



QUALITY IN SPORT

eISSN 2450-3118 · Open Access · Peer-reviewed

apcz.umk.pl/QS Nicolaus Copernicus University in Toruń



IWASZKO, Magdalena, SKAJEWSKA, Marcelina, STOJKO, Julia, KWIECIŃSKI, Wojciech, DZIEWIĘCKA, Oliwia, ZIĘBKA, Wojciech, MARKOWSKI, Bartłomiej, SZYMAŃSKI, Damian, IWASZKO, Paweł, and BIEGAŁA, Wiktoria. **Holistic Treatment of Obesity: The Importance of Integrating Pharmacotherapy, Dietary Therapy, and Physical Activity for Effective and Sustained Weight Loss.** *Quality in Sport*. 2026;73:75186. <https://doi.org/10.12775/QS.2026.73.75186>

ARTICLE TIMELINE

Received: 10.08.2026. Revised: 30.08.2026. Accepted: 06.09.2026. Published: 14.09.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).

Punkty Ministerialne z 2019 – aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych). © The Authors 2026.

OPEN ACCESS · CC BY-NC-SA 4.0 This article is published with open access under the License Open Journal Systems of Nicolaus Copernicus University in Toruń, Poland, and is distributed under the terms of the Creative Commons Attribution Non-commercial Share Alike License (<http://creativecommons.org/licenses/by-nc-sa/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the work is properly cited. The authors declare no conflict of interest regarding the publication of this paper.

Holistic Treatment of Obesity: The Importance of Integrating Pharmacotherapy, Dietary Therapy, and Physical Activity for Effective and Sustained Weight Loss

Magdalena Iwaszko

Jan Bziel University Hospital No. 2 in Bydgoszcz , Poland

ORCID : <https://orcid.org/0009-0000-6010-5443>

E-mail : iwaszkomagda1102@gmail.com

Marcelina Skajewska

Jan Bziel University Hospital No.2 in Bydgoszcz, Poland

ORCID : <https://orcid.org/0009-0009-5029-192X>

e-mail : msmarcelina49@gmail.com

Julia Stojko

Jan Bziel University Hospital No. 2 in Bydgoszcz , Poland

ORCID : <https://orcid.org/0009-0000-7724-1599>

E-Mail : jgoralska1@gmail.com

Wojciech Kwieciński

Independent Public Healthcare Centre in Szamotuly

ORCID : <https://orcid.org/0009-0004-2891-6974>

e-mail :wojciechkwiecinskimed@gmail.com

Oliwia Dziewięcka

A. Falkiewicz Specialist Hospital in Wroclaw, Poland

ORCID: <https://orcid.org/0009-0008-7784-1680>

E-mail: odziewiecka24@wp.pl

Wojciech Ziębka

A.Falkiewicz Specialist Hospital in Wroclaw, Poland

ORCID:<https://orcid.org/0009-0000-6835-6773>

E-mail: ziebka.wojciech@gmail.com

Bartłomiej Markowski

Medical University of Lodz, Poland

ORCID <https://orcid.org/0009-0006-2538-9907>

E-mail : bartekmarkowski1904@gmail.com

Damian Szymański

Independent Public Complex of Health Care Facilities in Lipsko,Poland

ORCID:<https://orcid.org/0009-0008-4671-7177>

E-mail:szymansky.d23@gmail.com

Pawel Iwaszko

Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń , Poland

ORCID: <https://orcid.org/0009-0006-2047-7713>

E-mail: iwaszkopawel@op.pl

Wiktoria Biegala

Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń , Poland

ORCID : <https://orcid.org/0009-0005-2495-1577>

E-mail: wiktoria.biegala04@gmail.com

Corresponding Author : Magdalena Iwaszko

E-mail : iwaszkomagda1102@gmail.com

Abstract

Introduction: Obesity is a chronic, complex, relapsing disease requiring long-term, individualized management. Incretin-based pharmacotherapy has increased the potential for clinically meaningful weight loss, but maintaining outcomes and limiting adverse body-composition changes also require dietary therapy and physical activity.

Aim: To assess integration of pharmacotherapy, dietary therapy, and physical activity in long-term obesity treatment.

Methods: A narrative literature review covering 2020 - 2026 was conducted, primarily including peer-reviewed publications on adult obesity treatment, as well as guidelines, expert statements, systematic reviews, meta-analyses, and randomized trials.

Results: Semaglutide and tirzepatide enable substantial weight loss and improvement in metabolic parameters. Dietary therapy supports adequate nutrient intake during reduced energy consumption, while physical activity, particularly resistance training, may help preserve fat-free mass and improve body composition. Weight regain may occur after pharmacotherapy discontinuation, supporting long-term treatment.

Conclusions: Obesity treatment should combine pharmacotherapy, dietary therapy, physical activity, and long-term lifestyle change. Assessment should include body weight, metabolic status, body composition, patient functioning, and outcome maintenance.

Keywords: obesity, pharmacotherapy, semaglutide, tirzepatide, dietary therapy, physical activity, comprehensive treatment

1. Introduction

Obesity is one of the most common chronic metabolic diseases in the modern world and one of the most important public health problems. In recent years, there has been a substantial change in the perception of this disease. Obesity is no longer regarded as a disorder resulting solely from unhealthy eating habits, but as a complex disease entity whose development depends on the interaction of genetic, hormonal, metabolic, environmental, and psychosocial factors. Obesity increases the risk of numerous complications, including type 2 diabetes, cardiovascular disease, hypertension, obstructive sleep apnea, metabolic dysfunction-associated steatotic liver disease (MASLD), and many cancers [1,2].

The contemporary approach to obesity treatment involves moving away from viewing it as a problem resulting solely from inappropriate dietary choices. It is now regarded as a chronic disease requiring long-term, individually tailored therapeutic management. Lifestyle modification, including changes in dietary habits and increased physical activity, remains the foundation of treatment; however, in many patients these measures do not lead to sustained weight loss. This results from biological mechanisms that counteract weight loss, such as changes in hormonal regulation of appetite, increased hunger, and an adaptive reduction in energy expenditure [2,3,4].

