research instrument administered to patients underwent LSG. The research was conducted during the academic year 2020/2021. **Results:** Results showed that the research participants agreed on the health-related, social and psychological effects of LSG. The statement “My health became better after surgery” ranked first in the subscale of health-related effect. Meanwhile, the statement “I feel that my life has better improved after surgery” ranked first in the subscale of social effect of LSG. Further, the statement “I feel happy after performing operation” ranked first in the subscale of psychological effect of LSG. **Conclusion:** The research results indicated some health-related, social and psychological effects of LSG. Therefore, insightful follow-up and ongoing evaluation of the expected effects of laparoscopic sleeve gastrectomy as well as increasing patients’ awareness on healthcare practices are highly recommended.

Keywords: Overweight, Obesity, Body Mass Index (BMI), Bariatric, Laparoscopic Sleeve Gastrectomy (LSG).

1 Introduction

The prevalence of obesity in a growing number of populations globally is considered a rising health hazard in this millennium. Overweight and obesity are characterized as excessive fat accumulation that may debilitate health. The World Health Organization (WHO) refines this definition, noting that body mass index (BMI) greater than or equal to 25 is considered overweight, and a BMI greater than or equal to 30 is described as obese.

BMI is the index of weight-for-height commonly used to classify overweight and obesity in adults. BMI is calculated as a person's weight in kilograms divided by his/ her height in meters. BMI is expressed metrically as kg/m², thus, BMI = (Weight in Pounds) x 703/(Height in Inches ²). The classification of risk by weight category and BMI cut-off points is shown in Table 1 [1].

Table (1): The classification of weight category depending on BMI

Classification of Population according to BMI	Principal cut-off points BMI (kg/m ²)
---	---

Normal range	18.5–24.9
Pre-obese	25.0–29.9
Obese class I	30.0–34.9
Obese class II	35.0–39.9
Obese class III	≥ 40.0

Source: Adapted from the World Health Organization 2015

Obesity has become an epidemic in many parts of the world. Individuals, communities, and culture are all affected by obesity's short- and long-term health and financial consequences [2]. Health complications due to obesity can be observed clearly as hepatic and gallbladder disease, diabetes class II, dyslipidaemia, hypertension and vascular diseases, gynaecological problems and infertility, coronary heart disease, respiratory problems, hypothyroidism, osteoarthritis, stroke, cancers, and depression [3]. It is worth being mentioned that one of the management tools for obesity is restrictive laparoscopic sleeve gastrectomy.

Bariatric surgery is a medical execution that leads to

*Corresponding author e-mail:

weight loss by either reducing the absorption of calories or reducing the stomach's absorption capacity. The objective of bariatric surgery is to help the patient to lose more than half of his/her excess weight, thus it helps to reduce, or prevent, obesity-related health hazards [3]. Bariatric surgery is taken into consideration an powerful and an increasing number of common treatment for obesity and obesity-related comorbidities [4].

The LSG is a bariatric operation in which approximately 85% of the stomach is removed, followed by shaping of the remaining stomach into a tube or sleeve. It can be used as a primary stage procedure prior to a gastric bypass or as a definite (particular) procedure [5]. During the sleeve gastrectomy procedure, a thin vertical sleeve of stomach is configured using a medical stapling device. Each sleeve is nearly equal the size of a banana. The remaining portion of the stomach then is removed as shown in figure (1).

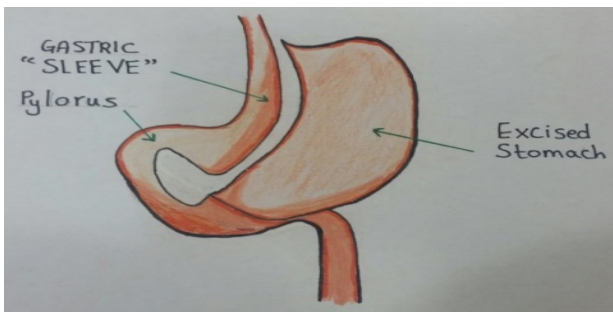


Fig. (1) Sleeve gastrectomy

Source: Abu-Jaish [5]

Not only does the success of bariatric surgery vary per procedure, but the outcomes of bariatric surgery also vary by population and geographic region. [6]. Patients may experience a reduction in BMI, weight, blood pressure, stroke, and cancer after a sleeve gastrectomy, as well as a significant remission in obesity-related diseases such as type 2 diabetes (T2D), non-alcoholic fatty liver disease (NAFLD), cardiovascular disease, obstructive sleep apnea, musculoskeletal problems, ovarian disorders, and urinary incontinence.. Bleeding, nutrient shortages, and leaking are the most prevalent sleeve gastrectomy consequences. [7].

In morbidly obese patients, a sleeve gastrectomy improved mental Problems. After a sleeve gastrectomy, some data showed a considerable improvement in psychological aspects and eating habit. [8] Pediatric surgeons and their institutions that provide bariatric surgery should participate in clinical research endeavors that evaluate outcomes and seek out the best treatment procedures. [9]. Candidates for bariatric surgery must be evaluated for surgical risk, which includes the existence of cardiovascular, pulmonary, and other system disorders, as well as the management of these concomitant conditions [10].

Moszkowicz et al. [11] stated that LSG reveals significant consequences that can arise in people who have a benign disease. Weight loss surgery dangers must not

outweigh the predicted health benefits. Careful patient selection, alternative safer techniques, especially in the condition of previous bariatric surgery, and close postoperative follow-up with early reoperation may all assist to reduce the risk of major problems and their implications. Padwal [12] indicated that more research is needed to thoroughly evaluate the advantages and downsides of various bariatric surgeries and to examine long-term benefits, hazards, and cost-effectiveness.

According to literature review as far as the researcher knows, no studies have explored the positive and negative effects on patients undergoing sleeve gastrectomy in Saudi Arabia in terms of health- related, social and psychological effects combined together. Hence, there is a big need to investigate those positive and negative effects. To sum up, the above considerations highlight the significance of the current research. The results of this research are hoped to pave the way for further research concerning sleeve gastrectomy effects, consequences and implications.

Research problem and its questions

The research problem can be stated as follows:

Sleeve gastrectomy has positive and negative effects on patients underwent this operation. Thus the current research attempts to investigate health- related, social and psychological effects.

The research seeks to answer the following questions:

1. What are the expected positive and negative health- related effects of LSG?
2. What are the expected positive and negative social effects of LSG?
3. What are the expected positive and negative psychological effects of LSG?

Objectives of the research

The research aims to identify the following:

1. The expected positive and negative health- related effects of LSG.
2. The expected positive and negative social effects of LSG.
3. The expected positive and negative psychological effects of LSG.

