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Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

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TRENDS IN OBESITY TREATMENT: A REVIEW OF THE LITERATURE FROM THE LAST SIX YEARS

Adam Sobiński *[AS] (Corresponding Author, Email: a.sobinski25@gmail.com)*
MEDAR Private Healthcare Facility in Leczyca, Kilinskiego 4, 99-100 Leczyca, Poland
ORCID ID: 0009-0003-3063-5621

Aleksandra Sadowska *[AS]*
J. Mikulicz-Radecki University Clinical Hospital in Wrocław, Borowska 213, 50-556 Wrocław, Poland
ORCID ID: 0009-0006-6458-1264

Aleksandra Welkier *[AW]*
Corten Dental Ltd. in Warsaw, Cybernetyki 19B, 02-677 Warszawa, Poland
ORCID ID: 0000-0003-3552-6726

Joanna Miśkiewicz *[JM]*
Regional Specialist Hospital in Kielce, Grunwaldzka 45, 25-736 Kielce, Poland
ORCID ID: 0009-0002-3300-940X

Aleksandra Dudek *[AD]*
Jan Biziel University Hospital No. 2 in Bydgoszcz, Kornela Ujejskiego 75, 85-168 Bydgoszcz, Poland
ORCID ID: 0009-0000-2547-3574

Patrycja Pietrusińska *[PP]*
Medical University of Silesia in Katowice, Mickiewicza 29, 40-085 Katowice, Poland
ORCID ID: 0009-0008-0722-4396

Jakub Moder *[JM]*
Warsaw South Hospital, Rotmistrza Witolda Pileckiego 99, 02-781 Warszawa, Poland
ORCID ID: 0009-0006-7747-6623

Anna Dziewierz *[AD]*
Mazowieckie Dental Center Ltd. in Warsaw, Nowy Zjazd 1, 00-301 Warszawa, Poland
ORCID ID: 0009-0006-5632-0427

Paula Kwaśniewska *[PK]*
Szpakmed Kochłowice in Ruda Śląska, ul. Radoszowska 163, 41-707 Ruda Śląska, Poland
ORCID ID: 0009-0007-2576-7573

Patrycja Śliwa-Tytko *[PŚT]*
Medical University of Lublin, Aleje Racławickie 1, 20-059 Lublin, Poland
ORCID ID: 0009-0005-5417-4924

ABSTRACT

Introduction: Obesity is a major health and economic issue, increasing the risk of type 2 diabetes, hypertension, and cardiovascular diseases. This review analyzes recent advances in
obesity treatment, focusing on pharmacotherapy, surgical techniques, minimally invasive methods, and psychotherapy.
Materials and Methods: This review included publications from 2018 to 2024 available in the PubMed and Google Scholar databases. The analysis focused on the efficacy and safety of various therapeutic interventions, including modern pharmacological agents, surgical procedures, the use of intragastric balloons, and psychotherapies such as Cognitive Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT).
Results: New pharmacotherapies, such as semaglutide and tirzepatide, lead to 15–25% weight loss. Surgical techniques like Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG) achieve 27–69% excess weight loss (EWL). Intragastric balloons provide a temporary 12–25% EWL. CBT effectively supports weight loss, enhances quality of life, and promotes long-term behavioral changes.
Conclusions: In conclusion, optimal obesity management requires a multifaceted approach that considers the patient's health status, comorbid conditions, and capacity for lasting lifestyle changes. The integration of pharmacological and surgical interventions with psychotherapeutic methods such as CBT and ACT allows for a more holistic approach to addressing this complex health issue. Future research should focus on the long-term effectiveness of these methods and their synergy, which could contribute to the development of more personalized and effective treatment strategies.

KEYWORDS

Obesity, GLP-1, Semaglutide, Sleeve Gastrectomy, Gastric Bypass, Psychotherapy

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Introduction

Obesity is one of the most significant health challenges of the modern world, affecting 890 million adults and over 160 milion children globally (1). According to the World Health Organization (WHO), it is prevalence continues to rise, having doubled since 1990, further increasing the burden on healthcare systems. (1) Obesity is recognized as a chronić disease with a complex interplay of genetic, enviromental, behavioral and metabolic factors.

This issue extends beyond excessive weight gain, representing a major risk factor for numerous diseases, including type 2 diabetes, hypertension, cardiovascular conditions, and certain cancers. It is projected that by 2030, the costs associated with treating obesity-related diseases will reach $3 trillion USD and exceed $18 trillion USD by 2060 (2), making this condition both a medical and economic challenge.

In response to the growing prevalence of obesity, new treatment strategies are being developed, encompassing pharmacotherapy, surgical interventions, and psychotherapy. Despite advancements in this field, significant gaps remain in knowledge regarding the efficacy, accessibility, and long-term outcomes of various treatment modalities.