Because of the multifactorial pathogenesis of obesity, current recommendations advocate a comprehensive therapeutic model that includes lifestyle modification, including individually tailored dietary therapy, physical activity, and, in selected patients when necessary, pharmacotherapy and behavioral interventions. Treatment should be adapted to the individual needs of the patient and conducted long term as therapy for a chronic disease [5,6].

In recent years, the possibilities for pharmacological treatment of obesity have increased substantially. Particular importance has been gained by drugs acting on the incretin pathway, including GLP-1 receptor agonists and dual GIP/GLP-1 receptor agonists. Available data indicate that semaglutide and tirzepatide are highly effective in reducing body weight and improving selected metabolic parameters in individuals with overweight and obesity. Pharmacotherapy should, however, be regarded as a component of comprehensive treatment that also includes appropriate dietary therapy, physical activity, and long-term lifestyle change [6,7,8].

The aim of this paper is to present current data on the holistic treatment of obesity, with particular emphasis on the importance of combining pharmacotherapy, dietary therapy, and physical activity in achieving sustained weight loss and improving patients' metabolic status.

2. Methodology and Criteria for Literature Selection

This paper was prepared as a narrative review of the literature on comprehensive obesity treatment, with particular emphasis on pharmacotherapy, dietary therapy, and physical activity. Publications were searched primarily in the PubMed database and on the websites of publishers, scientific societies, and institutions developing guidelines, using terms related to obesity, incretin-based pharmacotherapy, nutrition, physical activity, and comprehensive obesity treatment.

The review primarily included peer-reviewed scientific publications in English from 2020-2026 that directly addressed the treatment of obesity in adults. Current guidelines, expert statements, and reports from recognized organizations and scientific societies were also included. Systematic reviews, meta-analyses, randomized clinical trials, and current expert publications relating to pharmacotherapy, dietary therapy, and physical activity were preferred. Publications not directly related to the subject of this review and sources lacking sufficient scientific credibility were excluded. Literature selection took into account the recency of the publication, methodological quality, and consistency of the source content with the information used in this paper.

3. Pathophysiology of Obesity

3.1. Pathophysiology of Obesity as the Basis for Comprehensive Treatment

Obesity is a complex metabolic disease resulting from disturbances in the regulation of the body's energy balance. Its development and persistence are associated with interactions among genetic, environmental, neurohormonal, and metabolic factors. Contemporary research indicates that excess body weight is not solely the result of increased energy intake, but also a consequence of disturbances in mechanisms controlling appetite, metabolism, and the body's adaptation to changes in energy balance. The complexity of the processes leading to the development and persistence of obesity justifies the need for a multimodal therapeutic model including lifestyle modification and, in selected patients, pharmacotherapy [4,7].

3.2. Disturbances in Appetite Regulation and Gut-Brain Axis Mechanisms

Appetite regulation results from interactions among the gastrointestinal tract, the central nervous system, and hormonal signals that influence hunger and satiety. Disturbances in these mechanisms are among the key elements in the pathophysiology of obesity and contribute to the maintenance of a positive energy balance [7]. These mechanisms form the basis of action

of modern anti-obesity medications. GLP-1 receptor agonists and dual GIP/GLP-1 receptor agonists increase satiety, reduce appetite, and limit energy intake, leading to effective weight loss. According to current recommendations, pharmacotherapy should be used as part of comprehensive treatment that also includes dietary therapy, physical activity, and behavioral interventions [6,7].

3.3. Adipose Tissue

An excessive amount of adipose tissue, particularly visceral adipose tissue, is associated with the development of metabolic disorders, including insulin resistance, type 2 diabetes, and an increased risk of cardiovascular disease. Weight loss leads to improvements in glycemic control, insulin sensitivity, and other metabolic parameters [6,9].

3.4. Importance of a Multimodal Therapeutic Approach

One of the greatest challenges in obesity treatment is maintaining the achieved weight loss. After body weight is reduced, the body activates adaptive mechanisms that promote a return toward the previous body weight. These include increased hunger, changes in the secretion of appetite-regulating hormones, adaptive reductions in energy expenditure, and changes in body composition, including loss of part of the fat-free mass. These mechanisms increase the risk of weight regain and indicate that obesity requires long-term, comprehensive treatment [4].

Because of the multifactorial nature of obesity, current recommendations advocate comprehensive therapeutic management including lifestyle modification and, in selected patients, pharmacotherapy. Dietary therapy aims to reduce energy intake and improve diet quality, physical activity supports improvements in metabolic parameters and physical capacity, whereas pharmacotherapy acts on mechanisms regulating appetite and energy balance. Current guidelines emphasize the need to individualize treatment and provide long-term patient management, treating obesity as a chronic disease requiring comprehensive care [6,7,10].

4. Pharmacotherapy for Obesity

4.1. Pharmacotherapy for Obesity as a Component of Holistic Treatment

Obesity is a chronic disease with a complex etiology; therefore, its treatment should not be limited solely to lifestyle modification. Although dietary therapy, increased physical activity, and behavioral interventions remain the foundation of management, in some patients these measures do not allow clinically meaningful weight loss to be achieved or maintained. In such

cases, current guidelines recommend considering pharmacotherapy as a component of comprehensive obesity treatment [6,7].

Pharmacotherapy is not an alternative to lifestyle change but a complement to it. The aims of pharmacological treatment are to increase the effectiveness of weight loss, facilitate long-term maintenance of the achieved outcomes, and reduce the risk of development or progression of obesity-related comorbidities. Current recommendations emphasize the need to individualize therapy, taking into account the degree of obesity, the presence of comorbidities, patient preferences, and the safety of the medications used [6,11].

According to current recommendations, pharmacotherapy may be considered in adults with a BMI ≥ 30 kg/m² or in patients with a BMI ≥ 27 kg/m² who have at least one obesity-related condition, such as type 2 diabetes, hypertension, dyslipidemia, or obstructive sleep apnea. Pharmacological treatment should be conducted alongside lifestyle interventions, and its effectiveness and tolerability require regular assessment [6,11].

