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The role of physical activity in post-bariatric weight regain

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Abstract

Background. Bariatric surgery remains the most effective intervention for the treatment of obesity. However, weight regain is observed in a subset of patients during long-term follow-up, suggesting that durable weight loss is not consistently maintained.

Aim. The aim of this study was to analyse the proportion of patients experiencing postoperative weight regain and to determine the impact of physical activity on post-surgical weight outcomes.

Material and methods. A narrative review of the available literature was conducted, focusing on the impact of physical activity on the risk of postoperative weight regain in patients following bariatric surgery.

Results. Physical activity (PA) may help prevent postoperative weight regain after bariatric surgery. Higher objectively measured PA, including greater daily step counts and moderate-to-vigorous activity, is associated with improved long-term weight maintenance, whereas low PA and sedentary behavior are linked to an increased risk of weight regain.

Conclusions. Patients who have undergone bariatric surgery should engage in regular physical activity to help prevent postoperative weight regain.

Key words: obesity, bariatric surgery, Roux-en-Y gastric bypass, sleeve gastrectomy, weight regain, physical activity

1. Introduction

Obesity is a chronic, multifactorial disease characterized by excessive accumulation of adipose tissue that adversely affects health outcomes. It is defined by a body mass index (BMI) ≥ 30 kg/m² [1]. The prevalence of obesity has increased substantially over recent decades, making it one of the most significant public health challenges worldwide. It is estimated to affect more than 2 billion individuals [2]. Obesity is associated with an increased risk of numerous chronic diseases, including type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, and obstructive sleep apnea [3,4]. The increasing prevalence of obesity has resulted in considerable healthcare expenditures and economic burden. Obesity-related complications contribute substantially to healthcare utilization, hospital admissions, and long-term pharmacological treatment costs.

Conservative treatment remains the first-line management strategy for obesity and includes dietary modification, increased physical activity, behavioural interventions and pharmacotherapy [5]. Lifestyle interventions aim to establish a sustained negative energy balance through caloric restriction and increased energy expenditure. More recently, anti-obesity medications have demonstrated significant efficacy in promoting weight loss and improving metabolic outcomes [5]. Nevertheless, long-term maintenance of weight reduction remains challenging, and many patients experience weight regain following conservative treatment. Consequently, bariatric surgery has become the most effective treatment option for patients with severe obesity who fail to achieve adequate weight reduction through conservative management. The 2020 European Association for Endoscopic Surgery (EAES) guidelines, endorsed by the European Association for the Study of Obesity (EASO) and other European societies, recommend surgery for individuals with a body mass index (BMI) ≥ 40 kg/m², for those with a BMI of 35–39.9 kg/m² and obesity-related comorbidities, and for selected patients with a BMI of 30–34.9 kg/m² whose type 2 diabetes or other metabolic disease remains inadequately controlled despite optimal medical treatment. These recommendations are based on strong evidence demonstrating that bariatric surgery provides substantial and durable weight loss, improves obesity-related comorbidities, enhances quality of life, and reduces long-term mortality compared with non-surgical treatment [6,7].

The Laparoscopic sleeve gastrectomy (LSG) and Roux-en-Y gastric bypass (RYGB) are the most frequently performed bariatric procedures worldwide [1,5], with LSG being performed

more frequently [7]. The benefits of bariatric surgery are well established and include significant and durable weight loss, improvement in obesity-related comorbidities, enhanced quality of life and physical functioning, and a reduced risk of mortality [8]. Despite excellent long-term outcomes, a proportion of patients experience postoperative weight regain following both procedures [9,10].

2. Bariatric procedures

2.1 Laparoscopic sleeve gastrectomy (LSG)

LSG is a restrictive procedure involving longitudinal resection of approximately 75–80% of the stomach while preserving gastrointestinal continuity and pyloric function. In addition to restricting gastric volume, LSG reduces ghrelin production and induces favorable hormonal changes that contribute to appetite suppression and metabolic improvement [6]. Owing to its technical simplicity, shorter operative time, and favorable safety profile, LSG has become the most commonly performed bariatric operation worldwide [6].