Significance of the research

1. Discussing a critical issue concerning the effects of LSG.
2. Adding to research area which is somewhat limited in general and in Saudi Arabia in specific.
3. Identifying factors that may contribute to forming positive and negative effects of LSG.
4. Benefitting those who carrying out health care procedures for LSG patients.

Delimitations of the research

The research was delimited to a sample of those who underwent sleeve gastrectomy operations in Saudi Arabia. It was delimited to the academic year 2020/2021. It dealt with investigating positive and negative health-related, social and psychological effects of LSG.

Literature Review

Overweight is a BMI greater than or equal to 25 [1]. Further, obesity is a multifaceted disorder that is affected by both genetic and environmental influences, as well as their interactions. The World Health Organization defines obesity as a body mass index (BMI) over 30. Obesity in children and adolescents is increasing, leading to serious health problems [13]. Moreover, globalization, improving economic conditions, and evolving eating preferences are all factors contributing to the rapid rise in obesity and overweight rates [14].

The underutilization of bariatric surgery is mostly owing to misalignment of therapeutic paradigms, insurance policies, and public perception. When compared to lifestyle and behavioral changes, sleeve gastrectomy and gastric bypass are the two most common bariatric surgeries performed today, and both result in superior and long-lasting weight loss, a reduction in medical comorbidities, and a mortality benefit. [15].

Laparoscopic surgery involves using fiber-optic imaging devices that are inserted in the abdomen. Through small incisions, a surgeon removes a portion of the stomach, forming a narrow "sleeve" out of the stomach. The amount of food that may be eaten at one time is limited due to this smaller stomach. It aids patients in feeling full with fewer meals. The operation also results in changes in the production of hormones made by the stomach and intestines that decrease hunger [16].

Sleeve gastrectomy has recently become popular as a solution for obesity, but research into the procedure's long-term effects is revealed contradictory results in terms of social, psychological and health-related effects. Some studies indicated to positive effects of sleeve gastrectomy on patients who underwent this operation. Conversely, other studies referred to its positive effects. . An overview of some of those studies follows.

Barley and Mathers [17] indicted that iron, vitamin B12, folate and calcium levels were monitored annually for 26 patients who underwent SG. Researchers found that 44% showed normal results, while 17.5% showed abnormalities. They proposed a policy for annual follow-up.

Many studies also discussed the possible causes of malnutrition after SG operations. As the stomach has a unique role in food processing and bioavailability, and so, anemia has often resulted from gastrectomy. The reduction of hydrochloric acid secretion leading to decreased iron absorption was monitored in a number of studies, and it is

believed that this also led to decreased B12 levels. Weight loss and anemia can be the result of malnutrition [18].

Alagna et al [19] studied the relationship between the leptin level in obese patients, and levels of thyroid hormones (TSH, LT4, and LT3) among 38 patients before SGL and after 12 months. They observed that there was no change in TSH and LT4, but, there was a decrease in LT3 and the leptin level, though no relevant relation between thyroid functions and leptin level was observed.

The side effects of the SG operation in both the short and long term were studied by many researchers. They followed up with 53 patients during three to six years post operation. Eleven patients received duodenal switches and two patients re-sleeved again after the 3rd year due to regaining of weight, while 41% of patients had 50% weight loss after the 6th year and 21% suffered from oesophageal reflux [20].

Nath et al. [21] monitored the health status of the first 100 patients that underwent SG. Their data was collected from three to six months post operation. They concluded that the percent of weight loss increased from 34.2% in 3 months to 49.1% in 6 months. The hypertension cure rate was 38%, hyperlipidemia patients had a 19% cure rate, and those with diabetes were cured at a rate of 46%. On the other hand, they found some complications, including bleeding, acute renal failure, and bleeding at a gastric fistula. The results clarified that these complications were very limited in number. The net result of the study proved that SG is safe with few complications.

A case study conducted by Chouillard et al. [22] was designed as a control study in order to sort data during 2011. This study was conducted by the Department of Minimally Invasive and Digestive Surgery, Centre Hospitalier Intercommunal, Poesy-Saint-Germaine, Poissy, France. The conclusion from this study revealed LSG as the operation of choice for the treatment of morbid obesity or obesity in Type II Diabetes Mellitus (DM).

A study conducted by Soricelli et al. [23] aimed to evaluate the incidence of gastroesophageal reflux (GERD) and hiatal hernia (HH) post SG procedure in 378 patients; 25.6% of them had both SG and HH repair surgery, among this group, 15.8% had GERD and 11.1% had HH. Eighteen months post-surgery, a follow-up investigation of these patients found remission of GERD in 73.3%, while the remaining patients showed minimized effects of GERD with the aid of anti-reflux medications. GERD developed again in 22.9% of patients who underwent SG alone, compared to 0% of the patients who underwent both SG and HH operations.

The improvement of levothyroxine (LT4) absorption post bariatric surgery was monitored by another study conducted by Gkotsina et al. (2013). Blood samples were collected pre, post, and at 35 days from surgery for 32 patients with non-hypothyroid; ten patients underwent SG, seven patients underwent roux-en-y gastric bypass, and 15 patients

underwent biliopancreatic diversion (BPD). The study revealed that LT4 absorption after SG and BPD were improved. The study proved that the stomach and the duodenum were not the primary sites of absorption of LT4 since they were bypassed in those surgeries.

The effectiveness of SG to cure certain chronic diseases, as well as its ability to improve the general health status of individuals, was also clarified through the study conducted by Jadhav and Borude (2013). They found that SG patients showed improvements in weight loss, DM, hypertension and thyroid functions.

Another study conducted by Nedelcu et al. (2013) focused on whether there were any chronic leaks following surgery. This study was conducted on 80 patients across 16 months. The patients in the study had different procedures for partial surgery: four patients underwent endoprosthesis, sealing glue was used in two patients, and two others were treated with a combination of the previously mentioned procedures, the mean full recovery time was 32 days.

Peterhänsel et al. [24] conducted a study to present a systematic review of suicide mortality after bariatric surgery and calculate the suicide rate. When 190,000 person-years of post-bariatric surgery data were examined, 95 suicides were discovered. The suicide rate was 4.1 per 10,000 person-years (95 percent confidence interval [3.2, 5.1]). Suicide rates among bariatric surgery patients were greater than in the general population. As a result, identifying people who are at risk is critical, and post-operative psychiatric monitoring is recommended.

