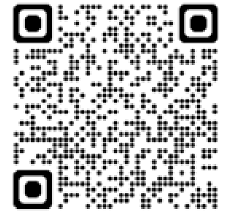
Al-Kunooze Scientific Journal

e-ISSN: 2706-6223

P-ISSN: 2706-6231

https://www.asj.kunoozu.edu.iq/

2026, 12(2):109-117



A Comparative Analysis of Anthropometric and Metabolic Parameters in Patients Four Years Post-Sleeve Gastrectomy

Rafida M. Al-Amiri

University of Basrah, College of Dentistry, Department of Basic Sciences, Basrah, Iraq

Corresponding author E-mail: rafeda.abdalhussain@uobasrah.edu.iq

Abstract

Background: Laparoscopic Sleeve Gastrectomy (LSG) is highly effective for weight loss, but long-term data regarding the durability of metabolic improvements remain varied. This study aimed to evaluate how significant metabolic markers—specifically blood sugar, renal function (urea), and lipid profiles [cholesterol/High Density Lipoprotein (HDL)] evolve alongside body mass index (BMI) over a 4-year period. **Methods:** A retrospective analysis of 30 patients was conducted, comparing preoperative data to 4-year follow-up results. **Results:** Among 30 patients aged 19-54 years [mean age: 34.67 ± 12.11], a sustained reduction in BMI and blood sugar was observed, with a significant increase in HDL levels. Younger patients had a substantially greater reduction in BMI over the 4-year postoperative period than older patients, and male patients tended to show greater postoperative changes in most metabolic parameters. **Conclusion:** The findings will provide insight into the long-term efficacy of LSG as metabolic surgery rather than just a weight-loss procedure.

Keywords: Sleeve Gastrectomy, BMI, Blood Sugar, Cholesterol, and HDL

Introduction

The best strategy for achieving long-term weight loss is bariatric surgery, which improves all obesity-related comorbidities [1]. Obesity is regarded as a key risk factor for a number of serious and long-term medical problems, including cancer, diabetes mellitus, cardiovascular disease, and musculoskeletal disorders [2]. Nevertheless, much remains to be learned about the physiological and metabolic changes following sleeve gastrectomy (SG) [3]. Bariatric endoscopy has recently been added to the list of treatments for obesity and related medical conditions, acting as a bridge between medical medicines, dietary and

This is an open access article under the CC BY 4.0 license

lifestyle recommendations, and the demonstrated effectiveness of bariatric surgery [4]. The antrum, most of the body, and the whole fundus are removed when the bulk of the stomach volume is vertically resected [5]. This process guarantees a high-pressure system, volume restriction, and advantageous hormonal [6]. So (LSG) has emerged as the gold standard for bariatric surgery because of its effectiveness in reducing weight and resolving comorbidities. While short-term outcomes are well-documented, the "mid-to-long-term" (4-year) stability of these changes is critical [7]. Following bariatric surgery, the neurohumoral regulatory circuits that govern hunger and glucose metabolism may be influenced by the vagal system. Although the exact mechanisms are still unknown, recent research indicates that alterations in gut microbiota and blood bile acid concentrations may be involved in metabolic changes following surgery. In this paper in the series, we examine the potential mechanisms underlying the effects of Laparoscopic adjustable gastric banding (LAGB), Vertical sleeve gastrectomy (VSG), and Roux-en-Y gastric bypass (RYGB) surgery on glucose metabolism and body weight. Elucidation of these mechanisms provides insight into BMI control and the pathogenesis of type 2 diabetes, which may aid in the discovery of novel therapeutic targets and enhance surgical methods [8]. After a few days, glucose levels usually return to normal. Changes in hormone secretion due to intestinal/gut rearrangement, such as elevated glucagon-like peptide 1 (GLP-1), may be one cause of bariatric surgery, i.e., before significant weight loss is achieved [9].

The objective of the study:

To assess pre-operative and 4 years post-operative mean difference in BMI and excess weight loss, to evaluate the long-term impact of LSG glycemic control (Blood Sugar) and lipid profiles (Total Cholesterol and HDL), To evaluate renal safety and metabolic byproduct variations through Serum Urea levels, and to ascertain if Age and sex tend to be independent predictors of the degree of metabolic improvement.