The development of new anti-obesity medications, particularly GLP-1 receptor agonists and dual GIP/GLP-1 receptor agonists, has substantially changed therapeutic possibilities in recent years. Clinical trial results indicate that modern pharmacotherapy enables greater weight loss than older agents, while also improving multiple metabolic parameters. At the same time, experts emphasize that obesity treatment should be regarded as a long-term process and that therapeutic decisions should be tailored to the individual characteristics of the patient [4,7,11].

4.2. Mechanisms of Action of Contemporary Anti-Obesity Medications

Pharmacotherapy for obesity includes medications that act through different mechanisms affecting the body's energy balance. Their aims are to reduce energy intake, increase satiety, reduce appetite, or decrease nutrient absorption. Regardless of the mechanism of action, pharmacotherapy should form part of comprehensive treatment conducted in parallel with dietary therapy, increased physical activity, and behavioral interventions [6,7].

One of the longest-used anti-obesity medications is orlistat, which acts by inhibiting gastric and pancreatic lipases. This reduces the absorption of fats from the gastrointestinal tract and limits energy intake. Because of its peripheral mechanism of action, the drug does not directly affect appetite regulation; however, its use may be associated with gastrointestinal adverse effects [7].

Another medication is the combination of naltrexone and bupropion, which acts on the central nervous system by influencing neurons that regulate hunger and satiety. Treatment reduces

appetite and limits behaviors associated with excessive food intake. Treatment efficacy is greater when pharmacotherapy is combined with sustained lifestyle change [7].

The introduction of GLP-1 receptor agonists, such as liraglutide and semaglutide, has represented a major advance in obesity treatment. These medications increase satiety, delay gastric emptying, and reduce hunger, leading to lower energy intake and gradual weight loss. Compared with earlier therapies, they show greater efficacy in achieving clinically meaningful weight loss [7,8].

The newest group of medications comprises dual GIP/GLP-1 receptor agonists, represented by tirzepatide. Combined stimulation of both receptors influences appetite regulation and energy metabolism, enabling greater weight loss than that achieved with GLP-1 receptor agonists used as monotherapy. Clinical trials and meta-analyses indicate that tirzepatide is currently among the most effective medications used in obesity treatment [8,11].

4.3. Clinical Efficacy of Contemporary Obesity Pharmacotherapy

The efficacy of obesity pharmacotherapy is assessed primarily on the basis of the degree of weight loss, its effect on cardiovascular risk factors, and the ability to maintain the achieved outcomes during long-term follow-up. In recent years, the greatest efficacy has been demonstrated by medications acting on the incretin pathway, particularly GLP-1 receptor agonists and dual GIP/GLP-1 receptor agonists [8,11]. A pivotal study evaluating the efficacy of semaglutide was the randomized phase 3 STEP 1 trial, which included 1,961 adults with obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) or overweight ($\text{BMI} \geq 27 \text{ kg/m}^2$) and at least one weight-related comorbidity, without type 2 diabetes. Participants received semaglutide at a dose of 2.4 mg once weekly or placebo while simultaneously participating in a lifestyle modification program. After 68 weeks, the mean change in body weight was -14.9% in the semaglutide group and -2.4% in the placebo group ($p < 0.001$). In addition, a greater proportion of patients treated with semaglutide achieved weight loss of at least 5%, 10%, and 15%, and treatment was accompanied by improvements in blood pressure, lipid profile, and parameters of glucose metabolism [12].

The efficacy of tirzepatide was evaluated in the phase 3 SURMOUNT-1 trial, which included adults with obesity or overweight and at least one comorbidity, without type 2 diabetes. After 72 weeks of treatment, mean weight loss was 15.0% with the 5 mg dose, 19.5% with the 10 mg dose, and 20.9% with the 15 mg dose, compared with approximately 3.1% in the placebo group. Treatment was also associated with a substantial improvement in waist circumference and selected metabolic parameters [13].

The results of registration trials have been confirmed in subsequent systematic reviews and meta-analyses. In the meta-analysis by Müllertz et al., both semaglutide and tirzepatide were shown to result in clinically meaningful weight loss and a reduction in waist circumference, with tirzepatide achieving greater efficacy in terms of weight loss. The most commonly reported adverse effects of both therapies were gastrointestinal symptoms, primarily nausea, vomiting, and diarrhea, which were generally mild or moderate and occurred mainly during dose escalation [8].

These results confirm that modern pharmacotherapy enables substantially greater weight loss than older anti-obesity medications. At the same time, current guidelines and review articles emphasize that the greatest clinical benefits are achieved when pharmacological treatment forms part of comprehensive management including dietary therapy, regular physical activity, and long-term patient care [6,8,11].

4.4. Individualization of Pharmacotherapy and Treatment Safety

Contemporary pharmacological treatment of obesity is based on the principle of individualized therapy. Selection of an appropriate medication should take into account not only the degree of obesity but also the presence of comorbidities, previous therapeutic experience, the safety profile, patient preferences, and the expected efficacy of treatment. Such an approach increases the likelihood of achieving sustained weight loss and improving the patient's metabolic status [6,11]. Current guidelines emphasize that the choice of pharmacotherapy should be tailored to the patient's clinical presentation. In patients with obesity and concomitant type 2 diabetes, high cardiovascular risk, or chronic kidney disease, medications with documented additional metabolic and cardiovascular benefits are preferred. Contraindications to treatment, the risk of adverse effects, and the possibility of long-term use of the selected agent should also be considered in therapeutic decision-making [6,11].

An important component of treatment is systematic assessment of therapeutic effectiveness. Monitoring should include changes in body weight, treatment tolerability, the occurrence of adverse effects, and the degree of adherence to lifestyle recommendations. In the event of an insufficient clinical response or poor medication tolerability, reassessment of the therapeutic strategy is recommended, including dose modification, switching medications, or using another management approach in accordance with current guidelines [6,11].

