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ORIGINAL ARTICLE

Quality of Life and Associated Factors among Individuals Undergoing Sleeve Gastrectomy in Rasht, Iran

Ramin Ebrahimian Jektaji[1], Mahta Moghaddam Ahmadi[2], Khashayar Khosravi[2], Moein Moghaddam Ahmadi[1,2]✉

[1] *Department of Surgery, School of Medicine, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran*

[2] *Clinical Research Development Unit of Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran*

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Abstract

Introduction: Sleeve gastrectomy represents a vital surgical intervention for individuals suffering from obesity, yielding substantial reductions in body weight and fostering beneficial effects on conditions associated with obesity. This study investigated patients' quality of life (QoL) and associated factors six months after sleeve gastrectomy in Rasht, Iran.

Methods: The cross-sectional study was conducted on 66 sleeve surgery patients. Patients were selected through a convincing sampling method. Demographic and clinical data of all participants were recorded, and the World Health Organization Quality of Life Questionnaire was utilized to assess their QoL. Data were analyzed in SPSS 16 using the Mann-Whitney U, Kruskal-Wallis, T-test, and Friedman tests, and the significant level was set at 0.05.

Results: The patients' body mass index (BMI) six months after sleeve gastrectomy surgery was significantly lower than their BMI before surgery (33.31±5.85 vs. 43.41±5.93, 95% confidence interval, P=0.001). The frequency of sleeve leak and bleeding was equal among patients (1.5%), and no pulmonary embolism or mortality cases were reported. The mean general QoL score among patients was 79.16±14.58. The mean score of the physical health domain of QoL was higher among men with obstructive sleep apnea and in patients without gastric leaks (P<0.05). The mean score of the psychological health domain of QoL was higher among patients with dyslipidemia (P<0.05). The mean scores of mental health and social relation domains of QoL, as well as that of general QoL, were higher in patients with sleeve leaks and bleeding after the surgery (P<0.05).

Conclusion: The findings suggested that sleeve gastrectomy contributes to improvements in various domains of QoL, particularly among men, patients with dyslipidemia and obstructive sleep apnea, and those who experienced gastric sleeve leaks and bleeding during and after the surgery.

Key words: Bariatric surgery, Gastrectomy, Obesity, Quality of life

Introduction

Bariatric surgery has been introduced as the most effective method for the treatment of obesity (1). Obesity is a global pandemic and a significant public health concern due to its high prevalence and negative impact on mortality, illness rates, healthcare expenditure, and quality of life (QoL) (2). Untreated obesity results in different health-related complications, including cardiovascular diseases, diabetes, dyslipidemia, hypertension, sleep apnea, musculoskeletal disorders, depression, and

Tel: +985632381203
Fax: +985632440488
Po Bax 97175-379
Email: jsurgery@bums.ac.ir

✉Correspondence to:
Moein Moghaddam Ahmadi, Department of Surgery, School of Medicine, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran;
Telephone Number: +989125653997
Email Address: moein.moghaddam.ahmadi@gmail.com

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malignancies (3,4). To address this problem, surgical interventions can lead to sustained weight loss over the long term, leading to enhancements in the QoL of the patients (4,5). The commonly performed bariatric interventions include laparoscopic sleeve gastrectomy (LSG), Roux-en-Y gastric bypass (LRYGB), and laparoscopic adjustable gastric banding (LAGB) (6). LSG involves removing a large portion of the stomach to reduce intake and induce hormonal changes (7). Meanwhile, LRYGB creates a small stomach pouch and reroutes the intestine, combining restriction and malabsorption for significant weight loss and hormonal shifts (8). On the other hand, LAGB uses an adjustable band to limit intake, offering reversibility but less weight loss and higher long-term complication rates (9). LSG and LRYGB provide greater, more sustained weight loss but with higher risks of complications and nutritional deficiencies, making the choice dependent on individual patient factors (10).