The aim of this review is to present current trends in obesity treatment based on articles published in the last six years. This study focuses on new advancements in pharmacotherapy, established surgical techniques, minimally invasive methods, and psychotherapy, offering a comprehensive perspective on the possibilities and challenges of contemporary approaches to this condition.

Methodology

The literature review was conducted based on scientific articles retrieved from the PubMed and Google Scholar databases, recognized for their extensive repository of high-quality academic publications. The scope of the search was restricted to articles published within the last six years (2018–2024) to ensure that the data presented reflects the most recent advancements and current trends in the field of obesity treatment. This time frame was selected to highlight innovations in therapeutic approaches and address the evolving understanding of obesity as a complex medical condition. The review focused exclusively on peer-reviewed publications in English and Polish to maintain a high standard of evidence and relevance. The inclusion criteria encompassed studies discussing pharmacological, surgical, and psychotherapeutic interventions for obesity. Particular emphasis was placed on assessing the effectiveness, safety, and long-term outcomes of these approaches. The selection process employed targeted keyword searches to identify pertinent literature. Key phrases such as "obesity pharmacotherapy," "bariatric surgery trends," "intragastric balloon," and "psychotherapy" were used to filter the results and ensure that only relevant studies addressing these specific aspects of obesity treatment were included. This strategy facilitated a comprehensive exploration of diverse treatment modalities, providing a robust foundation for analyzing both established methods and emerging innovations.

Pharmacological Therapies

Medication currently in use

Semaglutide

Semaglutide is an analog of human glucagon-like peptide-1 (GLP-1), with a molecular structure that is 94% homologous to the native GLP-1 molecule (3). his drug was approved by the FDA in 2021 for the treatment of obesity at a dose of 2.4 mg in injectable form (4) due to its demonstrated efficacy in achieving significant weight reduction, averaging approximately 15% of baseline body weight (5). The mechanism of action of semaglutide involves both peripheral

and central effects, making it a versatile tool in obesity management. In the central nervous system, semaglutide primarily acts on GLP-1 receptors located in the hypothalamus. Its primary effects include the direct stimulation of proopiomelanocortin (POMC) neurons and cocaine-amphetamine-regulated transcript (CART) neurons (6) as well as the indirect inhibition of neuropeptide Y (NPY) and agouti-related peptide (AgRP) neurons. These actions lead to enhanced satiety and a significant reduction in hunger perception (6).

Clinical trials have confirmed the efficacy of semaglutide in promoting weight loss. In the STEP 1 trial, which lasted 68 weeks, 1,961 adult participants with obesity (BMI ≥30 kg/m²) and at least one weight-related comorbidity but without diabetes were enrolled. Participants received either 2.4 mg of semaglutide administered subcutaneously once weekly or a placebo. Those treated with semaglutide achieved an average weight reduction of 14.9%, compared to 2.4% in the placebo group. The difference between the groups was 12.4% (95% CI: -13.4 to -11.5; $p < 0.001$) (7).

The STEP 3 trial, also conducted over 68 weeks, involved 611 participants with overweight or obesity. This study focused on evaluating the effects of semaglutide at a dose of 2.4 mg administered subcutaneously in combination with intensive behavioral therapy, including dietary and physical interventions. The participants receiving semaglutide achieved an average weight reduction of 16.0%, compared to 5.7% in the placebo group. The difference between the groups was 10.3% (95% CI: -12.0 to -8.6; $p < 0.001$) (8).

These findings underscore semaglutide's potential as a highly effective pharmacological option for the treatment of obesity, especially when combined with behavioral modifications. By leveraging its multifaceted mechanism of action, semaglutide not only addresses appetite regulation but also enhances adherence to lifestyle interventions, offering a promising approach to long-term weight management.

Tirzepatide

Tirzepatide is a novel compound that received FDA approval in 2022 for the treatment of type 2 diabetes (9) and is currently under investigation as a potential therapy for obesity. This medication is the first polypeptide to act as both a glucagon-like peptide-1 (GLP-1) receptor agonist and a glucose-dependent insulinotropic polypeptide (GIP) receptor agonist (9,10). The dual activation of GLP-1 and GIP receptors has a multifaceted mechanism of action, including delayed gastric emptying, suppression of glucagon secretion (11), enhanced insulin sensitivity in peripheral tissues, and improved lipid metabolism, thereby reducing fat accumulation (12).