A cohort study conducted by Rebibo et al. [25] involving 68 patients who underwent sleeve gastrectomy (SG) between August 2004 and December 2007. The findings revealed that, the procedure was effective five to nine years post operation in 60% of patients experiencing excessive BMI loss. Also there has been an update of body data with regard to patients who underwent SG between November 2004 and February 2012, this data was taken from 600 patients in small medical centers and a meta-analysis of other studies. The data collected from these 600 patients revealed that, among other things, the mean surgical duration was 84 minutes, the rate of gastric leak was 2.5%, and the hospital stay decreased from 4.9 days in 2004 to 4.3 in 2012. The rate of gastrointestinal hemorrhage minimized from 6.4% to 5.5%, and gastric fistula decreased from 4.6% to 1.9%.

A study conducted by Tack and Deloose [26] referred that dumping syndrome, vitamin deficiencies, and gastro-oesophageal reflux disease were other complications studied after bariatric surgeries. For all patients who underwent SG and RYGB and had dumping syndrome post operation, the incidence of GERD was increased post SG, while improved after RYGB. The patients in these studies were saved from malabsorption and vitamin deficiencies.

Jarvholm et al. [27] conducted a study on a group of 13–18-year-olds to examine if the good psychological results

seen in adult patients' research were replicated in these younger patients at 2-years post-surgery. Results showed that in a group of 88 adolescents, anxiety, despair, anger, and disruptive behavior all decreased significantly two years after bariatric surgery. Furthermore, at one year after surgery, self-esteem and self-concept significantly improved, stabilizing by the two-year mark.

Schmitt, et al. [28] conducted a study aimed at examining the effects of laparoscopic adjustable gastric banding, as well as note positive physiological outcomes in 16 subjects. Results showed a reduction in depressed symptoms and social isolation at one year after surgery. In addition, there was statistically significant improvement in emotional functioning, social functioning, and school functioning. This highlights that bariatric surgery has a large and positive influence on obese teenagers' psychological co-morbidities.

Alharbi, et al. [29] conducted a study aimed to compare the quality of life of morbidly obese individuals after bariatric (sleeve gastrectomy) surgery to their pre-operative state. A questionnaire was designed and given to 298 patients, with women accounting for 52 percent of the participants. Physical pain, psychological manifestations, and self-esteem are some of the characteristics used to assess quality of life. Results indicated that patients can now participate in a variety of sports (61%) with no significant change in social activity. When compared to the pre-operative period, productivity in everyday work tasks increased by 57%. In terms of post-operative discomfort, (57%) reported they had it, with the majority (64%) indicating it lasted less than a month. Patients with preoperative chronic illness had a higher percentage of patients who stated their health had improved significantly compared to their preoperative situation. The study concluded that sleeve gastrectomy for patients with morbid obesity showed a tremendous positive impact on the quality of life of the majority of patients

Gallart-Aragón, et al. [30] conducted a study to investigate the effect of the sleeve gastrectomy (SG) in the quality of life (QoL) and pain in a population of morbidly obese patients. In this descriptive observational study, 72 SG patients were examined before surgery and 6 months thereafter. Results revealed after 6 months practically all subscales of the GIQLI questionnaire showed substantial improvements: gastrointestinal symptoms ($P = .01$), physical well-being ($P = .001$), social well-being ($P = .03$), and overall GIQLI score ($P = .001$), but not emotional condition ($P = .20$). Patients also had improvements in spontaneous low back pain ($P = .002$), but not in the PPTs in all the body areas explored, including the cervical area, low back, and hands ($P > .05$).

Huang et al. [31] conducted a study to investigate the effect of laparoscopic sleeve gastrectomy on the Framingham risk score 6 and 12 months after surgery in morbidly obese patients (LSG). From June 2007 to June 2014, 870 morbid obesity patients who got LSG at Taipei

Medical University Hospital were retrospectively evaluated preoperatively, 6 months after surgery, and 12 months after surgery. The Framingham risk score was used to calculate the risk of coronary heart disease. Results showed that at 6 and 12 months after surgery, men and women's body mass indexes dropped from 43.3 6.9, 39.2 6.0 kg/m² preoperatively to 32.9 6.7, 31.0 5.2 kg/m² and 30.4 5.6, 28.2 4.7 kg/m², respectively (P 0.0001). At 6 and 12 months after LSG, there was a significant decrease in the prevalence of diabetes mellitus, systemic hypertension, and smoking, as well as a marked change in the lipid profile. At 6 and 12 months following surgery, the Framingham risk score in men and women decreased from 3.2 5.7, 6.1 5.7 preoperatively to 1.4 5.9, 3.3 5.9 and 0.1 6.2, 2.8 6.1, respectively (P 0.0001). This proved that the laparoscopic sleeve gastrectomy procedure is effective not only in reducing obesity and its comorbidities, but also in lowering the risk of long-term coronary events. Mackey, et al. (2018) conducted a study in order to examine the influence of adolescent-reported pre-operative social support around exercise, binge eating, and exercise in predicting excess body mass index (EBMI) decrease from 3 to 12 months after surgery in a study. A total of 101 adolescents aged 12 to 21 years old (M age = 16.6, SD = 1.8) took part in the study. Body mass index (BMI) before surgery ranged from 35 to 87 (M = 50.3, SD = 8.6). Results showed that social support predicted exercise and had a trend for predicting binge eating, with higher social support being related with more exercise and a trend for less binge eating. Binge eating was linked to a lower EBMI loss. However, there was no link between exercise and a decrease in EBMI. Salminen, et al. [32] conducted a study to investigate whether laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass are equal in terms of weight loss after five years in patients with severe obesity. Results showed that the use of laparoscopic sleeve gastrectomy compared to laparoscopic Roux-en-Y gastric bypass did not address requirements for comparability in terms of percentage excess weight loss at 5 years in patients with severe obesity. Although gastric bypass was associated with a larger percentage excess weight loss at 5 years when compared to sleeve gastrectomy, the difference was not statistically significant based on the pre-specified equivalency margins.

Timofte, et al. [33] conducted a study to assess if laparoscopic sleeve gastrectomy could help those with depressive symptoms. The results revealed that following surgery, the point prevalence of depressive illnesses dropped significantly ($p < 0.01$). After the laparoscopic sleeve gastrectomy, the depression scale score dropped considerably. In conclusion, our findings support a significant improvement in a psychological element such as depressive symptoms over the first year following a laparoscopic sleeve gastrectomy.