QoL refers to how an individual perceives their general life circumstances, which include cultural elements, values, objectives, prospects, worries, and the surrounding situation (11). Higher grades of obesity are associated with lower QoL and reduced survival, leading to a substantial financial burden (3). However, there is limited published data on the demographic and clinical factors that may influence the QoL after bariatric surgery (12,13). Given the multidimensional and complex nature of QoL (14,15), our study aims to investigate the QoL of patients and related factors six months after sleeve gastrectomy. Quality of life, which plays a crucial role in motivating individuals to consider bariatric surgery (4,16), pertains to an individual's subjective evaluation of their overall life circumstances. This evaluation encompasses various aspects, such as cultural factors, personal values, goals, expectations, standards, concerns, and the influence of the surrounding environment (11). In the current study, we investigated the QoL of patients and associated factors six months after sleeve gastrectomy in Rasht, Iran.

Methods

This cross-sectional study was conducted on 66 patients referred to public and private medical centers in Guilan province, Iran, for gastric sleeve surgery between 2019 and 2021. The present investigation has been confirmed by the Ethical Committee of Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1400.598). All patients gave their written informed consent to participate in the study. Individuals aged 16 to 60 of both genders were selected through a convincing sampling method. Exclusion criteria consisted of depression, neurological disorders, reflux disease, large hiatal hernia, active peptic ulcer disease, heart disease, and alcohol and opium use. Demographic characteristics and clinical data were collected through a questionnaire, including age, gender, marital status, level of education, body mass index (BMI) before and after sleeve gastrectomy, diabetes, hypertension, dyslipidemia, and obstructive sleep apnea. Additionally, complications, such as gastric sleeve leak, bleeding, and pulmonary embolism during and after surgery, were recorded based on the patient's medical records.

The QoL was evaluated using the abbreviated version of the World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF). This instrument was validated for the Iranian population, and Cronbach's alpha was above 0.70 for all domains (17). The WHOQOL-BREF comprises 26 items organized into four distinct domains, namely physical health, psychological health, social relations, and environmental health. The physical health domain includes seven items related to daily activities, mobility, functional capability, energy levels, pain perception, and sleep quality. The psychological health domain encompasses six items covering self-image, the presence of negative opinions, the cultivation of positive attitudes, self-esteem, mental outlook, learning ability, memory and concentration, religious beliefs, and overall mental status. The domain of social relations encompasses three distinct elements to evaluate personal relations, social support, and sexual well-being. Finally, the domain of environmental health encompasses a comprehensive set of eight items that examine various aspects, namely financial resources, safety, accessibility to health and social services, physical living environment, opportunities for skill development and knowledge acquisition, recreational facilities, general environmental factors (e.g., noise and air pollution), and transportation (18).

In addition to the specific domains, the WHOQOL-BREF instrument includes two general questions that capture overall QoL and satisfaction with health. These questions inquire about an individual's perception of their QoL and satisfaction with their current health status (11,19). In the present investigation, the QoL analysis was performed using the general QoL indicators, including the perception of QoL and satisfaction with health status, as well as the four specific domains of the WHOQOL-BREF questionnaire. This analysis was carried out over six months. According to the methodology, domain

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scores were transformed to a 0- to 100-point scale using the WHOQOL transformation table (20).

A uniform scale adjustment was implemented to standardize the scores across all domains, yielding a range of 4 to 20 for each domain. Higher scores correspond to a more favorable QoL assessment in this adjusted scale.

The normality of the variable distribution was assessed using the Shapiro-Wilk test. Quantitative variables were expressed as the mean ± standard deviation (SD), while categorical variables were reported as percentages. The correlation and association between variables were evaluated using Mann-Whitney U, Kruskal-Wallis, T-test, and Friedman tests. A significance level of 0.05 or less was adopted to determine statistical significance. All statistical analyses were performed using SPSS version 23.

Results

The mean age of individuals was 36.12±9.08 years, and 81.8% (n=54) of the participants were women. The BMI of the patients in the six months after sleeve gastrectomy surgery was lower than their BMI before the surgery (33.31±5.85 vs. 43.41±5.93, P=0.001). Dyslipidemia (37.9%) was the most frequent disorder among patients.