The efficacy of tirzepatide has been demonstrated in several pivotal trials. The SURMOUNT-1 on weight reduction over 72 weeks. This trial included 2,539 adults without diabetes who had a BMI ≥30 kg/m²

or ≥27 kg/m² with at least one weight-related comorbidity. Participants were randomized to receive tirzepatide subcutaneously at doses of 5 mg, 10 mg, or 15 mg weekly or a placebo in a double-blind fashion. The results showed dose-dependent weight loss: an average reduction of 15.0% for 5 mg, 19.5% for 10 mg, 20.9% for 15 mg, and 3.1% in the placebo group. (11,13)

In April 2023, the results of the SURMOUNT-2 trial, also conducted over 72 weeks, were published. This trial involved 1,514 adult participants from seven countries with a BMI ≥27 kg/m² and glycated hemoglobin (HbA1c) levels between 7% and 10%. Participants were randomized in a 1:1:1 ratio to receive tirzepatide at 10 mg or 15 mg or a placebo. The average weight reduction was 12.8% for the 10 mg dose, 14.7% for the 15 mg dose, and 3.2% for the placebo. Notably, 79-83% of participants in the tirzepatide groups achieved at least a 5% reduction in body weight, compared to only 32% in the placebo group. (14)

The SURMOUNT-3 trial, published on October 15, 2023, evaluated the efficacy and safety of tirzepatide in maintaining and further enhancing weight loss among individuals with overweight (BMI ≥27 kg/m²) or obesity (BMI ≥30 kg/m²) with at least one obesity-related comorbidity, excluding diabetes. Participants who had already achieved a ≥5% weight loss following a 12-week intensive lifestyle intervention were included. This trial enrolled 579 individuals with a mean baseline weight of 109.5 kg and an average BMI of 38.6 kg/m². Participants were randomized to receive tirzepatide at 10 mg, 15 mg, or placebo weekly for 72 weeks. The results demonstrated that tirzepatide significantly outperformed placebo, with average weight reductions of 18.4% and 2.5%, respectively. Furthermore, 87.5% of participants on tirzepatide achieved an additional weight loss of ≥5%, compared to 16.5% in the placebo group. More ambitious thresholds, such as ≥10%, ≥15%, and ≥20% weight loss, were also more frequently reached in the tirzepatide groups. Importantly, tirzepatide enabled participants to sustain earlier weight reductions, with 94% maintaining ≥80% of their initial weight loss, compared to 43.8% in the placebo group. (15)

The SURMOUNT-4 trial aimed to assess the long-term efficacy and safety of tirzepatide in maintaining weight loss. This study involved 783 participants with a BMI ≥30 kg/m² or ≥27 kg/m² with at least one weight-related comorbidity, excluding diabetes. The first phase of the trial was an open-label, 36-week period during which participants received titrated doses of tirzepatide up to 10 mg or 15 mg weekly. During this phase, the average weight reduction was 20.9%. The second phase was a double-blind, 52-week period in which 670 participants were randomized to continue tirzepatide treatment or switch to placebo. Continued tirzepatide use resulted in an additional 5.5% weight loss, whereas the placebo group regained 14% of the previously lost weight. Over the entire study period, the tirzepatide group achieved a total weight reduction of 25.3%, compared to 9.9% in the placebo group. Moreover, 89.5% of tirzepatide users maintained at least 80% of their initial weight loss, compared to only 16.6% in the placebo group. These findings emphasize the importance of sustained tirzepatide therapy for long-term weight management, as discontinuation is associated with significant weight regain. (16)

Tirzepatide represents a promising advancement in obesity pharmacotherapy, leveraging its dual agonistic mechanism to deliver substantial weight reductions and improve metabolic outcomes. Its efficacy, especially in combination with lifestyle modifications, positions it as a cornerstone in the future of obesity treatment strategies. Further studies are warranted to explore its long-term safety and broader applicability in diverse patient populations.

Emerging Therapies in Clinical Trials

Retratutide

Retratutide, also known as LY3437943, is a novel therapeutic agent designed to act as an agonist of three key hormonal receptors: GLP-1, GIP, and glucagon (17). This unique triple-receptor agonism targets multiple pathways implicated in obesity, with the aim of achieving substantial weight reduction through comprehensive metabolic regulation. By concurrently engaging these receptors, retratutide enhances satiety, regulates energy expenditure, and promotes weight loss.

In 2023, the New England Journal of Medicine published the results of a 48-week, randomized, double-blind, placebo-controlled Phase 2 trial that evaluated the efficacy and safety of retratutide in adults with obesity (BMI ≥30 kg/m²) or overweight (BMI ≥27 kg/m²) with at least one weight-related comorbidity, excluding individuals with diabetes (17). The trial enrolled 338 participants, who were randomly assigned to receive weekly subcutaneous injections of retratutide at doses of 1 mg, 4 mg, 8 mg, or 12 mg, or a placebo, for the duration of the study (17). The findings demonstrated a dose-dependent reduction in body weight, with the highest weight loss observed in participants receiving the 12 mg dose. This group achieved an average weight reduction of 24.2% of baseline body weight, compared to 22.8% for the 8 mg dose, 17.1% for the 4 mg dose,