Alkassis, et al. [34] conducted a study to assess the quality of life of obese people before and after bariatric surgery, taking into account their age, gender, and degree of

weight loss, as well as the influence of bariatric surgery on obesity-related comorbidities. Patients with a BMI of less than 30 kg/m² who underwent laparoscopic sleeve gastrectomy were included. The Moorehead-Ardelt Quality of Life Questionnaire II (MA II) was completed before the operation and one year later. A total of 75 patients took part in the research. The majority of the participants were women (75%) with an average age of 36.3 years. A total of 36.57 kg was lost on average (16-76). The total MA II score was initially -0.33 0.93. It increased to 1.68 0.62 ($p \leq 0.001$) after surgery. After surgery, all MA II parameters improved ($p \leq 0.001$), but this change was independent of age and gender. The degree of weight loss predicted improvements in self-esteem, physical activity, and work performance ($p \leq 0.001$). With the exception of gastric reflux and varicose veins of the lower limbs, all obesity-related comorbidities improved considerably ($p < 0.05$) after sleeve gastrectomy. The study concluded that sleeve gastrectomy improves quality of life and reduces comorbidities.

Ustundag, et al. [35] conducted a study to assess healthy lifestyle behaviors and the quality of life of obese individuals in 3–12 months after sleeve gastrectomy. The study sample included 172 patients agreeing to participate. Participants got the greatest and lowest scores for the subscales spiritual growth and physical activity, respectively, while the total HPLP II score was above average. The total score for the WHOQOL-BREF-TR was above average. The highest and lowest scores were obtained for the subscales psychological health and social relations, respectively. There was a significant correlation between the scores for HPLP II and its subscales and the scores for WHOQOL-BREF-TR.

Çöpür, Tinkir & Çöpür [36] conducted a study to investigate the psychological effects of bariatric surgery in teenage patients with obesity. Prior to surgery and one year later, the patients underwent psychiatric evaluations that included the Beck Depression Inventory, Beck Anxiety Inventory, Eating Attitudes Test, and World Health Organization Quality of Life questionnaire (WHOQOL-BREF). Results indicated that Adolescent patients admitted for bariatric surgery had a significant proportion of psychiatric comorbidities. Following a sleeve gastrectomy treatment, the psychological well-being of adolescent patients improved significantly, including depression, anxiety, feeding behaviour ratings, and quality of life.

Yates, et al. [37] conducted a study to investigate patients' perceptions after LSG and to help with shared decision-making. Twenty-two patients were chosen at random one, two, or three years after their LSG. Results showed that three global themes were emerged: 1) normality, 2) control and 3) ambivalence, with eight organizing sub-themes: 1) weight, 2) physical changes and daily living enhancements, 3) exercise, 4) emotional responses, 5) eating behaviour, 6) societal influences, 7) body image and 8) relationships. The study concluded that

LSG is often associated with high levels of patient satisfaction, as well as physical and emotional advantages beyond metabolic improvements.

Roberts [38] conducted a study to evaluate the findings of recent literature on the overall efficacy of bariatric surgery in adolescent patients in terms of weight and BMI reduction, hormonal changes, and co-morbidity resolution, as well as data on sleep and psychological effects. Race, ethnicity, and socioeconomic position were explored. Results concluded that existing evidence supports bariatric surgery as an effective treatment for obesity and related co-morbidities in teenagers; however, there is a scarcity of long-term data to appropriately assess efficacy and trends throughout adulthood. From baseline to two years, the majority of patients remained symptomatic or non-symptomatic, and remission was more common than the development of new symptomology across studies. At two years, anxiety, depression, disruptive behavior, and anger all dropped dramatically, in contrast to gains in mood, self-esteem, and self-concept, as measured by IWQOL-Kids, BDI, and perceived confidence scores.

Research Methodology and its Procedures

Research design

The research followed the descriptive analytical research design because it is appropriate for its nature and objectives. The descriptive design describes the studied phenomenon and also detects the relationship between the studied phenomenon and the variables that affect it.

Research population

The current research population consisted of people with any nationality who underwent sleeve gastrectomy operations during the period of study and residing in The Kingdom of Saudi Arabia.

Research sample

The research used the purposive sampling method and the sample consisted of 327 participants of those who underwent sleeve gastrectomy operations, whether Saudis or non- Saudis who reside in Saudi Arabia. An important consideration in the selection of respondents was the diversity of the sample; respondents were from several areas in various cities in Saudi Arabia. The sample was reached through gastric sleeve community on social media in Saudi Arabia. Table (2) shows the distribution of the research sample according to the variables.

Table (2) The distribution of the research sample according to the variables

Research sample variables		Sample	
		Frequency	%
Nationality	Saudi	298	91.1%
	not Saudi	29	8.9%

	Total	327	100%
Gender	Male	163	49.8%
	Female	164	50.2%
	Total	327	100%
Age	25 less than years	185	56.6%
	35 less than 45	97	29.7%
	45 less than 55	40	12.2%
	55 or older	5	1.5%
	Total	327	100%
Height	less than 145 cm	2	0.7%
	145 cm to less than 155cm	43	13.1%
	155 cm to less than 165 cm	120	36.7%
	165 cm to less than 175 cm	109	33.3%
	175 cm to less than 185 cm	45	13.8%
	185 cm or more	8	2.4%
	Total	327	100%
Weight in Kilogram before the operation	less than 85 Kg	15	4.6%
	85 to less than 95 kg	17	5.2%
	95 to less than 105 kg	40	12.2%
	105 to less than 115 kg	63	19.3%
	115 to less than 125 kg	66	20.2%
	125 kg or more	126	38.5%
	Total	327	100%
Marital Status	Married	192	58.7%
	Single	118	36.1%
	Divorced	17	5.2%
	Total	327	100%
Employment Status	Governmental Employees	146	44.6%
	private sector employees	61	18.7%
	Housewives	47	14.4%
	Students	42	12.8%
	self-employed	18	5.5%
	noted their employment status as other	13	4.0%
	Total	327	100%
in what country did	inside Kingdom of Saudi Arabia	210	64.2%

you have the operation	outside KSA	117	35.8%
	Total	327	100%
what kind of hospital conducted the surgery	private hospitals	257	87.6%
	governmental hospitals	70	21.4%
	Total	327	100%
the cost of the operation in private hospital	15000 less than 25000 SR	169	51.7%
	25000 less than 35000 SR	42	12.8%
	35000 less than 45000 SR	41	12.5%
	5000 less than 15000 SR	29	8.9%
	45000 less than 55000 SR	29	8.9%
	55000 less than 65000 SR	17	6.6%
	Total	327	100%
did you gain weight after the operation	regained weight after the operation	232	70.9%
	did not regained weight after the operation	95	29.1%
	Total	327	100%
when did you have the operation	less than six months prior to the research	160	48.9%
	between six months to less than one year	62	19%
	one year to less than two years	59	18.1%
	two years to less than 3 years from the research	20	6.1%
	five or more years from the research	10	3.1%
	Three to less than four years from the research	8	2.4%
	between four and five years from the research	8	2.4%
	Total	327	100%
did you complete your follow up	followed up with after their operation	144	44%
	had not been followed up with after the operation	127	38.8%
	followed up with somewhat after the operation	56	17.2%
	Total	327	100%
what do you feel you	follow up on nutrition	183	55.9%
	did not need to follow up	100	30.6%

need follow up with	with anyone		
	needed psychiatric follow up	44	13.5%
	Total	327	100%
was your life affected	their life had been affected by the operation	233	71.3%
	their life had been affected somewhat after the operation	53	16.2%
	their lives were not affected after the operation	41	12.5%
	Total	327	100%

Tool

The questionnaire has been approved as a tool for collecting research data and it has been designed by benefiting from theoretical framework and similar previous studies, and after designing it the following steps have been followed in order to verify the validity of its application.