2.2 Laparoscopic Roux-en-Y gastric bypass (RYGB)

Roux-en-Y gastric bypass (RYGB) is a bariatric surgical procedure that involves creating a small gastric pouch and connecting it directly to the jejunum, thereby bypassing a portion of the stomach and proximal small intestine. RYGB is the second most commonly performed bariatric surgery, following LSG. RYGB by combining gastric restriction with proximal intestinal bypass, produce both restrictive and malabsorptive effects while inducing profound neurohormonal changes that improve glucose homeostasis and insulin sensitivity [4,6]. Although both procedures demonstrate similar efficacy in weight reduction and metabolic improvement in most patients, the EAES guidelines recommend RYGB rather than LSG for patients with severe gastroesophageal reflux disease (GERD) or severe esophagitis because of its superior anti-reflux effect [6].

Table 1. Comparison of laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass

Characteristic	LSG	RYGB	References
Technique	Longitudinal resection of 75–80% of the stomach; restrictive procedure	Small gastric pouch with Roux-en-Y reconstruction; restrictive and mildly malabsorptive procedure	[6,11,12,13]
Main mechanism	Gastric restriction and reduced ghrelin secretion	Restriction, intestinal bypass, hormonal/metabolic effects	[6,11,13]
Weight loss	Excellent long-term weight loss RYGB generally comparable with LSG	Excellent long-term weight loss RYGB generally comparable with LSG	[6,7]
Type 2 diabetes	Significant improvement and remission	Significant improvement and remission; may provide greater metabolic benefit in selected patients	[4,6,7]
GERD	May worsen pre-existing GERD or induce de novo GERD	Improves GERD; preferred procedure in severe GERD	[6,7]
Early complications	Staple-line leak, bleeding, stenosis	Anastomotic leak, bleeding, bowel obstruction	[6,10,11]
Late complications	GERD, sleeve stenosis, weight regain	Internal hernia, marginal ulcer, dumping syndrome, hypoglycemia, nutritional deficiencies	[6,9–12]
Relative limitations	Severe GERD, severe reflux esophagitis	Greater need for lifelong nutritional supplementation and monitoring	[6,10]
Follow-up	Lifelong clinical and nutritional follow-up	Lifelong clinical and nutritional follow-up	[6,10]

Selection of the optimal bariatric procedure should be individualized through multidisciplinary assessment, considering obesity-related comorbidities, reflux symptoms, nutritional status, anatomical factors, operative risk, and patient preferences [6,10]. Long-term follow-up remains essential after either procedure to monitor weight loss, nutritional status, and the development of procedure-specific complications [6,9,10].

Among the modifiable lifestyle factors, physical activity has emerged as one of the most important determinants of long-term weight maintenance after bariatric surgery. However, its role in preventing postoperative weight regain remains incompletely understood, and the available evidence has not been comprehensively summarized.

The aim of this review was to evaluate the available evidence regarding postoperative weight regain after bariatric surgery, with particular focus on the role of physical activity in preventing weight recurrence. In addition, the review summarizes current recommendations concerning postoperative physical activity and discusses its clinical implications for long-term bariatric care.

3. Methodology

While preparing this manuscript, we searched the PubMed database using the following keywords: “Roux-en-Y”, “laparoscopic sleeve gastrectomy”, “bariatric surgery”, “weight regain”, and “physical activity”. Six studies were selected, as they represented diverse research methodologies, including the assessment of physical activity using self-reported questionnaires and objective tools measuring physical activity levels.

4. Factors related to weight management of bariatric surgery patients

The etiology of weight regain after bariatric surgery is multifaceted, involving interactions among dietary intake, physical activity, eating behaviors, psychological factors, and other behavioral determinants that collectively influence long-term weight-loss maintenance [14].

4.1 Poor dietary adherence

Postoperative weight regain in bariatric patients was associated with poor adherence to dietary guidelines, increased caloric intake, including excessive consumption of carbohydrates, alcohol, low-nutritional-value sweets, and high-fat foods, as well as a higher frequency of eating episodes. Employment in food production was also identified as a factor associated with an increased risk of postoperative weight regain [14, 15].

4.2 Lifestyle factors

Lifestyle-related factors were identified as important contributors to weight regain among patients following bariatric surgery. These included levels of physical activity, smoking habits, sedentary behavior, sleep patterns, and self-monitoring of body weight [16].