8.7% for the 1 mg dose, and 2.1% in the placebo group (17). These results highlight retratutide's potential as a highly effective pharmacological intervention for obesity. Adverse events were generally mild to moderate in severity, with the most common being gastrointestinal symptoms, including nausea, diarrhea, and constipation (17). Additionally, transient elevations in liver enzymes were observed during the dose-escalation phase but returned to baseline levels after stabilization (17). The safety profile indicates that while retratutide is well-tolerated, close monitoring is necessary during treatment to mitigate potential risks. Retratutide's promising results underscore its therapeutic potential in obesity management, particularly in achieving clinically significant weight reductions. However, further research is warranted to evaluate its long-term efficacy and safety. Currently, Phase 3 clinical trials are underway to address these critical aspects and to better define the clinical utility of retratutide across diverse patient populations. (18–21)

Orforglipron

Orforglipron is an oral, non-peptide agonist of the glucagon-like peptide-1 (GLP-1) receptor, developed as a potential treatment for obesity and type 2 diabetes (22). A distinguishing feature of this agent compared to other GLP-1 receptor agonists is its tablet formulation, which significantly enhances convenience and accessibility for patients. (22)

A study published in The New England Journal of Medicine in September 2023 evaluated the efficacy and safety of orforglipron over 36 weeks in 272 adults with obesity (BMI ≥30 kg/m²) or overweight (BMI 27–30 kg/m²) and at least one weight-related comorbidity, excluding those with diabetes. Participants were randomized to receive daily doses of orforglipron at 12 mg, 24 mg, 36 mg, or 45 mg, or a placebo. (22) By week 26, the weight reduction ranged from 8.6% for the 12 mg dose to 12.6% for the 45 mg dose, compared to a 2% reduction in the placebo group. By week 36, the weight loss further increased to 9.4–14.7% in the orforglipron groups, compared to 2.3% in the placebo group. (22)

Moreover, significant thresholds of weight loss were achieved more frequently in the orforglipron groups. Weight loss of ≥10% was observed in 46–75% of participants receiving orforglipron, compared to 9% in the placebo group, while ≥15% weight loss was achieved by 22–48% in the orforglipron groups, compared to only 1% in the placebo group (22) The most common adverse effects were mild to moderate gastrointestinal symptoms, including nausea, vomiting, and diarrhea. Serious adverse events were rare and did not differ significantly between the treatment and placebo groups. (22)

Another study, published in The Lancet, investigated orforglipron in 383 participants with type 2 diabetes, a BMI ≥23 kg/m², and glycated hemoglobin (HbA1c) levels between 7% and 10.5% (23). Participants were randomized to receive various doses of orforglipron (3 mg, 12 mg, 24 mg, 36 mg, or 45 mg), a placebo, or dulaglutide (1.5 mg weekly) (23). The study revealed a weight reduction of 10.1 kg in participants receiving orforglipron, surpassing both placebo (-2.2 kg) and dulaglutide (-3.9 kg). Additionally, the efficacy of orforglipron in reducing both body weight and HbA1c levels was dose-dependent, highlighting its therapeutic potential (23). These findings underscore orforglipron's promise as a novel pharmacological option for both obesity and type 2 diabetes management. Its oral administration offers a significant advantage in patient compliance, positioning it as a practical alternative to injectable GLP-1 receptor agonists. However, further Phase 3 studies are necessary to confirm the long-term benefits, safety, and broader applicability of this agent. (24,25)

With its unique formulation and robust efficacy profile, orforglipron has the potential to address some of the limitations associated with existing GLP-1 receptor agonists. Continued research will be critical in validating its role as a transformative therapy in the landscape of obesity and metabolic disease management.

Advantages and Challenges of New Medications

Retratutide and orforglipron represent significant advancements in pharmacological strategies for obesity management, demonstrating substantial efficacy in weight reduction and metabolic improvements. These therapies address critical gaps in the current treatment landscape and offer promising solutions for this complex condition. Retratutide is characterized by its unique triple-receptor agonist mechanism, targeting GLP-1, GIP, and glucagon receptors. This multi-faceted approach enables comprehensive metabolic regulation, contributing to notable reductions in body weight and improvements in energy homeostasis. Orforglipron, by contrast, introduces a key innovation with its oral tablet formulation, distinguishing it from injectable GLP-1 receptor agonists. This method of administration enhances patient convenience and adherence, making it a practical option for broader populations, including individuals less inclined toward injectable therapies.

While these agents exhibit considerable promise, certain challenges remain that must be addressed through further research. The safety profiles of retratutide and orforglipron, although favorable in initial studies, require long-term evaluation to confirm their safety over extended use. Adverse events, particularly gastrointestinal symptoms such as nausea, vomiting, and diarrhea, were commonly reported, underscoring the need for improved management of side effects. Additionally, transient elevations in liver enzymes observed with retratutide emphasize the necessity of close monitoring during treatment. Another challenge lies in the limited availability of long-term data, which leaves questions about the durability of their effects and their performance across diverse patient populations. Variability in individual responses further highlights the importance of developing personalized dosing regimens to optimize outcomes.