Tool validity

In order to understand the validity of the research tool for measuring what it has been designed to measure it was shown to a group of arbitrators, and in the light of their opinions the instrument of this research has been prepared in its final form.

Validity of internal consistency of the tool

After assuring the validity for the tool, the questionnaire was applied in the field.

Table (3) Person’s Correlation Coefficient for First Pivot Statements in total degree for the pivot

Statement No.	Correlation coefficient in the pivot	Statement No.	Correlation coefficient in the pivot
1	**0.578	5	**0.526
2	**0.648	6	**0.524
3	**0.512	7	**0.569
4	**0.605	-	-

** significant at level of 0.01 and less

Table (4) Person’s Correlation Coefficient for second Pivot Statements in total degree for the pivot

Statement No.	Correlation coefficient in the pivot	Statement No.	Correlation coefficient in the pivot
1	**0.511	5	**0.504
2	**0.529	6	**0.593
3	**0.661	7	**0.547
4	**0.546	-	-

** significant at level of 0.01 and less

Table (5) Person’s Correlation Coefficient for third Pivot Statements in total degree for the pivot

Statement No.	Correlation coefficient in the pivot	Statement No.	Correlation coefficient in the pivot
1	**0.580	5	**0.627
2	**0.583	6	**0.572
3	**0.630	7	**0.583
4	**0.583	-	-

** significant at level of 0.01 and less

Table (6) Person’s Correlation Coefficient for fourth Pivot Statements in total degree for the pivot

Statement No.	Correlation coefficient in the pivot	Statement No.	Correlation coefficient in the pivot
1	**0.528	5	**0.585
2	**0.543	6	**0.594
3	**0.530	7	**0.506
4	**0.522	-	-

** significant at level of 0.01 and less

The correlation coefficient value of each statement with its pivot is positive and statistically significance at level of (0.01) and less, which indicates that the validity is consistent with its pivots.

Tool reliability

Cronbach’s Alpha coefficient was applied in order to confirm the reliability. Results showed that the coefficient of general reliability is high where it was reached at (0.7214) and this indicates that the questionnaire has high reliability making it dependable in the field of implementation.

The methods of statistical processing

In order to fulfil the research objectives and analyze the collected data, several suitable statistical methods were used. The Statistical Package for Social Sciences (SPSS) was used after coding and data entry into the computer. To specify the length of Likert scale Quintet cells (maximum and minimum) used in the research pivots the degree was calculated (5-1=4) then divided into the scale cells in order to obtain the correct cell length i.e. (4/5=0.80), after that this value was added to the lower value in the scale (or the beginning of scale which is integer one). The length of the cells is as follows:

From 1.00 to 1.80 (Strongly disagree) towards each statement in difference of the pivot required to be measured.

From 1.81 to 2.60 (Disagree) towards each statement in difference of the pivot required to be measured.

From 2.61 to 3.40 (Agree somewhat) towards each

statement in difference of the pivot required to be measured.

From 3.41 to 4.20 (Agree) towards each statement in difference of the pivot required to be measured.

From 4.21 to 5.00 (Strongly agree) towards each statement in difference of the pivot required to be measured.

After that, the following statistical measures were calculated: frequency and percentage, arithmetic mean, and standard deviation.

Results and Discussion

Table (7): Sample responses on the health- related effect

No.	Item	Frequency	Degree of approval					Mean	SD	SER
			Percentage	Strongly disagree	Disagree	Agree somewhat	Agree			
6	My health became better after surgery	F	170	75	56	20	6	4.17	1.037	1
		%	52.0	22.9	17.1	6.1	1.8			
5	Helped me to commit healthy eating	F	150	81	71	16	9	4.06	1.058	2
		%	45.9	24.8	21.7	4.9	2.8			
11	Increased my activity and my desire to work performance	F	106	81	94	28	18	3.70	1.168	3
		%	32.4	24.8	28.7	8.6	5.5			
12	My fitness increased in the practice of sports activities	F	136	92	65	21	13	3.97	1.110	4
		%	41.6	28.1	19.9	6.4	4.0			
10	I have become more acceptable of performance (Labour duties) after the operation	F	97	86	89	37	18	3.63	1.177	5
		%	29.7	26.3	27.2	11.3	5.5			
2	Be sure to follow up with the health education before, after and during the process by the hospital	F	92	87	72	43	33	3.50	1.299	6
		%	28.1	26.6	22.0	13.1	10.1			
7	I feel sluggishly after surgery	F	44	36	93	87	67	2.70	1.285	7
		%	13.5	11.0	28.4	26.6	20.5			
4	I had symptoms of dryness, irritation and sudden dizziness	F	46	57	112	71	41	2.99	1.208	8
		%	14.1	17.4	34.3	21.7	12.5			
3	I suffer from a lack of vitamin D, B12 and anaemia after surgery	F	26	38	91	112	60	2.57	1.152	9
		%	8.0	11.6	27.8	34.3	18.3			
13	Many of the activities in the (Labour-duties) are not accomplished	F	34	37	59	97	100	2.41	1.307	10
		%	10.4	11.3	18.0	29.7	30.6			

	due to my body weakness										
14	I feel un-frequently in focus during my work performance or studying	F	22	33	76	111	85	2.38	1.168	11	
		%	6.7	10.1	23.2	33.9	26.0				
1	I suffered from health problems after the surgery	F	28	22	82	95	100	2.34	1.220	12	
		%	8.6	6.7	25.1	29.1	30.6				
9	I get tired after performing any effort	F	21	20	90	106	90	2.31	1.130	13	
		%	6.4	6.1	27.5	32.4	27.5				
8	I have weakness in my performance (school labour) after surgery	F	20	14	53	113	127	2.04	1.129	14	
		%	6.1	4.3	16.2	34.6	38.8				
Mean								3.05	0.559		

Table(7) shows that the research participants agreed on the health- related effect. The means of the health- related effect ranged between (2,04 to 4.17). The statement “My health became better after surgery” ranked first. Meanwhile, the statement “I have weakness in my performance (school- labour) after surgery” ranked last. The total mean of this sub- scale is (3.05) . This indicates that the health- related effect of LSG is moderate.