The most commonly reported adverse effects of modern anti-obesity medications involve the gastrointestinal tract and include nausea, vomiting, diarrhea, and constipation. These symptoms are usually mild or moderate in severity and most often occur at the beginning of treatment or

during gradual dose escalation. Appropriate patient education and gradual dose escalation may improve treatment tolerability and increase adherence to therapeutic recommendations [8,11]. The concept of precision medicine is gaining increasing importance in obesity treatment and aims to select therapy on the basis of individual patient characteristics. It takes into account, among other factors, obesity phenotype, eating behaviors, metabolic profile, genetic determinants, and potential biomarkers of treatment response. The authors emphasize that the current model for selecting pharmacotherapy is based mainly on trial and error, whereas the development of precision medicine may in the future enable more accurate selection of medication for an individual patient and increase treatment efficacy. Despite promising research findings, this approach requires further validation before implementation in routine clinical practice [11,14].

4.5. Future Directions in Obesity Pharmacotherapy

The rapid development of obesity pharmacotherapy indicates that treatment options for this disease will continue to expand in the coming years. Current research focuses on developing medications that simultaneously act on several pathways regulating energy balance and on developing strategies that enable more precise selection of therapy according to individual patient characteristics. The aim of these efforts is to increase treatment efficacy while maintaining a favorable safety profile and improving long-term maintenance of the achieved weight loss [11,14].

One of the most promising medications still under clinical investigation is retatrutide, a triple agonist of the GIP, GLP-1, and glucagon receptors. In a randomized phase 2 trial involving 338 adults with obesity or overweight and at least one comorbidity, treatment with the highest dose studied resulted in a mean weight loss of 24.2% after 48 weeks, compared with 2.1% in the placebo group. The most commonly observed adverse effects involved the gastrointestinal tract, were dose-dependent, and were predominantly mild or moderate. Despite very promising results, retatrutide remains an investigational therapy and requires further evaluation of efficacy and safety before its potential introduction into routine clinical practice [15].

Another important direction of development is combination therapy, which aims to act simultaneously on different mechanisms regulating appetite and energy balance. One example is the combination of cagrilintide, an amylin analogue, with semaglutide (CagriSema). The results of the REDEFINE 1 trial confirmed the high efficacy of this combination in reducing body weight in individuals with overweight and obesity. Further data on long-term efficacy,

safety, and outcomes in real-world clinical practice will be important in defining the role of combination therapies in obesity treatment [16].

Precision medicine also remains an important area for further development and may in the future enable more accurate selection of pharmacotherapy based on individual patient characteristics and the predicted response to treatment [11,14].

Despite the rapid development of pharmacotherapy, current guidelines emphasize that new medications do not replace comprehensive management including dietary therapy, regular physical activity, behavioral interventions, and long-term patient care. The future of obesity treatment will probably be based on combining modern pharmacological therapies with individualized management and a multidisciplinary model of care [6,11].

5. Dietary Therapy in the Treatment of Obesity

5.1. Role of Dietary Therapy in Comprehensive Obesity Treatment

Dietary therapy is a fundamental component of comprehensive obesity treatment and should be implemented in every patient as an integral part of therapeutic management, regardless of whether pharmacotherapy or bariatric treatment is used. Current guidelines emphasize that long-term maintenance of treatment outcomes requires sustained modification of dietary habits and other lifestyle components tailored to the individual needs of the patient [6,17].

The contemporary approach to obesity treatment is moving away from restrictive, short-term diets in favor of individualized dietary management. The dietary plan should take into account the patient's age, degree of obesity, comorbidities, food preferences, cultural determinants, and the possibility of long-term adherence to recommendations. The more closely the dietary plan is tailored to the individual patient, the greater the likelihood of successful adherence to the recommendations [6,11,17]. The aim of dietary therapy is not only to achieve a negative energy balance leading to weight loss, but also to improve diet quality, ensure an adequate intake of macro- and micronutrients, and support overall metabolic health. Current recommendations place increasing emphasis on the quality of the dietary pattern rather than solely on restricting energy intake. The diet should be based on nutrient-dense foods, with an adequate intake of vegetables, fruit, whole-grain products, and high-quality sources of protein [6,17].

The importance of dietary therapy is particularly evident in patients receiving pharmacological treatment, especially GLP-1 receptor agonists and GIP/GLP-1 receptor agonists. Appropriately planned dietary management may reduce the risk of inadequate nutrient intake, support preservation of fat-free mass, and improve treatment tolerability by appropriately adapting

dietary intake to gastrointestinal adverse effects. For this reason, therapy is recommended to be managed by a multidisciplinary team including a physician, dietitian, and other specialists [11,17,18,19,20]. Dietary therapy should be regarded as a long-term process requiring systematic nutrition education, regular assessment of intervention effectiveness, and modification of recommendations according to treatment progress and changing patient needs. This approach is consistent with current guidelines and constitutes one of the key elements of holistic obesity treatment, aimed not only at weight loss but also at sustained improvement in health and quality of life [6,11,17].

5.2. Dietary Therapy as Support for Obesity Pharmacotherapy

Dietary therapy is an integral component of pharmacological obesity treatment and should be conducted in parallel with the use of GLP-1 receptor agonists and GIP/GLP-1 receptor agonists. Current recommendations emphasize that an appropriately planned nutritional intervention supports treatment efficacy, promotes maintenance of adequate nutritional status, and helps reduce the risk of insufficient nutrient intake and selected treatment-related adverse effects [17,18,19]. Reduced appetite and earlier satiety during incretin-based therapy lead to lower energy intake, but may also be associated with limited intake of protein, vitamins, and minerals. Therefore, particular importance is attributed to ensuring an adequate protein intake in order to support preservation of fat-free mass during weight loss. The selection of nutrient-dense foods is also recommended to allow requirements for essential nutrients to be met despite a reduced amount of food consumed [17,18,19,20].