Cost and accessibility also pose potential barriers to the widespread adoption of these therapies. Ensuring affordability and equitable access, particularly in resource-constrained settings, will be critical for maximizing their impact. Nonetheless, retratutide and orforglipron represent a new frontier in obesity pharmacotherapy, offering innovative mechanisms and delivery methods that could significantly improve outcomes for patients. Addressing the existing challenges through further research will be essential for integrating these therapies into clinical practice and realizing their full potential as transformative options in the management of obesity.

Surgical Therapies

Currently utilized techniques

Roux – en-Y Gastric Bypass (RYGB)

Roux-en-Y Gastric Bypass (RYGB) is a combined surgical technique that incorporates both restrictive and malabsorptive elements, effectively improving glycemic control and addressing obesity-related metabolic imbalances (26). The mechanism of action in RYGB is multifaceted, starting with the mechanical restriction of stomach size. This involves reducing the stomach to a small pouch, which limits the amount of food that can be consumed, leading to a significant reduction in caloric intake (27). Furthermore, the bypassing of a portion of the jejunum reduces the absorption of nutrients, including sugars and fats, thereby contributing to the weight loss effects of the procedure. Additionally, the exclusion of the gastric fundus decreases the production of ghrelin, a hormone that stimulates appetite, further supporting weight management and appetite regulation (27). Beyond its restrictive and malabsorptive effects, RYGB enhances satiety and glycemic control through hormonal changes. The procedure stimulates the release of peptide YY (PYY) from the distal small intestine, a hormone associated with increased feelings of fullness. It also elevates incretin levels, which play a vital role in improving glycemic regulation and optimizing metabolic processes (27). These hormonal shifts are pivotal in addressing the metabolic complications often accompanying obesity.

The long-term outcomes of RYGB are well-documented. The procedure has been shown to result in an excess weight loss (EWL) ranging from 27% to 69% at 10 years postoperatively, making it one of the most effective surgical interventions for sustained weight management (28). For patients with type 2 diabetes, the benefits are particularly pronounced, with remission rates reported between 25% and 62% a decade after surgery (28). Additionally, large-scale database analyses have revealed a 33% reduction in cancer risk among individuals who have undergone RYGB compared to obese patients who did not undergo surgery. Specifically, the incidence of cancer decreased from 9.0 cases per 1,000 person-years in non-surgical patients to 5.6 cases per 1,000 person-years in those who underwent RYGB (28).

RYGB not only offers substantial and sustained weight loss but also provides significant metabolic and oncological benefits. However, as with any surgical intervention, patient selection and postoperative management are critical to optimizing outcomes and minimizing potential risks. The procedure continues to stand as a cornerstone in the surgical treatment of severe obesity and its associated complications.

Sleeve Gastrectomy (SG)

Sleeve gastrectomy (SG) involves the surgical removal of approximately 80–90% of the stomach, creating a smaller, sleeve-shaped stomach along a calibration tube, typically with a diameter of 1.2–1.5 cm. The excised portion of the stomach is permanently removed (28). This procedure has become the most commonly performed bariatric surgery worldwide, particularly for patients with a body mass index (BMI) of 40 kg/m² or higher, or a BMI of 35 kg/m² or higher in cases where obesity-related comorbidities are present. (29)

Short - term outcomes, observed over 1–3 years following the procedure, demonstrate excellent effectiveness. Excess weight loss (%EWL) has been reported to range between 70% and 80% within two years postoperatively, establishing SG as a highly effective intervention for initial weight management. (29)

Mid-term outcomes, spanning 4–7 years, are less consistent. Some studies report modest weight regain compared to the minimal weight observed in the short-term period. (29) For instance, three studies with relatively small sample sizes (26–68 patients) demonstrated %EWL ranging from 55% to 57% at five years post-surgery (29). In contrast, larger studies involving 96 and 130 participants reported %EWL of 40% and 45%, respectively, at the same time point (29). These variations highlight the potential for weight regain over time, particularly in larger and more diverse patient populations.

Sleeve gastrectomy remains a cornerstone of bariatric surgery due to its efficacy and relative simplicity compared to other surgical techniques. By significantly reducing stomach volume, SG limits food intake and impacts hormonal pathways associated with appetite and satiety, leading to meaningful weight loss. However, the variability in mid-term results underscores the importance of long-term follow-up and the incorporation of lifestyle and behavioral changes to sustain weight loss. Further research is necessary to better understand the factors influencing long-term outcomes and to optimize the effectiveness of SG for a wide range of patients.

LRYGB vs LSG

The SLEEVEPASS study enrolled 240 patients with severe obesity, aged 18 to 60 years, who were randomly assigned to undergo either laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LRYGB). Patients were followed for a period of seven years to evaluate long-term outcomes (30).