This result goes in line with other studies such as [22, 29, 37, 39, 40]. For instance, Alharbi, et al. [29] conducted a study aimed to compare the quality of life of morbidly obese individuals after bariatric (sleeve gastrectomy) surgery to their pre-operative state. Results indicated that there was an overall noticeable improvement in practicing different activities and much improvement in their health status.

Table (8) Sample responses on the social effect:

No.	Item	Frequency	Degree of approval					Mean	SD	SER
			Percentage	Strongly agree	Agree	Agree somewhat	Disagree			
1	I feel that my life has better improved after surgery	F	198	79	41	3	6	4.41	0.877	1
		%	60.6	24.2	12.5	0.9	1.8			
2	I have become best to attend social events	F	169	85	45	20	8	4.18	1.044	2
		%	51.7	26.0	13.8	6.1	2.4			
3	I improved my relationship with family and colleagues	F	151	101	52	17	6	4.14	0.988	3
		%	46.2	30.9	15.9	5.2	1.8			
5	I became the focus of attention at social events by relatives	F	136	102	54	23	12	4.00	1.094	4
		%	41.6	31.2	16.5	7.0	3.7			
4	I am no enjoying	F	92	66	78	55	36	3.38	1.344	5
		%	27.5	20.3	23.7	16.6	10.9			

	the participations in the diversity of diets	%	28.1	20.2	23.9	16.8	11.0			
6	I hear a lot of phrases charge me that i am arrogant and change my personality	F	40	36	51	97	103	2.43	1.354	6
		%	12.2	11.0	15.6	29.7	31.5			
7	I become less interactive with colleagues and family due to fatigue	F	27	22	49	117	112	2.19	1.214	7
		%	8.3	6.7	15.0	35.8	34.3			
Mean								3.53	0.620	

Table (8) shows that the research participants agreed on the social effect. The research participants strongly agreed on Statement No. (1) which is “I feel that my life has better improved after surgery” with an average of (4.41 out of 5) and this statement ranked first. Meanwhile, it is clear from the results that the participants agreed on social effect in statements No. (2 , 3 , 5). Statement No. (2) which is “I have become best to attend social events” has an average of (4.18 out of 5). Statement No. (3) which is “I improved my relationship with family and colleagues” has an average of (4.14 out of 5). Statement No. (5) which is “I became the focus of attention at social events by relatives” has an average of (4.00 out of 5). The research participants agreed somewhat on Statement No. (4) which is “I am no enjoying the participations in the diversity of diets” with average of (3.38 out of 5). It is clear from the results that the research participants disagreed on social effect in statements No. (6 , 7). Statement No. (6) which is “I hear a lot of phrases charge me that i am arrogant and change my personality” has an average of (2.43 out of 5). Statement No. (7) which is “I become less interactive with colleagues and family due to fatigue” has an average of (2.19 out of 5) and ranked last.

This result is in accordance with several studies e.g. [29, 30, 34, 35, 41]. For instance, Gallart-Aragón, et al. [30] conducted a study to investigate the effect of a sleeve gastrectomy (SG) on quality of life (QoL) and pain in a morbidly obese patient group. Results revealed that after 6 months, practically all of the subscales of the GIQLI questionnaire showed significant improvements: gastrointestinal symptoms, physical well-being, and social well-being. Similarly, Ustundag, et al. [35] conducted a study to assess obese people's healthy living practises and quality of life 3–12 months following a sleeve gastrectomy. Results showed a significant development in social relations.

Table (9) Sample responses on the psychological effect:

No.	Item	Frequency	Degree of approval	Mean	SD	SER

		Percentage	Strongly agree	Agree	Agree somewhat	Disagree	Strongly disagree			
6	I feel happy after performing operation	F	204	89	22	5	7			
		%	62.4	27.2	6.7	1.5	2.1	4.46	0.857	1
1	I feel good after surgery	F	193	90	32	5	7			
		%	59.0	27.5	9.8	1.5	2.1	4.40	0.887	2
5	increasing of my self confidence and expressing myself	F	177	77	57	10	6			
		%	54.1	23.5	17.4	3.1	1.8	4.25	0.971	3
7	I feel calm and do not feel nervous after surgery	F	117	75	93	27	15			
		%	35.8	22.9	28.4	8.3	4.6	3.77	1.156	4
3	I suffer from depression after surgery	F	19	19	77	81	13			
		%	5.8	5.8	23.5	24.8	40.1	2.13	1.175	5
4	I had unacceptable thoughts	F	11	14	52	85	165			
		%	3.4	4.3	15.9	26.0	50.5	1.84	1.056	6
2	I regret after surgery	F	17	12	46	74	178			
		%	5.2	3.7	14.1	22.6	54.4	1.83	1.128	7
Mean								3.24	0.400	

Table (9) shows that the research participants agreed somewhat on the psychological effect. The research participants were strongly agree on the psychological effect in statements No. (6,1,5). Statement No. (6) which is "I feel happy after performing operation" ranked first with an average of (4.46 out of 5). Statement No. (1) which is "I feel good after surgery" came in second rank with an average of (4.40 out of 5). Statement No. (5) which is "increasing of my self-confidence and expressing myself" came in third rank with an average of (4.25 out of 5). The participants agreed on Statement No. (7) which is "I feel calm and do not feel nervous after surgery" with an average of (3.77 out of 5). The participants disagreed on the psychological effect in statements No. (3,4,2). Statement No. (3) which is "I suffer from depression after surgery" came in fifth rank with an average of (2.13 out of 5). Statement No. (4) which is "I had unacceptable thoughts" came in the sixth rank with an average of (1.84 out of 5). Statement No. (2) which is "I regret after surgery" has an average of (1.83 out of 5) and ranked last.

This result is consistent with other studies e.g. [27, 28, 33, 35-38]. For instance, Timofte, et al. [33] conducted a study to determine if laparoscopic sleeve gastrectomy could help those with depression symptoms. The findings revealed that following surgery, the prevalence of depressive disorders dropped significantly. After the

laparoscopic sleeve gastrectomy, the depression scale score dropped significantly. Findings indicated a considerable improvement in a psychological aspect. Roberts [38] conducted a study to evaluate the findings of recent literature on the overall efficacy of bariatric surgery in adolescent patients in terms of weight and BMI reduction, hormonal changes, and co-morbidity resolution, as well as data on sleep and psychological effects. Results showed that bariatric surgery in adolescents is an effective method and anxiety, depression, disruptive behavior, and anger all decreased significantly at two years. Conversely, this result contradicted with Peterhänsel et al. [24] who conducted a study to present a systematic review of suicide mortality after bariatric surgery and calculate an estimate for the suicide rate. Results indicated that patients who had bariatric surgery had a greater suicide risk than the general population,.

