

## Original Article

# Evaluation of the Short-Term Effect of Bariatric Surgery on the Level of HbA1c

Hadi Salehnia<sup>1</sup>, Abbas Ali Dehghan<sup>1\*</sup>, Sara Rashki Ghalehnoo<sup>2</sup>

<sup>1</sup>Department of Surgery, Islamic Azad University-Yazd Branch, Yazd, Iran

<sup>2</sup>Department of Cardiology, Amir Al Momenin Hospital, Zabol University Of Medical Sciences, Zabol, Iran

Received: 22 August, 2024; Accepted: 27 October, 2024

DOI: 10.22037/nbm.v13i1.46061

## Abstract

**Background:** Obesity is one of the most common diseases in the world, and type 2 diabetes (T2DM) is one of the common complications of obesity. Bariatric surgery is one of the main treatments for the obese. It is recommended that this procedure can improve the status of T2DM, but there is limited data about the short-term effects of bariatric surgery on T2DM status. In this study, we aimed to evaluate the short-term effect of bariatric surgery on the level of HbA1c as a parameter of the status of T2DM during 6 months.

**Materials and Methods:** In this cross-sectional study that was conducted on patients who underwent bariatric surgery in Mortaz and Mojibinia Hospitals (Yazd-Iran) from 2016 to 2020 to evaluate the short-term effect of bariatric surgery on HbA1C level, patients who were candidates for performing bariatric surgery were evaluated for 6 months. Age, sex, body mass index (BMI) before surgery, and surgery types (sleeve gastrectomy or gastric bypass) were recorded. The patients were followed up for six months, and HbA1C was assessed before the operation, at 3 months, and at 6 months after the surgery. All data was recorded and analyzed by SPSSv.25, and the significance level was considered less than 0.05.

**Results:** A total of 713 patients were assessed (27 in the sleeve gastrectomy group and 286 in gastric bypass surgery). The mean level of HbA1C was  $8.59 \pm 1.85$  % at the baseline, and it decreased to  $8.41 \pm 1.85$  % after 3 months (P-value: 0.06). After 6<sup>th</sup> month, the HbA1C level decreased to  $7.79 \pm 5.04$  %, significantly decreasing from the baseline (P-values < 0.05). There was no association between the type of bariatric surgery (sleeve gastrectomy or gastric bypass) and the amount of HbA1C reduction (P-values > 0.05).

**Conclusion:** Bariatric surgery reduces HbA1C level, and a significant reduction can be seen after 6 months. Sleeve gastrectomy and gastric bypass have similar effects in terms of HbA1C improvement.

**Keywords:** Sleeve gastrectomy, Gastric bypass, Bariatric surgery, Hemoglobin A1C

\*Corresponding Author: Hadi Salehnia, Department of Surgery, Islamic Azad University-Yazd Branch, Yazd, Iran. Email: hsalehnia3@gmail.com

Please cite this article as: Salehnia H, Dehghan AA. Evaluation of the Short-Term Effect of Bariatric Surgery on the Level of HbA1c. Novel Biomed. 2025;13(1):17-21.

## Introduction

At this time, overfeeding is spreading around the world because of improved living standards,

urbanization, modernization, and accelerated socio-economic growth. Changing lifestyle to unhealthy food consumption and sedentary lifestyle is about the problems of this period and makes people more obese than in the past time<sup>1-3</sup>. Obesity can involve any organ

of the body and/or aggravate underlying disease<sup>4</sup>. Type 2 diabetes (T2DM) is one of the most prevalent complications of obesity. Obese people are at risk of T2DM, and this disease involves different systems like the cardiovascular, central and peripheral nervous system, and immune system<sup>5-7</sup>.

