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COMPARATIVE ANALYSIS OF CHEMICAL DRUGS AND PHYTOTHERAPEUTIC AGENTS IN THE TREATMENT OF OBESITY

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Annotation

Obesity is one of the most prevalent chronic metabolic disorders worldwide and is strongly associated with an increased risk of type 2 diabetes mellitus, cardiovascular disease, arterial hypertension, and metabolic syndrome. In recent years, glucagon-like peptide-1 receptor agonists, orlistat, and centrally acting anti-obesity medications have been widely used in obesity treatment. Although these agents demonstrate considerable clinical efficacy, their long-term use may be associated with adverse reactions. At the same time, phytotherapeutic products derived from medicinal plants have attracted growing scientific interest because of their antioxidant, anti-inflammatory, and metabolism-regulating properties. This article provides a comparative analysis of the efficacy, safety, and mechanisms of action of chemical anti-obesity drugs and phytotherapeutic agents based on current scientific evidence.

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INTRODUCTION. Obesity is one of the most important medical and public health challenges worldwide. It is characterized by excessive accumulation of adipose tissue and is associated with a substantially increased risk of cardiovascular diseases, arterial hypertension, type 2 diabetes mellitus, non-alcoholic fatty liver disease (NAFLD), and several types of cancer.

Abdominal obesity is considered the most metabolically harmful form of obesity. Visceral adipose tissue functions not only as an energy storage organ but also as an active endocrine organ. It secretes leptin, adiponectin, resistin, interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and numerous other biologically active mediators.

These bioactive molecules promote chronic low-grade inflammation, contribute to the development of insulin resistance, and disrupt the function of the hypothalamic–pituitary–adrenal (HPA) axis. Consequently, alterations in cortisol and other neuroendocrine biomarkers play a crucial role in the pathogenesis of obesity-related metabolic disorders.

Currently, obesity management includes lifestyle modification, dietary intervention, regular physical activity, pharmacotherapy, and, when clinically indicated, bariatric surgery. Pharmacological agents can produce significant reductions in body weight; however, their administration may be accompanied by adverse effects such as nausea, vomiting, diarrhea, steatorrhea, tachycardia, alterations in blood pressure, and other undesirable reactions.

Phytotherapeutic agents derived from medicinal plants are rich sources of flavonoids, phenolic compounds, essential oils, vitamins, and other biologically active constituents. These compounds exhibit antioxidant and anti-inflammatory properties, contribute to the regulation of lipid and carbohydrate metabolism, and improve overall metabolic homeostasis. Nevertheless, the efficacy and safety of phytotherapeutic preparations depend on their precise composition, dosage regimen, duration of administration, and individual patient characteristics.

The aim of this study was to comparatively evaluate the efficacy, safety, and biological mechanisms of action of the principal chemical anti-obesity drugs and medicinal plant-based phytotherapeutic agents using evidence from contemporary scientific literature.

MATERIALS AND METHODS

The present study was designed to comparatively evaluate the efficacy and safety of chemical anti-obesity drugs and medicinal plant-based phytotherapeutic agents used in the treatment of obesity. The study methodology was based on a comprehensive review of contemporary scientific literature and a comparative analysis of pharmacological and phytochemical evidence.

Scientific publications, systematic reviews, meta-analyses, and international clinical guidelines published between **2020 and 2025** were retrieved from **PubMed, Scopus, Web of Science, and Google Scholar**. The literature search was conducted using the following keywords: *obesity, anti-obesity drugs, phytotherapy, medicinal plants, GLP-1 receptor agonists, orlistat, insulin resistance, metabolic syndrome,* and *oxidative stress* [3,4,14].

The comparative analysis was performed according to the following criteria:

mechanism of action;
effect on body weight;
effect on lipid and carbohydrate metabolism;
effect on insulin resistance;
frequency of adverse effects;
long-term safety;
clinical efficacy.

The pharmacological agents included in the analysis were **orlistat, liraglutide, semaglutide**, and **phentermine-based medications**.

The phytotherapeutic agents included medicinal plants rich in biologically active compounds known to enhance metabolic function, particularly **lemon balm (*Melissa officinalis*)**, **basil (*Ocimum basilicum*)**, **black cumin (*Nigella sativa*)**, **peppermint (*Mentha piperita*)**, and **chamomile (*Matricaria chamomilla*)**. Scientific evidence regarding the bioactive constituents of these medicinal plants and their potential therapeutic effects in obesity management was comprehensively reviewed.