Research recommendations

- Trying to limit the negative effects of sleeve gastrectomy on the individual.
- Increasing the awareness of individuals who are conducting such operations on the importance of health care follow up for their cases postoperatively.
- Enhancing the individuals who have conducted sleeve gastrectomy to be abided by healthy nutrition.
- Establishing social and psychological rehabilitation centers for this category to mitigate the negative effects of sleeve gastrectomy on them.
- Preparing counseling programs and trainings that address the patients' social and psychological needs and help them overcome the negative effects of sleeve gastrectomy.
- Providing people who underwent sleeve gastrectomy with informative sessions and workshops that include social workers, psychologists and health care providers to enable them to engage and increase their awareness to adapt to society.
- Encouraging the individuals who have conducted sleeve gastrectomy operation to improve their postoperative performance.
- Enhancing individuals who have conducted sleeve gastrectomy to increase their interaction with their social surrounding from colleagues and family.
- Taking care of providing health and mental care services for individuals who have conducted sleeve gastrectomy.
- Conducting continuous evaluation for negative

impacts that occur to the individuals who have conducted sleeve gastrectomy.

- Conducting enough studies about negative and positive impacts for sleeve gastrectomy.

Suggestions for further research

In the light of the research results, the researcher suggests the following:

1. The current research could be replicated on a larger sample for investigating other factors related to LSG.
2. The current research could be replicated on a different sample i.e. surgeons of LSG to explore the medical effects.
3. More research is needed to investigate the advantages and disadvantages of LSG.

Conclusion

The main concern of this research was to investigate the positive and negative health-related, social and psychological effects of laparoscopic sleeve gastrectomy. Results showed that the research participants agreed on the health-related, social and psychological effects of LSG. To sum up, there is a necessity for increasing the patients' awareness to improve their general health, nutritional habits, postoperative fitness and interacting with their societies. Additionally, further studies on negative and positive effects of LSG should be conducted in order to monitor continuous evaluation of the medical procedure.

Conflict of interest :

The authors declare that there is no conflict of interest.

References

- [1] Overweight. Fact sheet No. 311, in, World Health Organization website, Geneva, Switzerland, (2015).
- [2] H.J. Lim, H. Xue and Y. Wang, Global trends in obesity, *Handbook of Eating and Drinking: Interdisciplinary Perspectives*, 1217-1235 (2020).
- [3] Covidien, *Bariatric Surgery: Overview of Procedural Options*, (2010).
- [4] L.E. Gagnon and E.J.K. Sheff, Outcomes and complications after bariatric surgery, *AJN The American Journal of Nursing*, **112 (9)**, 26-36 (2012).
- [5] W. Abu-Jaish and R.J. Rosenthal, Sleeve gastrectomy: a new surgical approach for morbid obesity, *Expert review of gastroenterology & hepatology*, **4 (1)**, 101-119 (2010).
- [6] W.M. Admiraal, F. Celik, V.E. Gerdes, R.M. Dallal, J.B. Hoekstra and F. Holleman, Ethnic differences in weight loss and diabetes remission after bariatric surgery: a meta-analysis, *Diabetes care*, **35 (9)**, 1951-1958 (2012).
- [7] M. Kheirvari, N.D. Nikroo, H. Jaafarinejad, M. Farsimadan, S. Eshghjoo, S. Hosseini and T. Anbara, The advantages and disadvantages of sleeve gastrectomy; clinical laboratory to bedside review, *Heliyon*, **6 (2)**, e03496 (2020).
- [8] N. Rieber, K.E. Giel, T. Meile, P. Enck, S. Zipfel and M. Teufel, Psychological dimensions after laparoscopic sleeve gastrectomy: reduced mental burden, improved eating behavior, and ongoing need for cognitive eating control, *Surgery for Obesity and Related Diseases*, **9 (4)**, 569-573 (2013).
- [9] D.A. Caniano, Ethical issues in pediatric bariatric surgery, in, Elsevier, (2009), pp. 186-192.
- [10] B.M. Wolfe, E. Kvach and R.H. Eckel, Treatment of obesity: weight loss and bariatric surgery, *Circulation research*, **118 (11)**, 1844-1855 (2016).
- [11] D. Moszkowicz, R. Arienzo, I. Khettab, G. Rahmi, F. Zinzindohoué, A. Berger and J.-M. Chevallier, Sleeve gastrectomy severe complications: is it always a reasonable surgical option?, *Obesity surgery*, **23 (5)**, 676-686 (2013).
- [12] R. Padwal, S. Klarenbach, N. Wiebe, M. Hazel, D. Birch, S. Karmali, A.M. Sharma, B. Manns and M. Tonelli, Bariatric surgery: a systematic review of the clinical and economic evidence, *Journal of general internal medicine*, **26 (10)**, 1183-1194 (2011).
- [13] L.A. Moreno, I. Pigeot and W. Ahrens, Epidemiology of obesity in children and adolescents, *Prevalence and etiology*, Nueva York: Springer, 483 (2011).
- [14] A. Desalew, A. Mandesh and A. Semahegn, Childhood overweight, obesity and associated factors among primary school children in dire dawa, eastern Ethiopia; a cross-sectional study, *BMC obesity*, **4 (1)**, 1-10 (2017).
- [15] O. Varban and J. Dimick, Bariatric surgery: Safe, effective, and underutilized, *Family Medicine*, **51 (7)**, 552-554 (2019).
- [16] N. Puzifferri and J.P. Almandoz, Sleeve gastrectomy for weight loss, *JAMA*, **319 (3)**, 316-316 (2018).
- [17] S.L. Barley and N. Mathers, An audit of the care of post-gastrectomy patients, *The Journal of the Royal College of General Practitioners*, **30 (215)**, 365-370 (1980).
- [18] S.J. Papini-Berto and R.C. Burini, Causes of malnutrition in post-gastrectomy patient, *Arq Gastroenterol*, **38 (4)**, 272-275 (2001).