4.3 Psychological determinants

Mental health disorders among patients following bariatric surgery have a significant impact on postoperative weight regain. In particular, depression and anxiety, as well as binge eating and emotional eating, were identified as the most prevalent psychological factors contributing to weight recurrence after bariatric procedures. Severe postoperative depressive symptoms

represent a major determinant of increased weight regain, highlighting the complex interplay between mental health and weight management following surgery [16, 17].

5. Weight Regain After Bariatric Surgery

Weight regain (WR) is a common long-term challenge following bariatric surgery and may diminish the metabolic and clinical benefits achieved after the procedure [5,9]. Although most patients reach their lowest postoperative weight (nadir weight) within 12–24 months after surgery, gradual weight recurrence may occur thereafter [9].

One of the major limitations of the current literature is the lack of a standardized definition of weight regain [5,9]. Commonly used definitions include regaining a percentage of the maximum weight lost after surgery, an increase in body weight from nadir weight, or regaining a proportion of excess weight loss previously achieved. As a result, reported prevalence rates vary substantially between studies.

Amundsen *et al.* (2016) described a cohort of 49 patients who had undergone RYGB at least one year prior to the study. Participants were classified as experiencing either suboptimal weight loss (SWL; excess weight loss [EWL] <50%; n = 22) or significant weight regain (SigWR; total weight regain $\geq$ 15%; n = 38). Unsuccessful weight loss after RYGB was associated with lower physical activity (PA) levels, disordered eating behaviors, and poorer quality of life. PA levels were measured using SenseWear Armbands and assessed using the International Physical Activity Questionnaire. The acceptable weight loss group had an average of 431 minutes of moderate PA per week (61.5 minutes per day), while the non-significant weight regain group had 567 minutes per week (81.0 minutes per day). These results suggest that the current PA recommendations proposed by the American College of Sports Medicine to prevent weight regain may not be sufficient after RYGB [18].

Nymo *et al.* (2022) described a cohort of 75 patients who had undergone RYGB at least 10 years prior to the study. PA levels were assessed using SenseWear armbands over a 7-day period. This study also revealed a higher average metabolic equivalent of task (MET) and PA duration in the no weight regain (NWR) group compared with the weight regain (WR) group. Low PA levels is associated with poorer WL outcomes 10–15 years after RYGB [19].

Hernandez *et al.* (2020) evaluated 21 patients who had undergone LSG. After a 3-year follow-up, participants were randomly assigned to either an exercise group (EG, n = 11), which participated in a 5-month supervised exercise program, or a control group (CG, n = 10), which

received standard postoperative care. The exercise program lasted 20 weeks, divided into five 4-week blocks. The exercise program lasted 20 weeks and was divided into five 4-week blocks, during which physical activity was progressively increased. In the final fifth block, patients performed 24 minutes of resistance training, 70 minutes of endurance training (including 20 minutes of HIIT and 50 minutes of ACT), and 4 minutes of stretching exercises. Both groups reached their maximum weight loss during the first year after bariatric surgery, followed by significant weight regain by the end of the follow-up period. During the exercise program, measurements were performed at 37, 42 and 44 months after bariatric surgery. After the exercise program, patients in the EG showed a reduction in fat mass (-2.5 ± 2.6 kg), whereas patients in the CG showed increases in body weight (1.5 ± 1.3 kg) and fat mass (1.8 ± 0.9 kg) during the same period. Two months after the end of the program, EG showed an increase in body weight (1.1 ± 1.2 kg) and fat mass (2.6 ± 2.2 kg) compared with the values measured immediately after the exercise program. Overall, the results suggest that structured exercise is an effective strategy for limiting weight regain and reducing the recurrence of cardiometabolic risk several years after LSG [20].

Olsen *et al.* (2022) conducted a study involving 121 post-bariatric surgery patients, with 64 assigned to a control group receiving basic postoperative physical activity information and 57 to an intervention group receiving physiotherapist-led PA recommendations. Outcome measures included self-reported PA and exercise levels as well as sedentary time, along with weight and waist circumference, assessed preoperatively and at 2, 6, and 12 months after surgery. No differences were observed between groups over one year, except for higher PA in the intervention group at 6 months postoperatively (579 vs. 182 min/week), which was not maintained at later follow-ups. Patients in both groups exhibited a significant loss of body weight. [21].