Materials and methods

Research participants: The study was observational and retrospective. Information was gathered from patients who underwent LSG at Al-Sadder Teaching Hospital between February 2022 and January 2026. The inclusion criteria for this study were: Body mass index (BMI) ≥ 32.5 kg/m² or≥ 27.5 kg/m², in accordance with the Chinese guidelines for bariatric and metabolic surgery [10]. Age 1 8 –65 years; Undergoing primary LSG surgery; Agreed to participate in follow-up and had complete clinical data. The exclusion criteria of this study were: History of other bariatric surgeries; Presence of severe comorbidities, such as chronic heart failure, myocardial infarction, stroke, malignancy, or other significant gastrointestinal diseases; Unstable psychiatric conditions; Incomplete clinical data.

The following were the study's inclusion criteria: BMI ≥ 32.5 kg/m² or BMI ≥ 27.5 kg/m² in compliance with Chinese bariatric and metabolic guidelines surgery [10]. Age range: 1–65 years; undergoing main LSG surgery; had complete clinical data and agreed to participate in

follow-up. The following were the study's exclusion criteria: A history of prior bariatric procedures; the existence of serious comorbidities such as myocardial infarction, stroke, or chronic heart failure.

Surgical technique:

The same surgical team carried out every procedure. The laparoscopic five-port method was employed. The following surgical steps were performed: the stomach's fundus and greater curvature were completely mobilized. Along with the lesser curvature, a 38-Fr orogastric bougie was placed. Gastric transection was started 4–6 cm proximal to the pylorus using a linear stapler. The transection proceeded cephalad along the bougie toward His angle. The angle of His was around 1.5 cm from where the resection line ended. A tubular gastric sleeve with an estimated volume of 60–80 m l was created by the full resection of the gastric fundus and increased curvature. After that, the bougie was taken out. A continuous seromuscular imbricating suture was used to strengthen the staple line [11].

Clinical information and general conditions:

"Data from 30 patients were retrospectively analyzed. Patient demographics were recorded, including sex, age, BMI, and operative time. Body mass index (BMI) was calculated and recorded using the formula: BMI (kg/m^2) =weight (kg) / [height (m)] ^{2}.

Laboratory biochemical indexes

All subjects were patients with morbid obesity. Data was collected on the day before surgery and at 4 years postoperatively. The data collected included: Biochemical parameters: fasting blood glucose, urea, total cholesterol, and HDL (High Density Lipoprotein). Statistical analysis.

Statistical analysis

Statistical analysis was performed for all tests using SPSS version 23. A significant level of < 0.05 was consider as significant in all test, Paired Samples T-Test was used to compare the pre and post operative value for variable used (BMI, Blood Sugar, Blood Urea, Cholesterol, HDL), while Pearson Correlation test used to assess the relationships between variables with age and gender, and for participants characteristic we used Descriptive Statistics to calculate Mean ± SD for all variables. Before performing these tests, a check for normality of data was done.

Results

More male participants than female participants, and the average age and range were shown in Table 1. investigate the effect of surgery on metabolic parameters from pre-operative to 4-year post-operative assessment, paired samples t-tests were used (Table 2). The findings showed that two important indicators had significantly improved: that is the mean BMI dropped by 11.72 units (95% CI: p value < 0.001) following surgery, a highly significant decrease. This is clinically significant weight loss and shows that the surgical operation was successful, and HDL cholesterol increased on average by 7.47 units (95% CI: p value = 0 .016) after surgery.

Table 1: The demographic distribution of the sample

Variable		No.	%
Age			
Mean ± Sd	34.67 ±12.11		
Range	(19-54)		
sex			
	Male	9	60.0
	Female	6	40.0

Table 2: the anthropometric and biochemical variables before and after surgery

Variables	Mean Difference	Direction	p-value
Blood Sugar	+3.47	Before > After	0.544
Blood Urea	+5.93	Before > After	0.589
Cholesterol	-24.47	Before < After	0.121
HDL	-7.47	Before < After	0.016
BMI	+11.72	Before > After	0.000

Paired sample t-test

Despite the lack of statistical significance, a consistent pattern emerged: male patients tended to show greater postoperative changes in most metabolic parameters (BMI, blood sugar, blood urea, and HDL), whereas female patients showed a slight tendency toward greater changes in cholesterol. This is the correlation between gender and changes in the variable measured in this study, as shown in Table 3.