The mean percentage of excess weight loss (%EWL) after seven years was 47% (95% CI, 43%-50%) in the LSG group and 55% (95% CI, 52%-59%) in the LRYGB group, resulting in a difference of 8.7 percentage points (95% CI, 3.5-13.9) favoring LRYGB (30). Quality of life outcomes, as measured by the Diabetes Surgery Quality of Life (DSQoL) score, were comparable between the two groups. The mean DSQoL score after seven years was 0.50 ± 1.14 for LSG and 0.49 ± 1.06 for LRYGB ($P = 0.63$). Similarly, the median Health-Related Quality of Life (HRQoL) score was 0.88 (IQR, 0.78-0.95) for LSG and 0.87 (IQR, 0.78-0.95) for LRYGB ($P = 0.37$). Importantly, greater weight loss was positively correlated with higher DSQoL scores ($r = 0.26$; $P < 0.001$), highlighting the association between weight reduction and improved quality of life (30). The overall rate of complications was comparable between the two groups, with 24.0% (29 out of 121 patients) in the LSG group and 28.6% (34 out of 119 patients) in the LRYGB group ($P = 0.42$) (30). Although LRYGB resulted in greater weight loss compared to LSG after seven years, both procedures were effective in improving quality of life. The incidence of complications was similar, suggesting that the choice of procedure should be tailored to the individual needs and clinical profile of each patient. (30)

These findings underscore the efficacy of both LSG and LRYGB in managing severe obesity and improving patient-reported outcomes over the long term. While LRYGB may offer slightly greater weight reduction, the comparable quality of life improvements and similar complication rates suggest that both procedures have their merits. The decision between LSG and LRYGB should be guided by patient preferences, comorbidities, and surgical risk profiles, ensuring a personalized approach to bariatric surgery.

Modern surgical techniques

Obalon Balloon Technique

The Obalon system is the first FDA-approved balloon technique specifically designed for weight loss. It is intended for patients with a BMI ranging between 30 and 40 kg/m², to be used in conjunction with dietary modifications and exercise (31). The Obalon balloon is encased in a gelatin capsule attached to a small catheter (31). Fluoroscopy is used to confirm the balloon's placement in the stomach. Once the capsule is ingested, the gelatin dissolves, and the catheter is utilized to inflate the balloon with gas from a canister. After the inflation procedure, the catheter is removed, and the balloon is designed to remain in place for six months before removal (31).

One advantage of this technique is its adaptability to individual patient needs, as up to three balloons can be inserted simultaneously, collectively occupying approximately 750 mL of gastric volume (31). This customization allows for tailored treatment based on the patient's weight loss goals and tolerance.

A study published in 2018 evaluated the efficacy of the Obalon system in a double-blind trial comparing weight loss achieved through the use of Obalon balloons in combination with lifestyle changes to weight loss achieved with lifestyle changes alone over a six-month period (32). The study found that weight loss in the lifestyle-only group was approximately half of that observed in the group combining lifestyle modifications with the Obalon therapy. (32)

The Obalon system demonstrates promising potential as an adjunctive treatment for weight loss, particularly when combined with lifestyle interventions. Its minimally invasive nature and the ability to customize therapy make it an appealing option for patients within the specified BMI range. Further research is needed to evaluate its long-term effectiveness and its role in the broader landscape of obesity management.

Orbera Balloon Technique

The Orbera system involves the placement of a flexible silicone balloon into the stomach via a guidewire. The correct positioning of the Orbera balloon is confirmed using an endoscope (31). Once in place, the balloon is inflated with 450–700 mL of saline, to which methylene blue is added as a safety indicator. In the event of a balloon rupture, methylene blue is absorbed systemically, causing a noticeable change in the color of the patient's urine to blue (31).

According to a meta-analysis of 17 studies, the percentage of excess weight loss (%EWL) after one year was 25.44%, while the total body weight loss (%TBWL) was 12.3%, 13.16%, and 11.27% at 3, 6, and 12 months post-implantation, respectively (31).

In a multicenter, randomized, open-label clinical trial involving 255 adults with a BMI between 30 and 40 kg/m², outcomes were evaluated over a 12-month period (31). his study compared weight loss in the Orbera balloon group combined with lifestyle modifications (n=125) to a control group that relied solely on lifestyle changes (n=130) (31). The balloons were removed after six months, but lifestyle interventions continued in both groups for the full 12 months. At six months, weight loss in the balloon group was -10.2% (-9.9 kg, $P < 0.001$) compared to -3.3% (-3.2 kg) in the control group. At nine months, the results were -9.1% (-8.8 kg, $P < 0.001$) versus -3.4% (-3.2 kg), and at 12 months, -7.6% (-7.4 kg, $P < 0.001$) compared to -3.1% (-2.9 kg) (31).

The authors concluded that the Orbera gastric balloon was significantly more effective in promoting weight loss than lifestyle modification alone. However, the study did not include long-term follow-up to assess the impact of this therapy on hyperlipidemia, diabetes, or cardiovascular risk. (31)

The Orbera balloon system offers a minimally invasive approach to weight management, with robust short-term outcomes when combined with lifestyle changes. While it is effective in achieving weight loss, further studies are necessary to evaluate its long-term effects on metabolic parameters and overall health outcomes.