Bonn *et al.* (2023) conducted a randomized controlled trial involving 146 patients after bariatric surgery, in which PA levels were objectively assessed using wrist-worn accelerometers. PA was measured at baseline before surgery and during postoperative follow-up visits at 18 weeks, 6 months, and 12 months. In this randomized controlled trial targeting physical activity after bariatric surgery, no clear overall effect of a smartphone application promoting increased activity was demonstrated. While the intervention showed potential effects on MVPA at 18 weeks and BMI at 18 weeks and 12 months, these findings were not reflected in significant differences between study groups [22].

Participants of a multicenter prospective cohort study who underwent RYGB surgery were followed annually for ≥ 7 years. Among 649 participants, the mean daily step count, the number of hours per day spent in sedentary behavior (SB), and the number of minutes per week of moderate-to-vigorous physical activity (MVPA) were assessed. PA was measured using the StepWatch™ 3 Activity Monitor, which was worn above the ankle. Among a large cohort of adults with severe obesity who underwent RYGB, higher daily step counts and lower SB duration were independently associated with greater sustained weight loss and reduced weight regain [23].

6. Postoperative physical activity recommendations after bariatric surgery

Regular physical activity is considered a fundamental component of long-term postoperative management after bariatric surgery. Although bariatric procedures such as LSG and RYGB provide substantial weight loss and metabolic improvement, surgery alone does not guarantee long-term maintenance of these benefits. Current guidelines emphasize that postoperative care should include structured lifestyle interventions, with physical activity counselling being an integral part of multidisciplinary follow-up [24].

The European Association for the Study of Obesity (EASO) recommends that physical activity should be progressively introduced after bariatric surgery according to individual recovery, functional capacity, and the presence of postoperative complications. Early postoperative management should focus on increasing daily mobility and reducing sedentary behaviour, primarily through walking and gradual increases in daily activity. After recovery, patients should be encouraged to achieve at least 150 minutes per week of moderate-intensity aerobic physical activity, with progression toward 300 minutes per week when feasible. In addition, resistance training should be incorporated approximately 2–3 times per week to preserve lean body mass, improve muscular strength, and counteract the loss of fat-free mass associated with rapid postoperative weight reduction [24,25].

PA recommendations should be individualized and adapted to the patient's baseline fitness level, obesity-related limitations, surgical procedure, nutritional status, and postoperative complications. Particular attention should be given to patients with low functional capacity or persistent weight regain, as these individuals may require supervised exercise programmes, behavioural counselling, and regular monitoring of activity levels. The integration of physiotherapists or exercise specialists into bariatric multidisciplinary teams may facilitate adherence and improve long-term outcomes [24,25].

The clinical relevance of these recommendations is supported by longitudinal studies demonstrating that higher levels of postoperative physical activity are associated with improved weight maintenance. Objective measurements of activity, including daily step count and moderate-to-vigorous physical activity, have been associated with greater sustained weight loss and reduced weight regain after RYGB [22]. Furthermore, exercise interventions performed several years after bariatric surgery have demonstrated beneficial effects on body composition, including reductions in fat mass and improvements in cardiometabolic risk factors, suggesting that structured exercise may represent an effective strategy for addressing postoperative weight recurrence after both RYGB and LSG [8,19].

Conclusions

Physical activity plays a critical role in long-term weight management following bariatric surgery. Higher levels of objectively measured PA, including increased daily step counts and greater engagement in moderate-to-vigorous activity, are associated with improved weight maintenance and reduced weight regain after RYGB and other bariatric procedures [18,19,20,23]. Conversely, low PA levels and prolonged sedentary behavior appear to be associated with poorer postoperative weight outcomes. Although structured exercise interventions and technology-based approaches demonstrate potential benefits, sustained behavioral changes remain difficult to achieve [18,23]. Future research should prioritize personalized, long-term PA strategies supported by objective monitoring to improve weight maintenance and optimize metabolic outcomes after bariatric surgery.