Table 3: Correlations Between Gender and Clinical Changes of Variables

Variable	r	p-value	Interpretation
BMI Change	-0.181	0.520	Weak negative
Blood Sugar Change	-0.292	0.291	Weak-moderate negative
Blood Urea Change	-0.250	0.368	Weak negative
Cholesterol Change	0.105	0.710	Very weak positive
HDL Change	-0.162	0.563	Weak negative

Bivariate correlation

Younger patients had a substantially greater BMI reduction over the 4-year postoperative period than older patients, as shown in Table 4, which demonstrates a statistically significant, strong negative association between age and BMI change (r = -0.616, p = 0.014).

There were mild negative correlations with changes in HDL (r = -0.144) and moderate negative correlations with changes in blood urea (r = -0.317), but neither relationship was statistically significant. There was almost no association between age and changes in cholesterol (r = - 0 .049) or blood sugar (r = - 0 .037).

Interestingly, there was a consistent trend toward greater postoperative improvements in younger patients across all metabolic parameters, with the effect most pronounced and statistically significant for BMI. All correlations between age and clinical changes were negative.

Table 4: Correlations Between Age and Clinical Variables

Variable	r	p-value	Interpretation
BMI Change	-0.181	0.520	Weak negative
Blood Sugar Change	-0.292	0.291	Weak-moderate negative
Blood Urea Change	-0.250	0.368	Weak negative
Cholesterol Change	0.105	0.710	Very weak positive
HDL Change	-0.162	0.563	Weak negative

*Statistically significant at $p < 0.05$

Discussion

A highly significant reduction in BMI was observed (mean difference: +11.72; $p < 0.001$), with values decreasing from pre- to post- surgery. Assuming standard units (kg/m^2), this magnitude of change represents a substantial clinical improvement, potentially shifting participants from higher-risk obesity categories toward healthier weight classifications. Such reductions are consistently associated with lowered risks of type 2 diabetes, cardiovascular disease, and metabolic syndrome. This finding aligns with prior research demonstrating that targeted lifestyle or therapeutic interventions can effectively modify anthropometric profiles [12]. Concurrently, HDL cholesterol increased significantly (mean difference: −7.47; $p = 0.016$). Given that HDL facilitates reverse cholesterol transport and exhibits anti-inflammatory properties, this elevation is considered cardioprotective. The concurrent improvement in BMI and HDL may reflect synergistic metabolic adaptations, as weight reduction often correlates with favorable lipid remodeling. Increases in HDL-cholesterol concentrations with weight loss may be due to less HDL uptake via reduced binding to adipocytes [13]. The absence of statistically significant correlations across all parameters warrants careful interpretation, where metabolic parameters are influenced by numerous confounding factors (e.g., diet, physical activity, medication use, circadian rhythms). Unmeasured heterogeneity may have attenuated observable correlations [14]. Elucidation of systemic metabolic changes following bariatric surgery is important for informing new management strategies for obesity and related comorbidities [15]. Single- timepoint assessments or variability in laboratory methods can introduce noise that obscures true relationships. Additionally,

using change scores (post − pre) can amplify measurement error if baseline values are unstable. Grinspoon et al. contextualize the clinical importance of your BMI and HDL findings [16]. Wide confidence intervals: The CIs for all non-significant correlations include zero and span substantial effect sizes (e.g., blood urea: −0.71 to +0.21), indicating low precision. This suggests that the study was underpowered to detect anything other than large effects.

Biological plausibility vs. statistical evidence: While age is physiologically linked to glycemic control and lipid metabolism, the absence of significant correlations here does not disprove such relationships, it merely indicates they were not detectable in this sample [17]. Potential non-linear effects: Age-related changes in metabolic parameters may follow curvilinear patterns (e.g., threshold effects in older adulthood) not captured by Pearson correlation. The significant age-BMI association suggests that older adults may derive disproportionate benefit from this intervention regarding weight management. Clinicians might prioritize or adapt such surgeries for older populations, while remaining cautious about generalizing to metabolic outcomes in which age effects were not observed [18]. The significant inverse correlation between age and BMI change aligns with evidence from sleeve gastrectomy cohorts showing that older adults may achieve more modest anthropometric improvements than younger patients [19]. However, consistent with findings that metabolic parameters (e.g., glycemic control, lipid profiles) may improve independently of the magnitude of weight loss and exhibit variable patterns across age groups [20]. These results should not be generalized to metabolic outcomes where age associations were non-significant. Future research should explicitly test age-by-outcome interactions to clarify whether intervention mechanisms differ across cardiometabolic domains following bariatric procedures."