An important component of dietary management is also an adequate intake of dietary fiber and proper hydration. Gradual increases in dietary fiber support normal gastrointestinal function and may reduce constipation, whereas adequate fluid intake reduces the risk of dehydration, particularly in patients reporting nausea or vomiting. Dietary recommendations should be adjusted to the patient's individual tolerance and clinical condition [17,18]. In the event of gastrointestinal adverse effects, smaller, more frequent meals and restriction of high-fat and hard-to-digest foods are recommended. Regular nutrition education and monitoring of dietary intake facilitate modification of dietary recommendations, improve treatment tolerability, and support long-term adherence to therapeutic recommendations [17,18,19].

Effective obesity treatment requires collaboration between the physician, dietitian, and other members of the care team. Integrated management enables individualization of dietary recommendations, supports treatment safety, and promotes achievement and maintenance of treatment outcomes over the long term [11,17,18].

5.3. Importance of Long-Term Nutritional Support in Maintaining Treatment Outcomes

Maintaining the achieved weight loss is one of the greatest challenges in obesity treatment. Current guidelines emphasize the importance of continuing dietary intervention even after the intended therapeutic goal has been achieved. Regular assessment of dietary intake and adjustment of recommendations to the patient's changing needs may support long-term maintenance of the achieved treatment outcomes [6,11,17].

An important component of long-term care is nutrition education aimed at establishing lasting dietary habits. Limiting the intake of ultra-processed foods and sugar-sweetened beverages and promoting a dietary pattern based on nutrient-dense foods are recommended. Greater exposure to ultra-processed foods is associated in epidemiological studies with a higher risk of obesity and other adverse health outcomes. At the same time, the diet should be adapted to patient preferences, clinical condition, and the possibility of long-term adherence to recommendations [6,17,21].

Long-term treatment should include systematic monitoring of progress and active patient engagement in the therapeutic process. Collaboration with a dietitian, regular follow-up visits, and individualized dietary recommendations enable difficulties in implementing the recommendations to be identified and management to be modified appropriately. This approach is an important component of comprehensive obesity treatment and complements the role of pharmacotherapy and physical activity in achieving and maintaining long-term health benefits [6,11,17].

6. Role of Physical Activity in Comprehensive Obesity Treatment

6.1. Role of Physical Activity in Comprehensive Obesity Treatment

Physical activity is one of the fundamental pillars of comprehensive obesity treatment and is recommended at every stage of therapy, regardless of the dietary therapy or pharmacotherapy used. Regular physical exercise contributes not only to increased energy expenditure but also to improvements in metabolic function, cardiorespiratory fitness, and patients' functional capacity [6,10,22]. The benefits of regular physical activity extend beyond its effect on weight loss. Regular exercise favorably affects insulin sensitivity and selected metabolic and cardiovascular risk factors [6,10]. Physical activity is particularly important during treatment combined with modern anti-obesity pharmacotherapy. Exercise, especially resistance training, promotes preservation of fat-free mass and more favorable changes in body composition during weight loss [23,24]. Current recommendations advocate multimodal physical activity,

including aerobic and resistance training, tailored to the patient's capabilities and clinical condition [6,10].

6.2. Physical Activity as an Adjunct to Dietary Therapy and Pharmacotherapy

Comprehensive obesity treatment includes lifestyle interventions and, when appropriate indications are present, pharmacotherapy, while physical activity remains an important component of management regardless of the use of pharmacological treatment [6,10]. Regular physical activity plays a particularly important role during treatment with GLP-1 receptor agonists and GIP/GLP-1 receptor agonists. Although these medications lead to substantial weight loss, loss of part of the fat-free mass may also occur. The inclusion of resistance training, together with appropriately planned dietary therapy and adequate protein intake, may help limit the loss of muscle mass and improve body composition [19,23,24].

Results of a randomized trial with subsequent follow-up after treatment discontinuation indicate that including a supervised exercise program during treatment may promote better maintenance of weight loss after completion of active therapy [25]. Physical activity should not be regarded as an alternative to pharmacotherapy or dietary therapy, but as an integral component of treatment alongside both. Integrated management allows body weight, body composition, physical fitness, and the patient's metabolic health to be addressed simultaneously [6,10].

6.3. Individualization of Physical Activity Recommendations

A physical activity program should be tailored to the patient's individual needs, functional capabilities, and clinical condition. When planning exercise, age, degree of obesity, comorbidities, physical capacity, and previous experience with physical activity should be considered. Individualization of management promotes treatment safety and long-term adherence to recommendations [6,10]. In most patients, a gradual increase in physical activity is recommended, beginning with exercise adapted to current tolerance and functional capabilities. Gradual progression of activity allows the workload to be adjusted to the patient's capabilities and supports long-term adherence to recommendations [6,10].

Effective obesity treatment requires collaboration between the patient and a multidisciplinary care team including a physician, dietitian, physiotherapist or physical activity specialist, and, when needed, a psychologist. A multidisciplinary approach supports individualization of therapy and implementation of lifestyle-change recommendations [6,10,17]. Individualization

of the physical activity program and its integration with dietary therapy and pharmacotherapy constitute an important component of long-term obesity treatment [6,10,25].

7. Integrated and Individualized Approach to Obesity Treatment

7.1. Integrated Model of Obesity Treatment

Obesity is a chronic, complex disease whose treatment should focus not only on weight loss but also on improving health, functioning, and reducing the consequences associated with excessive adipose tissue. The contemporary therapeutic approach includes lifestyle interventions, including dietary therapy and physical activity, and pharmacotherapy in appropriately selected patients. The selection and intensity of individual interventions should correspond to the patient's individual clinical situation [6,9].

Dietary therapy, physical activity, and pharmacotherapy fulfill different but complementary functions in obesity treatment. Dietary interventions support an appropriate intake of energy and nutrients, whereas regular physical activity favorably affects physical fitness, metabolic health, and body composition. Pharmacotherapy may increase the effectiveness of weight loss in appropriately selected patients. Integration of these methods enables a multimodal approach reflecting the complex nature of obesity [6,9,10,17].