The frequency of gastric sleeve leak and bleeding was equal among patients (1.5%), and pulmonary embolism and mortality were not reported in any of the patients (Table 1). The mean general QoL score among patients was 79.16±14.58. Among the domains of QoL, the highest and lowest mean scores were obtained for physical health and environmental health at 84.22±14.20 and 69.66±9.50, respectively (Table 2).

Table 1: Demographic and clinical characteristics of patients

Variables	Amounts*
Age	36.12±9.08
Gender	
Female	54 (81.8)
Male	12 (18.2)
Marital status**	
Single	21 (31.8)
Married	41 (62.12)
Level of education	
Under diploma	11 (16.7)
Diploma	23 (34.8)
Bachelor's degree	25 (37.9)
Master and PhD	7 (10.6)
BMI before surgery	43.41±5.93
BMI six months after surgery	33.31±5.85
Diabetes	
No	0 (0)
Yes	10 (15.2)
Hypertension	
No	0 (0)
Yes	11 (16.7)
Dyslipidemia	
No	0 (0)
Yes	25 (37.9)
Obstructive sleep apnea	
No	0 (0)
Yes	10 (15.2)
Gastric sleeve leak	
No	0 (0)
Yes	1 (1.5)
Bleeding	
No	0 (0)
Yes	1 (1.5)
Pulmonary embolism	
No	0 (0)
Yes	0 (0)
Mortality	
No	0 (0)
Yes	0 (0)

BMI: Body mass index; * Values are reported as mean ± standard deviation (Mean±SD) or frequency n (%).

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Table 2: Quality of life of patients measured according to its subscales

Domains	Mean±SD	95% CI
Physical health	84.22±14.20	(78.22-90.22)
Psychological health	72.22±10.03	(67.98-76.45)
Social relations	70.13±17.87	(62.59-77.68)
Environmental health	69.66±9.50	(65.64-73.67)
General QoL	79.16±14.58	(73.00-85.32)

SD: Standard deviation; 95% CI: Confidence interval; QoL: Quality of life.

Based on the Friedman test, the mean scores of QoL domains differed from one another, with physical health scoring at 3.66, psychological health at 2.14, social relations at 2.36, and environmental health at 1.84 (P=0.001).

Among the participants, the mean QoL score for the physical health domain was higher in men than in women (91.07±5.79 vs. 80.95±16.84, P=0.038). The mean QoL score in the psychological health domain was higher among patients with dyslipidemia than among those without dyslipidemia (75.83±8.24 vs. 70.42±10.65, P=0.028). The mean QoL score for the physical health domain was higher in patients with obstructive sleep apnea than in those without (94.04±4.32 vs. 82.99±14.76, P=0.016). Individuals without a gastric sleeve leak had a higher mean score in the physical health domain, while the other domains, excluding environmental health, exhibited higher mean scores in patients who experienced a gastric sleeve leak (P<0.05). Moreover, the mean scores of psychological health, social relation domains, and general QoL, except for the domain of physical health (P=0.923) and environmental health (P=0.095), were higher among patients with bleeding (P<0.05) (Table 3).

Table 3: Quality of life in patients after sleeve gastrectomy based on demographic and clinical variables