RESULTS AND DISCUSSION

The literature review demonstrated that currently available pharmacological agents used for obesity treatment reduce body weight through different biological mechanisms.

Orlistat inhibits pancreatic lipase, thereby reducing the digestion and intestinal absorption of dietary fats. As a result, energy intake decreases, leading to weight reduction. However, prolonged administration may be associated with **steatorrhea, diarrhea, and deficiencies of fat-soluble vitamins** [1,7].

GLP-1 receptor agonists, particularly **liraglutide** and **semaglutide**, suppress appetite by acting on hypothalamic satiety centers, delay gastric emptying, and stimulate insulin secretion. Although these agents have demonstrated remarkable clinical efficacy, adverse events such as **nausea, vomiting, gastrointestinal discomfort**, and, in rare cases, **acute pancreatitis** have been reported.

Centrally acting anti-obesity medications reduce hunger by stimulating the sympathetic nervous system. Nevertheless, their use may be accompanied by **tachycardia, elevated blood pressure, insomnia, and neuropsychiatric adverse effects**.

In contrast, phytotherapeutic agents exert **multitarget metabolic effects**.

Phenolic compounds and flavonoids present in **lemon balm (*Melissa officinalis*)** exhibit potent antioxidant and anti-inflammatory activities.

Essential oils and polyphenolic compounds of **basil (*Ocimum basilicum*)** contribute to the regulation of lipid metabolism.

The principal bioactive constituent of **black cumin (*Nigella sativa*)**, **thymoquinone**, has been shown to reduce oxidative stress and improve insulin sensitivity.

Peppermint (*Mentha piperita*) supports digestive function, whereas **chamomile (*Matricaria chamomilla*)** possesses anti-inflammatory and antispasmodic properties.

The synergistic interaction among these bioactive phytochemicals enhances antioxidant defense, decreases free radical production, and attenuates chronic low-grade inflammation. Consequently, phytocomplexes may play an important role in preventing metabolic disturbances associated with abdominal obesity.

Comparative Characteristics of Chemical Drugs and Phytotherapeutic Agents

Pharmacological agents used in the treatment of obesity differ considerably in their mechanisms of action. The most commonly prescribed medications in current clinical practice include **orlistat, liraglutide, semaglutide**, and **centrally acting anorectic agents**.

Among these, **GLP-1 receptor agonists** are considered one of the most promising therapeutic options for weight reduction because of their high clinical efficacy. However, they cannot replace a healthy diet and regular physical activity and should be administered only under medical supervision because of their potential adverse effects.

Unlike pharmacological drugs, phytotherapeutic agents contain a wide spectrum of biologically active compounds. Flavonoids, phenolic compounds, terpenoids, essential oils, and antioxidant vitamins exert complementary effects on multiple metabolic pathways. Their principal advantage lies in supporting the body's physiological functions while generally presenting a lower risk of adverse reactions. Nevertheless, phytotherapy should also follow the principles of evidence-based medicine, and preference should be given to medicinal plant preparations whose efficacy and safety have been clinically validated [9–13].

Table 1. Comparative Characteristics of Chemical Drugs and Phytotherapeutic Agents

Parameter	Chemical Drugs	Phytotherapeutic Agents
Onset of action	Rapid	Gradual
Mechanism of action	Targets specific receptors or enzymes	Multitarget biological effects
Weight-loss efficacy	High	Moderate
Antioxidant activity	Limited	High
Anti-inflammatory activity	Present in selected drugs	Common among medicinal plants
Long-term use	May be limited due to adverse effects	May be suitable for long-term use under medical supervision
Adverse effects	Relatively more frequent	Relatively less frequent

Biological Mechanisms of Phytocomplexes

Phytocomplexes composed of medicinal plants exert anti-obesity effects through multiple molecular pathways. Polyphenols and flavonoids neutralize reactive oxygen species, thereby reducing oxidative stress. Consequently, cellular membranes and mitochondrial function are preserved, while the synthesis of pro-inflammatory mediators is suppressed.

Melissa officinalis contains rosmarinic acid and flavonoids with potent antioxidant properties that may alleviate stress-related metabolic disturbances.

Essential oils and phenolic compounds present in **Ocimum basilicum** contribute to the improvement of lipid metabolism.

The principal bioactive constituent of **Nigella sativa**, **thymoquinone**, has been reported to enhance insulin sensitivity and attenuate inflammatory responses.

Mentha piperita promotes digestive function, whereas **Matricaria chamomilla** exhibits anti-inflammatory and antispasmodic activities.