The importance of this approach is particularly evident during the use of modern anti-obesity pharmacotherapy. Appropriately conducted dietary therapy may support adequate nutrient intake when food consumption is reduced, whereas physical activity, particularly resistance training, may promote preservation of fat-free mass during weight loss [17,19,23,24]. Results of a study involving liraglutide and a supervised exercise program further indicate that including physical activity during treatment may promote better maintenance of the achieved outcomes after completion of active therapy [25]. Integrated management therefore allows treatment effectiveness to be assessed beyond changes in body weight alone, while also taking into account improvements in health status and patient functioning [6,9].

7.2. Individualization and Interdisciplinary Therapy

Because of the heterogeneous nature of obesity, the therapeutic strategy should be tailored to the individual clinical circumstances of the patient. When selecting management, not only the degree of excess body weight but also the distribution and functional consequences of excess adipose tissue, the presence of complications and comorbidities, previous response to treatment, and the patient's individual needs and preferences should be taken into account [6,9].

Comprehensive treatment may require collaboration among specialists from different fields, depending on the clinical problems present in a given patient. A multidisciplinary care team may include a physician, dietitian, psychologist, and physical activity specialist, and its composition should be adapted to the patient's individual needs. Combining medical, nutritional, and behavioral care with physical activity support allows the various factors influencing the course of obesity and response to treatment to be considered simultaneously [6,9,17].

8. Discussion

The development of anti-obesity pharmacotherapy, particularly medications acting on the incretin system, has substantially changed the possibilities for treating obesity. Clinical trial results for semaglutide and tirzepatide indicate the possibility of achieving substantial and clinically meaningful weight loss. At the same time, the high efficacy of pharmacotherapy does not diminish the importance of dietary therapy and physical activity, which remain integral components of comprehensive treatment. Contemporary recommendations emphasize the need for individualized selection and, when indicated, combination of available therapeutic methods, taking into account the patient's clinical condition and needs [6,9].

The increasing efficacy of pharmacotherapy also draws attention to the quality of the weight loss achieved. During substantial weight reduction, loss of adipose tissue may be accompanied by a decrease in fat-free mass, which justifies particular attention to appropriate nutrition and physical activity. During treatment with incretin-based medications, reduced appetite and food intake increase the importance of ensuring adequate nutrient intake, including protein. At the same time, resistance training represents an important strategy supporting preservation of fat-free mass during weight loss. Available data therefore indicate that assessment of treatment effectiveness should not be limited solely to changes in body weight, but should also take into account body composition, nutritional status, and physical functioning [17,19,23,24].

Long-term maintenance of treatment outcomes remains an important challenge. Data from studies evaluating the consequences of discontinuing pharmacotherapy indicate weight regain after treatment withdrawal, underscoring the chronic and relapsing nature of obesity [6,26]. Results of a study using liraglutide and a supervised exercise program suggest, however, that including physical activity during therapy may promote better maintenance of the achieved outcomes after treatment has ended [25]. These results do not, however, allow the conclusion that physical activity can replace long-term pharmacotherapy in all patients. Available data

instead support a model in which lasting lifestyle changes and pharmacological treatment are selected and modified according to the individual clinical response [6,9,25].

When interpreting the available evidence, its limitations should be taken into account. Studies differ in terms of the populations studied, duration of follow-up, pharmacotherapy used, and the nature of lifestyle interventions, while the number of long-term studies evaluating specific combinations of modern anti-obesity medications with dietary therapy and structured exercise remains limited [19,24,25]. Further studies are needed to determine optimal strategies for preserving fat-free mass, the durability of treatment effects, and the best ways to integrate pharmacotherapy with nutritional interventions and physical activity. Nevertheless, current data support treating obesity as a disease requiring long-term, individualized, and multimodal management aimed not only at weight loss but also at improving health status and patient functioning [6,9,17,19,24,25].

9. Summary and Conclusions

Obesity is a chronic, complex, and relapsing disease whose effective treatment requires long-term and individualized management. The development of modern pharmacotherapy, particularly medications acting on the incretin system, has substantially increased the possibilities for achieving clinically meaningful weight loss. Pharmacotherapy should not, however, replace lifestyle interventions, but should form part of a comprehensive treatment model that also includes appropriately selected dietary therapy and regular physical activity [6,9].

As the efficacy of anti-obesity treatment increases, not only the magnitude of weight loss but also its quality becomes increasingly important. Appropriate nutrition, ensuring an adequate nutrient intake, and physical activity, particularly resistance training, may support preservation of fat-free mass and a more favorable body composition during weight loss [17,23,24].

Long-term maintenance of treatment outcomes remains an important challenge because weight regain may occur after discontinuation of pharmacotherapy [6,26]. This underscores the need to treat obesity as a disease requiring chronic management, regular assessment of treatment effectiveness, and appropriate adjustment of treatment to the patient's clinical response [6,9].

The contemporary approach to obesity treatment is therefore based on an integrated model combining pharmacotherapy, dietary therapy, and physical activity while taking into account the patient's clinical condition, needs, and preferences. The goal of therapy should be not only to reduce body weight but, more importantly, to achieve long-term improvement in health, functioning, and reduction of the clinical consequences of obesity [6,9].

Disclosure:

Author Contributions: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski , Damian Paweł Iwaszko, Wiktoria Biegała, Damian Szymański

Conceptualization: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski , Paweł Iwaszko, Wiktoria Biegała, Damian Szymański

Methodology: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski, Paweł Iwaszko, Wiktoria Biegała , Damian Szymański

Literature search and literature review: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski, Paweł Iwaszko, Wiktoria Biegała , Damian Szymański

Writing rough preparation: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski, Paweł Iwaszko, Wiktoria Biegała , Damian Szymański

Writing review and editing: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski , Paweł Iwaszko, Wiktoria Biegała, Damian Szymański

Visualization: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski, Paweł Iwaszko, Wiktoria Biegała, Damian Szymański

Supervision: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski, Paweł Iwaszko, Wiktoria Biegała , Damian Szymański

Project administration: Magdalena Iwaszko, Julia Stojko, Oliwia Dziewięcka, Wojciech Ziębka, Wojciech Kwieciński, Marcelina Skajewska, Bartłomiej Markowski, Paweł Iwaszko, Wiktoria Biegała , Damian Szymański

All authors have read and agreed to the published version of the manuscript.