- [19] S. Alagna, M.L. Cossu, A. Masala, M.M. Atzeni, M. Ruggiu, F.M. Satta, E. Fais, P.P. Rovasio and G. Noya, Evaluation of serum leptin levels and thyroid function in morbidly obese patients treated with bariatric surgery, *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, **8** (2), 95-99 (2003).
- [20] J. Himpens, J. Dobbeleir and G. Peeters, Long-term results of laparoscopic sleeve gastrectomy for obesity, *Annals of surgery*, **252** (2), 319-324 (2010).
- [21] A. Nath, K.A. LeBlanc, M.G. Hausmann, K. Kleinpeter, B.W. Allain and R. Romero, Laparoscopic sleeve gastrectomy: our first 100 patients, *JSLs: Journal of the Society of Laparoendoscopic Surgeons*, **14** (4), 502 (2010).
- [22] E.K. Chouillard, A. Karaa, M. Elkhoury and V.J. Greco, Laparoscopic Roux-en-Y gastric bypass versus laparoscopic sleeve gastrectomy for morbid obesity: case-control study, *Surgery for obesity and related diseases*, **7** (4), 500-505 (2011).
- [23] E. Soricelli, A. Iossa, G. Casella, F. Abbatini, B. Cali and N. Basso, Sleeve gastrectomy and crural repair in obese patients with gastroesophageal reflux disease and/or hiatal hernia, *Surgery for Obesity and Related Diseases*, **9** (3), 356-361 (2013).
- [24] C. Peterhänsel, D. Petroff, G. Klinitzke, A. Kersting and B. Wagner, Risk of completed suicide after bariatric surgery: a systematic review, *Obesity reviews*, **14** (5), 369-382 (2013).
- [25] L. Rebibo, C. Blot, P. Verhaeghe, C. Cosse, A. Dhahri and J.-M. Regimbeau, Effect of perioperative management on short-term outcomes after sleeve gastrectomy: a 600-patient single-center cohort study, *Surgery for Obesity and Related Diseases*, **10** (5), 853-858 (2014).
- [26] J. Tack and E. Deloose, Complications of bariatric surgery: dumping syndrome, reflux and vitamin deficiencies, *Best practice & research Clinical gastroenterology*, **28** (4), 741-749 (2014).
- [27] K. Järholm, J. Karlsson, T. Olbers, M. Peltonen, C. Marcus, J. Dahlgren, E. Gronowitz, P. Johnsson and C.E. Flodmark, Two-year trends in psychological outcomes after gastric bypass in adolescents with severe obesity, *Obesity*, **23** (10), 1966-1972 (2015).
- [28] F. Schmitt, E. Riquin, M. Beaumesnil, M. Dinomais, P. Topart, D. Weil, J. Malka, R. Coutant, G. Podevin and N. Bouhours-Nouet, Laparoscopic adjustable gastric banding in adolescents: results at two years including psychosocial aspects, *Journal of pediatric surgery*, **51** (3), 403-408 (2016).
- [29] K.L. Alharbi, A.O. Almutairi, A. hamed Alshebromi, A.S. Almufareh, R.A. Alharbi, M.H. Alhajjaj, I.N. Alanazi, A.S. Alwehibi, Y.I. Alomar and A.M. Almutairi, Quality of life post sleeve gastrectomy in Alqassim Region, Saudi Arabia, *Integrative Journal of Medical Sciences*, **5**, (2018).
- [30] T. Gallart-Aragón, C. Fernández-Lao, N. Galiano-Castillo, I. Cantarero-Villanueva, M. Lozano-Lozano and M. Arroyo-Morales, Improvements in health-related quality of life and pain: A cohort study in obese patients after laparoscopic sleeve gastrectomy, *Journal of Laparoendoscopic & Advanced Surgical Techniques*, **28** (1), 53-57 (2018).
- [31] C.-C. Huang, W. Wang, R.-J. Chen, P.-L. Wei, C. Tzao and P.-L. Chen, Predicted coronary heart disease risk decreases in obese patients after laparoscopic sleeve gastrectomy, *World Journal of Surgery*, **42** (7), 2173-2182 (2018).
- [32] P. Salminen, M. Helmiö, J. Ovaska, A. Juuti, M. Leivonen, P. Peromaa-Haavisto, S. Hurme, M. Soinio, P. Nuutila and M. Victorzon, Effect of laparoscopic sleeve gastrectomy vs laparoscopic Roux-en-Y gastric bypass on weight loss at 5 years among patients with morbid obesity: the SLEEVEPASS randomized clinical trial, *Jama*, **319** (3), 241-254 (2018).
- [33] D. Timofte, B. Ciuntu, D.B. Iliescu, R. Hainarosie, A.P. Stoian and V. Mocanu, Laparoscopic sleeve gastrectomy is associated with reduced depressive symptoms: a one-year follow-up study, *Revista de Cercetare si Interventie Sociala*, **61**, 147 (2018).
- [34] M. Alkassis, F.G. Haddad, J. Gharios, R. Noun and G. Chakhtoura, Quality of life before and after sleeve gastrectomy in Lebanese population, *Journal of obesity*, **2019**, (2019).
- [35] H. Ustundag, A. Gul, B. Ozkaya and N. Zengin, Healthy lifestyle behaviors and quality of life after sleeve Gastrectomy, *Gastroenterology Nursing*, **43** (6), 456-462 (2020).
- [36] M. Çöpür, N. SaatÇIoĞLu Tinkir and S. Çöpür, Effects of bariatric surgery on psychological well-being among adolescents: a case series study from Turkey, *Anatolian Journal of Psychiatry/Anadolu Psikiyatri Dergisi*, **21** (5), (2020).
- [37] N. Yates, A. Carbone, D. Gohel, Y. Trinh, S. Saini, F. Kong, A. Kothari and V. Liew, Patients' perceptions following laparoscopic sleeve gastrectomy: 'Sorry or satisfied'?, *Australian journal of general practice*, **49** (4), 208-214 (2020).
- [38] C.A. Roberts, Physical and psychological effects of

bariatric surgery on obese adolescents: a review,
Frontiers in pediatrics, **8**, 591598 (2021).

- [39] M. Gkotsina, M. Michalaki, I. Mamali, G. Markantes, G.C. Sakellaropoulos, F. Kalfarentzos, A.G. Vagenakis and K.B. Markou, Improved levothyroxine pharmacokinetics after bariatric surgery, *Thyroid*, **23 (4)**, 414-419 (2013).
- [40] S. Jadhav and S. Borude, Effect of laparoscopic sleeve gastrectomy on weight loss and co-morbid factors, *Inter Jour Surg*, **29 (1)**, (2013).
- [41] E.R. Mackey, A. Olson, S. Merwin, J. Wang and E.P. Nadler, Perceived social support for exercise and weight loss in adolescents undergoing sleeve gastrectomy, *Obesity Surgery*, **2(2)**, 426-421 . (2018)