Variables	Domains									
	Physical health		Psychological health		Social Relations		Environmental health		General QoL	
	Values	P	Values	P	Values	P	Values	P	Values	P
Age	-1.22	0.544	-0.008	0.946	0.040	0.752	-0.055	0.661	-0.076	0.553
Gender										
Male	91.07±5.79	[a] 0.038	71.87±8.90	[b] 0.822	78.78±15.52	[a] 0.067	72.39±6.36	[b] 0.266	77.27±9.38	[b] 0.190
Female	80.95±16.84		72.60±10.41		67.29±16.57		69.84±7.26		81.97±14.52	
Marital status										
Single	82.93±17.56	0.646	71.42±9.34	0.307	67.54±15.93	0.507	69.49±6.98	0.657	80.00±12.43	0.895
Married	86.12±16.70		72.10±61.69		69.17±04.29		70.70±53.40		80.14±31.12	
Level of education										
Under diploma	87.50±11.10		75.75±7.64		75.00±11.18		69.88±6.13		78.40±19.43	
Diploma	85.26±16.58		71.73±10.50		70.45±16.20		68.61±7.62		80.95±12.88	
Bachelor's degree	82.14±16.14	0.506	71.16±10.81	0.676	63.88±17.83	0.268	70.50±6.25	0.154	80.20±12.17	0.335
Master's and PhD degree	90.71±5.41		74.40±10.04		7500±20.41		75.89±8.40		89.28±11.24	
BMI	-0.322	0.101	-0.011	0.931	-0.069	0.585	+0.100	0.422	-0.005	0.972
Diabetes										
No	85.06±15.01	0.975	71.94±10.28	0.291	68.20±16.82	0.274	70.53±7.27	0.650	79.95±12.81	0.088
Yes	87.14±8.22		75.41±8.88		75.00± 16.66		69.06±6.49		87.50±17.67	
Hypertension										
No	85.38±15.06	[a] 0.548	72.57±9.77	[b] 0.857	68.71±17.51	[a] 0.784	70.45±7.21	[b] 0.916	81.00±12.74	[b] 0.862
Yes	85.71±7.98		71.96±12.08		71.96±13.57		69.60±7.00		81.81±18.84	
Dyslipidemia										
No	83.92±17.20	[a] 0.960	70.42±10.65	[a] 0.028	66.66±19.11	[a] 0.137	69.81±7.76	[b] 0.474	80.44±13.69	[a] 0.729
Yes	87.66±7.02		75.83±8.24		7333±11.78		71.12±6.00		8229±14.23	
Obstructive sleep apnea										
No	82.99±14.76	[a] 0.014	71.50±10.38	[b] 0.064	67.74±17.66	[a] 0.063	69.75±7.44	[b] 0.134	80.55±14.87	[b] 0.407
Yes	94.04±4.32		7.91±6.22		77.50±7.90		73.43±3.96		84.72±13.66	
Gastric sleeve leak										
No	85.44±13.90	0.016	72.37±10.14	<0.001	69.17± 16.97	0.008	70.28±7.18	0.079	80.84±13.71	<0.001
Yes	78.57		79.17		75.00		71.88		100.00	
Bleeding										
No	85.43±14.17	0.923	72.30±10.08	<0.001	69.17±16.97	0.008	70.28±7.18	0.095	80.84±13.71	<0.001
Yes	85.71		83.33		75.00		71.88		100.00	

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BMI: Body mass index; Analysis method of each domain of QoL based on variables: Age according to Pearson correlation method; Gender according to [a] Mann-Whitney U test and [b] Independent-samples t-test; Marital status according to Mann-Whitney U test; Education level according to Kruskal-Wallis H test; BMI according to Pearson correlation method; Diabetes according to Mann-Whitney U test; Hypertension according to [a] Mann-Whitney U test and [b] Independent-samples t-test; Dyslipidemia according to [a] Mann-Whitney U test and [b] Independent-samples t-test; Obstructive sleep apnea according to [a] Mann-Whitney U test and [b] Independent-samples t-test; Gastric sleeve leak according to One-sample t-test; Bleeding according to One-sample t-test.

Discussion

Recent studies investigated the effects of bariatric surgery on individuals' post-surgical QoL, focusing on biomedical factors, including weight loss and the amelioration of associated conditions. Nevertheless, given the growing global prevalence of these surgical procedures, it is crucial to conduct comprehensive assessments of patients' QoL and related factors (21). This study investigated the QoL scores assessed using the WHOQOL-BREF instrument in a population-based sample from Northern Iran. In the present study, males had higher mean QoL scores in physical health than females. This observation is consistent with previous research findings suggesting that males generally exhibit higher levels of overall QoL than females (22,23). Additionally, it is well-known that males have greater exercise capacity than females across all age groups, which may contribute to higher ratings for physical health-related QoL (24). However, no significant gender difference was observed in other domains of QoL. Similarly, a study by Soares et al. found no gender variation in the QoL after bariatric surgery (12).