References

1. Akalestou E, Miras AD, Rutter GA, le Roux CW. Mechanisms of weight loss after obesity surgery. Endocrine reviews. 2022 Feb 1;43(1):19-34. https://doi.org/10.1210/endrev/bnab022.

2. Brito H, Santos AC, Preto J, Carvalho D, Freitas P, CRIO Group. Obesity and cancer: the profile of a population who underwent bariatric surgery. Obesity Surgery. 2021 Nov;31(11):4682-91. https://doi.org/10.1007/s11695-021-05626-0

3. Lopez-Nava G, Negi A, Bautista-Castaño I, Rubio MA, Asokkumar R. Gut, and metabolic hormones changes after endoscopic sleeve gastroplasty (ESG) vs. laparoscopic sleeve gastrectomy (LSG). Obesity surgery. 2020 Jul;30(7):2642-51. https://doi.org/10.1007/s11695-020-04541-0.

4. Cheskin LJ, Hill C, Adam A, Fayad L, Dunlap M, Badurdeen D, Koller K, Bunyard L, Frutchey R, Al-Grain H, Kahan S. Endoscopic sleeve gastroplasty versus high-intensity diet and lifestyle therapy: a case-matched study. Gastrointestinal endoscopy. 2020 Feb 1;91(2):342-9. https://doi.org/10.1016/j.gie.2019.09.029 .

5. Akki R, Raghay K, Errami M. Potentiality of ghrelin as antioxidant and protective agent. Redox Report. 2021 Jan 1;26(1):71-9.

https://doi.org/10.1080/13510002.2021.1913374.
6. Al-Amiri RM, Kadhum HS, Ali FM. The role of gut hormonal aspect in Iraqi patients subjected to sleeve Gastrectomy. Baghdad Science Journal. 2024;21(11):9. DOI: https://doi.org/10.21123/bsj.2024.8990
7. Cao P, Li J, Wang G, Sun X, Luo Z, Zhu S, Zhu L. Effects of sleeve gastrectomy on populations with obesity and obstructive sleep apnea: a meta-analysis. Surgery for Obesity and Related Diseases. 2025 Mar 1;21(3):288-300. https://doi.org/10.1016/j.soard.2024.10.007
8. Madsbad, S., Dirksen, C., & Holst, J. J. (2014). Mechanisms of changes in glucose metabolism and body weight after bariatric surgery. The lancet Diabetes & Endocrinology, 2(2), 152-164.)
9. Gudbrandsen OA, Dankel SN, Skumsnes L, Flølo TN, Folkestad OH, Nielsen HJ, Våge V, Mohn AC, Nedrebø BG, Sagen JV, Fernø J. Short-term effects of Vertical sleeve gastrectomy and Roux-en-Y gastric bypass on glucose homeostasis. Scientific Reports. 2019 Oct 15;9(1):14817. https://doi.org/10.1038/s41598-019-51347-x
10. Chinese Society of Cardiology, Chinese Medical Association, Chinese College of Cardiovascular Physicians, Chinese Heart Failure Association of the Chinese Medical Doctor Association, Editorial Board of the Chinese Journal of Cardiology. Chinese guidelines for the diagnosis and treatment of heart failure 2024. Cardiology Discovery. 2025 Mar 25;5(01):1-38. *DOI:* 10.1097/CD9.0000000000000146
11. Fu C, Han Y, Chen J, Chen J, Chen Y, Liang X, Sun L. Risk factors for early-onset hyperuricemia and gout following laparoscopic sleeve gastrectomy: a retrospective study. BMC surgery. 2025 Nov 14;25(1):547. https://doi.org/10.1186/s12893-025-03306-9
12. Idris I, Anyiam O. The latest evidence and guidance in lifestyle and surgical interventions to achieve weight loss in people with overweight or obesity. Diabetes, Obesity, and Metabolism. 2025 Apr; 27:20-34. DOI: 10.1111/dom. 16296
13. Dansinger M, Williams PT, Superko HR, Asztalos BF, Schaefer EJ. Effects of weight change on HDL-cholesterol and its subfractions in over 28,000 men and women. Journal of Clinical Lipidology. 2019 Mar 1;13(2):308-16. https://doi.org/10.1016/j.jacl.2018.12.001
14. Li S, Shi C, Wu H, Yan H, Xia M, Jiao H, He Y, Zhong M, Lou W, Gao X, Bian H. Longitudinal changes of serum metabolomic profile after laparoscopic sleeve gastrectomy in obesity. Endocrine Connections. 2024 Nov 1;13(11). https://doi.org/10.1530/EC-24-0292
15. Pantelis AG. Metabolomics in bariatric and metabolic surgery research and the potential of deep learning in bridging the gap. Metabolites. 2022 May 19;12(5):458. (https://doi.org/10.3390/metabo12050458)
16. Grinspoon, S.K., Watanabe, M., Ribaudo, H.J., Bloomfield, G.S., Fichtenbaum, C.J., Umbleja, T., Chu, S.M., Fitch, K.V., Diggs, M.R., Zhao, S. and Looby, S.E., 2026. Factors Affecting Risk of Cardiovascular Disease (CVD) Events in a Global CVD Prevention Cohort of People With HIV. *Clinical Infectious Diseases*, *81*(6), pp. e548-e557.