Receiving funding: Not applicable - no specific funding.

Funding Statement:

The study did not receive external funding.

Institutional Review Board Statement:

Not applicable.

Informed Consent Statement:

Not applicable.

Data Availability Statement:

Not applicable.

Acknowledgments:

Not applicable.

Conflicts of Interest:

The authors declare no conflicts of interest.

Declaration of the Use of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT for the purpose of language editing and stylistic refinement to improve clarity and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the accuracy, integrity and conclusions of the publication.

References

1. World Obesity Federation. World Obesity Atlas 2024. World Obesity Federation; 2024 <https://data.worldobesity.org/publications/WOF-Obesity-Atlas-v7.pdf>
2. Wharton, S., Lau, D. C. W., Vallis, M., Sharma, A. M., Biertho, L., Campbell-Scherer, D., Adamo, K., Alberga, A., Bell, R., Boulé, N., Boyling, E., Brown, J., Calam, B., Clarke, C., Crowshoe, L., Divalentino, D., Forhan, M., Freedhoff, Y., Gagner, M., Glazer, S., ... Wicklum, S. (2020). Obesity in adults: a clinical practice guideline. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne*, 192(31), E875–E891. <https://doi.org/10.1503/cmaj.191707>
3. American Diabetes Association Professional Practice Committee for Diabetes*; 8. Obesity and Weight Management for the Prevention and Treatment of Diabetes: Standards of Care in Diabetes–2026. *Diabetes Care* 1 January 2026; 49 (Supplement_1): S166–S182. <https://doi.org/10.2337/dc26-S008>
4. van Baak, M. A., & Mariman, E. C. M. (2025). Physiology of Weight Regain after Weight Loss: Latest Insights. *Current obesity reports*, 14(1), 28. <https://doi.org/10.1007/s13679-025-00619-x>
5. National Institute for Health and Care Excellence. Overweight and obesity management. NICE guideline NG246. Published January 14, 2025. Updated January 8, 2026. Accessed August 8, 2026. <https://www.nice.org.uk/guidance/ng246>
6. American Diabetes Association Professional Practice Committee for Diabetes*; 8. Obesity and Weight Management for the Prevention and Treatment of Diabetes: Standards of Care in Diabetes - 2026. *Diabetes Care* 1 January 2026; 49 (Supplement_1): S166 -S182.<https://doi.org/10.2337/dc26-S00>
7. Roomy, M. A., Hussain, K., Behbehani, H. M., Abu-Farha, J., Al-Harris, R., Ambi, A. M., Abdalla, M. A., Al-Mulla, F., Abu-Farha, M., & Abubaker, J. (2024). Therapeutic advances in obesity management: an overview of the therapeutic interventions. *Frontiers in endocrinology*, 15, 1364503. <https://doi.org/10.3389/fendo.2024.1364503>
8. Müllertz, A. L. O., Sandsdal, R. M., Jensen, S. B. K., & Torekov, S. S. (2024). Potent incretin-based therapy for obesity: A systematic review and meta-analysis of the efficacy of semaglutide and tirzepatide on body weight and waist circumference, and safety. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, 25(5), e13717. <https://doi.org/10.1111/obr.13717>
9. Busetto, L., Dicker, D., Frühbeck, G., Halford, J. C. G., Sbraccia, P., Yumuk, V., & Goossens, G. H. (2024). A new framework for the diagnosis, staging and management

- of obesity in adults. *Nature medicine*, 30(9), 2395–2399. <https://doi.org/10.1038/s41591-024-03095-3>
10. Jakicic, J. M., Apovian, C. M., Barr-Anderson, D. J., Courcoulas, A. P., Donnelly, J. E., Ekkekakis, P., Hopkins, M., Lambert, E. V., Napolitano, M. A., & Volpe, S. L. (2024). Physical Activity and Excess Body Weight and Adiposity for Adults. American College of Sports Medicine Consensus Statement. *Medicine and science in sports and exercise*, 56(10), 2076–2091. <https://doi.org/10.1249/MSS.00000000000003520>
 11. Steenackers, N., Toumazia, J., Deleus, E., Mertens, A., Lannoo, M., Pazmino, S., van Laar, A. D. E., Van der Schueren, B., & Vangoitsenhoven, R. (2025). Pharmacotherapy for obesity: are we ready to select, tailor and combine pharmacotherapy to achieve more ambitious goals?. *Frontiers in endocrinology*, 16, 1569468. <https://doi.org/10.3389/fendo.2025.1569468>
 12. Wilding, J. P. H., Batterham, R. L., Calanna, S., Davies, M., Van Gaal, L. F., Lingvay, I., McGowan, B. M., Rosenstock, J., Tran, M. T. D., Wadden, T. A., Wharton, S., Yokote, K., Zeuthen, N., Kushner, R. F., & STEP 1 Study Group (2021). Once-Weekly Semaglutide in Adults with Overweight or Obesity. *The New England journal of medicine*, 384(11), 989–1002. <https://doi.org/10.1056/NEJMoa2032183>
 13. Jastreboff, A. M., Aronne, L. J., Ahmad, N. N., Wharton, S., Connery, L., Alves, B., Kiyosue, A., Zhang, S., Liu, B., Bunck, M. C., Stefanski, A., & SURMOUNT-1 Investigators (2022). Tirzepatide Once Weekly for the Treatment of Obesity. *The New England journal of medicine*, 387(3), 205–216. <https://doi.org/10.1056/NEJMoa2206038>
 14. Anazco, D., & Acosta, A. (2025). Precision medicine for obesity: current evidence and insights for personalization of obesity pharmacotherapy. *International journal of obesity* (2005), 49(3), 452–463. <https://doi.org/10.1038/s41366-024-01599-z>
 15. Jastreboff, A. M., Kaplan, L. M., Frías, J. P., Wu, Q., Du, Y., Gurbuz, S., Coskun, T., Haupt, A., Milicevic, Z., Hartman, M. L., & Retatrutide Phase 2 Obesity Trial Investigators (2023). Triple-Hormone-Receptor Agonist Retatrutide for Obesity - A Phase 2 Trial. *The New England journal of medicine*, 389(6), 514–526. <https://doi.org/10.1056/NEJMoa2301972>
 16. Garvey, W. T., Blüher, M., Osorto Contreras, C. K., Davies, M. J., Winning Lehmann, E., Pietiläinen, K. H., Rubino, D., Sbraccia, P., Wadden, T., Zeuthen, N., Wilding, J. P. H., & REDEFINE 1 Study Group (2025). Coadministered Cagrilintide and Semaglutide in Adults with Overweight or Obesity. *The New England journal of medicine*, 393(7), 635–647. <https://doi.org/10.1056/NEJMoa2502081>