Losing weight is one of the concerns of the population worldwide. Healthy diet and exercise are weight loss methods, but people do not observe them for long<sup>8,9</sup>. Bariatric has become popular due to its long-term effect on weight loss. There are four types of bariatric surgery, but sleeve gastrectomy and gastric bypass are more prevalent<sup>10</sup>. Laparoscopic sleeve gastrectomy is a widely recognized bariatric surgical technique that modifies the stomach into a slender, tubular form using five or six ports in the upper abdominal region<sup>11,12</sup>. In contrast, Gastric Bypass (Roux-en-Y) is a complex surgical intervention that entails several stages, including the use of a balloon to size the upper stomach, the formation of a tract for dissection along the lesser curvature utilizing hook cautery, and the division of the stomach with an endoscopic stapler<sup>13,14</sup>.

Some studies have been performed on the effects of bariatric surgeries on controlling T2DM and its improvement. Some studies demonstrated that bariatric surgery improves the status of T2DM and decreases fasting blood sugar and HbA1c<sup>15-17</sup>. These studies showed that bariatric surgery is effective on T2DM status in the long term, but limited studies were performed on the short-term effect of bariatric surgery on T2DM status<sup>18</sup>. So, in this study, we aimed to evaluate the short-term effect of bariatric surgery on the level of HbA1c as an important parameter for controlling T2DM.

## Methods

In this cross-sectional study that was conducted to evaluate the short-term effect of bariatric surgery on the status of HbA1c level after 6 months of the bariatric surgery, all patients who were undergoing bariatric surgery in Mortaz and Mojibinia Hospitals (Yazd-Iran) from April 2016 to April 2020 were enrolled in the study.

Inclusion criteria were performing bariatric surgery, including sleeve gastrectomy or gastric bypass for

weight loss. Exclusion criteria were gastric band bariatric surgery, not having consent to participate in the study, and no referring for follow-ups.

Age, sex, body mass index (BMI) before surgery, and surgery types (sleeve gastrectomy or gastric bypass) were assessed and recorded. The patients were followed up for 6 months. In each follow-up, HbA1c was evaluated to evaluate 3-month blood glucose status. HbA1c levels were assessed and recorded before the surgery, at 3rd month, and at 6th month after surgery. HbA1c level less than 5.7 was considered normal, between 5.7 % to 6.4 % as prediabetic, and equal or more than 6.5% as diabetes<sup>19</sup>.

**Ethical Considerations:** This study has received ethical clearance from the Research Ethics Committees of the Islamic Azad University-Yazd Branch, with an assigned ethics code (IR.IAU.YAZD.REC.1403.035).

**Statistical analysis:** Frequency and percentage were used to describe qualitative data, and mean standard deviation was used for quantitative data. Chi-square and T-tests were used to compare the variables between the two treatment groups. Analyzes were performed using SPSS 25.0 statistical software, and a P-value less than 0.05 was considered statistically significant.

## Results

In this study, 713 patients were assessed. 427 patients underwent sleeve gastrectomy, and 286 patients underwent gastric bypass surgery. We evaluated demographic data, and its results are seen in Table 1.

We evaluated the level of HbA1c before the surgery, at 3<sup>rd</sup> month and 6<sup>th</sup> month of the surgery. Although bariatric surgery reduced the HbA1c level after 3 months, there was no statistically significant difference between baseline HbA1c level and HbA1c level in the 3<sup>rd</sup> month. In the 6<sup>th</sup> month follow-up, the HbA1c significantly reduced, and there was a statistically significant difference with the baseline level (Table 2). The status of HbA1c levels was evaluated based on the type of surgery. The data are seen in Table 3. There were no significant differences between the surgeries regarding HbA1c levels (all P-values>0.05).