17. Chia CW, Egan JM, Ferrucci L. Age-related changes in glucose metabolism, hyperglycaemia, and cardiovascular risk. Circulation research. 2018 Sep 14;123(7):886-904.
18. Salazar-Londoño S, Londoño-Pereira M, Martín-Marco A, Patricio Baldera J, Lafuente Sanchis P, Aarsland D, Pérez-Zepeda MU, Borda MG, Tarazona-Santabalbina FJ. Body Mass Index and Age-Adjusted Body Mass Index in Older Individuals: Clinical and Functional Correlations across Categories. Study of 30,904 Older Adults Living in the Community. Journal of Nutrition in Gerontology and Geriatrics. 2025 Jul 3;44(3):133-50.
https://doi.org/10.1080/21551197.2025.2550286
19. Nevo N, Eldar SM, Lessing Y, Sabo E, Nachmany I, Hazzan D. Sleeve gastrectomy in the elderly. Obesity facts. 2019 Oct 31;12(5):502-8.
https://doi.org/10.1159/000502697
20. Nnakenyi ID, Nnakenyi EF, Parker EJ, Uchendu NO, Anaduaka EG, Ezeanyika LU. Relationship between glycaemic control and lipid profile in type 2 diabetes mellitus patients in a low-resource setting. Pan African Medical Journal. 2022 Apr 7;41(1).
https://www.panafrican-med-journal.com//content/article/41/281/full

تحليل مقارن للمعايير الأنثروبومترية والأيضية لدى المرضى بعد أربع سنوات من عملية تكميم المعدة

رافده مجيد عبد الحسين العامري
كلية طب الاسنان /فرع العلوم الاساسية/جامعة البصرة

ملخص
الخلفية: تُعدّ عملية تكميم المعدة بالمنظار (LSG) فعّالة للغاية في إنقاص الوزن، إلا أن البيانات طويلة الأمد المتعلقة بمدى استدامة التحسينات الأيضية لا تزال متفاوتة. هدفت هذه الدراسة إلى تقييم كيفية تطور المؤشرات الأيضية الهامة - وتحديدًا سكر الدم، ووظائف الكلى (اليوريا)، ومستويات الدهون) الكوليسترول - (HDL/جنبًا إلى جنب مع مؤشر كتلة الجسم (BMI)على مدى أربع سنوات. المنهجية: أُجري تحليل استرجاعي لبيانات 30 مريضًا، حيث تمت مقارنة البيانات قبل الجراحة بنتائج المتابعة بعد أربع سنوات. النتائج: تشمل النتائج المتوقعة انخفاضًا مستدامًا في مؤشر كتلة الجسم وسكر الدم، مع زيادة ملحوظة في مستويات HDL. سيحدد التحليل الإحصائي ما إذا كان العمر والجنس يؤثران على درجة هذه التغيرات. الاستنتاج: ستوفر هذه النتائج نظرة ثاقبة حول فعالية عملية تكميم المعدة بالمنظار على المدى الطويل كجراحة أيضية وليست مجرد إجراء لإنقاص الوزن.

الكلمات المفتاحية: تكميم المعدة، مؤشر كتلة الجسم، سكر الدم، الكوليسترول، والكوليسترول عالي الكثافة