17. Mozaffarian, D., Agarwal, M., Aggarwal, M., Alexander, L., Apovian, C. M., Bindlish, S., Bonnet, J., Butsch, W. S., Christensen, S., Gianos, E., Gulati, M., Gupta, A., Horn, D., Kane, R. M., Saluja, J., Sannidhi, D., Stanford, F. C., & Callahan, E. A. (2025). Nutritional priorities to support GLP-1 therapy for obesity: A joint Advisory from the American College of Lifestyle Medicine, the American Society for Nutrition, the Obesity Medicine Association, and The Obesity Society. *Obesity* (Silver Spring, Md.), 33(8), 1475–1503. <https://doi.org/10.1002/oby.24336>
18. Sievenpiper, J. L., Ard, J., Blüher, M., Chen, W., Dixon, J. B., Fitch, A., Gigliotti, L., Khunti, K., Lecube, A., Lean, M. E. J., Mittendorfer, B., Pfeiffer, A. F. H., Ryan, D. H., Vilsbøll, T., & Van Gaal, L. F. (2025). Nutritional and lifestyle supportive care recommendations for management of obesity with GLP-1 - based therapies: An expert consensus statement using a modified Delphi approach. *Obesity pillars*, 17, 100228. <https://doi.org/10.1016/j.obpill.2025.100228>
19. Bruna-Mejias, A., Valenzuela-Fuenzalida, J. J., Oyanedel, G., Figueroa-Puig, J., Cabezas-Salgado, J. J., Orellana-Donoso, M., Cifuentes-Suazo, G., & Loro-Ferrer, J. F. (2026). GLP-1RA- and Incretin-Based Therapies Within Lifestyle Interventions for Adults with Overweight or Obesity: A Systematic Review and Meta-Analysis. *Nutrients*, 18(11), 1781. <https://doi.org/10.3390/nu18111781>
20. Sawicka-Gutaj, N., Gruszczyński, D., Nijakowski, K., Derwich-Rudowicz, A., Krenz, M., Kumar, A., Lu, P. Y., & Ruchała, M. (2026). GLP-1 agonists and changes in body mass and composition in adults with overweight or obesity with or without type 2 diabetes mellitus: a systematic review and meta-analysis. *International journal of obesity* (2005), 10.1038/s41366-026-02088-1. Advance online publication. <https://doi.org/10.1038/s41366-026-02088-1>
21. Lane, M. M., Gamage, E., Du, S., Ashtree, D. N., McGuinness, A. J., Gauci, S., Baker, P., Lawrence, M., Rebholz, C. M., Srouf, B., Touvier, M., Jacka, F. N., O'Neil, A., Segasby, T., & Marx, W. (2024). Ultra-processed food exposure and adverse health outcomes: umbrella review of epidemiological meta-analyses. *BMJ (Clinical research ed.)*, 384, e077310. <https://doi.org/10.1136/bmj-2023-077310>
22. Jayedi, A., Soltani, S., Emadi, A., Zargar, M. S., & Najafi, A. (2024). Aerobic Exercise and Weight Loss in Adults: A Systematic Review and Dose-Response Meta-Analysis. *JAMA network open*, 7(12), e2452185. <https://doi.org/10.1001/jamanetworkopen.2024.52185>

23. Lopez, P., Taaffe, D. R., Galvão, D. A., Newton, R. U., Nonemacher, E. R., Wendt, V. M., Bassanesi, R. N., Turella, D. J. P., & Rech, A. (2022). Resistance training effectiveness on body composition and body weight outcomes in individuals with overweight and obesity across the lifespan: A systematic review and meta-analysis. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, 23(5), e13428. <https://doi.org/10.1111/obr.13428>
24. Locatelli, J. C., Costa, J. G., Haynes, A., Naylor, L. H., Fegan, P. G., Yeap, B. B., & Green, D. J. (2024). Incretin-Based Weight Loss Pharmacotherapy: Can Resistance Exercise Optimize Changes in Body Composition?. *Diabetes care*, 47(10), 1718–1730. <https://doi.org/10.2337/dci23-0100>
25. Jensen, S. B. K., Blond, M. B., Sandsdal, R. M., Olsen, L. M., Juhl, C. R., Lundgren, J. R., Janus, C., Stallknecht, B. M., Holst, J. J., Madsbad, S., & Torekov, S. S. (2024). Healthy weight loss maintenance with exercise, GLP-1 receptor agonist, or both combined followed by one year without treatment: a post-treatment analysis of a randomised placebo-controlled trial. *EClinicalMedicine*, 69, 102475. <https://doi.org/10.1016/j.eclinm.2024.102475>
26. Wilding, J. P. H., Batterham, R. L., Davies, M., Van Gaal, L. F., Kandler, K., Konakli, K., Lingvay, I., McGowan, B. M., Oral, T. K., Rosenstock, J., Wadden, T. A., Wharton, S., Yokote, K., Kushner, R. F., & STEP 1 Study Group (2022). Weight regain and cardiometabolic effects after withdrawal of semaglutide: The STEP 1 trial extension. *Diabetes, obesity & metabolism*, 24(8), 1553–1564. <https://doi.org/10.1111/dom.14725>