## Discussion

In this study, which evaluated the short-term effect of

**Table 1.** Demographic data of patients.

		Surgery		
		Sleeve, N=427	Bypass, N=286	P-value*
Sex	Man	179 (41.9%)	130 (45.5%)	0.356
	Woman	248 (58.1%)	156 (54.5%)	--
Age	<30	229 (53.6%)	155 (54.2%)	0.031
	30-40	173 (40.5%)	107 (37.4%)	--
	40-50	19 (4.4%)	24 (8.4%)	--
	>50	6 (1.4%)	0 (0.0%)	--
BMI before surgery	>40	405 (94.8%)	275 (96.2%)	0.471
	35-40	22 (5.2%)	11 (3.8%)	--

**Table 2.** Status of HbA1c level at baseline and follow-ups.

	Baseline HbA1c	HbA1c 3 months after the surgery	HbA1c 6 months after the surgery	P-value
Number of patients with normal HbA1c	0 (0%)	0 (0%)	79 (11.04%)	P < 0.00*
Number of prediabetes	0 (0%)	49 (6.87%)	178 (24.96%)	P < 0.00*
Number of Diabetics	713 (100%)	664 (93.13%)	456 (64%)	P < 0.00*
Mean level of HbA1c (%)	8.59±1.85 <sup>1</sup>	8.41±1.85 <sup>2</sup>	7.79±5.04 <sup>3</sup>	1-2: 0.06** 1-3: 0.00** 2-3: 0.00**

\* P-value based on chi-square, \*\*P-value based on T-test

**Table 3.** Levels of HbA1c based on the type of surgery.

	Surgery	Number	Mean	P-Value
Baseline HbA1c	Sleeve	427	8.63±1.88	P = 0.47
	Bypass	286	8.53±1.80	
HbA1c in 3 <sup>rd</sup> month	Sleeve	427	8.45±1.88	P = 0.43
	Bypass	286	8.34±1.80	
HbA1c in 6 <sup>th</sup> month	Sleeve	427	7.58±1.88	P = 0.18
	Bypass	286	8.09±7.62	

bariatric surgery on HbA1c level, patients who were candidates for bariatric surgery were evaluated for 6 months. We found that the mean level of HbA1c was 8.59±1.85 % of the baseline, and it decreased to 8.41±1.85 % after 3 months without a significant difference. However, after 6 months, the HbA1c level decreased to 7.79±5.04 %. It was significantly different from the baseline and 3<sup>rd</sup> month follow-up levels. We found no association between the type of bariatric surgery (sleeve gastrectomy or gastric bypass) and the amount of HbA1c reduction. It demonstrated that reduction in the HbA1c level has no association with the type of bariatric surgery.

Type 2 diabetes is a complication of obesity. Weight loss by exercise and a healthy diet are recommended in the primary stages of diabetes. However, because most patients are unable to observe these recommendations, drug treatment is started from the control of T2DM<sup>20-22</sup>. Bariatric surgeries that reduce calorie intake induce weight loss and it helps to control T2DM. Also, it has been found that bariatric surgeries have regulatory effects on hormonal secretion, such as glucagon-like peptide-1 (GLP-1), and it helps to control insulin sensitivity<sup>22-24</sup>. Most studies evaluated the long-term (more than 6 months) effects of bariatric surgery on HbA1c level, and few studies assessed short-term

effects<sup>25</sup>.

Sridhar et al. assessed the impact of bariatric surgery on HbA1c. They assessed 351 participants based on the cutoff of HbA1c of 8%. They mentioned that HbA1c levels were significantly lower in patients with HbA1c<8% than those with HbA1c≥8%. However, in the first month after surgery, it was insignificant, and the significant difference manifested in 3-6 months<sup>26</sup>. We have not categorized participants based on the cutoff of 8% but found that the significant difference manifested after 3 months of the surgery HbA1c. At the 6th-month follow-up, HbA1c significantly reduced from baseline. One of the advantages of the current study, compared to the study by Sridhar et al., was that our study was conducted on 713 patients. Sridhar et al.'s study was performed on 351 patients with a larger sample size.

Samuel et al. mentioned that up to the first thirty days after the operation, no significant difference in the HbA1c level was observed. However, a stable decrease trend was observed in HbA1c levels at 6-month and 1-year follow-up<sup>27</sup>. In the current study, we did not assess patients one month after the operation because the HbA1c level shows the average blood glucose status in the last 90 days<sup>28</sup>. Therefore, we evaluated the patients' HbA1c status at 3<sup>rd</sup> month and 6<sup>th</sup> month after the operation, and it was found that although HbA1c levels decreased from the baseline to 3<sup>rd</sup> month, this reduction was not statistically significant. In the 6<sup>th</sup> month follow-up, the HbA1c level significantly decreased compared to baseline and 3<sup>rd</sup> month.