Wu et al. reported that bariatric surgery demonstrated efficacy in promoting weight loss, achieving diabetes remission, and improving dyslipidemia in the five-year post-surgery period (25). Correspondingly, our study demonstrated that patients with dyslipidemia had higher average QoL scores in the psychological health domain. Obesity poses a substantial risk for various comorbidities, including dyslipidemia, diabetes, heart disease, stroke, hypertension, atherosclerosis, and certain kinds of cancer (26). Additionally, it has been observed that obesity is associated with increased mortality and a reduction in lifespan of approximately ten years (27), and obese individuals are more likely to experience disordered eating behaviors, psychological distress, and diminished health-related QoL (28). The impact of the patient's perception of assuming control over their disease and life on postoperative psychological well-being is a phenomenon that can be expected and understood (29,30). Furthermore, we found that patients with apnea had higher average QoL scores in the physical health domain compared to those without apnea after gastric sleeve surgery. It is widely recognized that weight gain can precede the onset of obstructive sleep apnea symptoms (31), and sleeve gastrectomy has been shown to significantly reduce the apnea-hypopnea index and improve obstructive sleep apnea symptoms, resulting in a significant reduction in the use of continuous positive airway pressure in most patients (32).

According to a meta-analysis conducted by Greenburg, bariatric surgery has been found to significantly affect daytime sleepiness and the harshness of obstructive sleep apnea (33). In addition, a greater initial sleep latency has been linked to decreased enhancements in physical functioning, while insufficient sleep quality has been connected to reduced efficacy in weight loss endeavors (34). Therefore, it can be concluded that by reducing obesity, increasing lung volume and function, and improving sleep apnea, individuals' mental and physical health are enhanced (35). The incidence of postoperative complications following sleeve surgery ranges between 0% and 6% (36). We observed a frequency distribution of 1.5% for gastric leakage and bleeding after gastric sleeve surgery, with no reported fatal cases among the 66 participants. This aligns with findings from other studies, which indicate that gastric leaks may occur in approximately 1% of cases (37,38). We found that individuals who experienced gastric leaks and bleeding had higher average scores in the domains of mental health, social relations, and general QoL.

These findings are consistent with previous research, suggesting that, despite the minor side effects of sleeve gastrectomy, body image improvements, patient satisfaction, and self-esteem contribute to enhanced QoL across various domains (21,37). Moreover, using the WHOQOL-BREF questionnaires in our study enhanced its credibility, as these instruments are widely acknowledged and validated for assessing QoL. In the present study, the controlled before-after design, assessing QoL at different time points after surgery, allows for a holistic understanding of the overall influence on patient QoL. Nevertheless, the study faced some limitations, including its cross-sectional nature, patients' recall biases in self-reporting data, small sample size, restrictions related to the study center, incomplete data of QoL of the patients at the beginning, lack of a healthy control group that made it difficult to ascertain

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whether the observed enhancements in QoL could be exclusively attributed to bariatric surgery. It would be advisable to conduct further research with a larger sample size across multiple health centers.

Conclusions

The results indicated improvements in various domains of QoL for men and patients with dyslipidemia and obstructive sleep apnea. Our findings highlighted the significance of incurporating patient-derived QoL evaluation in the treatment strategy for assessing the effectiveness of surgical procedures beyond clinical assessment.

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Conflict of Interest

The authors declare that they have no competing interests.