Discussion

Patients who underwent one of the two most commonly performed bariatric procedures, RYGB or LSG, demonstrated a tendency toward weight regain over time. The development of postoperative weight regain is a complex, multifactorial process influenced by poor dietary adherence, psychological determinants, and lifestyle-related factors, including physical activity levels [14,15,16]. These factors may collectively contribute to long-term weight maintenance or, conversely, the failure to sustain postoperative weight loss. In the present study, we focused specifically on the impact of physical activity on weight regain following bariatric surgery, as PA represents a potentially modifiable factor that may play a crucial role in optimizing long-term surgical outcomes. Among the analyzed studies, the findings regarding the impact of physical activity on weight regain after bariatric surgery appear to be inconsistent and, in some

cases, contradictory. On the one hand, several studies support recommendations promoting increased physical activity as an important component of postoperative weight management [18,19,20,23]. On the other hand, some investigations have reported no significant association between physical activity levels and weight outcomes, showing comparable body weight changes between physically active patients and those with a more sedentary lifestyle [21,22]. An important factor contributing to these discrepancies may be the methodology used for assessing and reporting physical activity levels. Differences between subjective self-reported measures and objective assessment methods may influence the interpretation of study results and contribute to variability in the observed associations between physical activity and postoperative weight regain. It has been demonstrated that the time spent on PA is overestimated when assessed using self-reported measures compared with objective measurement methods, highlighting the need for further studies employing objective approaches to assess physical activity levels [18,23].

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Conceptualization and Methodology: KK, KR

Investigation: WB, UZ, MR, AP

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Writing-rough preparation: KR, KK, JPe, NP, JPo

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References:

- [1] Bond, D. S., *et al.* (2025). Motivating increases in physical activity to prevent recurrence of weight gain after metabolic bariatric surgery: The Exercise Values of Life and Vitality Everyday (EVOLVE) trial. *Contemporary clinical trials*, 158, 108098. <https://doi.org/10.1016/j.cct.2025.108098>

- [2] Caballero B. (2019). Humans against Obesity: Who Will Win?. *Advances in nutrition* (Bethesda, Md.), 10(suppl_1), S4–S9. <https://doi.org/10.1093/advances/nmy055>

- [3] Pouwels, S., *et al.* (2015). Aspects of Exercise before or after Bariatric Surgery: A Systematic Review. *Obesity facts*, 8(2), 132–146. <https://doi.org/10.1159/000381201>

- [4] Piché, M. E., Tchernof, A., & Després, J. P. (2020). Obesity Phenotypes, Diabetes, and Cardiovascular Diseases. *Circulation research*, 126(11), 1477–1500. <https://doi.org/10.1161/CIRCRESAHA.120.316101>

- [5] Althumiri N. A., *et al.* (2024). A Systematic Review Exploring Dietary Behaviors, Psychological Determinants and Lifestyle Factors Associated with Weight Regain After Bariatric Surgery. *Healthcare* (Basel, Switzerland), 12(22), 2243. <https://doi.org/10.3390/healthcare12222243>

- [6] Di Lorenzo, N., *et al.* (2020). Clinical practice guidelines of the European Association for Endoscopic Surgery (EAES) on bariatric surgery: update 2020 endorsed by IFSO-EC, EASO and ESPCOP. *Surgical endoscopy*, 34(6), 2332–2358. <https://doi.org/10.1007/s00464-020-07555-y>

- [7] Peterli, R., *et al.* (2018). Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical Trial. *JAMA*, 319(3), 255–265. <https://doi.org/10.1001/jama.2017.20897>
- [8] Bellicha, A., *et al.* (2022). Effect of exercise training after bariatric surgery: A 5-year follow-up study of a randomized controlled trial. *PloS one*, 17(7), e0271561. <https://doi.org/10.1371/journal.pone.0271561>
- [9] Noria, S. F., *et al.* (2023). Weight Regain After Bariatric Surgery: Scope of the Problem, Causes, Prevention, and Treatment. *Current diabetes reports*, 23(3), 31–42. <https://doi.org/10.1007/s11892-023-01498-z>
- [10] Shilton H. (2025). Bariatric surgery. *Australian journal of general practice*, 54(4), 202–206. <https://doi.org/10.31128/AJGP-10-24-7432>
- [11] Mitchell, B. G., Collier, S. A., & Gupta, N. (2024). Roux-en-Y Gastric Bypass. In *StatPearls*. StatPearls Publishing. <https://pubmed.ncbi.nlm.nih.gov/31985950/> (Accessed 16 July 2026)
- [12] Garofalo, F., *et al.* (2018). Laparoscopic Sleeve Gastrectomy: A Radiological Guide to Common Postsurgical Failure. *Canadian Association of Radiologists journal = Journal l'Association canadienne des radiologistes*, 69(2), 184–196. <https://doi.org/10.1016/j.carj.2017.10.004>
- [13] Benaiges, D., *et al.* (2015). Laparoscopic sleeve gastrectomy: More than a restrictive bariatric surgery procedure?. *World journal of gastroenterology*, 21(41), 11804–11814. <https://doi.org/10.3748/wjg.v21.i41.11804>
- [14] Kaouk, L., *et al.* (2019). Modifiable factors associated with weight regain after bariatric surgery: a scoping review. *F1000Research*, 8, 615. <https://doi.org/10.12688/f1000research.18787.2>