Lee et al. evaluated the effects of bariatric surgery 6 and 12 months after different types of bariatric surgeries. They found no difference between gastric bypass and sleeve gastrectomy after 6 or 12 months of the operation regarding the reduction in the level of HbA1c, and the results of the types of bariatric surgery were similar<sup>29</sup>. The current study's findings were similar to those of Lee et al. regarding the effects of different types of bariatric surgery on the decreasing HbA1c level. We found no difference between sleeve gastrectomy and gastric bypass in reducing HbA1c level after 6 months of the operation.

Leonetti et al. compared the effects of bariatric surgery with conventional therapy in patients with morbid obesity. They demonstrated that bariatric

surgery significantly reduced HbA1c levels after 18 months compared to conventional therapy<sup>30</sup>. In the current study, we did not compare bariatric surgery with conventional therapy; it was one of the differences between the current study and Leonetti et al. study. We found that bariatric surgery significantly reduced HbA1c levels after 6 months of operation, and there was no significant difference in the effects of different types of surgery.

## Conclusion

Sleeve gastrectomy and gastric bypass have similar effects on reduction in HbA1c level, and the significant effects of these surgeries are manifested after 6 months of the operation. The reduction trend can be seen in the third month of the surgery, but it is not significant.

## Acknowledgment

None.

## Conflict of interest

The authors further declare that they have no conflict of interest.

## References

1. Tsai AG, Bessesen DH. Obesity (Japanese version). *Annals of Internal Medicine*. 2019;170(5):JITC33-JITC48.
2. Kumanyika S, Dietz WH. Solving population-wide obesity-progress and future prospects. *N Engl J Med*. 2020;383(23):197-2200.
3. Lobstein T, Brinsden H, Neveux M. *World obesity atlas 2022*. 2022.
4. Blüher M. Obesity: global epidemiology and pathogenesis. *Nature Reviews Endocrinology*. 2019;15(5):288-98.
5. Grasset E, Burcelin R. The gut microbiota to the brain axis in the metabolic control. *Reviews in Endocrine and Metabolic Disorders*. 2019;20(4):427-438.
6. Sun K, Kusminski CM, Scherer PE. Adipose tissue remodeling and obesity. *The Journal of clinical investigation*. 2011;121(6):2094-2101.
7. Care D. *Care in diabetes—2022*. *Diabetes care*. 2022;45:S17.
8. Herrera MF, García-García E, Arellano-Ramos JF, Madero MA, Aldrete-Velasco JA, Corvalá JAL. Metabolic surgery for the treatment of diabetes mellitus positioning of leading medical associations in Mexico. *Obesity Surgery*. 2018;28:3474-83.
9. Laing P, Pham T, Taylor LJ, Fang J. Filling the void: a review of intragastric balloons for obesity. *Digestive Diseases and Sciences*. 2017;62:1399-1408.
10. Stahl JM, Malhotra S. Obesity surgery indications and

contraindications. 2018.