The ReShape Duo Balloon System

The ReShape Duo system consists of two interconnected balloons linked by a flexible tube. Each balloon is filled with approximately 450 mL of saline mixed with methylene blue (31). An innovative feature of this system is its ability to remain partially functional if one balloon deflates, as the other can continue to operate independently (31). The mechanism of action is similar to other gastric balloon systems, limiting food intake and promoting a feeling of satiety.

A multicenter, randomized, controlled Phase III clinical trial, REDUCE, evaluated the efficacy and safety of the ReShape Duo system. The study included 326 participants with a BMI between 30 and 40 kg/m². The intervention group received the ReShape Duo balloon in combination with dietary modifications and physical exercise, while the control group underwent sham endoscopy along with diet and exercise alone (31). Over a 24-week period, patients in the balloon group achieved significantly greater weight loss compared to the control group. The mean percentage of excess weight loss (%EWL) was 25.1% in the intent-to-treat (ITT) analysis and 27.9% in completed cases (CC, n=167) for the balloon group, compared to 11.3% (ITT, $P = 0.004$) and 12.3% (CC, n=126) in the lifestyle-only group (31). The %EWL observed in the balloon group was nearly double that achieved through lifestyle modification alone. Additionally, the system was associated with a relatively low rate of adverse events, including balloon deflation and gastric ulcers. However, during the initial phase of the study, a high frequency of gastric erosions and ulcers (39%) was reported, predominantly in the region of the gastric incisura. Following modifications to the balloon design, this rate significantly decreased to 10.3% (31).

Psychological therapies

Interdisciplinary Cognitive - Behavioral Therapy (IT + CBT)

This therapy represents a novel approach to obesity management, combining traditional strategies such as goal setting, impulse control, and problem-solving with specific cognitive strategies and procedures (33). The primary aim is to help patients not only achieve healthy weight loss but also maintain their progress over time and adopt sustainable lifestyle habits to support long-term weight management.

A study published in 2021 analyzed and compared three different treatment modalities for their impact on anthropometric measures, eating behaviors, anxiety and depression levels, and quality of life in adults with obesity (34). Interdisciplinary cognitive-behavioral therapy (IT+CBT) demonstrated superior results compared to the other approaches. The 30-week study involved 43 participants aged 30–50 years with a BMI of 30–39.9 kg/m². Participants had no obesity-related comorbidities, were not receiving pharmacological treatment for

obesity, and had no psychiatric disorders. They were divided into three groups: a health education group (EH, n=12), a physical exercise group (PE, n=13), and an interdisciplinary therapy group combined with cognitive-behavioral therapy (IT+CBT, n=18) (34).

The IT+CBT group achieved a mean weight loss of 3.06 kg, surpassing the EH and PE groups, which achieved weight losses of 2.74 kg and 1.43 kg, respectively. Additionally, BMI decreased by 1.45 kg/m² in the IT+CBT group, compared to reductions of 1.04 kg/m² in the EH group and 0.51 kg/m² in the PE group. Fat mass reduction was also greater in the IT+CBT group, with a decrease of 2.34 kg compared to 1.37 kg in the EH group and 0.20 kg in the PE group (34).

In terms of quality of life, participants in the IT+CBT group showed improvements across all domains. Physical quality of life increased by 1.70 points, psychological by 1.24 points, social by 1.80 points, and environmental by 1.19 points. These improvements were more pronounced than in the other groups, especially the PE group, which demonstrated the smallest changes. Psychologically, the IT+CBT group experienced a reduction in anxiety symptoms by 4.41 points (though this was not statistically significant) and a significant decrease in depression scores by 10.13 points, compared to reductions of 4.90 points in the PE group and 4.12 points in the EH group (34).

In terms of eating behaviors, the IT+CBT group showed a significant reduction in emotional eating by 4.22 points, compared to 1.92 points in the EH group and 2.03 points in the PE group. External eating decreased by 2.55 points in the IT+CBT group, compared to 1.37 points in the EH group and 1.27 points in the PE group. The total DEBQ score decreased by 8.39 points in the IT+CBT group, compared to reductions of 4.50 points in the EH group and 4.97 points in the PE group. (34)

Compared to the EH and PE groups, changes observed in the IT+CBT group were significantly greater, particularly in the domains of emotional eating, external eating, and total DEBQ scores. The IT+CBT group demonstrated more substantial and positive changes in modifying unhealthy eating habits. The findings of this study clearly indicate the high efficacy of IT+CBT in obesity treatment, both in terms of weight reduction and improvements in quality of life and mental health.

Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment Therapy (ACT) is a behavioral therapeutic approach grounded in functional contextualism (35) and relational frame theory (36). The central premise of ACT posits that psychological suffering arises from psychological inflexibility. The therapy aims to cultivate psychological flexibility by teaching individuals to experience the present moment fully and to align their behaviors with their personal values. (37)

One of the most comprehensive systematic reviews on the efficacy of ACT in the context of overweight and obesity treatment, as well as mental health improvement, was published in Clinical Psychology and Psychotherapy in 2021 (38). his review analyzed eight studies focused on the effectiveness of ACT in weight loss and two studies examining its impact on mental well-being. The findings indicated limited efficacy of ACT in achieving long-term weight reduction (38). Most studies did not demonstrate significant differences between groups employing ACT and control groups (38). Furthermore, ACT showed no substantial impact on physical health variables or eating-related outcomes in studies focused on these aspects, as seen in research such as Afari et al., 2019. However, ACT may support the development of healthier eating habits and reduce unhealthy patterns in certain patient groups (38).

While ACT shows promise in improving psychological well-being in individuals with overweight or obesity, several important limitations of the therapy must be considered. First, there is a limited number of randomized controlled trials (RCTs), which are considered the gold standard in clinical research. This lack of high-quality studies complicates the ability to draw definitive conclusions about the efficacy of ACT in obesity treatment. Additionally, discrepancies in study outcomes may be attributed to methodological differences across studies, contributing to variability in results. (38)

Another limitation is that many studies primarily focus on interventions aimed at weight reduction, potentially overlooking ACT's full potential in enhancing psychological well-being. As a result, some studies may fail to adequately assess ACT’s core focus on increasing psychological flexibility and acceptance, which could lead to less precise findings. (38)

Furthermore, some studies have a high risk of bias, which can impact the quality and interpretation of results. These limitations also complicate the evaluation of ACT's effectiveness in long-term obesity management, particularly in terms of weight stabilization and lasting behavioral changes. (38)

In summary, while ACT holds promise in addressing certain psychological dimensions of obesity and supporting healthier behaviors, further high-quality, methodologically rigorous studies are needed to fully understand its potential and limitations in both the physical and mental health domains.

Conclusions

Effective obesity treatment requires a comprehensive approach that integrates diverse strategies, including surgical, pharmacological, and psychological interventions. Bariatric procedures, such as sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB), remain among the most effective methods for achieving long-term weight reduction. These procedures provide significant benefits in terms of excess weight loss, improvements in metabolic parameters, and enhanced quality of life. However, due to their invasive nature and associated risks, such as nutritional deficiencies, they are primarily reserved for patients with high BMI or severe obesity-related complications.

Less invasive alternatives include gastric balloons, such as Obalon, Orbera, and ReShape Duo. These methods, particularly when combined with lifestyle modifications, have proven effective in supporting short-term weight reduction. Nevertheless, limitations such as the occurrence of gastric erosions and ulcers underscore the need for further technological development and improvements in the safety profiles of these devices.Pharmacotherapy is playing an increasingly important role in obesity management, particularly for patients with overweight or moderate obesity. Medications such as semaglutide, tirzepatide, retratutide, and orforglipron demonstrate significant efficacy, enabling weight reduction of 15–25% of initial body weight while improving metabolic parameters. However, further studies are needed to evaluate their long-term safety, efficacy, and applicability across broader patient populations.

Psychological therapies, such as cognitive-behavioral therapy (CBT) and acceptance and commitment therapy (ACT), also play a crucial role in obesity management. These approaches support changes in eating behaviors, reduce symptoms of anxiety and depression, and improve patients' quality of life. Although their impact on long-term weight reduction is limited, they are essential for maintaining healthy habits and achieving lasting lifestyle changes.

The choice of an appropriate treatment method should be individually tailored, taking into account the patient's health status, BMI, comorbidities, and personal preferences. A key component of any therapy remains the adoption of a sustainable lifestyle, including healthy dietary habits and regular physical activity, which are essential for maintaining the effects of treatment. Future research should focus on better understanding the synergy between various treatment methods, their long-term effectiveness, and the potential for individualization, enabling a more personalized approach to obesity therapy.

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Author's Contribution Statement:

Conceptualization: Adam Sobiński, Aleksandra Sadowska, Jakub Moder

Methodology: Adam Sobiński, Joanna Miśkiewicz, Patrycja Pietrusińska

Investigation: Adam Sobiński, Aleksandra Welkier, Paula Kwaśniewska

Writing – rough preparation: Adam Sobiński, Aleksandra Dudek, Patrycja Śliwa-Tytko

Writing – review and editing: Adam Sobiński, Anna Dziewierz, Patrycja Śliwa-Tytko

Project administration: Adam Sobiński, Aleksandra Sadowska, Aleksandra Welkier, Joanna Miśkiewicz, Aleksandra Dudek, Patrycja Pietrusińska, Jakub Moder, Anna Dziewierz, Paula Kwaśniewska, Patrycja Śliwa-Tytko

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