The combination of these medicinal plants provides synergistic biological effects that support metabolic homeostasis through multiple complementary mechanisms [11–13].

Discussion

The available scientific evidence indicates that pharmacotherapy and phytotherapy should not be regarded as competing treatment strategies for obesity but rather as complementary components of an integrated therapeutic approach.

Although **GLP-1 receptor agonists** have demonstrated remarkable efficacy in promoting weight loss, their widespread use is limited by high treatment costs and the occurrence of gastrointestinal adverse effects in some patients.

Conversely, phytotherapy supports physiological metabolic regulation. Bioactive compounds derived from medicinal plants possess antioxidant, anti-inflammatory, and hypolipidemic properties. When combined with healthy nutrition and regular physical activity, phytotherapeutic interventions may represent a promising strategy for comprehensive obesity management.

Nevertheless, additional high-quality randomized controlled clinical trials are required to further establish the long-term efficacy and safety of phytotherapeutic agents in obesity treatment.

CONCLUSION. Obesity is a chronic multifactorial disease that requires a comprehensive therapeutic approach. Although chemical anti-obesity medications can achieve significant weight reduction within a relatively short period, their long-term use may be associated with an increased risk of adverse effects. In contrast, phytotherapeutic agents support the physiological regulation of metabolic processes, reduce oxidative stress and chronic low-grade inflammation, and generally demonstrate a more favorable safety profile.

Current scientific evidence suggests that phytotherapy should not be considered an alternative to pharmacotherapy but rather a complementary strategy within comprehensive obesity management. The combination of evidence-based phytotherapeutic interventions with lifestyle modification, balanced nutrition, regular physical activity, and, when indicated, pharmacological treatment may improve therapeutic outcomes while minimizing treatment-related adverse effects.

Therefore, an integrated therapeutic approach incorporating healthy lifestyle practices, rational nutrition, regular physical exercise, and scientifically validated phytotherapy represents one of the most promising strategies for the treatment of obesity and the prevention of its associated metabolic complications. Nevertheless, further large-scale randomized controlled clinical trials are required to confirm the long-term efficacy and safety of medicinal plant-based phytotherapeutic agents in obesity management.

References

1. Bray G.A., Ryan D.H. Medical Therapy for the Patient with Obesity. Circulation. 2021;143(21):2065–2080.
2. Blüher M. Obesity: Global Epidemiology and Pathogenesis. Nature Reviews Endocrinology. 2021;17(5):288–298.
3. Wilding J.P.H., Batterham R.L., Calanna S., et al. Once-Weekly Semaglutide in Adults with Overweight or Obesity. New England Journal of Medicine. 2021;384(11):989–1002.
4. American Diabetes Association. Standards of Care in Diabetes—2025. Diabetes Care. 2025;48(Suppl.1):S1–S350.
5. World Health Organization. Obesity and Overweight. Geneva: WHO; 2024.
6. Guyton A.C., Hall J.E. Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2021.
7. Katzung B.G. Basic and Clinical Pharmacology. 15th ed. New York: McGraw-Hill; 2021.
8. Gropper S.S., Smith J.L. Advanced Nutrition and Human Metabolism. 8th ed. Boston: Cengage Learning; 2022.

9. Onakpoya I.J., Posadzki P., Ernst E. The Efficacy of Herbal Supplements in Weight Loss: A Systematic Review. Obesity Reviews. 2021;22:e13197.
10. Hursel R., Westerterp-Plantenga M.S. Green Tea Catechins and Body Weight Regulation. American Journal of Clinical Nutrition. 2021;113(4):1045–1053.
11. Ahmad A., Husain A., et al. Therapeutic Potential of Nigella sativa in Metabolic Disorders. Phytotherapy Research. 2023;37(8):3560–3575.
12. Salehi B., Sharifi-Rad J., et al. Melissa officinalis: Phytochemistry, Pharmacological Activities and Clinical Applications. Phytotherapy Research. 2022;36(5):1884–1902.
13. Shaito A., Posadino A.M., et al. Potential Benefits of Medicinal Plants in Metabolic Syndrome. Frontiers in Pharmacology. 2022;13:875045.
14. Müller T.D., Blüher M., Tschöp M.H., et al. Anti-Obesity Drug Discovery: Advances and Challenges. Nature Reviews Drug Discovery. 2022;21(3):201–223.
15. Kushner R.F., Ryan D.H. Assessment and Lifestyle Management of Patients with Obesity. New England Journal of Medicine. 2023;389(12):1087–1098.