11. Lessing Y, Pencovich N, Lahat G, Klausner JM, Abu-Abeid S, Eldar SM. Laparoscopic sleeve gastrectomy for diabetics—5-year outcomes. *Surgery for Obesity and Related Diseases*. 2017;13(10):1658-63.
12. Ramos AC, Bastos ELdS, Ramos MG, et al. Technical aspects of laparoscopic sleeve gastrectomy. *ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo)*. 2015;28:65-8.
13. Duvoisin C, Favre L, Allemann P, Fournier P, Demartines N, Suter M. Roux-en-Y gastric bypass: ten-year results in a cohort of 658 patients. *Annals of surgery*. 2018;268(6):1019-25.
14. Aderinto N, Olatunji G, Kokori E, Olaniyi P, Isarinade T, Yusuf IA. Recent advances in bariatric surgery: a narrative review of weight loss procedures. *Annals of Medicine and Surgery*. 2023;85(12):6091-104.
15. Aminian A, Vidal J, Salminen P, et al. Late relapse of diabetes after bariatric surgery: not rare, but not a failure. *Diabetes care*. 2020;43(3):534-540.
16. El Ansari W, Elhag W. Weight regain and insufficient weight loss after bariatric surgery: definitions, prevalence, mechanisms, predictors, prevention and management strategies, and knowledge gaps—a scoping review. *Obesity surgery*. 2021;31:1755-66.
17. Mingrone G, Panunzi S, De Gaetano A, et al. Metabolic surgery versus conventional medical therapy in patients with type 2 diabetes: 10-year follow-up of an open-label, single-centre, randomised controlled trial. *The Lancet*. 2021;397(10271):293-304.
18. Alqunai MS, Alrashid FF. Bariatric surgery for the management of type 2 diabetes mellitus-current trends and challenges: a review article. *American Journal of Translational Research*. 2022;14(2):1160.
19. Eyth E, Naik R. Hemoglobin A1c. 2019.
20. Lai LL, Wan Yusoff WNI, Vethakkan SR, Nik Mustapha NR, Mahadeva S, Chan WK. Screening for non- alcoholic fatty liver disease in patients with type 2 diabetes mellitus using transient elastography. *Journal of gastroenterology and hepatology*. 2019;34(8):1396-403.
21. Eckstein ML, Williams DM, O'Neil L, Hayes J, Stephens J, Bracken R. Physical exercise and non- insulin glucose- lowering therapies in the management of Type 2 diabetes mellitus: a clinical review. *Diabetic Medicine*. 2019;36(3):349-58.
22. Massey CN, Feig EH, Duque-Serrano L, Wexler D, Moskowitz JT, Huffman JC. Well-being interventions for individuals with diabetes: A systematic review. *Diabetes research and clinical practice*. 2019;147:118-33.
23. Bawahab MA, Assiri AS, Maksoud WA, et al. Effects of weight reduction after sleeve gastrectomy on metabolic variables in Saudi obese subjects in Aseer Province of Kingdom of Saudi Arabia. *Obesity Surgery*. 2017;27:2005-14.
24. Liakopoulos V, Franzén S, Svensson A-M, et al. Pros and cons of gastric bypass surgery in individuals with obesity and type 2 diabetes: nationwide, matched, observational cohort study. *BMJ open*. 2019;9(1):e023882.
25. Panagiotou OA, Markozannes G, Kowalski R, et al. Short-and long-term outcomes after bariatric surgery in the Medicare population. 2019.
26. Sridhar N, Hetzel E, Kindel TL, Gould JC, Higgins RM. The Impact of hemoglobin A1c on post-operative outcomes in bariatric surgery patients. *Journal of Surgical Research*. 2021;267:636-41.
27. Samuel N, Mustafa A, Hawkins H, et al. Influence of pre-operative HbA1c on Bariatric surgery outcomes—the Sunderland (UK) experience. *Obesity Surgery*. 2022:1-6.
28. Gilstrap LG, Chernew ME, Nguyen CA, et al. Association between clinical practice group adherence to quality measures and adverse outcomes among adult patients with diabetes. *JAMA network open*. 2019;2(8):199139-9.
29. Lee JH, Nguyen Q-N, Le QA. Comparative effectiveness of 3 bariatric surgery procedures: Roux-en-Y gastric bypass, laparoscopic adjustable gastric band, and sleeve gastrectomy. *Surgery for Obesity and Related Diseases*. 2016;12(5):997-1002.
30. Leonetti F, Capoccia D, Coccia F, et al. Obesity, type 2 diabetes mellitus, and other comorbidities: a prospective cohort study of laparoscopic sleeve gastrectomy vs medical treatment. *Archives of Surgery*. 2012;147(8):694-700.