References

1. Nguyen NT, Varela JE. Bariatric surgery for obesity and metabolic disorders: state of the art. Nat Rev Gastroenterol Hepatol. 2017;14(3):160-169.
2. Busutil R, Espallardo O, Torres A, Martínez-Galdeano L, Zozaya N, Hidalgo-Vega Á. The impact of obesity on health-related quality of life in Spain. Health Qual Life Outcomes. 2017;15(1):197.
3. Tarride JE, Breau R, Sharma AM, Hong D, Gmora S, Guertin JR, et al. The effect of bariatric surgery on mobility, health-related quality of life, healthcare resource utilization, and employment status. Obes Surg. 2017;27(2):349-356.
4. De Oliveira Lima MD, da Silva TPR, de Menezes MC, Mendes LL, Pessoa MC, de Araújo LPF, et al. Environmental and individual factors associated with quality of life of adults who underwent bariatric surgery: a cohort study. Health Qual Life Outcomes. 2020;18(1):87.
5. Bužgová R, Bužga M, Holéczy P. Health-related quality of life in morbid obesity: the impact of laparoscopic sleeve gastrectomy. Cent Eur J Med. 2014;9:374–381.
6. Welbourn R, Hollyman M, Kinsman R, Dixon J, Liem R, Ottosson J, et al. Bariatric surgery worldwide: baseline demographic description and one-year outcomes from the fourth IFSO global registry report 2018. Obes Surg. 2019;29(3):782–795.
7. Sioka E, Tzovaras G, Perivoliotis K, Bakalis V, Zachari E, Magouliotis D, et al. Impact of Laparoscopic Sleeve Gastrectomy on Gastrointestinal Motility. Gastroenterol Res Pract. 2018;2018:4135813.
8. Scott WR, Batterham RL. Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy: understanding weight loss and improvements in type 2 diabetes after bariatric surgery. Am J Physiol Regul Integr Comp Physiol. 2011;301(1):R15– R27.
9. Gundogdu E, Moran M. Adjustable gastric banding. Ann Laparosc Endosc Surg. 2021;6.
10. Gehrer S, Kern B, Peters T, Christoffel-Courtin C, Peterli R. Fewer nutrient deficiencies after laparoscopic sleeve gastrectomy (LSG) than after laparoscopic Roux-Y-gastric bypass (LRYGB)—a prospective study. Obes Surg. 2010;20(4):447–453.
11. The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. Soc Sci Med. 1995;41 (10):1403–1409.
12. Soares C, Pinho AC, Sousa HS, da Costa EL, Preto J. Health-related quality of life 6 years after bariatric surgery: Factors influencing outcome. Porto Biomed J. 2022;7(3):e163.
13. Janik MR, Rogula T, Bielecka I, Kwiatkowski A, Paśnik K. Quality of life and bariatric surgery: cross-sectional study and analysis of factors influencing outcome. Obes Surg. 2016;26(12):2849–2855.
14. Bujang MA, Lai WH, Hon YK, Yap EPP, Tiong XT, Ratnasingam S, et al. Measuring population health and quality of life: Developing and testing of the significant quality of life measure (SigQOLM). Heliyon.2023; 9(12):e22668.
15. Potter J, Cantarero R, Wood H. The multidimensional nature of predicting quality of life. Procedia-Social Behav Sci. 2012;50:781–790.
16. Major P, Matłok M, Pędziwiatr M, Migaczewski M, Budzyński P, Stanek M, et.al, Budzyński A. Quality of Life After Bariatric Surgery. Obes Surg. 2015;25(9): 1703-1710.
17. Nedjat S, Montazeri A, Holakouie K, Mohammad K, Majdzadeh R. Psychometric properties of the Iranian interview-administered version of the World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF): a population-based study. BMC Health Serv Res. 2008;8:61.
18. World Health Organization. World Health Organization's Quality of Life group: WHOQOL-BREF Introduction. Adm Scoring Generic Version Assessment, F Trial Version. 1996:16.
19. Fleck MP de A. O instrumento de avaliação de qualidade de vida da Organização Mundial da Saúde (WHOQOL-100): características e perspectivas. Cien Saude Colet. 2000;5:33–38.