- [15] Bastos, E. C., *et al.* (2013). Determinants of weight regain after bariatric surgery. *Arquivos brasileiros de cirurgia digestiva : ABCD = Brazilian archives of digestive surgery*, 26 Suppl 1, 26–32. <https://doi.org/10.1590/s0102-67202013000600007>
- [16] Althumiri, N. A., *et al.* (2024). A Systematic Review Exploring Dietary Behaviors, Psychological Determinants and Lifestyle Factors Associated with Weight Regain After Bariatric Surgery. *Healthcare (Basel, Switzerland)*, 12(22), 2243. <https://doi.org/10.3390/healthcare12222243>
- [17] King, W. C., *et al.* (2020). Patient Behaviors and Characteristics Related to Weight Regain After Roux-en-Y Gastric Bypass: A Multicenter Prospective Cohort Study. *Annals of surgery*, 272(6), 1044–1052. <https://doi.org/10.1097/SLA.0000000000003281>
- [18] Amundsen, T., Strømmen, M., & Martins, C. (2017). Suboptimal Weight Loss and Weight Regain after Gastric Bypass Surgery-Postoperative Status of Energy Intake, Eating Behavior, Physical Activity, and Psychometrics. *Obesity surgery*, 27(5), 1316–1323. <https://doi.org/10.1007/s11695-016-2475-7>
- [19] Nymo, S., *et al.* (2022). Diet and physical activity are associated with suboptimal weight loss and weight regain 10-15 years after Roux-en-Y gastric bypass: A cross-sectional study. *Obesity research & clinical practice*, 16(2), 163–169. <https://doi.org/10.1016/j.orcp.2022.03.006>
- [20] Marc-Hernández, A., *et al.* (2020). Effects of a High-Intensity Exercise Program on Weight Regain and Cardio-metabolic Profile after 3 Years of Bariatric Surgery: A Randomized Trial. *Scientific reports*, 10(1), 3123. <https://doi.org/10.1038/s41598-020-60044-z>
- [21] Fagevik Olsén, M., *et al.* (2022). Long-term effects of physical activity prescription after bariatric surgery: A randomized controlled trial. *Physiotherapy theory and practice*, 38(11), 1591–1601. <https://doi.org/10.1080/09593985.2021.1885087>
- [22] Bonn, S. E., *et al.* (2023). Effect of a Smartphone Application on Physical Activity and Weight Loss After Bariatric Surgery-Results from a Randomized Controlled Trial. *Obesity surgery*, 33(9), 2841–2850. <https://doi.org/10.1007/s11695-023-06753-6>

- [23] King, W. C., *et al.* (2022). Associations Between Physical Activity and Changes in Weight Across 7 Years After Roux-en-Y Gastric Bypass Surgery: A Multicenter Prospective Cohort Study. *Annals of surgery*, 275(4), 718–726. <https://doi.org/10.1097/SLA.0000000000004456>
- [24] Busetto, L., *et al.* (2017). Practical Recommendations of the Obesity Management Task Force of the European Association for the Study of Obesity for the Post-Bariatric Surgery Medical Management. *Obesity facts*, 10(6), 597–632. <https://doi.org/10.1159/000481825>
- [25] King, W. C., & Bond, D. S. (2013). The importance of preoperative and postoperative physical activity counseling in bariatric surgery. *Exercise and sport sciences reviews*, 41(1), 26–35. <https://doi.org/10.1097/JES.0b013e31826444e0>