[DOI: 10.61186/jsurgtrauma.12.2.61]

20. Murphy B, Herrman H, Hawthorne G, Pinzone T, Evert H. Australian WHOQoL instruments: User's manual and interpretation guide. Melbourne, Aust Aust WHOQOL F Study Cent. 2000.

21. Soroceanu RP, Timofte DV, Danila R, Timofeiov S, Livadariu R, Miler AA, et al. The impact of bariatric surgery on quality of life in patients with obesity. J Clin Med. 2023;12(13):4225.

22. West EC, Williams LJ, Stuart AL, Pasco JA. Quality of life in south-eastern Australia: normative values for the WHOQOL-BREF in a population-based sample of adults. BMJ Open.2023;13(12):e073556.

23. Bilgili N, Arpacı F. Quality of life of older adults in Turkey. Arch Gerontol Geriatr. 2014;59(2):415-421.

24. Simões LA, Dias J, Marinho KC, Pinto CLLR, Britto RR. Relationship between functional capacity assessed by walking test and respiratory and lower limb muscle function in community-dwelling elders. Rev Bras Fisioter. 2010;14(1):24–30.

25. Wu T, Wong SKH, Law BTT, Grieve E, Wu O, Tong DKH, et al. Five-year effectiveness of bariatric surgery on disease remission, weight loss, and changes of metabolic parameters in obese patients with type 2 diabetes: a population-based propensity score-matched cohort study. Diabetes Metab Res Rev. 2020;36(3):e3236.

26. Scully T, Ettela A, LeRoith D, Gallagher EJ. Obesity, type 2 diabetes, and cancer risk. Front Oncol. 2021;10:615375.

27. Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. J Am Assoc Nurse Pract. 2017;29(S1): S3–S14.

28. Sarwer DB, Polonsky HM. The psychosocial burden of obesity. Endocrinol Metab Clin North Am. 2016;45(3):677–688.

29. Al Khalifa K, Al Ansari A, Alsayed AR, Violato C. The impact of sleeve gastrectomy on hyperlipidemia: a systematic review. J Obes. 2013;2013:643530.

30. Kubik JF, Gill RS, Laffin M, Karmali S. The impact of bariatric surgery on psychological health. J Obes. 2013;2013:837989.

31. Garvey JF, Pengo MF, Drakatos P, Kent BD. Epidemiological aspects of obstructive sleep apnea. J Thorac Dis. 2015;7(5):920-929.

32. Suliman LAM, Abdalla DA. Does sleeve gastrectomy improve obstructive sleep apnea? Egypt J Chest Dis Tuberc. 2016;65(2):505–510.

33. Greenburg DL, Lettieri CJ, Eliasson AH. Effects of surgical weight loss on measures of obstructive sleep apnea: a meta-analysis. Am J Med. 2009;122(6):535–542.

34. Gangitano E, Martinez-Sanchez N, Bellini MI, Urciuoli I, Monterisi S, Mariani S, et al. Weight Loss and Sleep, Current Evidence in Animal Models and Humans. Nutrients. 2023;15(15):3431.

35. Leinum CJ, Dopp JM, Morgan BJ. Sleep-disordered breathing and obesity: pathophysiology, complications, and treatment. Nutr Clin Pract. 2009;24(6):675-687.

36. Chung AY, Thompson R, Overby DW, Duke MC, Farrell TM. Sleeve gastrectomy: surgical tips. J Laparoendosc Adv Surg Tech. 2018;28(8):930–937.

37. Arishi AA, Gosadi IM, Hakami IA, Darraj H, Abusageah F, Hakami KM, et al. Bariatric Surgery Reduces Weight Loss, Comorbidities Prevalence, and Improves Quality of Life in the Southern Region of Saudi Arabia. Medicina (Kaunas). 2023;59(10):1695.

38. Loo GH, Rajan R, Mahmood NRKN. Staple-line leak post primary sleeve gastrectomy. A two patient case series and literature review. Ann Med Surg. 2019;44:72–76.

[DOI: 10.61186/jsurgtrauma.12.2.61]